The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)

Version 1.0



Image created by author via Copilot AI

Marcus Lacher

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)

Marcus Lacher



Made in Minnesota, 2024-2025



eBook available on Opendora at: <u>https://opendora.minnstate.edu/</u> eBook available on Open Textbook Library at: <u>https://open.umn.edu/opentextbooks/</u> x

LICENSE



<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons</u> <u>Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted.

Disclaimer, Acknowledgement & Dedication

Acknowledgements: The material in this text consists of many screenshots of Microsoft® 365 using Windows 11.

The goal of this text was to create a resource for students that was effective, concise and cost-effective. This text will not include extra content that does not align with course outcomes. This conciseness is designed to be keep the material on-point and keep printing costs low.

Disclaimer: This OER textbook is a mashup/update of content from the textbook: *Learning How to Use Microsoft Excel 2016* by <u>Kaaren McGlynn</u>, which is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u> and supplemented by additional original content.

The text was written using Microsoft Windows 11 Professional and Windows (Office) 365 Professional. Considerable effort was given to verify the accuracy of information presented. However, due to the continuous improvements made to both the operating system and individual software applications, your experience could vary slightly from the time this material was compiled and printed.

All screenshots that appear throughout this text are copyright of Microsoft Corporation. All Rights Reserved. They have been used with permission from Microsoft Corporation. *The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)* and *Learning How to Use Microsoft® Excel® 2016* are independent publications and are not affiliated with, nor have they been authorized, sponsored, or otherwise approved by Microsoft Corporation.

Dedication: I dedicate my contributions to this text to the three most important pages in my book of life: Annmarie, Hayden and Julia. Thank you for your patience and love!

Table of Contents

1.1 An Overview of Microsoft® Excel®	1
Making Decisions with Excel	2
Starting Excel	3
The Excel Workbook	3
Navigating Worksheets	4
The Excel Ribbon	5
Quick Access Toolbar and Right-Click Menu	7
The File Tab	8
Saving Workbooks (Save As)	10
The Status Bar	12
Excel Help	13
1.2 Entering, Editing, and Managing Data	15
Entering Data	15
Editing Data	18
Auto Fill	20
Deleting Data and the Undo Command	22
Adjusting Columns and Rows	24
Hiding Columns and Rows	28
Inserting Columns and Rows	31
Moving Data	33
Deleting Columns and Rows	34
1.3 Formatting and Data Analysis	37
1.4 Data Alignment	43
Data Alignment (Wrap Text, Merge Cells, and Center)	43
Creating Multi-Line Worksheet Titles	46
Borders (Adding Lines to a Worksheet)	47
AutoSum	51
1.5 Simple Chart	52
Inserting a Column Chart	52
Cut, Copy, and Paste	58
Sorting Data (One Level)	59
Moving, Renaming, Inserting, and Deleting Worksheets	63
Printing	66

Page Setup	66
Headers and Footers	69
Printing Worksheets and Workbooks	71
Chapter Sample Exercise	73

Chapter 2 Mathematical Computations	76
2.1 Formulas	76
Creating a Basic Formula	77
Relative References (Copying and Pasting Formulas)	82
Creating Complex Formulas (Controlling the Order of Operations)	83
Auditing Formulas	86
2.2 Statistical Functions	91
The SUM Function	92
Absolute References (Calculating Percent of Totals)	95
The COUNT Function	99
The AVERAGE Function	101
The MAX and MIN Functions	105
Copy and Paste Formulas (Pasting without Formats)	107
Sorting Data (Multiple Levels)	109
2.3 Functions for Personal Finance	113
Defining and using names in formulas	113
Types of Names	114
Naming Rules	116
Manage names by using the Name Manager dialog box	118
The Fundamentals of Loans and Leases	121
The PMT (Payment) Function for Loans	123
The PMT (Payment) Function for Leases	129
Creating an Amortization Schedule for a Loan	132
Linking Worksheets with 3-D Cell References. (Creating a Summary Worksheet)	136
Time Value of Money Concepts	141
The FV (Future Value) Function	144
NPER	148
RATE	149
Chapter Sample Exercise	151

Chapter 3	158
3.1. Logical Functions	159
Freeze Panes	160
Formula and Functions Review	162
The Logical Test	174
IF Function	176
Assumption Tables	180
The OR Function	180
The AND Function	183
Simple Nested IF Functions	186
Nested Logical Functions	190
Basic Conditional Formats	192
3.2. Statistical IF Functions	199
The COUNTIF Function	200
The AVERAGEIF Function	203
The SUMIF Function	206
The COUNTIFS Function	211
The AVERAGEIFS Function	215
The SUMIFS Function	218
3.3. Data Validation	224
Data Validation List – Created Source	224
Data Validation List Named Range	226
Data Validation – Date	228
Data Validation - Number	229
Data Validation – Text	230
Data Validation – Calculated Field	231
3.4. Lookup Functions	232
The VLOOKUP Function	232
Naming a Table_array:	235
The HLOOKUP Function	240
IFERROR	246
Chapter Sample Exercise	250

Chapter 4 Presenting Data with Charts	-253
4.1 Choosing a Chart Type	- 253
Line Chart	-256
Adjusting the Y Axis Scale	- 260
Line Chart 2: Trend Comparisons Over Time	-262
Column Chart 1: Frequency Distribution	-265
Moving a Chart to a Chart Sheet	-267
Clustered Column Chart: Frequency Comparison	-269
Combo Chart: Non-comparative values	- 275
Pie Chart: Percent of Total	-278
Stacked Column Chart: Percent of Total Trend:	- 282
4.2 Formatting Charts	- 286
Getting to Know the Elements of a Chart	- 286
X and Y Axis Formats	- 287
Chart Legend and Title Formats	- 290
X and Y Axis Titles	- 293
Data Series Labels and Formats	- 294
Formatting the Plot and Chart Areas	-297
Adding Series Lines and Annotations to a Chart	- 300
4.3 The Scatter Chart	- 307
The Scatter Chart: Supply and Demand	- 307
Changing the Scale of the X and Y Axes	-315
Adding a Trendline and Equation	- 317
4.4 Using Charts with Microsoft® Word® and PowerPoint®	- 320
Pasting a Chart Image into Word	-320
Pasting a Linked Chart Image into PowerPoint	- 323

Chapter 5 Tables and PivotTables	328
Creating an Excel Table	328
Creating a Table	328
Adding Records	331
Finding and Editing Records	332
Deleting Records	332
Adding a Total Row	333

Adding a New Column	335
5.2 Sorting and Filtering Data	336
Sorting One Column	336
Multi-Column Sort	338
Sort Using a Custom List	340
5.3 Filtering Data	
Clearing Filters	348
5.4 Subtotals	349
Creating Subtotals	349
Subtotal Outline View	354
Removing Subtotals	356
5.6 PivotTables and PivotCharts	357
Creating a PivotTable	358
Rearranging a PivotTable	360
Value Field Settings	360
PivotTable Formatting	361
Recommended PivotTables	362
Slicers	364
Group or Ungroup Data in a PivotTable	366
PivotCharts	374
Import Data from a Database	376
Understanding Different File Formats Supported by Excel	379
Importing Data from Text Files	381
Importing Data from Databases	381
Importing Data from Web Sources	382
Chapter X: What's New and Overlooked in Excel?	383
Artificial Intelligence in Excel	384
Copilot in Excel	387
Solver	388
Power ³ – Oh, so much power!!!	392
Power Query	392
Power Pivot	393
3-D References	

Chapter 1

Fundamental Skills

Microsoft® Excel® is a tool that can be used in virtually all careers and is valuable in both professional and personal settings. Whether you need to keep track of medications in inventory for a hospital or create a financial plan for your retirement, Excel enables you to do these activities efficiently and accurately. This chapter introduces the fundamental skills necessary to get you started in using Excel. You will find that just a few skills can make you very productive in a short period of time.

1.1 An Overview of Microsoft® Excel®

LEARNING OBJECTIVES 1. Examine the value of using Excel to make decisions 2. Learn how to start Excel 3. Become familiar with the Excel workbook 4. Understand how to navigate worksheets 5. Examine the Excel Ribbon 6. Become familiar with the Quick Access Toolbar 7. Examine the right-click menu options 8. Become familiar with the commands in the File tab 9. Learn how to save workbooks 10. Examine the Status Bar

11. Become familiar with the features in the Excel Help window

Microsoft® Office contains a variety of tools that help people accomplish many personal and professional objectives. Microsoft Excel is perhaps the most versatile and widely used of all the Office applications. No matter which career path you choose, you will likely need to use Excel to accomplish your professional objectives, some of which may occur daily. This chapter provides an overview of the Excel application along with an orientation for accessing the commands and features of an Excel workbook.

Making Decisions with Excel

Follow-along file: Not needed for this skill

Taking a very simple view, Excel is a tool that allows you to enter quantitative data into an electronic spreadsheet to apply one or many mathematical computations. These computations ultimately convert that quantitative data into information. The information produced in Excel can be used to make decisions in both professional and personal contexts. For example, employees can use Excel to determine how much inventory to buy for a clothing retailer, how much medication to administer to a patient, or how much money to spend to stay within a budget. With respect to personal decisions, you can use Excel to determine how much you can spend on car lease payments, or how much you need to save to reach your retirement goals. We will demonstrate how you can use Excel to make these decisions and many more throughout this text.

Figure 1.1 "Example of an Excel Worksheet with Embedded Chart" shows a completed Excel worksheet that will be constructed in this chapter. The information shown in this worksheet is top-line sales data for a hypothetical merchandise retail company. The worksheet data can help this retailer determine the number of salespeople needed for each month, how much inventory is needed to satisfy sales, and what types of products should be purchased. Notice that the embedded chart makes it very easy to see which months have the highest unit sales.



Figure 1.1 Example of an Excel Worksheet with Embedded Chart

@ 080

Starting Excel

Follow-along file: Not needed for this skill

The following steps will guide you in starting the Excel application. Note that these steps along with Figure 1.2 "Start Menu" relate to the Windows 10 operating system.

- 1. Click the Windows button on the lower left corner of your computer screen.
- 2. Start typing Excel. You will see Excel pop up as an option.
- 3. Click the Microsoft Excel 2016 option. This will start the Excel application.



Figure 1.2 Start Menu

The Excel Workbook

Once Excel is started, a blank workbook will open on your screen. A workbook is an Excel file that contains one or more worksheets (sometimes referred to as *spreadsheets*). Excel will assign a file name to the workbook, such as Book1, Book2, Book3, and so on, depending on how many new workbooks are opened.

Navigating Worksheets

Follow-along file: Not needed for this skill

Data are entered and managed in an Excel worksheet. The worksheet contains several rectangles called cells for entering numeric and nonnumeric data. Each cell in an Excel worksheet contains an address, which is defined by a column letter followed by a row number. For example, the cell that is currently activated in **Worksheet**" is **A1**. This would be referred to as cell location **A1** or cell reference A1. The following steps explain how you can navigate in an Excel worksheet:

- Place your mouse pointer over cell D5 and left click. Check to make sure column letter D and row number 5 are highlighted in gray, as shown in Figure 1.5 "Activating a Cell Location".
- 2. Move the mouse pointer to cell A1.
- 3. Click and hold the left mouse button and drag the mouse pointer back to cell D5.
- 4. Release the left mouse button. You should see several cells highlighted, as shown in Figure 1.6 "Highlighting a Range of Cells". This is referred to as a cell range and is documented as follows: A1:D5. Any two cell locations separated by a colon are known as a cell range. The first cell reference is the top left corner of the range, and the second cell reference is the lower right corner of the range



Figure 1.5 Activating a Cell Location

@ 080

Figure 1.6 Highlighted Range of Cells

8 5-	da -	1. A.	В	ook1 Excel	Ка	iren McGlyn	n 📼	-		×
File	Home Insert	Draw Page	Layout	Formulas	Data	Review	View	♀ Tell r	ne A	A Share
A 10	Calibri - 11	· = =	-	General	- Con	ditional For	matting *	調査	Q	
	BIU - A	^* ≡ ≡ ÷	≡ 閏 +	\$ - %	For	mat as Table	+	Cells	Editing	
Paste S	🖽 • 🔷 • 🗛	· •= •=	87 -	50 00	Cel	Styles *		- ens		
Clipboard R	Font	G Aligne	ient 🕫	Number	6	Styles				~
4.7	-									
AT		14								
A A	8 C	D	F	F	6	н	R 31	1		K I-
1		12							_	
2										
3				The cell	range A1:0	05 is				
4				hig	shlighted					
5				-				_		_
0										_
8								-		_
9										
10										_
11										
12										
13										
14				-				_		
15										_
10				-				-		_
18										
19	Click the teh to	move to that	1	Click the + 1	to create a	Dalw				
20	workst	eet		wo	rksheet	mean				
21	/ \			/						
22			/							
23	V V		4							~
4 F	Sheet1 Sh	eet2 🗍 🕀			-				10	•
Ready 10					III		-	1	+	10096

- 5. Click the + in the circle to create a new worksheet. Excel 2016 comes with only 1 worksheet in a new workbook.
- 6. Click the Sheet2 worksheet tab at the bottom of the worksheet. This is how you open a worksheet within a workbook.
- 7. Click the Sheet1 worksheet tab at the bottom of the worksheet to return to the worksheet shown

Keyboard Shortcuts - Basic Worksheet Navigation

- 1. Use the arrow keys on your keyboard to activate cells on the worksheet.
- 2. Hold the SHIFT key and press the arrow keys on your keyboard to highlight a range of cells in a worksheet.
- **3.** Hold the CTRL key while pressing the PAGE DOWN or PAGE UP keys to open other worksheets in a workbook.

The Excel Ribbon

Excel's features and commands are found in the Ribbon, which is the upper area of the Excel screen that contains several tabs running across the top. Each tab provides access to a different set of Excel commands. Figure 1.7 "Ribbon for Excel" shows the commands available in the Home tab of the Ribbon. Table 1.1 "Command Overview for Each Tab of the Ribbon" provides an overview of the commands that are found in each tab of the Ribbon.

Figure 1.7 Ribbon for Excel

ſ		Ca • + some	Insert	Page Layout	Formulae	Oata	Review	B	ook1 - Microso	oft Excel			_		
R	Paste	Calibri B J	<u>ц</u> .	• 11 •	A' A' =	= =	ان کې د کې کې	部 記。	General \$ • % • Plumber	- 	Conditional Formatting	Format as Table *	1	Delete +	Σ · Sort & Fiel 2 · Fiter · Select Editing
	AI A I The Ribbon	8	c	F.	The Hon Ribbon	ne tab of Is activat	the H		E [].# [8	L	Click	c here t e the Ri	o p o lbbon.	Minimize the Ribbon Show only the tab no Ribbon

Table 1.1 Command Overview for Each Tab of the Ribbon

Tab Name	Description of Commands
File	Also known as the Backstage view of the Excel workbook. Contains all commands for opening, closing, saving, and creating new Excel workbooks. Includes print commands, document properties, e-mailing options, and help features. The default settings and options are also found in this tab.
Home	Contains the most frequently used Excel commands. Formatting commands are found in this tab along with commands for cutting, copying, pasting, and for inserting and deleting rows and columns.
Insert	Used to insert objects such as charts, pictures, shapes, PivotTables, Internet links, symbols, or text boxes.
Page Layout	Contains commands used to prepare a worksheet for printing. Also includes commands used to show and print the gridlines on a worksheet.
Formulas	Includes commands for adding mathematical functions to a worksheet. Also contains tools for auditing mathematical formulas.
Data	Used when working with external data sources such as Microsoft® Access®, text files, or the Internet. Also contains sorting commands and access to scenario tools.
Review	Includes Spelling and Track Changes features. Also contains protection features to password protect worksheets or workbooks.
View	Used to adjust the visual appearance of a workbook. Common commands include the Zoom and Page Layout view.

The Ribbon shown in Figure 1.7 "Ribbon for Excel" is full or maximized. The benefit of

having a full Ribbon is that the commands are always visible while you are developing a worksheet. However, depending on the screen dimensions of your computer, you may find that the Ribbon takes up too much vertical space on your worksheet. If this is the case, you can minimize the Ribbon by clicking the button shown in Figure 1.7 "Ribbon for Excel". When minimized, the Ribbon will show only the tabs and not the command buttons. When you click on a tab, the command buttons will appear until you select a command or click anywhere on your worksheet.

Keyboard Shortcuts - Minimizing or Maximizing the Ribbon

1. Hold down the CTRL key and press the F1 key

2. Hold down the CTRL key and press the F1 key again to maximize the Ribbon

Quick Access Toolbar and Right-Click Menu

The Quick Access Toolbar is found at the upper left side of the Excel screen above the Ribbon. This area provides access to the most frequently used commands, such as Save and Undo. You also can customize the Quick Access Toolbar by adding commands that you use on a regular basis. By placing these commands in the Quick Access Toolbar, you do not have to navigate through the Ribbon to find them. To customize the Quick Access Toolbar, click the down arrow as shown in Figure 1.8 "Customizing the Quick Access Toolbar". This will open a menu of commands that you can add to the Quick Access Toolbar. If you do not see the command, you are looking for on the list, select the More Commands option.



Figure 1.8 Customizing the Quick Access Toolbar

080

In addition to the Ribbon and Quick Access Toolbar, you can also access commands by right clicking anywhere on the worksheet. Figure 1.9 "Right-Click Menu"_shows an example of the commands available in the right-click menu.



Figure 1.9 Right-Click Menu

The File Tab

If you have used Office 2007, you may have noticed that the Office button has disappeared in the 2016 version. It has been replaced with the File tab on the far-left side of the Ribbon. The File tab is also known as the Backstage view of the workbook. It contains a variety of features and commands related to the workbook that is currently open, new workbooks, or workbooks stored in other locations on your computer or network. Figure 1.10 "File Tab or Backstage View of a Workbook" shows the options available in the File tab or Backstage view. To leave the Backstage view and return to the worksheet, click any tab on the Ribbon

or click the image of the worksheet on the right side of the window. You must click the Info button (highlighted in green in Figure 1.10 "File Tab or Backstage View of a Workbook") to see the image of your worksheet on the right side of the window.



Figure 1.10 File Tab or Backstage View of a Workbook

Included in the File tab are the default settings for the Excel application that can be accessed and modified by clicking the Options button. Figure 1.11 "Excel Options Window" shows the Excel Options window, which gives you access to settings such as the default font style, font size, and the number of worksheets that appear in new workbooks.





Saving Workbooks (Save As)

Once you create a new workbook, you will need to change the file name and choose a location on your computer or network to save it. The following steps explain how to save a new workbook and assign it a file name. It is important to remember where you save this workbook on your computer or network as you will be using this file in the Section 1.2 "Entering, Editing, and Managing Data" to construct the workbook shown in Figure 1.1 "Example of an Excel Worksheet with Embedded Chart".

- 1. If you have not done so already, start Excel. A blank workbook should appear on your screen.
- 2. Check to make sure the workbook is maximized (see Figure 1.4 "Restored Worksheet").
- 3. Click the File tab.
- 4. Click the Save As button in the upper left side of the Backstage view window, as shown in Figure 1.10 "File Tab or Backstage View of a Workbook". This will open the Save As dialogbox.
- 5. Click in the File Name box at the bottom of the Save As dialog box.

- 6. Use the BACKSPACE key to remove the current file name of the workbook.
- 7. Type the file name: **Excel Objective 1.0**.
- 8. Click the Desktop button on the left side of the Save As dialog box if you wish to save this file on your desktop. If you want to save this workbook in a different location on your computer or network, double click the Computer option, as shown in Figure 1.12 "Save As Dialog Box", and select your preferred location.
- 9. Click the Save button on the lower right side of the Save As dialog box.



Figure 1.12 Save As Dialog Box-

Keyboard Shortcuts - Save As

- Press the F12 key and use the tab and arrow keys to navigate around the Save As dialog box. Use the ENTER key to make a selection.
- Or press the ALT key on your keyboard. You will see letters and numbers, called Key Tips, appear on the Ribbon. Press the F key on your keyboard for the File tab and then the A key. This will open the Save As dialog box.

Skill Refresher- Saving Workbooks (Save As)

- 1. Click the File tab on the Ribbon.
- 2. Click the Save As option.
- 3. Select a location on your PC or network.
- 4. Click in the File name box and type a new file name if needed.
- 5. Click the down arrow next to the "Save as type" box and select the appropriate file type if needed.
- 6. Click the Save button.

The Status Bar

The Status Bar is located below the worksheet tabs on the Excel screen (see Figure 1.15 "Customizing the Status Bar"). It displays a variety of information, such as the status of certain keys on your keyboard (e.g., CAPS LOCK), the available views for a workbook, the magnification of the screen, and mathematical functions that can be performed when data are highlighted on a worksheet. You can customize the Status Bar as follows:

- 1. Place the mouse pointer over any area of the Status Bar and right click (see Figure 1.15 "Customizing the Status Bar").
- 2. Select the Caps Lock option from the menu (see Figure 1.15 "Customizing the Status Bar").
- 3. Press the CAPS LOCK key on your keyboard. You will see the Caps Lock indicator on the lower right side of the Status Bar.
- 4. Press the CAPS LOCK key again. The indicator on the Status Bar goes away.



C	Book1	10 Cu	stomize Status Bar		~ ·	49 .83
fer Home Insert Page La	iyout Formulas Data Review	vies 1	Cell Mode	Ready		51 83
Parte	· A' A' ≡ ≡ ≡ ∦ ∦ ⊘· <u>A</u> · ≡ ≡ ≡ ∦ ∦		Signatures prformation Menagement Policy Permissions	off Off Off	instrater Σ • 27 An instrater = 2 • Sort & Find & instrater = 2 • Fitter + Select +	
F18 • (* A	r, Alguroeit	*	Caps Lock	10	Cells Edzing	(v)
A B C D Click hi Click hi Click hi Lock india	ere to add the Caps cator to the Status Bar.		Signif Lock Signif Lock Exect Decimal Dwittype Mode End Mode Macro Recording Selection Mode	Off Off	List of indicators that be added to the State	t can is Bar.
11 12 13		2	Ebge Number Arerage			
Right click any in the Status Bar	where to open	>	Spant Numerical Coung Minimum Magimum			
the list of indi	cators.	~	Sam			
22 23 24 * + + * Sheet1 / Sheet2 / Sh	eets _	2 2 2 3	Upliced Status View Shortouts Zoom	100%		*
Ready	*		and a construction of the second s		100% (-)	(+)

Excel Help

Follow-along file: Continue with a blank workbook or open a new one.

The Help feature provides extensive information about the Excel application. Although some of this information may be stored on your computer, the Help window will automatically connect to the Internet, if you have a live connection, to provide you with resources that can answer most of your questions. You can open the Excel Help window by clicking the question mark in the upper right corner of the screen. Here you can search for specific topics or type a question in the upper-left side of the window, as shown in Figure 1.16 "Excel Help Window".

Keyboard Shortcuts - Excel Help

• Press the F1 key on your keyboard.

Figure 1.16 Excel Help Window



Key Takeaways

- Excel is a powerful tool for processing data for the purposes of making decisions
- You can find Excel commands throughout the tabs in the Ribbon.
- You can customize the Quick Access Toolbar by adding commands you frequently use.
- You must save your workbook in the Excel 97-2003 file format when sharing workbooks with people who are running Microsoft Office 2003 and older versions.
- Office 2007 can open files created in Office 2016
- You can add or remove the information that is displayed on the Status Bar
- The Help window provides you with extensive information about Excel.

1.2 Entering, Editing, and Managing Data

LEARNING OBJECTIVES

- 1. Understand how to enter data into a worksheet.
- 2. Examine how to edit data in a worksheet.
- 3. Examine how Auto Fill is used when entering data.
- 4. Understand how to delete data from a worksheet and use the Undo command.
- 5. Examine how to adjust column widths and row heights in a worksheet.
- 6. Understand how to hide columns and rows in a worksheet.
- 7. Examine how to insert columns and rows into a worksheet.
- 8. Understand how to delete columns and rows from a worksheet.
- 9. Learn how to move data to different locations in a worksheet

In this section, we will begin the development of the workbook shown in Figure 1.1 "Example of an Excel Worksheet with Embedded Chart". The skills covered in this section are typically used in the early stages of developing one or more worksheets in a workbook. A theme we will continue to pursue in this book is making your spreadsheets tell a story all by itself. Meaning, a person can look at the spreadsheet and know exactly what information the spreadsheet is conveying.

Entering Data

Follow-along file: Excel Objective 1.0 (This is a blank workbook that was named in the previous section. If you skipped the previous section, open a new workbook and save it with the file name "Excel Objective 1.0.")

The XYZ Corporation has sales data they would like to have put into a worksheet. They want it professionally formatted and include an embedded chart. The sales data they are giving you is for the year 2017.

We will begin building the workbook shown in Figure 1.1 "Example of an Excel Worksheet with Embedded Chart" by manually entering data into the worksheet. There are other ways in which you can bring data into an Excel worksheet, such as importing data from a website or a Microsoft Access database. However, we will demonstrate these other methods later. The following steps explain how the column headings in Row 2 are typed into the worksheet:

@ 080

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

- 1. Activate cell location A2 on the worksheet.
- 2. Type the word **Month**. Press the RIGHT ARROW key. This will enter the word into cell A2 and activate the next cell to the right.
- 3. Type **Unit Sales** and press the RIGHT ARROW key.
- 4. Repeat step 4 for the words **Average Price** and **SalesDollars**.

Figure 1.17 "Entering Column Headings into a Worksheet" shows how your worksheet should appear after you have typed the column headings into Row 2. Notice that the word Price in cell location C2 is not visible. This is because the column is too narrow to fit the entry you typed. We will examine formatting techniques to correct this problem in the next section.





Integrity Check - Column Headings

It is critical to include column headings that accurately describe the data in each column of a worksheet. In professional environments, you will likely be sharing Excel workbooks with coworkers. Good column headings reduce the chance of someone misinterpreting the data contained in a worksheet, which could lead to costly errors depending on your career.

- 5. Activate cell location B3. Type the number **2670** and press the ENTER key. After you press the ENTER key, cell B4 will be activated. Using the ENTER key is an efficient way to enter data vertically down a column.
- 6. Repeat step 5 by entering the following numbers in cells B4 through B14:**2160**, **515**, **590**, **1030**, **2875**, **2700**, **900**, **775**, **1180**, **1800**, and **3560**.
- 7. Activate cell location C3.
- 8. Type the number 9.99 and press the ENTER key.
- 9. Repeat step 8 by entering the following numbers in cells C4 through C14:12.49, 14.99, 17.49, 14.99, 12.49, 9.99, 19.99, 19.99, 19.99, 17.49, and 14.99.
- 10. Activate cell location D3.
- 11. Type the number 26685 and press the ENTER key.

12. Repeat step 12 by entering the following numbers in cells D4through D14:26937, 7701, 10269, 15405, 35916, 26937, 17958, 15708, 23562,31416, and 53370.

Why?

Avoid Formatting Symbols When Entering Numbers

When typing numbers into an Excel worksheet, it is best to avoid adding any formatting symbols such as dollar signs and commas. Although Excel allows you to add these symbols while typing numbers, it slows down the process of entering data. It is more efficient to use Excel's formatting features to add these symbols to numbers after you type them into a worksheet.

Integrity Check – Data Entry

It is very important to proofread your worksheet carefully, especially when you have entered numbers. Transposing numbers when entering data manually into a worksheet is a common error. For example, the number 563 could be transposed to 536. Such errors can seriously compromise the integrity of your workbook.

Figure 1.18 "Completed Data Entry for Columns B, C, and D" shows how your worksheet should appear after entering the data. Check your numbers carefully to make sure they are accurately entered into the worksheet.

Figure 1.18 Completed Data Entry for Columns B, C, and D

S F	ile H	ome Insert	Page Layou	t Formulas	Data	
19	3 8	Calibri	* 11	· A A	= = [
Pas	te Car	B / U -		8- A-		
" lint	and E		Font		Ali	
inpre	A1	• (*	f.	1.18		
1	A	В	С	D	E	
1						
2	Month	Unit Sales	Average P	Sales Dolla	rs	
3		2670	9.99	26685	7	
4		2160	12.49	26937		
5		515	14.99	7701		
6		590	17.49	10269		
7		1030	14.99	15405		Numbers have been
8		2875	12.49	35916		entered without
9		2700	9.99	26937	1	symbols such as
0		900	19.99	17958		dollar signs or commas.
1		775	19.99	15708		
12		1180	19.99	23562		
13		1800	17.49	31416		
14		3560	14.99	53370)	
15						
16						
17						
18						
9	L N C	haatt /Chan	D /Cheat	107		0

Editing Data

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.01 if you are starting with this skill.)

Data that has been entered in a cell can be changed by:

- double clicking the cell location
- clicking in the Formula Bar
- clicking the F2 function key while the cell is active.

You may have noticed that as you were typing data into a cell location, the data you typed appeared in the Formula Bar. The Formula Bar can be used for entering data into cells as well as for editing data that already exists in a cell.

The following steps provide an example of entering and then editing data that has been entered into a cell location:

- 1. Activate cell A15 in the Sheet1 worksheet.
- 2. Type the abbreviation Tot and press the ENTER key.
- 3. Click cell A15.
- 4. Move the mouse pointer up to the Formula Bar. You will see the pointer turn into a cursor. Move the cursor to the end of the abbreviation Tot and left click.
- 5. Type the letters al to complete the word Total.
- 6. Click the checkmark to the left of the Formula Bar (see Figure 1.19 "Using the Formula Bar to Edit and Enter Data"). This will enter the change into the cell.
- 7. Double click cell A15.
- 8. Add a space after the word Total and type the word Sales.
- 9. Press the ENTER key.





• Activate the cell that is to be edited and press the F2 key on your keyboard.

Auto Fill

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.02 if you are starting with this skill.)

The Auto Fill feature is a valuable tool when manually entering data into a worksheet. This feature has many uses, but it is most beneficial when you are entering data in a defined sequence, such as the numbers 2, 4, 6, 8, and so on, or nonnumeric data such as the days of the week or months of the year. The following steps demonstrate how Auto Fill can be used to enter the months of the year in Column A:

- 1. Activate cell A3 in the Sheet1worksheet.
- 2. Type the word **January** and press the ENTER key.
- 3. Activate cell A3 again.
- 4. Move the mouse pointer to the lower right corner of cell A3. You will see a small square in this corner of the cell; this is called the Fill Handle (see Figure 1.20 "Fill Handle"). When the mouse pointer gets close to the Fill Handle, the white block plus sign will turn into a black plus sign.
- 5. Left click and drag the Fill Handle to cell A14. Notice that the Auto Fill tip box indicates what month will be placed into each cell (see Figure 1.21 "Using Auto Fill to Enter the Months of the Year"). Release the left mouse button when the tip box reads "December."



Figure 1.20 Fill Handle

Figure 1.21 Using Auto Fill to Enter the Months of the Year

Pas		ne Insert Calibri B I ∐ ▼	Page Layou	t Formula A A A - A				
Clipt	board IS	- (2	Font	(Fa				
1	A3	• (0	J× Janu	lary	-			
	A	В	C	D	N			
1	Manth	Unit Calas	A	Cales Dall				
2	Month	Unit Sales	Average P	Sales Dolla	ars			
3	January	2670	9.99	26685				
4		2160	12.49	26937				
5		515	14.99	7701				
6		590	17.	The mouse	pointer			
7		1030	14. cł	anges to a black plus ign when it is placed				
8		2875	17. s					
9		2700	9.	over the Fill Handle.				
10		900	19.99	17958				
11		778	19.99	15708				
12		1180	19.99	23562				
13		1800	17.49	31416				
14		3560	14.99	E2220				
15	Total Sale	+ S Decembr		This tip box	indicates that			
16		Decembe		entered i	nto cell A14.			
			-					

Once you release the left mouse button, all twelve months of the year should appear in the cell range A3:A14, as shown in Figure 1.22 "Auto Fill Options Button". You will also see the Auto Fill Options button. By clicking this button, you have several options for inserting data into a group of cells.

- 6. Left click the Auto Fill Options button.
- 7. Left click the Copy Cells option. This will change the months in the range A4:A14 to January.
- 8. Left click the Auto Fill Options button again.
- **9.** Left click the Fill Months option to return the months of the year to the cell range A4:A14. The Fill Series option will provide the same result.



Figure 1.22 Auto Fill Options Button

Deleting Data and the Undo Command

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.03 if starting with this skill.)

There are several methods for removing data from a worksheet, a few of which are demonstrated here. With each method, you use the Undo command. This is a helpful command in the event you mistakenly remove data from your worksheet.

The following steps demonstrate how you can delete data from a cell or range of cells:

1. Activate cell C2 by placing the mouse pointer over the cell and clicking the left mouse button.

- 2. Press the DELETE key on your keyboard. This removes the contents of the cell.
- **3**. Highlight the range C3:C14 by placing the mouse pointer over cell C3. Then left click and drag the mouse pointer down to cell C14.
- 4. Place the mouse pointer over the Fill Handle. You will see the white block plus sign change to a black plus sign.
- 5. Left click and drag the mouse pointer up to cell C3 (see Figure 1.23 "Using Auto Fill to Delete Contents of Cell"). Release the mouse button. The contents in the range C3:C14 will be removed.



Figure 1.23 Using Auto Fill to Delete Contents of Cell

- 6. Click the Undo button in the Quick Access Toolbar. This should replace the data in the range C3:C14.
- 7. Click the Undo button again. This should replace the data in cellC2.
- 8. Highlight the range C2:C14 by placing the mouse pointer over cell C2. Then left click and drag the mouse pointer down to cell C14.
- 9. Click the Clear button in the Home tab of the Ribbon, which is next to the Cells group of commands (see Figure 1.24 "Clear Command Drop-Down Menu"). This opens a drop down menu that contains several options for removing or clearing data from a cell. Notice that you also have options for clearing just the formats in a cell or the

hyperlinks in a cell.

- **10**. Click the Clear All option. This removes the data in the cell range.
- **11.** Click the Undo button. This replaces the data in the range C2:C14.





Keyboard Shortcuts -Undo Command

• Hold down the CTRL key while pressing the letter *Z* on your keyboard.

Adjusting Columns and Rows

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.03 if starting with this skill.)

In Figure 1.22 "Auto Fill Options Button", there are a few entries that appear cut off. For example, the last letter of the word *September* cannot be seen in cell A11. This is because the column is too narrow for this word. The columns and rows on an Excel worksheet can be adjusted to accommodate the data that is being entered into a cell. The following steps explain how to adjust the column widths and row heights in a worksheet:

- 1. Bring the mouse pointer between Column A and Column B in the Sheet1 worksheet, as shown in Figure 1.25 "Adjusting Column Widths". You will see the white block plus sign turn into double arrows.
- 2. Left click and drag the column to the right so the entire word September in cell A11 can

be seen. As you drag the column, you will see the column width tip box. This box displays the number of characters that will fit into the column using the Calibri 11-point font.

3. Release the left mouse button.

Figure 1.25 Adjusting Column Widths



You may find that using the click-and-drag method is inefficient if you need to set a specific character width for one or more columns. Steps 4 through 7 illustrate a second method for adjusting column widths when using a specific number of characters:

- 4. Activate any cell location in Column A by moving the mouse pointer over a cell location and clicking the left mouse button. You can highlight cell locations in multiple columns if you are setting the same character width for more than one column.
- 5. In the Home tab of the Ribbon, left click the Format button in the Cells group (see Figure 1.26 "Cells Group in the Home Tab").
- 6. Click the Column Width option from the drop-down menu (see Figure 1.27 "Format Drop-Down Menu"). This will open the Column Width dialog box.
- 7. Type the number **13** and click the OK button on the Column Width dialog box. This will set Column A to this character width (see Figure 1.28 "Column Width Dialog Box").

Figure 1.26 Cells Group in the Home Tab



Figure 1.27 Format Drop-Down Menu



Figure 1.28 Column Width Dialog Box

	ial 19 . (*	- 8	Ŧ			4		Exce	Objective 1	1.0
F	Hor	rie	Insert	Page Layout	Formulas	Data	Review	Vie	w	
ľ	X	alibri		- 11 - A	x . =	-	p	部 wi	ap Text	
Pat	te y	B Z	y +)	· · ·	<u>∧</u> · ≡		* *	BM	erge & Center	-
Clip	board 12		For	ut.	Ť6		Alignme	nt		15
	A11		• (*	fx	Septembe	r				
1	A		в	C	D	E		F	G	
1						Care-resources	-	-		
2	Month	U	nit Sales	Average P	Sales Doll	Column V	Vidth			Column width in number of
3	January		2670	9.99	26685	Çolumn wi	dth: 1	-		characters is entered here
4	February		2160	12.49	26937	-	-	-		characters is entered here
5	March		515	14.99	7701	OK	-0	Q	Incel	
б	April		590	17.49	10269		110	-		
7	May		1030	14.99	15405	i .				
8	June		2875	12.49	35916	i i				
9	July		2700	9.99	26937	1				
10	August	_	900	19.99	17958	1				
11	Septembe	r	775	19.99	15708					
12	October		1180	19.99	23562					

Keyboard Shortcuts - Column Width

• Press the ALT key on your keyboard, then press the letters *H*, *O*, and *W* one at a time.

The following steps demonstrate how to adjust row height, which is similar to adjusting column width:

- 1. Activate cell A15 by placing the mouse pointer over the cell and clicking the left mouse button.
- 2. In the Home tab of the Ribbon, left click the Format button in the Cells group (see Figure 1.26 "Cells Group in the Home Tab").
- 3. Click the Row Height option from the drop-down menu (see Figure 1.27 "Format Drop Down Menu"). This will open the Row Height dialog box.
- 4. Type the number 24 and click the OK button on the Row Height dialog box. This will set Row 15 to a height of 24 points. A point is equivalent to approximately 1/72 of an inch. This adjustment in row height was made to create space between the totals for this worksheet and the rest of the data.

Figure 1.29 "Excel Objective 1.0 with Column A and Row 15 Adjusted" shows the appearance of the worksheet after Column A and Row 15 are adjusted.

Figure 1.29 Excel Objective 1.0 with Column A and Row 15 Adjusted

	🐴 🍝 🛛 Calibri	-	11 - A	A" = =			
Pas	te B	u • 199	- 3-1	A- ==	三 詳 (
lipl	board II.	Font		Fa	Alignment		
1013.404	11	• (~) •	ų				
A	A	В	C	D	The width of		
1	-				- Column A		
2	Month	Unit Sales	Average P	Sales Dollar:	was nicreased.		
3	January	2670	9.99	26685			
4	February	2160	12.49	26937			
5	March	515	14.99	7701			
6	April	590	17.49	10269			
7	May	1030	14.99	15405			
8	June	2875	12.49	35916			
9	July	2700	9.99	26937			
0	August	900	19.99	17958			
1	September	775	19.99	15708			
2	October	1180	19.99	23562			
з	November	1800	17.49	31416	C		
4	December	3560	14.99	53370	The height of Row 15		
5	Total Sales	l Sales			space between the tota		
6					and the rest of the data		

kow heights can be adjusted by placing the mouse pointer between two row numbers and clicking and dragging to the desired height.

Keyboard Shortcuts - Row Height

• Press the ALT key on your keyboard, then press the letters *H*, *O*, and *H*ome at a time.

Skill Refresher - Adjusting Columns and Rows

- 1. Activate at least one cell in the row or column you are adjusting.
- 2. Click the Home tab of the Ribbon.
- 3. Click the Format button in the Cells group.
- 4. Click either Row Height or Column Width from the drop-down menu.
- 5. Enter the Row Height in points or Column Width in characters in the dialog box.
- 6. Click the OK button.

Hiding Columns and Rows

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.04 if starting with this skill.)

In addition to adjusting the columns and rows on a worksheet, you can also hide columns and rows. This is a useful technique for enhancing the visual appearance of a worksheet that contains data that is not necessary to display. These features will be demonstrated using the Excel Objective 1.0 workbook. However, there is no need to have hidden columns or rows for this worksheet. The use of these skills here will be for demonstration purposes only.

@ 080

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted
- 1. Activate cell C1 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.
- 2. Click the Format button in the Home tab of the Ribbon.
- 3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu (see Figure 1.27 "Format Drop-Down Menu"). This will open a submenu of options.
- 4. Click the Hide Columns option in the submenu of options (see Figure 1.30 "Hide & Unhide Submenu"). This will hide Column C.



Figure 1.30 Hide & Unhide Submenu

Keyboard Shortcuts - Hiding Columns

• Hold down the CTRL key while pressing the number 0 on your keyboard.

Figure 1.31 "Hidden Column" shows the workbook with Column C hidden in the Sheet1 worksheet. You can tell a column is hidden by the missing letter *C*.

Figure 1.31 Hidden Column



@080

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted To unhide a column, follow these steps:

- 1. Highlight the range B1:D1 by activating cell B1 and clicking and dragging over to cell D1.
- 2. Click the Format button in the Home tab of the Ribbon.
- 3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu (see Figure 1.27 "Format Drop-Down Menu").
- 4. Click the Unhide Columns option in the submenu of options (see Figure 1.30 "Hide & Unhide Submenu"). Column C will now be visible on the worksheet.

Keyboard Shortcuts – Unhiding Columns

Unhiding Columns

• Highlight cells on either side of the hidden column(s), then hold down the CTRL key and the SHIFT key while pressing the close parenthesis key ()) on your keyboard.

The following steps demonstrate how to hide rows, which is similar to hiding columns:

- 1. Activate cell A3 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.
- 2. Click the Format button in the Home tab of the Ribbon.
- 3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu (see Figure 1.27 "Format Drop-Down Menu"). This will open a submenu of options.
- 4. Click the Hide Rows option in the submenu of options (see Figure 1.30 "Hide & Unhide Submenu"). This will hide Row 3.

Keyboard Shortcuts - Hiding Rows

• Hold down the CTRL key while pressing the number 9 key on your keyboard.

To unhide a row, follow these steps:

- 1. Highlight the range A2:A4 by activating cell A2 and clicking and dragging over to cell A4.
- 2. Click the Format button in the Home tab of the Ribbon.
- 3. Place the mouse pointer over the Hide & Unhide option in the drop-down menu (see Figure 1.27 "Format Drop-Down Menu").
- 4. Click the Unhide Rows option in the submenu of options (see Figure 1.30 "Hide & Unhide Submenu"). Row 3 will now be visible on the worksheet.

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Keyboard Shortcuts – Unhiding Rows

• Highlight cells above and below the hidden row(s), then hold down the CTRL key and the SHIFT key while pressing the open parenthesis key (() on your keyboard.

Skill Refresher – Hiding Columns and Rows

- 1. Activate at least one cell in the row(s) or column(s) you are hiding.
- 2. Click the Home tab of the Ribbon.
- 3. Click the Format button in the Cells group.
- 4. Place the mouse pointer over the Hide & Unhide option.
- 5. Click either the Hide Rows or Hide Columns option.

Inserting Columns and Rows

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.04 if starting with this skill.)

Using Excel workbooks that have been created by others is a very efficient way to work because it eliminates the need to create data worksheets from scratch. However, you may find that to accomplish your goals, you need to add additional columns or rows of data. In this case, you can insert blank columns or rows into a worksheet. The following steps demonstrate how to do this:

- 1. Activate cell C1 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.
- 2. Click the down arrow on the Insert button in the Home tab of the Ribbon (see Figure 1.32 "Insert Button (Down Arrow)").
- 3. Click the Insert Sheet Columns option from the drop-down menu (see Figure 1.33 "Insert Drop- Down Menu"). A blank column will be inserted to the left of Column C. The contents that were previously in Column C now appear in Column D. Note that columns are always inserted to the left of the activated cell.
- 4. Activate cell A3 in the Sheet1 worksheet by placing the mouse pointer over the cell location and clicking the left mouse button.
- 5. Click the down arrow on the Insert button in the Home tab of the Ribbon (see Figure 1.32 "Insert Button (Down Arrow)").





Keyboard Shortcuts – Inserting Columns

• Press the ALT key and then the letters *H*, *I*, and *C* one at a time. A column will be inserted to the left of the activated cell.

Figure 1.33 Insert Drop-Down Menu



6. Click the Insert Sheet Rows option from the drop-down menu (see Figure 1.33 "Insert Drop-Down Menu"). A blank row will be inserted above Row 3. The contents that were previously in Row 3 now appear in Row 4. Note that rows are always inserted above the activated cell.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Keyboard Shortcuts – Inserting Rows

• Press the ALT key and then the letters *H*, *I*, and *R* one at a time. A row will be inserted above the activated cell.

Skill Refresher - Inserting Columns and Rows

- 1. Activate the cell to the right of the desired blank column or below the desired blank row.
- 2. Click the Home tab of the Ribbon.
- 3. Click the down arrow on the Insert button in the Cells group.
- 4. Click either the Insert Sheet Columns or Insert Sheet Rows option

Moving Data

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.05 if you skipped the previous skill and are starting with this skill.)

Once data are entered into a worksheet, you can move it to different locations. The following steps demonstrate how to move data to different locations on a worksheet:

- 1. Highlight the range D2:D15 by activating cell D2 and clicking and dragging down to cell D15.
- 2. Bring the mouse pointer to the left edge of cell D2. You will see the white block plus sign change to cross arrows (see Figure 1.34 "Moving Data"). This indicates that you can left click and drag the data to a new location.
- 3. Left click and drag the mouse pointer to cellC2.
- 4. Release the left mouse button. The data now appears in Column C.
- 5. Click the Undo button in the Quick Access Toolbar. This moves the data back to Column D.

Figure 1.34 Moving Data

Clip	board 🗔	Font	r	8	Alignment	
	D2	▼ (* fx	Average Price			
1	A	В	C	D	E	F
1			0			
2	Month	Unit Sales	(. A	erage P	Sales Dolla	rs
3	1		Y	*		
4	January	2670		9.99	The cru	oss arrows
-	F - 1	2110		12.40	indicate t	hat this da

Integrity Check - Moving Data

Before moving data on a worksheet, make sure you identify all the components that belong with the series you are moving. For example, if you are moving a column of data, make sure the column heading is included. Also, make sure all values are highlighted in the column before moving it.

Deleting Columns and Rows

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.05 if starting with this skill.)

You may need to delete entire columns or rows of data from a worksheet. This need may arise if you need to remove either blank columns or rows from a worksheet or columns and rows that contain data. The methods for removing cell contents were covered earlier and can be used to delete unwanted data.

However, if you do not want a blank row or column in your workbook, you can delete it using the following steps:

- 1. Activate cell A3 by placing the mouse pointer over the cell location and clicking the left mouse button.
- **2**. Click the down arrow on the Delete button in the Cells group in the Home tab of the Ribbon.
- 3. Click the Delete Sheet Rows option from the drop-down menu (see Figure 1.35 "Delete Drop-Down Menu"). This removes Row 3 and shifts all the data (below Row 2) in the worksheet up one row.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Figure 1.35 Delete Drop-Down Menu

Keyboard Shortcuts – Deleting Rows

- Press the ALT key and then the letters *H*, *D*, and *R* one at a time. The row with the activated cell will be deleted.
- Or, highlight the entire row by clicking in the row number box, holding the Ctrl key and pressing the minus (-) key.

Figure 1.35 Delete Drop-Down Menu



- 4. Activate cell C1 by placing the mouse pointer over the cell location and clicking the left mouse button.
- 5. Click the down arrow on the Delete button in the Cells group in the Home tab of the Ribbon.
- 6. Click the Delete Sheet Columns option from the drop-down menu (see Figure 1.35 "Delete Drop- Down Menu"). This removes Column C and shifts all the data in the worksheet (to the right of Column B) over one column to the left.

Keyboard Shortcuts - Deleting Columns

• Press the ALT key and then the letters *H*, *D*, and *C* one at a time. The column with the activated cell will be deleted.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Skill Refresher – Deleting Columns and Rows

- 1. Activate any cell in the row or column that is to be deleted.
- 2. Click the Home tab of the Ribbon.
- 3. Click the down arrow on the Delete button in the Cells group.
- 4. Click either the Delete Sheet Columns or the Delete Sheet Rows option

Key Takeaways

- Column headings should be used in a worksheet and should accurately describe the data contained in each column.
- Using symbols such as dollar signs when entering numbers into a worksheet can slow down the data entry process.
- Worksheets must be carefully proofread when data has been manually entered
- The Undo command is a valuable tool for recovering data that was deleted from a worksheet.
- When using a worksheet that was developed by someone else, look carefully for hidden column or rows

1.3 Formatting and Data Analysis

LEARNING OBJECTIVES

- 1. Use formatting techniques to enhance the appearance of a worksheet.
- 2. Understand how to align data in cell locations.
- 3. Examine how to enter multiple lines of text in a cell location.
- 4. Understand how to add borders to a worksheet.
- 5. Examine how to use the AutoSum feature to calculate totals.
- 6. Understand how to insert a chart into a worksheet.
- 7. Use the Cut, Copy, and Paste commands to manipulate the data on a worksheet.
- 8. Examine how to use the Sort command to rank data on a worksheet.
- 9. Understand how to move, rename, insert, and delete worksheet tabs.

This section addresses formatting commands that can be used to enhance the visual appearance of a worksheet. It also introduces mathematical calculations and charts. The skills introduced in this section will give you powerful tools for analyzing the data that we have been working with in this workbook and will highlight how Excel is used to make key decisions in virtually any career.

Formatting Data and Cells

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.04 if starting with this skill.)

Enhancing the visual appearance of a worksheet is a critical step in creating a valuable tool for you or your coworkers when making key decisions. The following steps demonstrate several fundamental formatting skills that will be applied to the workbook that we are developing for this chapter. Several of these formatting skills are identical to ones that you may have already used in other Microsoft applications such as Microsoft® Word® or Microsoft® PowerPoint®.

- 1. Highlight the range A2:D2 in the Sheet1 worksheet by placing the mouse pointer over cell A2 and left clicking and dragging to cell D2.
- 2. Click the Bold button in the Font group of commands in the Home tab of the Ribbon (see Figure 1.36 "Font Group of Commands").

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted





- 3. Highlight the range B15:D15 by placing the mouse pointer over cell A15 and left clicking and dragging to cell D15.
- 4. Click the Bold button in the Font group of commands in the Home tab of the Ribbon.
- 5. Click the Italics button in the Font group of commands in the Home tab of the Ribbon.
- 6. Highlight the range B15:D15. Click the drop-down arrow next to the Borders button in the Font group of commands in the Home tab of the Ribbon. From the drop-down, select the Top and Double Bottom border style. This is a standard business/accounting presentation of totals in a worksheet and denotes the end of a set of data.

Figure 1.36b Border Icon



- 7. Highlight the range B3:B14 by placing the mouse pointer over cell B3 and left clicking and dragging down to cell B14.
- 8. Click the Comma Style button in the Number group of commands in the Home tab of the Ribbon (see Figure 1.37 "Number Group of Commands").





- 9. Click the Decrease Decimal button in the Number group of commands in the Home tab of the Ribbon (see Figure 1.37 "Number Group of Commands").
- 10. The numbers will also be reduced to zero decimal places.
- 11. Highlight the range C3:D3 by placing the mouse pointer over cell C3 and left clicking and dragging across to cell D3.
- 12. Click the Accounting Number Format button in the Number group of commands in the Home tab of the Ribbon (see Figure 1.37 "Number Group of Commands"). This will add the US currency symbol and two decimal places to the values. This format is common when working with pricing data.

Keyboard Shortcuts Bold Format • Hold the CTRL key while pressing the letter *B* on your keyboard. Italics Format • Hold the CTRL key while pressing the letter I on your keyboard. Underline Format • Hold the CTRL key while pressing the letter U on your keyboard.

Why?

Format Column Headings and Totals

Applying formatting enhancements to the column headings and column totals in a worksheet is a very important technique, especially if you are sharing a workbook with other people. These formatting techniques allow users of the worksheet to clearly see the column headings that define the data. In addition, the column totals usually contain the most important data on a worksheet with respect to making decisions, and formatting techniques allow users to quickly see this information

- 13. Highlight the range C4:D14 by placing the mouse pointer over cell D3 and left clicking and dragging down to cell D14.
- 14. Click the Comma symbol to the values as well as two decimal places.
- 15. Highlight D3:D14 and click the Decrease Decimal button twice in the Number group of commands in the Home tab of the Ribbon. You are decreasing the decimals to none because the Sales Dollars do not have any cents displayed. Decimal places when only zeroes are displayed adds clutter to your worksheet.
- 16. This will add the comma style to the values and reduce the decimal places to zero. The comma style aligns the numbers in the cells with the Accounting style where \$ are displayed.
- 17. Highlight the range A1:D1 by placing the mouse pointer over cell A1 and left clicking and dragging over to cell D1.
- 18. Click the down arrow next to the Fill Color button in the Font group of commands in the Home tab of the Ribbon (see Figure 1.38 "Fill Color Palette").
- 19. Click the Aqua, Accent 5, Darker 25% color from the palette (see Figure 1.38 "Fill Color Palette").

Notice that as you move the mouse pointer over the color palette, you will see a preview of how the color will appear in the highlighted cells.

Figure 1.38 Fill Color Palette

	A Cal	bri -	11	- A' A' = = =	\$~-	膏	General	
Pas	ite 🦪 B	I <u>U</u> - E	-	<u>⊘.*</u> A· = = =	**	-4-	Click this down arrow open the Fill Color Pa	w to
lipl	board Ty	Font		Theme Colors		5	Numt	
	AI	• (*)						
Å	A	В				F	G	
1								
2	Month	Unit Sales	Av			100 - 11 34 K	Contraction of the	
3	January	2,670	S	Standard Colors	Aqua, A	ccent 5, 1	Darker 25%	
4	February	2,160	S					
5	March	515	5	No Fill	*			
	1		ċ	The Mary Colors	-			

- 20. Click the down arrow next to the Font Color button in the Font group of commands in the Home tab of the Ribbon (see Figure 1.36 "Font Group of Commands"), and select White for the font color. This change will be visible once text is typed into the highlighted cells.
- 21. Click the Increase Font Size button in the Font group of commands in the Home tab of the Ribbon (see Figure 1.38 "Fill Color Palette"). Each click will increase the font size 1 point.
- 22. Highlight the range A1:D15 by placing the mouse pointer over cell A1 and left clicking and dragging down to cell D15.
- 23. Click the drop-down arrow on the right side of the Font button in the Home tab of the Ribbon (see Figure 1.36 "Font Group of Commands").
- 24. Notice that as you move the mouse pointer over the font style options, you can see the font change in the highlighted cells.
- 25. Expand the row width of Column D to 10 characters.

Figure 1.39 "Formatting Techniques Applied" shows how the Sheet1 worksheet should appear after the formatting techniques are applied.

Figure 1.39 Formatting Techniques Applied

E	5-ೇ -			Excel_Obje	ective_1.04 -
Fik	e Home Inse	rt Draw	Page Layout	Formulas Da	ta Revie
Past	Calibri B I U	• 12 • • □ • □ ▲	A A ≡ ≡	E = ↔ · E	General \$ - € • €.00 .00 5 Numb
A1		√ f _x			
	А	В	С	D	E
1]			
2	Month	Unit Sales	Average P	Sales Dollars	
3	January	2,670	\$ 9.99	\$ 26,685	
4	February	2,160	12.49	26,937	
5	March	515	14.99	7,701	
6	April	590	17.49	10,269	
7	May	1,030	14.99	15,405	
8	June	2,875	12.49	35,916	
9	July	2,700	9.99	26,937	
10	August	900	19.99	17,958	
11	September	775	19.99	15,708	
12	October	1,180	19.99	23,562	
13	November	1,800	17.49	31,416	
14	December	3,560	14.99	53,370	
15	Total Sales				
16					
47					

Why?

Pound Signs (####) Appear in Columns

When a column is too narrow for a long number, Excel will automatically convert the number to a series of pound signs (####). In the case of words or text data, Excel will only show the characters that fit in the column. However, this is not the case with numeric data because it can give the appearance of a number that is much smaller than what is actually in the cell. To remove the pound signs, increase the width of the column.

1.4 Data Alignment

Data Alignment (Wrap Text, Merge Cells, and Center)

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.06 if starting with this skill.)

The skills presented in this segment show how data are aligned within cell locations. For example, text and numbers can be centered in a cell location, left justified, right justified, and so on. In some cases, you may want to stack multiword text entries vertically in a cell. instead of expanding the width of a column. This is referred to as wrapping text. These skills are demonstrated in the following steps:

- 1. Highlight the range B2:D2 by placing the mouse pointer over cell B2 and left clicking and dragging over to cell D2.
- 2. Click the Center button in the Alignment group of commands in the Home tab of the Ribbon (see Figure 1.40 "Alignment Group in Home Tab"). This will center the column headings in each cell location.



Figure 1.40 Alignment Group in Home Tab

3. Click the Wrap Text button in the Alignment group (see Figure 1.40 "Alignment Group in Home Tab"). The height of Row 2 automatically expands, and the words that were cut off because the columns were too narrow are now stacked vertically (see Figure 1.42 "Sheet1 with Data Alignment Features Added").

Keyboard Shortcuts - Wrap Text

• Press the ALT key and then the letters *H* and *W* one at a time.

Why?

Wrap Text

The benefit of using the Wrap Text command is that it significantly reduces the need to expand the column width to accommodate multiword column headings. The problem with increasing the column width is that you may reduce the amount of data that can fit on a piece of paper or one screen. This makes it cumbersome to analyze the data in the worksheet and could increase the time it takes to make a decision.

- 4. Highlight the range A1:D1 by placing the mouse pointer over cell A1 and left clicking and dragging over to cell D1.
- **5**. Click the down arrow on the right side of the Merge & Center button in the Alignment group of commands in the Home tab of the Ribbon.
- 6. Left click the Merge & Center option (see Figure 1.41 "Merge Cell Drop-Down Menu"). This will create one large cell location running across the top of the dataset with centered text.



Figure 1.41 Merge Cell Drop-Down Menu

Why? Merge & Center One of the most common reasons the Merge & Center command is used is to center the title of a worksheet directly above the columns of data. Once the cells above the column headings are merged, a title can be centered above the columns of data. It is very difficult to center the title over the columns of data if the cells are not merged.

Figure 1.42 "Sheet1 with Data Alignment Features Added" shows the Sheet1 worksheet with the data alignment commands applied. The reason for merging the cells in the range A1:D1 will become apparent in the next segment.

E	5 •∂•∓			Excel_0	bjective_1.
Fil	e Home Inse	rt Draw	Page Layout	Formulas	Data F
Past	Calibri	• 12 •	• A • ≡	=	Ge \$ □ ▼ *
Al	e i la	Font	154	Alignment	Ta I P
AI	A	B	С	D	F
1			~		
2	Month	Unit Sales	Average Price	Sales Dollars	The cell range A1:D1 is merged into one cell.
3	January	2,670	\$ 9.99	\$ 26,685	
4	February	2,160	12.49	26,937	
5	March	515	14.99	7,701	The Wran Text feature was
6	April	590	17.49	10,269	applied to the range B2:D2.
7	May	1,030	14.99	15,405	
8	June	2,875	12.49	35,916	
9	July	2,700	9.99	26,937	
10	August	900	19.99	17,958	
11	September	775	19.99	15,708	
12	October	1,180	19.99	23,562	
13	November	1,800	17.49	31,416	
14	December	3,560	14.99	53,370	
15	Total Sales				
16					

Figure 1.42 Sheet1 with Data Alignment Features Added

Skill Refresher – Wrap Text

- 1. Activate the cell or range of cells that contain text data.
- 2. Click the Home tab of the Ribbon.
- 3. Click the Wrap Text button.

Skill Refresher - Merge Cells

- 1. Highlight a range of cells that will be merged.
- 2. Click the Home tab of the Ribbon.
- 3. Click the Merge & Center button.

Creating Multi-Line Worksheet Titles

Your worksheets need to tell their story without a person there to explain them. They need to be clearly labeled and formatted for ease of understanding. However, one important part of the story that often gets left out is the title of the story. All worksheets should include an informative title that describes the contents of the worksheet and the date, or range of dates, the data pertains to. We will include a title.

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.07 if starting with this skill.)

In the Sheet1 worksheet, the cells in the range A1:D1 were merged for the purposes of adding a title to the worksheet. This title will require that three lines of text be entered into a cell. The following steps explain how you can enter text into a cell and determine where you want the second line of text to begin:

- 1. Activate cell A1 in the Sheet1 worksheet by placing the mouse pointer over cell A1 and clicking the left mouse button. Since the cells were merged, clicking cell A1 will automatically activate the range A1:D1.
- 2. Type the text **General Merchandise World**.
- **3.** Hold down the ALT key and press the ENTER key. This will start a new line of text in this cell location.
- 4. Type the text **2017 Retail Sales (in millions)** and press the ENTER key.
- **5**. Select cell A1. Then click the Italics button in the Font group of commands in the Home tab of the Ribbon.
- 6. Increase the height of Row 1 to 30 points. Once the row height is increased, all the text typed into the cell will be visible (see Figure 1.43 "Title Added to the Sheet1 Worksheet").

Figure 1.43 Title Added to the Sheet1 Worksheet

-				Excel Ch	postive_1.07	
T last +	3. 3. 3. 3. 3. 3. 3. 3. 3. 3.	+]e + + ≡+ ≙	∧° ∧° = : • ∧ • =	- 11 6 - 11 11	6eren 5 - 12 - 22 - 2	1000 1000 2000
1421	board G	Fort	General M	Asprenent	G Rappi	0.41
-1	A	в	C	D	E	
1	Gene 2017	ral Mercho Retail Sale	andise Wo s (in millio	rld ins)		
2	Month	Unit Sales	Average Price	Sales Dollars		Title
3	January	2,670	\$ 9.99	\$ 26,685		
4	February	2,160	12.49	26,937		
5	March	515	14.99	7,701		
6	April	590	17.49	10,269		
7	May	1,030	14.99	15,405		
8	June	2,875	12.49	35,916		
9	July	2,700	9.99	26,937		
10	August	900	19.99	17,958		
11	September	775	19.99	15,708		
12	October	1,180	19.99	23,562		
13	November	1,800	17.49	31,416		
14	December	3,560	14.99	53,370		
15	Total Sales					
16						

Skill Refresher - Entering Multiple Lines of Text

- 1. Activate a cell location.
- 2. Type the first line of text.
- 3. Hold down the ALT key and press the ENTER key.
- 4. Type the second line of text and press the ENTER key.

Borders (Adding Lines to a Worksheet)

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.08 if starting with this skill.)

In Excel, adding custom lines to a worksheet is known as adding borders. Borders are different from the grid lines that appear on a worksheet and that define the perimeter of the cell locations. The Borders command lets you add a variety of line styles to a worksheet that can make reading the worksheet much easier.

The following steps illustrate methods for adding preset borders and custom borders to a worksheet:

1. Highlight cells A2:D2.



<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

- 2. Click the down arrow to the right of the Borders button in the Font group of commands in the Home page of the Ribbon (see Figure 1.44 "Borders Drop-Down Menu").
- E Insert Page Layout Formulas Data Click this down arrow to open the Borders Ж drop-down menu. Paste R U 9 Clipboard Click here to remove all 41 ٠ lines from the highlighted Tag Sarder range of cells. B Left Border General Bight Sord Click here to apply vertical 2011 Retail S 1 and horizontal lines to the No Borde Unit highlighted range of cells. Sale 2 Month all Borders -3 2.61 January FT I Outside Borders February 4 2,16 Thick Bax Border S March 5 Eattom Double Border April 6 5 Click here to apply vertical and horizontal lines to the Thick Bottom Barder May Ż 1.0: highlighted range of cells. Top and Bottom Border 8 June 2.8 22 9 July 2.70 Top and Thick Sottom Border 10 August 90 Top and Double Bottom Border 11 September 7 Draw Borders 12 October 1,18 1 Drag Border 13 November 1.80 Draw Border Grid December 3.5 14 Erase Sorder P Total Sale 15 Line Color 16 Line Style H + + H Shgett Sheet Click here to open the More Borders. Borders tab of the Format Ready Cells dialog box. The selected borders option will be applied to the highlighted range of cells.
- Figure 1.44 Borders Drop-Down Menu

- **3**. Left click the All Borders option from the Borders drop-down menu (see Figure 1.44 "Borders Drop- Down Menu"). This will add vertical and horizontal lines to the range A2:D2.
- 4. Highlight the range A2:D2 by placing the mouse pointer over cell A2 and left clicking and dragging over to cell D2.
- 5. Click the down arrow to the right of the Borders button.
- 6. Left click the Thick Bottom Border option from the Borders drop-down menu.
- 7. Highlight the range A1:D15.

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

- 8. Click the down arrow to the right of the Borders button.
- 9. This will open the Format Cells dialog box (see Figure 1.45 "Borders Tab of the Format Cells Dialog Box"). You can access all formatting commands in Excel through this dialog box.
- 10. In the Style section of the Borders tab, left click the thickest line style (see Figure 1.45 "Borders Tab of the Format Cells Dialog Box").
- 11. Left click the Outline button in the Presets section (see Figure 1.45 "Borders Tab of the Format Cells Dialog Box").
- 12. Click the OK button at the bottom of the dialog box (see Figure 1.45 "Borders Tab of the Format Cells Dialog Box").



Figure 1.45 Borders Tab of the Format Cells Dialog Box

Figure 1.46 Borders Added to the Sheet1 Worksheet

	А	В	С	D	
	Gener	al Mercha	ndise Wo	rld	
	2017 R	Retail Sale	s (in millio	ins)	
		Unit	Average	Sales	
	Month	Sales	Price	Dollars	
	January	2,670	\$ 9.99	\$ 26,685	
	February	2,160	12.49	26,937	
	March	515	14.99	7,701	
	April	590	17.49	10,269	
	May	1,030	14.99	15,405	
	June	2,875	12.49	35,916	
	July	2,700	9.99	26,937	
)	August	900	19.99	17,958	
	September	775	19.99	15,708	
2	October	1,180	19.99	23,562	
5	November	1,800	17.49	31,416	
ł	December	3,560	14.99	53,370	
;	Total Sales				

Skill Refresher – Preset Borders

- 1. Highlight a range of cells that requireborders.
- 2. Click the Home tab of the Ribbon.
- 3. Click the down arrow next to the Borders button.
- 4. Select an option from the preset borders list.

Skill Refresher – Custom Borders

- Highlight a range of cells that require borders. Click the Home tab of the Ribbon.
- 2. Click the down arrow next to the Borders button.
- 3. Select the More Borders option at the bottom of the options list.
- 4. Select a line style and line color.
- 5. Select a placement option.
- 6. Click the OK button on the dialog box.

AutoSum

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.09 if starting with this skill.)

You will see at the bottom of Figure 1.46 "Borders Added to the Sheet1 Worksheet" that Row 15 is intended to show the totals for the data in this worksheet. Applying mathematical computations to a range of cells is accomplished through functions in Excel. Chapter 2 "Mathematical Computations" will review mathematical formulas and functions in detail. However, the following steps will demonstrate how you can quickly sum the values in a column of data using the AutoSum command:

- 1. Activate cell B15 in the Sheet1worksheet.
- 2. From the right side of the Home Ribbon, or the left side of the Formula ribbon, click the down arrow next to the AutoSum button. You will see that the AutoSum can sum, average, count numbers, and create Max and Min functions.

Θ.	and a company			3	licet, Obe	1014,120	. Becel		interes McGlar	in 100		a	2
	Hame	err Dree	Page Layout	Fermates	Des	-	-					8	-
	Callor M 2 9	-[1] - -	× × =	= 50 80 - = 50 80 Migroid	路 田・ 1	General \$ - % 53 -23 Norther	· Ricon Uprom	dilloanal Formatting nation Tables - Tigles - Tigles	in Billion An Dia Bill Person Com	N N	E Jam Brand David	O.	1
	A	8	с +7 40	0	Land	Apre 1 440 1 1	F	G	H	Cogenet	NAME OF THE OWNER	estam.	
	141000	uner Denne	Page Lanta	Ferrudat	thats	Reason		Q Telline who					
Jx topen function	Σ Autotase 1 Σ Sum downeys Crown Ho	and Logical and archaes	r III - III - Yana - III -	Rarra di ci	Street Falser on one Falser ongline frager and Filamine	nia - Selaction	De Traca P - S Traca D 25, Remov	rectebereta 🔥 Ingenedertik 🍲 = 4. Automa = 🛞 Pantrake Austiturg	Watch Window	Calculation Calculation Calculation	100 100		
133	3.6++		6										
al.	Mart Lat	them.	c	D		E	E.	G	н	-	1	1.	

Figure 1.47 AutoSum Drop-Down List

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License,

- 3. The default command for AutoSum is Sum. Select Sum from the drop-down list. (see Figure 1.47 "AutoSum Drop-Down List"). Note that the AutoSum button can also be found in the Editing group of commands in the Home tab of the Ribbon.
- 4. Excel will provide a total for the values in the Unit Sales column.
- 5. Click in cell D15 and click the AutoSum button. You will see that with this sum the Accounting format (\$) has been applied to your total row. Excel will copy the formatting from your top row as the default number format for your total row. (*Note: you should not add the Average Price column because it is only a list of prices.*)

	~	D	C	U
	Gener	al Mercho	indise Wo	rld
1	2017 R	Retail Sale	s (in millio	ons)
		Unit	Average	Sales
2	Month	Sales	Price	Dollars
3	January	2,670	\$ 9.99	\$ 26,685
4	February	2,160	12.49	26,937
5	March	515	14.99	7,701
6	April	590	17.49	10,269
7	May	1,030	14.99	15,405
8	June	2,875	12.49	35,916
9	July	2,700	9.99	26,937
10	August	900	19.99	17,958
11	September	775	19.99	15,708
12	October	1,180	19.99	23,562
13	November	1,800	17.49	31,416
14	December	3,560	14.99	53,370
15	Total Sales	20,755		\$ 291,864

Figure 1.48 Totals Added to the Sheet1 Worksheet

1.5 Simple Chart

Inserting a Column Chart

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.10 if starting with this skill.)

As mentioned at the beginning of this chapter, Excel serves as a critical tool for making decisions in both personal and professional contexts. Charts are a powerful tool in Excel that allow you to graphically display the data in a worksheet. Graphical displays allow the

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted reader to immediately identify key trends and behaviors in the data that is being analyzed. For the workbook that we are using for this chapter, understanding the trends in monthly sales data is critical for making decisions such as how many staff members to assign to the store for each month as well as supplying the store with enough inventory to accommodate expected sales. To assist the reader in analyzing this data, a column chart will be created to graphically display the data. It is important for you to plan which type of chart will best display the data so your readers can quickly see key trends. More details on creating charts and on chart types will be presented in a later chapter. The following steps are an introduction to creating the column chart required for this chapter's objective:

- 1. Highlight the range A2:B14.
- 2. Click the Insert tab of the Ribbon.
- **3**. Click the Column button (see Figure 1.49 "Column Chart Drop-Down Menu"). This will open the column chart drop-down menu of options.
- 4. Select the Clustered Column option from the list of column chart options (see Figure 1.49 "Column Chart Drop-Down Menu"). This will create an *embedded chart* in the Sheet1 worksheet (see Figure 1.50 "Embedded Column Chart in Sheet1"). Embedded means that the chart is on the worksheet that contains the original chart data. The chart is floating on the top of the worksheet and can be moved and sized on the face of the worksheet.

Figure 1.49 Column Chart Drop-Down Menu

E	5 • ♂• ∓				Excel_Obj	ective_1.10 -	
Fil	e Home In	sert Draw	Page Layout	Formulas	Data	Review	
Pivot A2	Table Recommended PivotTables Tables	Table Illustratie	Add- ins - Re Month	commend to a	K - III Charts	ee F	2-D Column 3-D Column 3-D Column
1	Gen 2017	eral Mercha Retail Sale Unit	ndise Wo s (in millic Average	Colu but	umn ton		
2	Month	Sales	Price	Dollars		la	3-D Bar
3	January	2,670	\$ 9.99	\$ 26,68	5	5,5	e 编 编
4	February	2,160	12.49	26,93	7	7,7	Ind More Column Charts
5	March	515	14.99	7,70	1	0,7	
6	April	590	17.49	10,26	9		
7	May	1,030	14.99	15,40	5		
8	June	2,875	12.49	35.91	6		
9	July	2,700	9.99	26,93	7		
10	August	900	19.99	17,95	8		Excel will use the
11	September	775	19.99	15,70	8		highlighted data to
12	October	1,180	19.99	23,56	2		create a chart
13	November	1,800	17.49	31,41	6		
14	December	3,560	14.99	53,37	0		
15	Total Sales	20,755		\$ 291,86	4		

Figure 1.50 "Embedded Column Chart in Sheet1" shows the column chart that is created once a selection is made from the column chart drop-down menu. Notice that there are two new tabs added to the Ribbon. These tabs contain features for enhancing the appearance and construction of Excel charts. These commands will be covered in more detail in a later chapter. For now, you will see that Excel places the chart over the data in the worksheet. The following steps explain how to move and resize the chart:.



Figure 1.50 Embedded Column Chart in Sheet1

- 5. While the chart is selected (buttons are visible around the outside of the chart), left click anywhere it the chart and drag the chart so the upper left corner is placed in the middle of cell F1.
- 6. Place the mouse pointer over the top center sizing handle (see Figure 1.50 "Embedded Column Chart in Sheet1"). You will see the mouse pointer change from a white block plus sign to a vertical double arrow. Make sure the mouse pointer is not in the cross-arrow mode as this will move the chart instead of resizing it.
- 7. While holding down the ALT key on your keyboard, left click and drag the mouse pointer slightly up. The chart will automatically adjust up to the top of Row 1.
- 8. Place the mouse pointer over the left center sizing handle.
- 9. While holding down the ALT key on your keyboard, left click and drag the mouse slightly toward the left. The chart will automatically adjust to the left side of Column F.
- 10. Place the mouse pointer over the lower center sizing handle.
- 11. While holding down the ALT key on your keyboard, left click and drag the mouse slightly down. The chart will automatically adjust to the bottom of Row14.
- **12**. Place the mouse pointer over the right center sizing handle.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

13. While holding down the ALT key on your keyboard, left click and drag the mouse slightly to the right. The chart will automatically adjust to the right side of Column M.

Why?

There Are No Sizing Handles on a Chart

If you do not see the dots or sizing handles around the perimeter of a chart, it could be that the chart is not activated. To activate a chart, left click anywhere on the chart.

Figure 1.52 "Embedded Chart Moved and Resized" shows the column chart moved and resized. Notice that the sizing handles are not visible around the perimeter of the chart. This is because the chart is not activated. Once you click anywhere on the worksheet outside the chart area, the chart is automatically deactivated.

Figure 1.52 Embedded Chart Moved and Resized



Why?

Use the ALT Key When Resizing a Chart

Using the ALT key while resizing an embedded chart locks the perimeter of the chart to the columns and rows of the worksheet. This gives you the ability to adjust the chart to precise sizes as you adjust the width and height of the worksheet rows and columns

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

As shown in Figure 1.50 "Embedded Column Chart in Sheet1", when a chart is created, two tabs are added to the Ribbon. The following steps explain how to use a few of the formatting and design features in these tabs:

- 1. Check to make sure the column chart in Sheet1 is activated. To activate the chart, left click anywhere on the chart.
- 2. Click the Design tab under the Chart Tools set of tabs on the Ribbon.
- 3. Click the down arrow on the right side of the Chart Styles section (see Figure 1.53 "Chart Styles in the Design Tab").

Figure 1.53 Chart Styles in the Design Tab



- 4. Click Style 9 in the Chart Styles section. This style has a black background with blue columns (see Figure 1.53 "Chart Styles in the Design Tab").
- 5. Click the Format tab under the Chart Tools set of tabs on the Ribbon.
- 6. Click the down arrow on the right side of the WordArt Styles section (see Figure in).

Excel **Chart Tools** Design Q Tell me what you was Formulas Data Review View Format out 🖄 Shape Fill 🔻 Abc Abc Abc Shape Outline • Ŧ G Shape Effects ▼ 86 Shape Styles G, WordArt styles 15 Word Art styles down arrow. G н D e World Unit Sa millions

Figure 1.54 WordArt Styles in the Format Tab

<u>@080</u>

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted 7. Click the Blue, Accent 1, Inner Shadow option Notice that as you move the mouse pointer over the WordArt Styles options, the format of the chart title as well as the X and Y axis titles changes.

Figure 1.55 "Formatting Features Applied to the Column Chart" shows the embedded column chart with the formatting features applied. This chart is very effective in displaying the Unit Sales trends for this company. You can see very quickly that the tallest bar in the chart is the month of December, followed by the months of June, July, January, and February.



Figure 1.55 Formatting Features Applied to the Column Chart

Skill Refresher – Creating a Column Chart

- 1. Highlight a range of cells that contain data that will be used to create the chart.
- 2. Click the Insert tab of the Ribbon.
- 3. Click the Column button in the Charts group.
- 4. Select an option from the Column drop-down menu.

Cut, Copy, and Paste

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.11 if starting with this skill.)

The Cut, Copy, and Paste commands are perhaps the most widely used commands in Microsoft Office. With regard to Excel, the Copy and Paste commands are often used to make copies of worksheets for developing different scenarios or versions for the data being

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted analyzed. The following steps demonstrate how these commands are used for the objective in this chapter:

1. Click the Select All button in the upper left corner of the Sheet1 worksheet (see Figure 1.56 "Clipboard Group of Commands").



Figure 1.56 Clipboard Group of Commands

2. Click the Copy button in the Clipboard group of commands in the Home tab of the Ribbon (see Figure 1.56 "Clipboard Group of Commands").

Keyboard Shortcuts - Command: Copy

- Press the CTRL key and then the letter *C* key on your keyboard.
 - 3. Create a new worksheet by clicking on the + button to the right of the Sheet1 tab.



- 4. Activate cell location A1.
- 5. Click the Paste button in the Clipboard group of commands in the Home tab of the Ribbon. Be sure to click the upper area of the Paste button and not the down arrow at the bottom of the button. A copy of Sheet1 will now appear in Sheet2.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Keyboard Shortcuts- Paste

- Press the CTRL key and then the letter V key on your keyboard.
 - 6. Click anywhere on the chart in the Sheet2worksheet.
 - 7. Click the Cut button in the Clipboard group on the Home tab of the Ribbon. This will remove the chart from the Sheet2worksheet.

Keyboard Shortcuts - Cut

• Press the CTRL key and then the letter *X* key on your keyboard.

- 8. Open the Sheet3 worksheet by left clicking on the Sheet3 worksheet tab at the bottom of the workbook.
- 9. Activate cell location A1.
- **10**. Click the Paste button in the Home tab of the Ribbon. This will paste the chart from the Sheet2 worksheet into the Sheet3worksheet.

Sorting Data (One Level)

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.12 if starting with this skill.)

As mentioned earlier in this section, a chart is a tool that enables worksheet readers to analyze data quickly to spot key trends or patterns. Another powerful tool that provides similar benefits is the Sort command. This feature ranks the rows of data in a worksheet based on designated criteria. The following steps demonstrate how the Sort command is used to rank the data in the Sheet2 worksheet:

- 1. In the Sheet2 worksheet, highlight the range A2:D14
- 2. Click the Data tab of the Ribbon.
- 3. Click the Sort button in the Sort & Filter group of commands. This will open the Sort dialog box (see Figure 1.57 "Sort & Filter Group of Commands").

Figure 1.57 Sort & Filter Group of Commands

	File Home	F C	ata tab	ormulas Data	Exci Review Vie	el Objective 1.0 - Mie w	crosoft
	From Access From Web From Text Sour Get Extern	Other Existin ces * Connecti	g ons All +	Connections Properties GB Edit Links onnections	2 J ZZ ZZ Sort La So	Filter	Text t Colum
	AZ	▼ (* fs	Month	/	Sort		
1	A	В	C		Show the	Sort dialog box to sort	
	Gen	eral Merch	andise	Sort button	data base	ed on several criteria at	
1	2011	Retail Sale	es (in mill	lions)	once.		
		Unit	Average	Sales	Press	F1 for more help.	
2	Month	Sales	Price	Dollars			
3	January	2,670	\$ 9.99	\$ 26,685			

4. Click the down arrow next to the "Sort by" drop-down box in the Sort dialog box (see Figure 1.58 "Sort Dialog Box"). Make sure the box "My data has headers" is checked.

Figure 1.58 Sort Dialog Box

Add	Level .	X Delete Level	Copy Level		Options		My data h	as beaders	
Column			Sort On			Order			
iort by		6	Values			A to Z		•	-
	Soles (oolars c		ownlist	1			Click here to s to ascending o	et the sort criteria r descending orde

- 5. Click the Unit Sales option from the drop-downlist.
- 6. Click the down arrow next to the Order drop-downbox.
- 7. Click Largest to Smallest from the drop-downlist.
- 8. Click the OK button at the bottom of the Sort dialog box. The data in the range A2:D14 will now be sorted in descending order based on the values in the Unit Sales column. (Note that when you perform the sort, your chart will automatically change to match the new sorted data.)

Integrity Check - Sorting Data

Carefully check the data you are sorting. It is critical that all columns are in a contiguous range of data before sorting. If Excel detects that you are trying to sort only part of a contiguous range of data, it will give you a warning dialog box.

Figure 1.59 "Data Sorted Based on Unit Sales" shows the data in the Sheet2 worksheet sorted based on the values in the Unit Sales column. Similar to the chart, the Sort command makes it easy to identify the months of the year with the highest unit sales.

	From Access From Web From Text Get Externu	Other Existin es * Connecti	Refresh All •	Connections	24 <u>2</u> 24 5	art F	itter	, Clear Teapy Advar
-	11 .	• (+ J.	1				Car i frida	_
1	A	B	С	D	E		F	
1	Gene 2017	eral Mercho Retail Sale	andise Wo s (in millic	rld ons)				
z	Month	Unit Sales	Average Price	Sales Dollars				
3	December	3,560	14.99	53,370	1			
Į.	June	2,875	12.49	35,916				
5	July	2,700	9.99	26,937				
5.	January	2,670	\$ 9.99	\$ 26,685				
	February	2,160	12.49	26,937		Data is	sorter	haso
\$	November	1,800	17.49	31,416		on the	value	s in th
1	October	1,180	19.99	23,562	1	Unit	Sales co	olumn
0	May	1,030	14.99	15,405			1.110.000	
1	August	900	19.99	17,958				
2	September	775	19.99	15,708				
3	April	590	17.49	10,269				
4	March	515	14.99	7,701	1			
5	Total Sales	20,755		\$ 291,864				

Figure 1.59 Data Sorted Based on Unit Sales

Skill Refresher - Sorting Data (One Level)

- 1. Make any cell active in a range of contiguous cells to be sorted.
- 2. Click the Data tab of the Ribbon.
- 3. Click the Sort button in the Sort & Filter group.
- 4. Select a column from the "Sort by" drop-down list.
- 5. Select a sort order from the Order drop-downlist.
- 6. Click the OK button on the Sort dialogbox.

Moving, Renaming, Inserting, and Deleting Worksheets

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.13 if starting with this skill.)

The default names for the worksheet tabs at the bottom of workbook are Sheet1, Sheet2, and so on. However, you can change the worksheet tab names to identify the data you are using in a workbook. Additionally, you can change the order in which the worksheet tabs. appear in the workbook. The following steps explain how to rename and move the worksheets in a workbook:

1. With the left mouse button, double click the Sheet1 worksheet tab at the bottom of the workbook (see Figure 1.60 "Renaming a Worksheet Tab"). NOTE: This screenshot is an older version of Excel. In the 2016 version, the add worksheet icon is

- 2. Type the name **Sales by Month**.
- 3. Press the ENTER key on your keyboard.
- 4. With the left mouse button, double click the Sheet2 worksheet tab at the bottom of the workbook.
- 5. Type the name **Unit Sales Rank**.
- 6. Press the ENTER key on your keyboard.

Figure 1.60 Renaming a Worksheet Tab



1. Left click and drag the Unit Sales Rank worksheet tab to the left of the Sales by Month worksheet tab.

2. Right click the Sheet3 worksheet tab. Click Delete to delete the worksheet. Alternatively, you can:

- a. Click the Home tab of the Ribbon.
- b. Click the down arrow on the Delete button in the Cells group of commands.
- c. Click the Delete Sheet option from the drop-down list .
- d. Click the Delete button on the Delete warning box.

3. Click the Insert Worksheet tab at the bottom of the workbook (see Figure 1.60 "Renaming a Worksheet Tab").

Integrity Check – Deleting Worksheets

Be very cautious when deleting worksheets that contain data. Once a worksheet is deleted, you cannot use the Undo command to bring the sheet back. Deleting a worksheet is a permanent command.

Keyboard Shortcuts - Inserting New Worksheets

• Press the SHIFT key and then the F11 key on yourkeyboard.
Figure 1.61 "Final Appearance of the Excel Objective 1.0 Workbook" shows the final appearance of the Excel Objective 1.0 workbook after the worksheet tabs have been renamed and moved.

h.	2 · C · · ·			Man	zotacel	1.0_Excel_O	bjective
Fi	e Home Inse	ert Draw	Page Layout	Formulas	Data	Review	View
1	Calibri	- 11 -	A* A* = =		8	General	
Past	BIU		· A · = =		.	\$ - 96	
Clip	board 74	Font	- 14	Alignment	16	Num	ber
H13	2 - 1 3	x v fe					
4	A	В	С	D	1	E	F
1	Gene 2011 I	ral Merch Retail Sal	andise W es (in mill	/orld ions)			
2	Month	Unit Sales	Average Price	Sales Dollars			
3	December	3,560	\$ 14.99	\$ 53,370	D		
4	June	2,875	12.49	35,916	6		
5	July	2,700	9.99	26,93	7		
6	January	2,670	9.99	26,68			
7	February	2,160	12.49	9 26.937			
8	November	1,800	17.49	31,416	6		
9	October	1,180	19.99	23,562	2		
10	May	1,030	14.99	15,40	5		
11	August	900	19.99	17,958	в		
12	September	775	19.99	15 70	R		
13	April	590	17 49	Wor	kshee	t tabs hav	ve
14	March	515	4.99	b	een r	enamed	
15	Total Sales	20,755		\$ 291,864	4		
16	+		+				
1	Unit Sa	les Rank S	ales by Month	Sheet3	+		
lead	w the					·(j)·	

Figure 1.61 Final Appearance of the Excel Objective 1.0 Workbook

Skill Refresher - Renaming Worksheets

- 1. Double click the worksheet tab.
- 2. Type the new name.
- 3. Press the ENTER key.

Skill Refresher - Moving Worksheets

- 1. Left click the worksheet tab.
- 2. Drag it to the desired position.

1.6 Printing

LEARNING OBJECTIVES

- 1. Use the Page Layout tab to prepare a worksheet for printing.
- 2. Add headers and footers to a printed worksheet.
- 3. Examine how to print worksheets and workbooks.

Once you have completed a workbook, it is good practice to select the appropriate settings. for printing. These settings are in the Page Layout tab of the Ribbon and discussed in this section of the chapter.

Page Setup

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.14 if starting with this skill.)

Before you can properly print the worksheets in a workbook, you must establish appropriate settings. The following steps explain several of the commands in the Page Layout tab of the Ribbon used to prepare a worksheet for printing:

1. Open the Unit Sales Rank worksheet by left clicking on the worksheet tab.

2. Click the Page Layout tab of the Ribbon.

3. Click the Margins button in the Page Setup group of commands. This will open a dropdown list of options for setting the margins of your printed document.

- 4. Click the Wide option from the Margins drop-downlist.
- 5. Open the Sales by Month worksheet by left clicking on the worksheet tab.

6. Click the Page Layout tab of the Ribbon (see Figure 1.62 "Page Layout Commands for

Printing").

- 7. Click the Margins button in the Page Setup group of commands.
- 8. Click the Narrow option from the Margins drop-downlist.
- 9. Click the Orientation button in the Page Setup group of commands.
- 10. Click the Landscape option.
- 11. Click the down arrow to the right of the Width button in the Scale to Fit group of commands.
- 12. Click the 1 Page option from the drop-downlist.

13. Click the down arrow to the right of the Height button in the Scale to Fit group of commands.

14. Click the 1 Page option from the drop-down list. This step along with step 12 will automatically reduce the worksheet so that it fits on one piece of paper. It is very common for professionals to create worksheets that fit within the width of the paper being used. However, for long data sets, you may need to set the height to more than one page. Table 1.2 "Printing Resources: Purpose and Use for Page Setup Commands" provides a list of commands found in the Page Layout tab of the Ribbon.

Why?

Use Print Settings

Because professionals often share Excel workbooks, it is a good practice to select the appropriate print settings in the Page Layout tab even if you do not intend to print the worksheets in a workbook. It can be extremely frustrating for recipients of a workbook who wish to print your worksheets to find that the necessary print settings have not been selected. This may reflect poorly on your attention to detail, especially if the recipient of the workbook is your boss.



one page for printing.

Figure 1.62 Page Layout Commands for Printing

Heading

J. Niew

Print

arrows to open the

lists of scaling options.

Command	Purpose	Use		
Margins	Sets the top, bottom, right, and left	1. Click the Page Layout tab.		
-	margin space for the printed	2. Click the Margin button.		
	document	3. Click one of the preset margin options or click Custom Margins.		
Orientation	Sets the orientation of the printed	1. Click the Page Layout tab of the		
	document to either portrait or	2. Click the Orientation button.		
	landscape	3. Click one of the preset orientation		
Size	Sets the paper size for the printed	1. Click the Page Layout tab of the		
	document	2. Click the Size button.		
		3. Click one of the preset paper size options or click More Paper Sizes.		
Print Area	Used for printing only a specific area or range of cells on a worksheet	1. Highlight the range of cells on a worksheet that you wish to print.		
		2. Click the Page Layout tab of the		
		3. Click the Print Area button.		
		4. Click the Set Print Area option from the drop-down list.		
Breaks	Allows you to manually set the page breaks on a worksheet	1. Activate a cell on the worksheet where the page break should be placed. Breaks are created above and to the left		
		2. Click the Page Layout tab of the		
		3. Click the Breaks button.		
		4. Click the Insert Page Break option from the drop-down list.		
Background	Adds a picture behind the cell	1. Click the Page Layout tab of the		
	locations in a worksheet	2. Click the Background button.		
		3. Select a picture stored on your computer or network.		

Table 1.2 Printing Resources: Purpose and Use for Page Setup Commands



Command	Purpose	Use		
Print Titles	Used when printing large data sets that	1. Click the Page Layout tab of the		
	are several pages long. This command	2. Click the Print Titles button.		
	will repeat the column headings at the	3. Click in the Rows to Repeat at Top		
	top of each printed page.	input box in the Page Setup dialog box.		
		4. Click any cell in the row that contains		
		the column headings for your		
		5. Click the OK button at the bottom of		
		the Page Setup dialog box.		

Headers and Footers

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.15 if you are starting with this skill.)

When printing worksheets from Excel, it is common to add headers and footers to the printed document. Information in the header or footer could include the date, page number, file name, company name, and so on. The following steps explain how to add headers and footers to the Excel Objective 1.0 workbook:

- 1. Open the Unit Sales Rank worksheet by left clicking on the worksheet tab.
- 2. Click the Insert tab of the Ribbon. (Make sure your Excel window is maximized)
- 3. Click the Header & Footer button in the Text group of commands. You will see the Design tab added to the Ribbon; this is used for creating the headers and footers for the printed worksheet. Also, this will convert the view of the worksheet from Normal to Page Layout (see Figure 1.63 "Design Tab for Creating Headers and Footers").

	1.1.2. 4	and Philaselin 1	O . Monach Long	NITE OF	ALC HIPS ALC		
Figure Har	ne Insert Page	e Layout Form	ulai Data Reve	n view	Design	This tab appears when the header or foote activated.	ris
	AB	B (B)				Different First Page	Scale with Document
rreader Fotter	Page Number C Number of Reges	Date Time	Får File Sher Path Nilsme Filem	e Pictury Formut Pictury	Co.fs. Go.to Header Footer	Different Odd & Even Pager 🕼	Align with Page Margins
mader & Pooter		A Header &	Topler Elements		Navgation	Optioni	
section head	Header All All All All All All All All All All		C D	e a		Click here to active the footer section	R C
2	2011	Fintail Salos fi	n millions)				Click to add
	Month	Unit Au Sales P	erage Sales rice Dollars				
1	December June	3,560 \$	4 99 \$ 53,370				
		Click her current date section of the	to the activated a header or footer.				

Figure 1.63 Design Tab for Creating Headers and Footers

- 4. Type your name in the center section of the Header.
- 5. Place the mouse pointer over the left section of the Header and left click (see Figure 1.63 "Design Tab for Creating Headers and Footers").
- 6. Click the Current Date button in the Header & Footer Elements group of commands in the Design tab of the Ribbon.
- 7. Click the Go to Footer button in the Navigation group of commands in the Design tab of the Ribbon.
- 8. Place the mouse pointer over the far-right section of the footer and left click.
- 9. Click the Page Number button in the Header & Footer Elements group of commands in the Design tab of the Ribbon.
- 10. Click any cell location outside the header or footer area. The Design tab for creating headers and footers will disappear.
- 11. Click the Normal view button in the lower right side of the Status Bar (see Figure 1.64 "Worksheet in Page Layout View").
- 12. Open the Sales by Month worksheet by left clicking the worksheet tab.
- 13. Repeat steps 2 through 11 to create the same header and footer for this worksheet.

X Call	n •	и • А	× =		-	Senetal			TTO D	E Brekser
63-						-11.11.11.		28		Delet
B	1 11 - 123	- ST.	<u>A</u> · E	個 道 課 日	1 HB*	\$ - % .	0.0 0.0	Conditional En/matting #	Tuble + th	dan = Lik Form
	Prest			Alimmenter		and the second		- demanding -	There are	inter and
M	Tool		191	angunem		reamper			3131015	
13	• · ·									
S-MORE	1. 1. 1. 1	Statistics and			4 1	The state of the	All and a	1 1 1 1 M	1.21	
	A		. ¢.	D I	1		P			1.00
	Gene 2011	rai Morch. Retai Sale	andise Wo is (in milic	ria vis)			/			Cli
	Gene 2011 I	ral Morch Retuit Sale Unit Sales	andiso Wo es (in millio Average Price	nd vns) Sales Dollars		/	/			Cli
	Gene 2011 Month December	Unit Sales 3.560	Average Price	Nd Sales Dollars 5 53.370		/	/			Cli
	Gene 2011 Month December June	And Morch Retail Sale Unit Sales 3.560 2.875	Average Price S 14.99 S 12.49	(k/ Sales Dollars 3 53.370 \$ 35.916	C	_	/			Cli
	Gene 2011 J Month December June June	Unit Sales 3,560 2,875 2,700	Average Price 5 14.99 5 12.49 5 9.99	Nd Sales Dollars 5 53.370 5 35.916 5 26.937	C	_	/			Cli
	Gene 2011 Month December June July January	Unit Sales 3,560 2,875 2,700 2,670	Average Price 5 14.99 5 12.49 5 9.99 5 9.90	rid Sales Dollars \$ 53,370 \$ 35,916 \$ 26,937 \$ 26,685	C	_	/			Cli
	Gene 2011 J December June July January February	ral Morch Retail Sale Unit Sales 3,560 2,875 2,700 2,670 2,160	andise Wo ss (in mille Price S 14.99 S 12.49 S 9.99 S 9.90 S 12.49	rid Sales Dollars \$ 53,370 \$ 35,916 \$ 26,937 \$ 26,085 \$ 26,937	C	_				Cli
	Gene 2011 J December Jule July January February November	ral Morch Retail Sale Unit Sales 3,560 2,875 2,700 2,870 2,670 2,160 1,800	Andres Wo s (in million Average Price 5 14 99 5 12 49 5 9 99 5 9 99 5 12 49 5 12 49 5 12 49 5 12 49 5 12 49 5 17 40	Ad Sales Dollars 5 53,370 5 35,916 5 26,937 5 26,937 5 31,416	C	_				Cli
	Gene 2011 December July Jancary February November October	ral Morch Potat Sale Unit Sales 3,560 2,875 2,700 2,670 2,670 2,160 1,800 1,180	andese Wo so (in milition Price 5 14.99 5 12.49 5 9.99 5 9.99 5 12.49 5 12.49 5 17.40 8 19.99	Add vis() Sales Dollars \$ 53,370 \$ 35,916 \$ 26,937 \$ 26,937 \$ 26,937 \$ 26,937 \$ 31,416 \$ 32,562	C	=				Cli
	Gene 2011 December June July Jancary February Rovember October May	ral Morch Potat Sale Unit Sales 3,560 2,875 2,700 2,670 2,670 2,160 1,800 1,180 1,038	Induse Worsge Average Price S 14.99 S 12.49 S 9.99 S 9.99 S 12.49 S 9.90 S 12.49 S 9.90 S 12.49 S 19.00 S 19.00 S 14.59	Sales Dollars 5 5 26,937 5 26,695 5 26,937 5 31,416 5 6 7	C	_				Cli
	Gene 2011 December June July January February November October May August	Unit Sales 3.560 2.875 2.700 2.670 2.160 1.800 1.800 1.180 1.038 900	Induse Worsge Average Price S 14.99 S 12.49 S 9.99 S 9.99 S 12.49 S 9.99 S 12.49 S 9.99 S 12.49 S 19.99 S 19.99 S 14.99 S 19.99	Sales Dollars 5 7068	C	=				Cli
	Gene 2011 December June July Jaruary Pebruary Neivember October May August September	Tel Morch Retail Sales 3,560 2,875 2,700 2,670 2,160 1,800 1,800 1,180 1,039 900 775	Average Price Average Price 5 14.99 5 9.90 5 9.90 5 12.49 5 9.90 5 12.49 5 12.49 5 14.99 5 12.49 5 19.90 5 14.99 5 19.99 5 19.99 5 19.99	bd Sales Dollars 5 5 50.370 5 50.916 5 26.937 5 26.966 5 26.937 5 31.416 5 23.562 5 15.405 5 17.958 5 15.706	C	=	Click	here to ret	um the	Cli
	Cene 2011 December July Jaruary February Rovember October May Auguist September April	ral Morch Rotari Sale 3,560 2,875 2,700 2,670 2,100 2,100 1,800 1,180 1,038 9,000 7,775 5,590	and/so Hotos Average Price S 14.99 S 12.49 S 17.40 S 19.90 S 19.90	K/r Sales Dollars \$ \$ 55.910 \$\$ 25.910 \$\$ 25.910 \$\$ 26.937 \$\$ 36.966 \$\$ 36.962 \$\$ 31.416 \$\$ 25.662 \$\$ 15.405 \$\$ 17.958 \$\$ 10.269	C	_	Click worksl	here to ret	turn the	Cli
	Cene 2011 December June June June June June June June June	ral Morch Retail Sale Sale 3,560 2,875 2,700 2,670 2,750 2,670 2,670 2,670 2,670 2,670 2,750 2,670 2,750 2,670 2,750 2,670 2,750 2,670 2,670 2,670 2,670 2,670 2,670 2,750 2,670 2,6	Average Price 9 12 49 5 12 49 5 12 49 5 9 99 5 12 49 5 14 99 5 14 99 5 19 99 5 19 99 5 17 49 5 19 99 5 19 99 5 19 49	No Sales Dollars \$ 55.370 \$ 35.916 \$ 28.937 \$ 35.916 \$ 28.937 \$ 31.416 \$ 28.562 \$ 15.706 \$ 17.958 \$ 15.708 \$ 10.709 \$ 7.701	Status R	- T	Click worksl	here to ret	um the mal view.	Cli

Figure 1.64 Worksheet in Page Layout View

Printing Worksheets and Workbooks

Follow-along file: Excel Objective 1.0 (Use file Excel Objective 1.16 if starting with this skill.)

Once you have established the print settings for the worksheets in a workbook and have added headers and footers, you are ready to print your worksheets. The following steps explain how to print the worksheets in the Excel Objective 1.0 workbook:

1. Open the Unit Sales Rank worksheet by left clicking on the worksheet tab.

2. Click the File tab on the Ribbon.

3. Click the Print option on the left side of the Backstage view (see Figure 1.65 "Print Preview"). On the right side of the Backstage view, you will be able to see a preview of your printed worksheet.

4. Click the Print Active Sheets button in the Print section of the Backstage view (see Figure 1.65 "Print Preview").

Figure 1.65 Print Preview

		Manufand 12 first Objection 1.12 (Read-Only) - final V	
\odot			1212/2/2/2/
Info	Print		
New	Copies 1		
Open	Print		
iave	Distance P	General Merchandise Woldd 2011 Retail Sales (în millions) Unit Average Sales	
int .	Brother MFC-9130CW Printer	Month Sales Price Dollars January 2,670 \$ 999 \$ 25685 Extra 0 456 6 436.0 9 2022	
are	Printer Properties	Petruary 2,160 \$ 12.49 \$ 26.971 March 515 \$ 14.99 \$ 7,701 April 590 \$ 17.49 \$ 10.269	
on	Settings	May 1,030 \$ 14.99 \$ 15.405 June 2,875 \$ 12.49 \$ 35.5916 Let. 2,700 \$ 0.06 \$ 26.037	
ish	Print Active Sheets Only print the active sheets	August 900 \$ 19.99 \$ 17.958 September 775 \$ 19.99 \$ 15,708	
	Pages to Print One Sided	October 1,100 \$ 19.96 \$ 23.562 November 1,000 \$ 17.26 \$ 24.146 December 3.560 \$ 14.99 \$ 5.3.370	
4	Collated *	Total Sales 20,755 § 291,864	
ck	Portrait Orientation +		
	Letter *		
	Left: 0.7" Right: 0.7"		
	No Scaling Print sheets at their actual size *		
	Page Setup		
		4 T at t	II 6

5. Click the Print Entire Workbook option from the drop-down list. This will print all worksheets in a workbook when the Print button is clicked.

- 6. Click the Next Page arrow at the bottom of the preview window.
- 7. Click the Print button.
- 8. Click the Home tab of the Ribbon.
- 9. Save and close the Excel Objective 1.0 workbook.

Key Takeaways

- The commands in the Page Layout tab of the Ribbon are used to prepare a worksheet for printing.
- You can add headers and footers to a worksheet to show key information such as page numbers, the date, the file name, your name, and so on.
- The Print commands are in the File tab of the Ribbon

Chap 1 Sample Exercise

Creating and maintaining budgets are common practices in many careers. Budgets play a critical role in helping a business or household control expenditures. In this exercise, you will create a budget for a hypothetical medical office.

Begin the exercise by opening the file named **Chapter 1 CiP Exercise 1**.

- 1. Activate all the cell locations in the Sheet1 worksheet by left clicking the Select All button in the upper left corner of the worksheet.
- 2. In the Home tab of the Ribbon, set the font style to Arial and the font size to 12 points.
- 3. Increase the width of Column A so all the entries in the range A3:A8 are visible. Place the mouse pointer between the letter A and letter B of Column A and Column B. When the mouse pointer changes to a double arrow, left click and drag it to the right until the character width is 18.00.
- 4. Enter Quarter 1 in cell B2.
- 5. Use Auto fill to complete the headings in the range C2:E2. Activate cell B2 and place the mouse pointer over the Fill Handle. When the mouse pointer changes to a black plus sign, left click and drag it to cell E2.
- 6. Increase the width of Columns B, C, D, and E to 10.14 characters. Highlight the range B2:E2 and click the Format button in the Home tab of the Ribbon. Click the Column Width option, type 10.14 in the Column Width dialog box, and then click the OK button in the Column Width dialog box.
- 7. Make the following format adjustment to the range A2:E2: bold; and change the cell fill color to orange.
- 8. Set the alignment in cell B2 to Wrap Text. Activate the cell location and click the Wrap Text button in the Home tab of the Ribbon.
- 9. Copy cell B3 and paste the contents into the range C3:E3.
- 10. Copy the contents in the range B6:B8 by highlighting the range and clicking the Copy button in the Home tab of the Ribbon. Then, highlight the range C6:E8 and click the Paste button in the Home tab of the Ribbon.
- 11. Insert a blank column between Columns A and B. Activate any cell location in Column B. Then, click the drop-down arrow of the Insert button in the Home tab of the Ribbon. Click the Insert Sheet Columns option. (Alternatively, you can right click and insert column.)
- 12. Adjust the width of Column B to 13.29 characters.
- 13. Enter the words Budget Cost in cell B2.

- 14. Calculate the total budget for all four quarters for the salaries. Activate cell B3 and click the down arrow on the AutoSum button in the Formulas tab of the Ribbon. Click the Sum option from the drop- down list. Then, highlight the range C3:F3 and press the ENTER key on your keyboard.
- 15. Copy the contents of cell B3 and paste them into the range B4:B8.
- 16. Enter the words Medical Office Budget in cell A1.
- 17. Merge the cells in the range A1:F1. Highlight the range and click the Merge & Center button in the Home tab of the Ribbon.
- 18. Make the following format adjustments to the range A1:F1: bold; italics; change the font size to 14 points; change the cell fill color to Blue, Accent 1, Darker 50%; and change the font color to white.
- 19. Increase the height of Row 1 to fit the title.
- 20. Sort the data in the range A2:F8 based on the values in the Quarter 4 column in ascending order. Have an active cell anywhere in the range A2:F8 and click the Sort button in the Data tab of the Ribbon. Select Quarter 4 in the "Sort by" drop-down box and select Smallest to Largest in the Order drop-down box. Click the OK button. (Because you have inserted a merged cell title you will need to select the data you want to sort.)
- 21. Format the range B3:F8 with a US dollar sign and zero decimal places.
- 22. Add vertical and horizontal lines to the range A1:F8. Highlight the range and click the down arrow next to the Borders button in the Home tab of the Ribbon. Select the All Borders option from the drop-down list.
- 23. Change the name of the Sheet1 worksheet tab to "Budget." Double click the worksheet tab, type the word Budget, and press the ENTER key.
- 24. Insert a pie chart using the data in the range A2:B8. Highlight the range and click the Pie button in the Insert tab of the Ribbon. Click the first option on the list (the Pie option).
- 25. Click and drag the chart so the upper left corner is in the center of cell H2.
- 26. Add labels to the chart by clicking the Layout 1 option from the Chart Layouts list in the Design tab of the Ribbon. Make sure the chart is activated by clicking it once before you look for the Layout 1 Chart Layout option.
- 27. Change the orientation of the Budget worksheet so it prints landscape instead of portrait.
- 28. Adjust the appropriate settings so the Budget worksheet prints on one piece of paper.
- 29. Add a header to the Budget worksheet that shows the date in the upper left corner and your name in the center.
- 30. Add a footer to the Budget worksheet that shows the page number in the lower right corner.

- 31. Use the Save As command in the File tab of the Ribbon to save the workbook by adding your name in front of the current workbook name (i.e., "your name Chapter 1 CiP Exercise 1").
- 32. Close the workbook and Excel. Compare your results with the figure below.

8/2//2024					You	ır Name						
	Medical	Office	Budaet									
ltem	Budget Co	Quarte	Quarter	Quarter	Quarter	4		News A				
Phone & Utilities	\$8,400	\$2,100	\$2,100	\$2,100	\$2,100			Utilities	Budget	Cost		
Office Supplies	\$12,000	\$3,000	\$3,000	\$3,000	\$3,000			3%	~ 0	ffice Supplies		
Bent	\$30,000	\$7,500	\$7,500	\$7,500	\$7,500					4%		
Medical Supplies	\$60,000	\$18,000	\$13,800	\$9,000	\$19,200							
Medications	\$90,000	\$27,000	\$20,700	\$13,500	\$28,800					Rent		
Salaries	\$120,000	\$30,000	\$30,000	\$30,000	\$30,000			Salar	ies	1 1		
		,		,	,			375	× (Medic	al l	
									_ /	Suppli	ies.	
										193		
									Medic	ations		
									28	196		

Figure 1 - Completed Medical Budget Exercise

Budget Sheet2 Sheet3	(+)
----------------------	------------------

1

Chapter 2

Mathematical Computations

Perhaps the most valuable feature of Excel is its ability to produce mathematical outputs using the data in a workbook. This chapter reviews several mathematical outputs that you can produce in Excel through the construction of formulas and functions. The chapter begins with the construction of formulas for basic and complex mathematical computations. The second section reviews statistical functions, such as SUM, AVERAGE, MIN, and MAX, which can be applied to a range of cells. The last section of the chapter addresses functions used to calculate mortgage and lease payments as well as the valuation of investments. This chapter also shows how you can use data from multiple worksheets to construct formulas and functions. These skills will be demonstrated in the context of a personal cash budget, which is a vital tool for managing your money for long-term financial security. The personal budget objective will also provide you with several opportunities to demonstrate Excel's what-if scenario capabilities, which highlight how formulas and functions automatically produce new outputs when one or more inputs are changed.

2.1 Formulas

LEARNING OBJECTIVES

- 1. Learn how to create basic formulas.
- 2. Understand relative referencing when copying and pasting formulas.
- 3. Work with complex formulas by controlling the order of mathematical operations.

This section reviews the fundamental skills for entering formulas into an Excel worksheet. The objective used for this chapter is the construction of a personal cash budget. Most financial advisors recommend that all households construct and maintain a personal budget to achieve and maintain strong financial health. Organizing and maintaining a personal budget is a skill you can practice at any point in your life. Whether you are

managing your expenses during college or maintaining the finances of a family of four, a personal budget can be a vital tool when making financial decisions. Excel can make managing your money a fun and rewarding exercise.

Figure 2.1 "Completed Personal Cash Budget Workbook" shows the completed workbook that will be demonstrated in this chapter. Notice that this workbook contains four worksheets. The first worksheet, **Budget Summary**, contains formulas that utilize or reference the data in the other three worksheets. As a result, the **Budget Summary** worksheet serves as an overview of the data that was entered and calculated in the other three worksheets of the workbook.

	17.0.4					Persona	d Budget - M	lernstoft Exe	el				100.000	11.58	6) XX
100 E	A Aral Jan B Z U -	• [14 • [14	· A* A* = → ▲- ■		narren - & - in in in	ites Billion	Gerneral \$ - % +	- -28-21	Conditional Form Formation Table Table		Griebuert + States - (E) Format + Cells	E · ZV a · ZV · Source · Source	AN CO Find A Select *	0.44	225
	AL • (*	A	onal Cash Budget												
A	A	8	C		0	1	t	F	6	-14	1	- J.)	К.	L	*
1		Person	al Cash Bu	ıdg	jet										
2	Net Income			\$	33,000										
3.	Expenses		\$ 17,950	1											
4	Mortgage Paymen	nts	\$ 10,629												
5	Car Lease Payme	ints	\$ 2,479												
G	Total Plan Spend	1		\$	31,058	1	94.1%								-
7	Net Change in C	ash		s	1,942		5.9%								
					NO15										
9		S	avings Plan	\$	25,000										
10		Saving	s Projection	\$	25,606		~	1							
11		Plan vs	Projection	\$	606		The output	ts in this we	orksheet are						
12		Ye	ars of Saving		10	D that re		nce the dat	a entered in lots.						
13		R	ate of Return	-	3.5%		-	>1	-						
14		Cu	rrent Balance	\$	2,000	-	/	/							
15	* * Budget Summ	ary Bod	pet Curtail M	ingi	or Peymain	-	W (sma Pay	nents			-		1		1

Figure 2.1 Completed Personal Cash Budget Workbook

Creating a Basic Formula

Follow-along file: Excel Objective 2.00

Formulas are used to calculate a variety of mathematical outputs in Excel and can be used to create virtually any custom calculation required for your objective. Furthermore, when

constructing a formula in Excel, you use cell locations that, when added to a formula, become cell references. This means that Excel uses, or references, the number entered into the cell location when calculating a mathematical output. As a result, when the numbers in the cell references are changed, Excel automatically produces a new output. This is what gives Excel the ability to create a variety of what-if scenarios, which will be explained later in the chapter.

To demonstrate the construction of a basic formula, we will begin working on the **Budget Detail** worksheet in the Personal Budget workbook, which is shown in Figure 2.2 "Budget Detail Worksheet". To complete this worksheet, we will add several formulas and functions. Table 2.1 "Spend Category Definitions" provides definitions for each of the spend categories listed in the range A3:A11. When you develop a personal budget, these categories are defined based on how you spend your money. It is likely that every person could have different categories or define the same categories differently. Therefore, it is important to review the definitions in Table 2.1 "Spend Category Definitions" to understand how we are defining these categories before proceeding.

	A	В	C	D	E	F	G	Н	I
		E	Expense P	lan					
1		(Does no	t include mortg	gage and car)					
		Percent of	Monthly	Annual		Percent			
2	Category	Total	Spend	Spend	Last Year	Change			
3	Household Utilities			\$ 3,000	\$ 3,000				
4	Food			2,500	2,250				
5	Gasoline			1,500	1,200				
6	Clothes			1,200	1,000				
7	Insurance			1,500	1,500				
8	Taxes			3,500	3,500				
9	Entertainment			2,000	2,250				
10	Vacation			1,500	2,000		Ч	Formulas and t	funcitons
11	Miscellaneous			1,250	1,558			blank cells to	produce
12	Totals							mathematical	outputs
13		Number of	Categories						
14		Ave	rage Spend						
15			Min Spend						
16			Max Spend] _			
17									

Figure 2.2 Budget Detail Worksheet

Category	Definition						
Utilities	Money spent on electricity, heat, and water and on cable, phone, and						
	Internet access						
Food	Money spent on groceries, toiletries, and related items						
Gasoline	Money spent on fuel for automobiles						
Clothes	Money spent on clothes, shoes, and accessories						
Insurance	Money spent on homeowner's or automobile insurance						
Taxes	Money spent on school and property taxes (this example of the personal						
	budget assumes that we own property).						
Entertainment	Money spent on entertainment, including dining out, movie and theater						
	tickets, parties, and so on						
Vacation	Money spent on vacations						
Miscellaneous	Includes any other spending categories, such as textbooks, software,						
	journals, school or work supplies, and so on						

Table 2.1 Spend Category Definitions

The first formula that we will add to the **Budget Detail** worksheet will calculate the Monthly Spend values. The formula will be constructed so that it takes the values in the Annual Spend column and divides them by 12. This will show how much money will be spent per month for each of the categories listed in Column A. The following explains how this formula is created:

1. Click the **Budget Detail** worksheet tab to open the worksheet.

2. Click cell C3.

3. Type an equal sign (=). When the first character entered into a cell location is an equal sign, it signals Excel to perform a calculation or produce a logical output.

4. Click on cell **D3**. This adds D3 to the formula, which is now a cell reference. Excel will use whatever value is entered into cell D3 to produce an output.

5. Type the slash symbol (/). This is the symbol for division in Excel. As shown in Table 2.2 "Excel Mathematical Operators", the mathematical operators in Excel are slightly different from those found on a typical calculator.

6. Type the number **12**. This divides the value in cell D3 by 12. In this formula, a number, or constant, is used instead of a cell reference because it will not change. In other words, there will always be 12 months in a year.

7. Press the ENTER key.

Symbo	Operation
+	Addition
-	Subtraction
/	Division
*	Multiplication
^	Power/Expon

Why?

Use Cell References

Cell references enable Excel to dynamically produce new outputs when one or more inputs in the referenced cells are changed. Cell references also allow you to trace how outputs are being calculated in a formula. As a result, **you should never use a calculator to determine a mathematical output and type it into the cell location of a worksheet**. Doing so eliminates Excel's cell-referencing benefits as well as your ability to trace a formula to determine how outputs are being produced.

Figure 2.3 "Adding a Formula to a Worksheet" shows how the formula appears in cell C3 before you press the ENTER key. Figure 2.4 "Formula Output for Monthly Spend" shows the output of the formula after you press the ENTER key. The monthly spend for Household Utilities is \$250 because the formula is taking the Annual Spend in cell D3 and dividing it by 12. If the value in cell D3 is changed, the formula automatically produces a new output. We are calculating the spend per month for each category because people often get paid and are billed for these items monthly. This formula allows you to compare your monthly income to your monthly bills to determine whether you have enough income to pay these expenses.



Figure 2.3 Adding a Formula to a Worksheet

Figure 2.4 Formula Output for Monthly Spend

	a •(*	≸ =03/12				_	The formula in the activated cell is displayed here.
1	A	В	c	D	E	F	
1		(Does no	Expense include moi	Plan tgage and car)			
2	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percen Change	t B
3	Household Utilities		\$ 250	\$ 3,000	\$ 3,000		
4	Food		1	2,500	2,250		
5	Gasoline			1,500	1,200		
6	Clothes			1,200	1,000		
4	Incurance	1		1 500	1 500	1	

Why?

Use Universal Constants

If you are using constants, or numerical values, in an Excel formula, they should be universal constants that do not change, such as the number of days in a week, weeks in a year, and so on. **Do not type the values that exist in cell locations into an Excel formula**. This will eliminate Excel's cell- referencing benefits, which means if the value in the cell location you are using in a formula is changed, Excel will not be able to produce a new output.

Relative References (Copying and Pasting Formulas)

Follow-along file: Continue with Excel Objective 2.00 or Excel Objective 2.01 if starting here.

Once a formula is typed into a worksheet, it can be copied and pasted to other cell locations. For example, Figure 2.4 "Formula Output for Monthly Spend" shows the output of the formula that was entered into cell C3. However, this calculation needs to be performed for the rest of the cell locations in Column C. Since we used the D3 cell reference in the formula, Excel automatically adjusts that cell reference when the formula is copied and pasted into the rest of the cell locations in the column. This is called **relative referencing** and is demonstrated as follows:

1. Click cell C3.

- 2. Click the Copy button in the Home tab of the Ribbon.
- 3. Highlight the range C4:C11.
- 4. Click the Paste button in the Home tab of the Ribbon. (or hit Enter)

5. While the cells are still highlighted, format cells C4:C11 for comma with no decimals.

6. Double click cell C6. Notice that the cell reference in the formula automatically changed to D6 when copied.

7. Press the ENTER key.

Figure 2.5 "Relative Reference Example" shows the outputs added to the rest of the cell locations in the Monthly Spend column. For each row, the formula takes the value in the Annual Spend column and divides it by 12. You will also see that cell D6 has been double clicked to show the formula. Notice that Excel automatically changed the original cell reference of D3 to D6. This is the result of relative referencing, which means Excel automatically adjusts a cell reference relative to its original location when it is pasted into new cell locations. In this example, the formula was pasted into eight cell locations below the original cell location. As a result, Excel increased the row number of the original cell reference by a value of one for each row it was pasted into.

1	A	В	C	D	E	F	G
1		(Does no	Expense P ot include mort				
2	Category	Percent of Total	Monthly Spend	Annual Spend	Last Year	Percent Change	
3	Household Utilities		\$ 250	\$ 3,000	\$ 3,000		
4	Food		208	2,500	2,250		
5	Gasoline		125	1,500	1,200	This c	ell reference
6	Clothes		=D6/12	4 1,200	1,000	was a	utomatically
7	Insurance		125	1,500	1,500	chang	ed when the
8	Taxes		292	3,500	3,500	formu	la was pasted
9	Entertainment		167	2,000	2,250	here b	ecause of
10	Vacation		125	1,500	2,000	relativ	/e cell
11	Miscellaneous		104	1,250	1,558	refere	ncing.
12	Totals						
13		Number o	f Categories		6		
14		Ave	erage Spend				

Figure 2.5 Relative Reference Example

Why?

Use Relative Referencing

Relative referencing is a convenient feature in Excel. When you use cell references in a formula, Excel automatically adjusts the cell references when the formula is pasted into new cell locations. If this feature were not available, you would have to manually retype the formula when you want the same calculation applied to other cell locations in a column or row.

Creating Complex Formulas (Controlling the Order of Operations)

Follow-along file: Continue with Excel Objective 2.00 or file Excel Objective 2.02 if starting here.

The next formula to be added to the Personal Budget workbook is the percent change in spending this year over last year. This formula determines the difference between the values in the LY (Last Year) Spend column and shows the difference in terms of a percentage. This requires that the order of mathematical operations be controlled to get an accurate result. Table 2.3 "Standard Order of Mathematical Operations" shows the standard order of operations for a typical formula.

Table 2.3 Standard Order of Mathematical Operations

Symbo	Order
^	First: Excel executes any exponential computations first.
* or /	<i>Second:</i> Excel performs any multiplication or division computations second. When there are multiple instances of these computations in a formula, they are executed in order from left to right.
+ or –	<i>Third:</i> Excel performs any addition or subtraction computations third. When there are multiple instances of these computations in a formula, they are executed in order from left to right.
()	<i>Override Standard Order:</i> Any mathematical computations placed in parentheses are performed first and override the standard order of operations. If there are layers of parentheses used in a formula, Excel computes the innermost parentheses first and the outermost parentheses last.

To change the order of operations shown in the table, we use parentheses to process certain mathematical calculations first. This formula is added to the worksheet as follows:

1. Click cell F3 in the **Budget Detail** worksheet.

- 2. Type an equal sign (=).
- 3. Type an open parenthesis (().

4. Click cell D3. This will add a cell reference to cell D3 to the formula. When building formulas, you can click cell locations instead of typing them.

- 5. Type a minus sign (-).
- 6. Click cell E3 to add this cell reference to the formula.
- 7. Type a closing parenthesis ()).
- 8. Type the slash (/) symbol for division.

9. Click cell E3. This completes the formula that will calculate the percent change of last year's actual spent dollars vs. this year's budgeted spend dollars (see Figure 2.6 "Adding the Percent Change Formula").

- 10. Press the ENTER key.
- 11. Click cell F3 to activate it.
- 12. Place the mouse pointer over the Auto Fill Handle in the lower right corner of the cell.
- 13. When the mouse pointer turns from a white block plus sign to a narrow black plus sign,

click and drag down to cell F11. This pastes the formula into the range F4:F11. Figure 2.6 "Adding the Percent Change Formula" shows the formula that was added to the **Budget Detail** worksheet to calculate the percent change in spending. The parentheses were added to this formula to control the order of operations. Any mathematical computations placed in parentheses are executed first before the standard order of mathematical operations (see Table 2.3 "Standard Order of Mathematical Operations"). In this case, if parentheses were not used, Excel would produce an erroneous result for this worksheet.

	А	В	С	D	E	F	G	Н	I.	
		E	Expense P	lan						
1		(Does no	t include mortg	gage and car)						
		Percent of	Monthly	Annual		Percent				
2	Category	Total	Spend	Spend	Last Year	Change				
3	Household Utilities		\$ 250	\$ 3,000	\$ 3,000	0.0%				
4	Food		208	2,500	2,250	11.1%				
5	Gasoline		125	1,500	1,200	25.0%	Mather	matical com	putations in	
6	Clothes		100	1,200	1,000	20.0%	parent	hesis are pe	formed first	
7	Insurance		125	1,500	1,500	0.0%				
8	Taxes		292	3,500	3,500	0.0%				
9	Entertainment		167	2,000	2,250	-11.1%				
10	Vacation		125	1,500	2,000	-25.0%				
11	Miscellaneous		104	1,250	1,558	-19.8%				
12	Totals	1								
13		Number of	Categories							

Figure 2.6 Adding the Percent Change Formula

Figure 2.7 "Removing the Parentheses from the Percent Change Formula" shows the result of the percent change formula if the parentheses are removed. The formula produces a result of a 299900% increase. Since there is no change between the LY spend and the budget Annual Spend, the result should be 0%.

However, without the parentheses, Excel is following the standard order of operations. This means the value in cell E3 will be divided by E3 first (3,000/3,000), which is 1. Then, the value of 1 will be subtracted from the value in cell D3 (3,000–1), which is 2,999. Since cell F3 is formatted as a percentage, Excel expresses the output as an increase of 299900%.



Figure 2.7 Removing the Parentheses from the Percent Change Formula

Auditing Formulas

Follow-along file: Continue with Excel Objective 2.00 or use Excel Objective 2.03 if starting here.

Excel provides a few tools that you can use to review the formulas entered into a worksheet. For example, instead of showing the outputs for the formulas used in a worksheet, you can have Excel show the formula as it was entered in the cell locations. This is demonstrated as follows:

1. With the **Budget Detail** worksheet open, click the Formulas tab of the Ribbon.

2. Click the Show Formulas button in the Formula Auditing group of commands. This

displays the formulas in the worksheet instead of showing the mathematical outputs.

3. Click the Show Formulas button again. The worksheet returns to showing the output of the formulas.

Integrity Check

Does the Output of Your Formula Make Sense?

It is important to note that the accuracy of the output produced by a formula depends on how it is constructed. Therefore, always check the result of your formula to see whether it makes sense with data in your worksheet. As shown in Figure 2.7 "Removing the Parentheses from the Percent Change Formula", a poorly constructed formula can give you an inaccurate result. In other words, you can see that there is no change between the Annual Spend and LY Spend for Household Utilities. Therefore, the result of the formula should be 0%. However, since the parentheses were removed in this case, the formula is clearly producing an erroneous result.

Figure 2.8 "Show Formulas Command" shows the **Budget Detail** worksheet after activating the Show Values command in the Formulas tab of the Ribbon. As shown in the figure, this command allows you to view and check all the formulas in a worksheet without having to click each cell individually. After activating this command, the column widths in your worksheet increase significantly. The column widths were adjusted for the worksheet shown in Figure 2.8 "Show Formulas Command" so all columns can be seen. The column widths return to their previous width when the Show Formulas command is deactivated.

f.	rune bust Σ	Nage Lands - Formula	Data Rainan	Earel Objective 2.00 Vers) - Microsoft E Biodes eu A ² stat a te	nand 1996 - Die Traine Princ 1996 - All Traine Deap	atlasta 🧟 State Forenation andasta 🍕 Errar Charlog +	» Q -
1	m + Used + +	Function Library	+ Neferance + Traj	* Runckom * Manaj	pr 102 Chain to Defined Nets	on beledise – Éflemsee k 17	novs + @ Dostate former Formers Authors	Witten Catto
ŝ	A.		5	D	T	E	6	The Show Formula command is activat
and a second sec	Category	(Dee	Expense mot include mo Monthly Spend	Plan rtgage and car) Annual Spend	LY Spend	Percent Change	-	
ļ	Household Utilities	a de	=D3/12	3000	3000	=(D3-E3)/E3		
Ì	Food		=D4/12	2500	2250	=(D4-E4)/E4		
	Gasoline		=D5/12	1500	1200	=(D5-E5)/E5		
	Clothes		=D6/12	1200	1000	=(D6-E6)/E6	The formulas are dis	played
Ī	Insurance		=D7/12	1500	1500	=(D7-E7)/E7	Instead of outputs w	hen the
	Taxes	1	=D8/12	3500	3500	=(D8-E8)/E8	Show Formulas con	remand,
	Entertainment		=D9/12	2000	2250	=(D9-E9)/E9	C. Marganies	
	Vacation	1	=D10/12	1500	2000	=(D10-E10)/E10		
ļ	Miscellaneous		=D11/12	1250	1558	=(D11-E11)/E11		
	Totals			1				
		Number	of Categories	/				
		A	verage Spend	CENTRAL	N	constructions after 1		
1	* * Bodget Summar	Bodget Detail	Min Spend	Show Form	nules command	f is activated.		-

Figure 2.8 Show Formulas Command

Keyboard Shortcuts – Show Formulas

• Hold down the CTRL key while pressing the accent symbol (`). (Above the tab key on the left-hand side.)

Two other tools in the Formula Auditing group of commands are the **Trace Precedents** and **Trace Dependents** commands. These commands are used to trace the cell references used in a formula. The Trace Dependents command shows where any given cell is referenced in a formula. The Trace Precedents command shows what cells have been

referenced in a formula that exists in an activated cell. The following is a demonstration of these commands:

1. Click cell D3 in the **Budget Detail** worksheet.

2. Click the Trace Dependents button in the Formula Auditing group of commands in the Formulas tab of the Ribbon. A double blue arrow appears, pointing to cell locations C3 and F3 (see Figure 2.9"Trace Dependents Example"). This indicates that cell D3 is referenced in formulas that are entered in cells C3 and F3.

3. Click the Remove Arrows command in the Formula Auditing group of commands in the Formulas tab of the Ribbon. This removes the Trace Dependents arrow.

4. Click cell F3 in the Budget Detail worksheet.

5. Click the Trace Precedents button in the Formula Auditing group of commands in the Formulas tab of the Ribbon. A blue arrow running through cells D3 and E3 and pointing to cell F3 appears (see Figure 2.10 "Trace Precedents Example"). This indicates that cells D3 and E3 are references in a formula entered in cell F3.

6. Click the Remove Arrows command in the Formula Auditing group of commands in the Formulas tab of the Ribbon. This removes the Trace Precedents arrow.

Figure 2.9 "Trace Dependents Example" shows the Trace Dependents arrow on the **Budget Detail** worksheet. The blue dot represents the activated cell. The arrows indicate where the cell is referenced in formulas.



Figure 2.9 Trace Dependents Example

Figure 2.10 "Trace Precedents Example" shows the Trace Precedents arrow on the **Budget Detail** worksheet. The blue dots on this arrow indicate the cells that are referenced in the formula contained in the activated cell. The arrow is pointing to the activated cell location that contains the formula.

	Home Buen 1	Tage Layout Far	mulai Data	Escal O	bjective 2.00 +	Microsoft Excel	/		Click here to activate the ace Precedents commar
f.	n Addultant Recently Finance	d Logad Ted	Dere in Lucky Time + Referen	a shath bi kee a shath bi kee	n Jana	Radiation Hanne + All this in Formula + All Create from Selection Defined Martines	De Traca Precade	ets 🏨 Share Formulas etts 🍨 Error Checking et * 🎯 Error Checking et * 🧑 Endyate Formula Formula Auditing	
	FI • 0	& =(0)+日 /日							
a,	A	ð	C	D	E	E.	G H	1 1 1	
		(Does no	Expense F	Plan tgage and car)				The arrow is point	ing to
	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Chapge		the activated of	ef.
	Household Utilities		\$ 250	\$-3:000	5 3,000	0.0%			
	Food		\$ 208	\$ 2,500	\$ 2,250	11.1%			
	Gasoline		\$ 125	\$ 1,500	\$ 1,200	25.0%			
	Mathen	1.5	le ton	E 1.000 The blue dot that are refere contain	s indicate the ce need in the form red in cell F1.	lls on our l			

Figure 2.10 Trace Precedents Example

Skill Refresher – Trace Dependents

- 1. Click a cell location that contains a number or formula.
- 2. Click the Formulas tab on the Ribbon.
- 3. Click the Trace Dependents button in the Formula Auditing group of commands.
- 4. Use the arrow(s) to determine where the cell is referenced in formulas and functions.
- 5. Click the Remove Arrows button to remove the arrows from the worksheet.

Skill Refresher – Trace Precedents

- 1. Click a cell location that contains a formula or function.
- 2. Click the Formulas tab on the Ribbon.
- 3. Click the Trace Precedents button in the Formula Auditing group of commands.
- 4. Use the dot(s) along the line to determine what cells are referenced in the formula or function.
- 5. Click the Remove Arrows button to remove the line with the dots.

Key Takeaways

- Mathematical computations are conducted through formulas and functions.
- An equal sign (=) precedes all formulas and functions.
- Formulas and functions must be created with cell references to conduct what-if scenarios where mathematical outputs are recalculated when one or more inputs are changed.
- Mathematical operators on a typical calculator are different from those used in Excel. Table 2.2 "Excel Mathematical Operators" lists Excel mathematical operators.
- When using numerical values in formulas and functions, only use universal constants that do not change, such as days in a week, months in a year, and so on.
- Relative referencing automatically adjusts the cell references in formulas and functions when they are pasted into new locations on a worksheet. This eliminates the need to retype formulas and functions when they are needed in multiple rows or columns on a worksheet.
- Parentheses must be used to control the order of operations when necessary for complex formulas
- Formula auditing tools such as Trace Dependents, Trace Precedents, and Show Formulas should be used to check the integrity of formulas that have been entered into a worksheet

2.2 Statistical Functions

In addition to formulas, another way to conduct mathematical computations in Excel is through functions. Statistical functions apply a mathematical process to a group of cells in a worksheet. For example, the SUM function is used to add the values contained in a range of cells. A list of commonly used statistical functions is shown in Table 2.4 "Commonly Used Statistical Functions". Functions are more efficient than formulas when you are applying a mathematical process to a group of cells. If you use a formula to add the values in a range of cells, you would have to add each cell location to the formula one at a time. This can be very time-consuming if you must add the values in a few hundred cell locations. However, when you use a function, you can highlight all the cells that contain values you wish to sum in just one step. This section demonstrates a variety of statistical functions that we will add to the Personal Budget workbook. In addition to demonstrating functions, this section also reviews percent of total calculations and the use of absolute references.

LEARNING OBJECTIVES

- 1. Use the **SUM function** to calculate totals.
- 2. Use **absolute references** to calculate percent of totals.
- 3. Use the **COUNT function** to count cell locations with numerical values.
- 4. Use the **AVERAGE function** to calculate the arithmetic mean.
- 5. Use the **MAX and MIN functions** to find the highest and lowest values in a range of cells.
- 6. Use the AutoSum feature to quickly insert statistical functions.
- 7. Learn how to copy and paste formulas without formats applied to a cell location.
- 8. Learn how to set a **multiple level sort** sequence for data sets that have duplicate values or outputs.

Function	Output
ABS	The absolute value of a number
AVERAGE	The average or arithmetic mean for a group of numbers
COUNT	The number of cell locations in a range that contain a numeric character
COUNTA	The number of cell locations in a range that contain a text or numeric character
MAX	The highest numeric value in a group of numbers
MEDIAN	The middle number in a group of numbers (half the numbers in the group are higher than the median and half the numbers in the group are lower than the median)
MIN	The lowest numeric value in a group of numbers
MODE	The number that appears most frequently in a group of numbers
PRODUCT	The result of multiplying all the values in a range of cell locations
SQRT	The positive square root of a number
STDEV.S	The standard deviation for a group of numbers based on a sample
SUM	The total of all numeric values in a group

Table 2.4 Commonly Used Statistical Functions

The SUM Function

Follow-along file: Continue with Excel Objective 2.00 or file Excel Objective 2.03 if starting here.

The SUM function is used when you need to calculate totals for a range of cells or a group of selected cells on a worksheet. Regarding the **Budget Detail** worksheet, we will use the SUM function to calculate the totals in row 12. It is important to note that there are several methods for adding a function to a worksheet, which will be demonstrated throughout the remainder of this chapter. The following illustrates how a function can be added to a worksheet by typing it into a cell location:

- 1. Click the **Budget Detail** worksheet tab to open the worksheet.
- 2. Click cell C12.
- 3. Type an equal sign (=).
- 4. Type the function name SUM.
- 5. Type an open parenthesis (().

6. Click cell C3 and drag down to cell C11. This places the range C3:C11 into the function.

7. Type a closing parenthesis Note: you can hit enter without the closing parenthesis and Excel will insert it for you.

8. Press the ENTER key. The function calculates the total for the Monthly Spend column, which is \$1,496.

Figure 2.11 "Adding the SUM Function to the Budget Detail Worksheet" shows the appearance of the SUM function added to the **Budget Detail** worksheet before pressing the ENTER key.

VLO	OKUP 🔻 : 🗙 🖌 f	SUM(C3:C11)						
	А	В	С	D	E	F	G	Н	1
		E	xpense P	lan					
1		(Does no	t include mortg	gage and car)					
		Percent of	Monthly	Annual		Pe The blue	outline sho	ws the ran	ge
2	Category	Total	Spend	Spend	Last Year	Ch of cells i	ncluded in t	he functio	n.
3	Household Utilities		\$ 250	<mark>4\$ 3,000</mark>	\$ 3,000	0.0%			
4	Food		208	2,500	2,250	11.1%			
5	Gasoline		125	1,500	1,200	25.0%			
6	Clothes		100	1,200	1,000	20.0%			
7	Insurance		125	1,500	1,500	0.0%			
8	Taxes		292	3,500	3,500	0.0%			
9	Entertainment		167	2,000	2,250	-11.1%			
10	Vacation		125	1,500	2,000	-25.0%			
11	Miscellaneous		104	1,250	1,558	-19.8%			
12	Totals		=SUM(C3:	C11)					
			•	\sim					
13		Number of	Categories	This fu	unction will calc	ulate the			
14		Ave	rage Spend	total o	f the values in t	he range.			
15			Min Spend						
16			Max Spend						
17									
4	Budget Detail	vlortgage Payments	Car Lease Pay	rments 🕘 🕂			•		

Figure 2.11 Adding the SUM Function to the Budget Detail Worksheet

As shown in Figure 2.11 "Adding the SUM Function to the Budget Detail Worksheet", the SUM function was added to cell C12. However, this function is also needed to calculate the totals in the Annual Spend and LY Spend columns. The function can be copied and pasted into these cell locations because of relative referencing. Relative referencing serves the same purpose for functions as it does for formulas. The following demonstrates how the

total row is completed:

1. Click cell C12 in the **Budget Detail** worksheet.

2. Use the fill handle in the lower right corner to copy the formula across to cells D12:E12.

3. Activate cell F12 and click on the AutoSum button in the Editing section of the Home ribbon. Hit Enter. Then increase decimal places to one.

4. Click cell F11.

5. Click the Copy button in the Home tab of the Ribbon.

6. Click cell F12, then click the Paste button in the Home tab of the Ribbon. Since we now have totals in row 12, we can paste the percent change formula into this row.

Figure 2.12 "Results of the SUM Function in the Budget Detail Worksheet" shows the output of the SUM function that was added to cells C12, D12, and E12. In addition, the percent change formula was copied and pasted into cell F12. Notice that this version of the budget is planning a 1.7% decrease in spending compared to last year.

Figure 2.12 Results of the SUM Function in the Budget Detail Worksheet

B14	· · · · · · · · · · · · · · · · · · ·	* Average Sper	na						
	А	В		С		D		E	F
		E	xp	ense P	lan	1			
1		(Does not	t incl	ude morto	age	and car)			-
		Percent of	Mo	nthly	An	nual			Percent
2	Category	Total	Spe	end	Sp	end	Las	st Year	Change
3	Household Utilities		\$	250	\$	3,000	\$	3,000	0.0%
4	Food			208		2,500		2,250	11.1%
5	Gasoline			125		1,500		1,200	25.0%
6	Clothes			100		1,200		1,000	20.0%
7	Insurance			125		1,500		1,500	0.0%
8	Taxes			292		3,500		3,500	0.0%
9	Entertainment			167		2,000		2,250	-11.1%
10	Vacation			125		1,500		2,000	-25.0%
11	Miscellaneous			104		1,250		1,558	-19.8%
12	Totals		\$	1,496	\$	17,950	\$	18,258	-1.7%
13		Number of	Cat	egories					
14		Ave	rage	Spend					



Integrity Check – Cell Ranges in Statistical Functions

When you intend to use a statistical function on a range of cells in a worksheet, make sure there are two cell locations separated by a colon and not a comma. If you enter two cell locations separated by a comma, the function will produce an output but it will be applied to only two cell locations instead of a range of cells. For example, the SUM function shown in Figure 2.13 "SUM Function Adding Two Cell Locations" will add only the values in cells C3 and C11, not the range C3:C11.

Figure 2.13 SUM Function Adding Two Cell Locations



Absolute References (Calculating Percent of Totals)

Follow-along file: Continue with Excel Objective 2.00 or use Excel Objective 2.04 if starting here. Since totals were added to row 12 of the **Budget Detail** worksheet, a percent of total calculation can be added to Column B beginning in cell B3. The percent of total calculation shows the percentage for each value in the Annual Spend column with respect to the total in cell D12. However, after the formula is created, it will be necessary to turn off Excel's relative referencing feature before copying and pasting the formula to the rest of the cell locations in the column. Turning off Excel's relative referencing feature is accomplished by creating an absolute cell reference. An absolute cell reference will remain locked in a

formula no matter where the formula is copied. The following steps explain this:

- 1. Click cell B3 in the **Budget Detail** worksheet.
- 2. Type an equal sign (=).
- 3. Click cell D3.
- 4. Type a forward slash (/).
- 5. Click cell D12.

6. Press the ENTER key. You will see that Household Utilities represents 16.7% of the Annual Spend budget (see Figure 2.14 "Adding a Formula to Calculate the Percent of Total").

33	• I X 🗸 J	+ =D3/D12							
1	A	\sim	C	D	E	F	G	н	1
		E	xpense P	lan	-				
1		(Does no	t include mort	gage and car)			Formula e	entered into	o B3
		Percent of	Monthly	Annual		Percent			
2	Category	Total	Spend	Spend	Last Year	Change			
3	Household Utilities	16.7%	\$ 250	\$ 3,000	\$ 3,000	0.0%			
4	Food	1	208	2,500	2,250	11.1%			
5	Gasoline		125	1,500	1,200	25.0%			
6	Clothes		100	1,200	1,000	20.0%			
7	Insurance		125	1,500	1,500	0.0%			
8	Taxes		292	3,500	3,500	0.0%			
9	Entertainment		167	2,000	2,250	-11.1%			
0	Vacation		125	1,500	2,000	-25.0%			
1	Miscellaneous	/	104	1,250	1,558	-19.8%			
2	Totals		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%			
3	Household ut	ilites represent 1	Z D E F G H I Expense Plan Formula entered into B3 Formula entered into B3 of Monthly Annual Percent Formula entered into B3 7% \$ 250 \$ 3,000 \$ 3,000 0.0% Image Image 7% \$ 250 \$ 3,000 \$ 3,000 0.0% Image Image Image 7% \$ 250 \$ 3,000 \$ 3,000 0.0% Image Image Image Image 7% \$ 250 \$ 3,000 \$ 3,000 0.0% Image Image						
4	the total Ar	A B C D E Expense Plan (Does not include mortgage and car) ategory Total Spend Annual ousehold Utilities 16.7% \$ 250 \$ 3,000 \$ 3,000 ood 208 2,500 2,250 asoline 125 1,500 1,200 lothes 100 1,200 1,000 isurance 125 1,500 1,500 axes 292 3,500 3,500 ntertainment 167 2,000 2,250 acation 125 1,500 1,500 liscellaneous 104 1,250 1,558 otals \$ 1,496 \$ 17,950 \$ 18,258 Household utilites represent 16.7% of the total Annual Spend in cell D12 ries end							
5			Min Spend						

Figure 2.14 Adding a Formula to Calculate the Percent of Total

Figure 2.14 "Adding a Formula to Calculate the Percent of Total" shows the completed formula that is calculating the percentage that Household Utilities Annual Spend represents to the total Annual Spend for the budget (see cell B3). Normally, we would copy this formula and paste it into the range B4:B11.

However, because of relative referencing, both cell references will increase by one row as the formula is pasted into the cells below B3. This is fine for the first cell reference in the

formula (D3) but not for the second cell reference (D12). Figure 2.15 "#DIV/0 Error from Relative Referencing" illustrates what happens if we paste the formula into the range B4:B12 in its current state. Notice that Excel produces the #DIV/0 error code. This means that Excel is trying to divide a number by zero, which is impossible.

Looking at the formula in cell B4, you see that the first cell reference was changed from D3 to D4. This is fine because we now want to divide the Annual Spend for Insurance by the total Annual Spend in cell D12. However, Excel has also changed the D12 cell reference to D13. Because cell location D13 is blank, the formula produces the #DIV/0 error code.

Figure 2.15 #DIV/0 Error from Relative Referencing

1	A	В	C	D	E	F	
1		(Does not	Expense P	lan gage and car)			
2	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Change	
3	Household Utilities	16.7%	\$ 250	\$ 3,000	\$ 3,000	0.0%	
1	Food	=D4/D13	\$ 208	\$ 2,500	\$ 2,250	11.1%	
ŝ	Gasoline	#W/V/0!	\$ 125	\$ 1,500	\$ 1,200	25.0%	
5	Clothes	#DIV/0!	\$ 100	\$ 1,200	\$ 1,000	20.0%	
1	Insurance	#DIV/0!	\$ 125	\$ 1,500	\$ 1,500	0.0%	
3	Taxes	#DIV/0!	\$ 292	\$ 3,500	\$ 3,500	0.0%	
3	Entertainment /	#DIV/0!	\$ 16Z	\$ 2,000	\$ 2,250	-11.1%	
0	Vacation	#DIV/0!	\$ 125	\$ 1,500	\$ 2,000	-25.0%	
1	Miscellaneous	#DIV/0!	\$ 104	\$ 1,250	\$ 1,558	-19.8%	
2	Totals		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%	
3		Number of	Categories	1		Divide by	zen
4	/	Ave	rage Spend			error co	de.
5	+ Budget Summary	Budget Det	Min Spend	Payments /	Car Lease Payr	nents 🔊 🕷	
R	elative Referencing changed his cell reference to D13, but cell D13 is blank						

To eliminate the divide-by-zero error shown in Figure 2.15 "#DIV/0 Error from Relative Referencing", we must add an **absolute reference** to cell D12 in the formula. An absolute reference prevents relative referencing from changing a cell reference in a formula. This is also referred to as *locking a cell*.

Excel uses the \$ to lock either the column letter, the row number, or both. In an absolute cell reference, Excel will lock both the column and row references. This prevents the cell from changing relatively when copied or moved.

The following explains how this is accomplished:

1. Double click cell B3.

2. Place the mouse pointer in front of D12 and click. The blinking cursor should be in front of the D in the cell reference D12.

3. Press the F4 key. You will see a dollar sign (\$) added in front of the column letter D and the row number 12. You can also type the dollar signs in front of the column letter and row number.

4. Press the ENTER key.

5. Click cell B3.

6. Click the Copy button in the Home tab of the Ribbon.

- 7. Highlight the range B4:B11.
- 8. Click the Paste button in the Home tab of the Ribbon.

Figure 2.16 "Adding an Absolute Reference to a Cell Reference in a Formula" shows the percent of total formula with an absolute reference added to D12. Notice that in cell B4, the cell reference remains D12 instead of changing to D13 as shown in Figure 2.15 "#DIV/0 Error from Relative Referencing". Also, you will see that the percentages are being calculated in the rest of the cells in the column, and the divide-by- zero error is now eliminated.

VLOOKUP ▼ : × ✓ f _x =D7/\$D\$12											
		А	В	С	D			E	F		
			Percent of	Monthly	Annua	I .			Percent		
2	Category	y	Total	Spend	Spend		Last	Year	Change		
3	Househo	old Utilities	16.7%	\$ 250	\$3,	,000	\$	3,000	0.0%		
4	Food		13.9%	208	2,	500		2,250	11.1%		
5	Gasoline	9	8.4%	125	1,	,500		1,200	25.0%		
6	Clothes		6.7%	100	1,	200		1,000	20.0%		
7	Insurance		=D7/\$D\$12	125	l 1,	,500		1,500	0.0%		
8	Taxes		19.5%	292	3,	,500		3,500	0.0%		
9	Entertainment		/ 11.1%	167	2,	,000		2,250	-11.1%		
10	Vacatior	ו /	8.4%	125	1,	500		2,000	-25.0%		
11	Miscellaneous		7.0%	104	1,	250		1,558	-19.8%		
12	Totals			\$ 1,496	\$ 17,	950	\$1	8,258	-1.7%		
13		The \$ signs	indicate that	Categories	Ī						
14	an absolute		eference was	age Spend							
15		added to		Min Spend							
16				Max Spend							

Figure 2.16 Adding an Absolute Reference to a Cell Reference in a Formula

The COUNT Function

Follow-along file: Continue with Excel Objective 2.00 or use Excel Objective 2.05 if starting here. The next function that we will add to the **Budget Detail** worksheet is the COUNT function. The COUNT function is used to determine how many cells in a range contain a numeric entry. The function will count <u>only</u> those cells that have a numeric entry. Cells that contain text, or are blank, will not be included in the total count.

For the **Budget Detail** worksheet, we will use the COUNT function to count the number of items that are planned in the Annual Spend column (Column D). The following explains how the COUNT function is added to the worksheet by using the function list:

1. Click cell D13 in the **Budget Detail** worksheet.

2. Type an equal sign (=).

3. Type the letter C.

4. Click the down arrow on the scroll bar of the function list (see Figure 2.17 "Using the Function List to Add the COUNT Function") and find the word *COUNT*.

5. Double click the word *COUNT* from the function list.

6. Highlight the range D3:D11.

7. Type a closing parenthesis ()).

8. Press the ENTER key. The function produces an output of 9 since there are 9 items planned on the worksheet.

Figure 2.17 "Using the Function List to Add the COUNT Function" shows the function list box that appears after completing steps 2 and 3 for the COUNT function. The function list provides an alternative method for adding a function to a worksheet.

ļ	A	8	C		D	E	F	G
2 Category		Percent of Total	Percent of Monthly Total Spend		nual end	LY Spend	Percent Change	
	Household Utilities	16.7%	\$ 25	0 \$	3,000	\$ 3,000	0.0%	
	Food	13.9%	20	8	2,500	2,250	11.1%	
5 Gasoline		8.4%	12	5	1,500	1,200	25.0%	
	Clothes	6.7%	10	0	1,200	1,000	20.0%	
	Insurance	8.4%	12	5	1,500	1,500	0.0%	
	Taxes	19.5%	29	2	3,500	3,500	0.0%	Function list
	Entertainment	11.1%	16	7	2,000	2,250	-11.1%	
ŝ	Vacation	8.4%	12	5	1,500	2,000	-25.0%	
	Miscellaneous	7.0%	10	4	1,250	1,558	-19.8%	
	Totals		\$ 1,49	6 \$	17,950	(6) сончент (7) сончент	× -1. Do	uble click the functio
	This definition appears	Number of Categories =c			8 cos	~	to add it to the works	
	function name once.	Average openu			B COLATA	1		
5		Min Spend				COUNTELANK IO COUNTE	130	
			Max Spend			(COUNTES		
	H Rudger Summary Bodge	t Detail / Mongage Py	ummes . Car	Leane Paur	City annual	 (c) coursers (c) coursers (c) coursers (c) coursers 	-	CT UR

Figure 2.17 Using the Function List to Add the COUNT Function

Figure 2.18 "Completed COUNT Function in the Budget Detail Worksheet" shows the output of the COUNT function after pressing the ENTER key. The function counts the number of cells in the range D3:D11 that contain a numeric value. The result of 9 indicates that there are 9 categories planned for this budget.
A	R					meaning in call [313]
	and the second sec	C	D	E	F	appears in centric.
ory	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Change	
ehold Utilities	16.7%	\$ 250	\$ 3,000	\$ 3,000	0.0%	
	13.9%	208	2,500	2,250	11.1%	
line	8.4%	125	1,500	1,200	25.0%	
85	6.7%	100	1,200	1,000	20.0%	
ance	8.4%	125	1,500	1,500	0.0%	
5	19.5%	292	3,500	3,500	0.0%	
tainment	11.1%	167	2,000	2,250	-11.1%	
tion	8.4%	125	1,500	2,000	-25.0%	
llaneous	7.0%	104	1,250	1,558	-19.8%	
s		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%	
	Number of	Categories	9			
	Ave	rage Spend	1		COUNT	function
		Min Spend	1			
		Max Spend	1			
		Ave	Average Spend Min Spend Max Spend			

Figure 2.18 Completed COUNT Function in the Budget Detail Worksheet

The AVERAGE Function

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.06 if starting here.)

The next function we will add to the **Budget Detail** worksheet is the AVERAGE function.

This function is used to calculate the arithmetic mean for a group of numbers. For the

Budget Detail worksheet, we will use the function to calculate the average of the values in the Annual Spend column. We will add this to the worksheet by using the Function Library. The following steps explain how this is accomplished:

- 1. Click cell D14 in the **Budget Detail** worksheet.
- 2. Click the Formulas tab on the Ribbon.
- 3. Click the More Functions button in the Function Library group of commands.
- 4. Place the mouse pointer over the Statistical option from the drop-down list of options.

5. Click the AVERAGE function name from the list of functions that appear in the menu (see Figure 2.19 "Selecting the AVERAGE Function from the Function Library"). This opens the Function Arguments dialog box.

6. Click the Collapse Dialog button in the Function Arguments dialog box (see Figure 2.20 "Function Arguments Dialog Box").

7. Highlight the range D3:D11.

8. Click the Expand Dialog button in the Function Arguments dialog box (see Figure 2.21 "Selecting a Range from the Function Arguments Dialog Box"). You can also press the ENTER key to get the same result.

9. Click the OK button on the Function Arguments dialog box. This adds the AVERAGE function to the worksheet.

Figure 2.19 "Selecting the AVERAGE Function from the Function Library" illustrates how a function is selected from the Function Library in the Formulas tab of the Ribbon.

EI I	al 47 • EV (22 •	opt Layed. For	nates Data	Eanel O	lijentive 2.00 - 1	fiero	soft Escal	_			More Fu	nctions ton
1.	tr E in the set of the	F Logical Test	Cate & Lookup Tate * Reference	A 100 A 100	Lange I		fra Name *	anter 2	大田大山	ala Prasiderts ala Digunderts musia Antons = 1 Form	Show for Show for Calendrate (Calendrate)	Place the mouse pointer over this option to see a lis of statistical functions.
	- F	A COUNT(D) C	ntij		Supremus 8		C.TRACE					
2	A	B Percent of Total	Monthly Spend	Annual C	Site +	1	RIENALER AVERALER	AVERA	0 62(*	H umber1.number	1 D efr	
3	Household Utilities	16.7%	\$ 250	\$ 3,0 114	Compatibility 1	1	solitorial	maan be tu	nd it now	ti argimietti, ohi oʻsr Hameli, artiq	A 148	
4	Canalina	13.9%	208	2,500	2,250	11	META-COT	reters	oces	That contain same	pera	
2	Clothas	8.4%	125	1,500	1,200	11	RETAIN!	0 P	ens 7	1 for more help.		
7	Insurance	8 4 %	125	1,200	1,000	1	SECONDET					
8	Taxes	19.5%	292	3,500	3,500		REICH/21/					File and an an and a set
9	Entertainment	11,1%	167	2.000	2.250	1-	CHART-		-			it to the worksheet.
10	Vacation	8.4%	125	1,500	2,000	1	CHEQ.257.A	T.	- 1			
11	Miscellaneous	7.0%	104	1,250	1,558	1	OBON					
12	Totals		\$ 1,496	\$ 17,950	\$ 18,258	1	0400,007.00	t .				
13		Number of	Categories	9			CHSQ.7817	in the second				
14		Ave	rage Spend				CONDENCE	T				
15			Min Spend			6	brief Sprin		1.53			
16			Max Spend			1-	and Derive		_			
17		I have been a second										

Figure 2.19 Selecting the AVERAGE Function from the Function Library

Figure 2.20 "Function Arguments Dialog Box" shows the Function Arguments dialog box. This appears after a function is selected from the Function Library. The Collapse Dialog button is used to hide the dialog box so a range of cells can be highlighted on the worksheet and then added to the function.

Figure 2.20 Function Arguments Dialog Box

Function Arg	umenta				19-19	Collapse Dialog
AVERAGE	Number1 Number2	013	± = 5 ± = mil	er.	The	definition of the tion appears here.
Returns the av	erage (arithmeti	c mean) of its arguments, Number1: number1,	= \$ which can be numbers or nam number2, are 1 to 255 nume	es, arrays, or references th ric arguments for which yo	at contain numbers. u want the average.	/
Formula result	= s nction	9		ОК	Cancel	

Figure 2.21 "Selecting a Range from the Function Arguments Dialog Box" shows how a range of cells can be selected from the Function Arguments dialog box once it has been collapsed.

Figure 2.21 Selecting a Range from the Function Arguments Dialog Box

J	E S Punction Argument	1 (A) (Q)	8	- 61	- 1	a (iii	è.	13 3	Confine Name -	-	De train	2141 	
in i	time 09:011										1		Expand Dialog
-	AVERAGE .	× ✓ fa -AVES	RAGE	(D3:D11)	0			De	thed hames	-			Contone
ä	Α	8	10.24	C	1	D	1	E	F.		G		
	Category	Percent of Total	Mor	nthiy	An	nual end	LY	Spend	Percent Change				
É	Household Utilities	16.7%	S	250	S	3,000	5	3,000	0.0%				
	Food	13.9%	\$	208	S	2,500	\$	2,250	11.1%				
	Gasoline	8.4%	\$	125	S	1,500	\$	1,200	25.0%				
	Clothes	6.7%	S	100	S	1,200	\$	1,000	20.0%	6		11.2.112	
	Insurance	8.4%	\$	125	S	1,500	\$	1,500	0.0%		This cel	Irang	e was highlighted
	Taxes	19.5%	S	292	5	3,500	\$	3,500	0.0%		after c	ollaps	ing the Function
Ì	Entertainment	11.1%	\$	167	5	2,000	\$	2,250	-11.1%	L	Arg	umen	ts dialog box,
0	Vacation	8.4%	\$	125	15	1,500	\$	2,000	-25.0%				
1	Miscellaneous	7.0%	S	104	5	1,250	\$	1,558	-19.8%				
2	Totals		\$	1,496	s	17,950	\$	18,258	-1.7%				
3		Number o	f Cal	tegories		9	-			-	-		
4	19	Ave	orage	e Spend	E(D	3:D11)	-				celi	being built.	
5			Mit	n Spend						-	and and		
6			Ma	x Spend									

Figure 2.22 "Function Arguments Dialog Box after a Cell Range Is Defined for a Function" shows the Function Arguments dialog box after the cell range is defined for the AVERAGE function. The dialog box shows the result of the function before it is added to the cell location. This allows you to assess the function output to determine whether it makes sense before adding it to the worksheet.

Function Argu	ments				WIT ST	C
AVERAGE	Number1 Number2	03:011	(3000; (3000) = 1000110	2500;1500;1250;1500;3500;2000; *		The first few values that are entered into the cell range appear here.
Returns the ave	erage (artihmeti	c mean) of its arguments Number1: number	, which can be numbers to home Lnumber2, are 1 to 255 numer	Annova, or references that contains is arguments for which you want t	n numbers. he sverage	The output of the function appears here.
Formula result	= \$ ctore			OK N	3,994 Cancel	

Figure 2.22 Function Arguments Dialog Box after a Cell Range Is Defined for a Function

Figure 2.23 "Completed AVERAGE Function" shows the completed AVERAGE function in the Budget Detail worksheet. The output of the function shows that on average we expect to spend \$1,994 for each of the categories listed in Column A of the budget. This average spend calculation per category can be used as an indicator to determine which categories are costing more or less than the average budgeted spend dollars.

-	D14 • (*	AVERAGE[D]	011)				The AVERAGE function
	A	B	C	D	E	F	as it appears in centor.
2	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Change	
3	Household Utilities	16.7%	\$ 250	\$ 3,000	\$ 3,000	0.0%	2
4	Food	13.9%	208	2,500	2,250	11.1%	2
5	Gasoline	8.4%	125	1,500	1,200	25.0%)
6	Clothes	6.7%	100	1,200	1,000	20.0%	2
7	Insurance	8.4%	125	1,500	1,500	0.0%	
8	Taxes	19.5%	292	3,500	3,500	0.0%	2
9	Entertainment	11.1%	167	2,000	2,250	-11.1%	>
10	Vacation	8.4%	125	1,500	2,000	-25.0%	
11	Miscellaneous	7.0%	104	1,250	1,558	-19.8%	>
12	Totals		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%	>
13		Number of	Categories	9			
14	1	Ave	rage Spend	\$ 1,994	-		AVERAGE function output
15			Min Spend			3	
16			Max Spend				
17		and the second second				-	

Figure 2.23 Completed AVERAGE Function

The MAX and MIN Functions

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.07 if starting here.)

The final two statistical functions that we will add to the Budget Detail worksheet are the MAX and MIN functions. These functions identify the highest and lowest values in a range of cells. The following steps explain how to add these functions to the Budget Detail worksheet:

- 1. Click cell D15 in the **Budget Detail** worksheet.
- 2. Type an equal sign (=).
- 3. Type the word MIN.
- 4. Type an open parenthesis (().
- 5. Highlight the range D3:D11.
- 6. Type a closing parenthesis ()).

7. Press the ENTER key. The MINError! Bookmark not defined. function produces an output of \$1,200, which is the lowest value in the Annual Spend column (see Figure 2.24 "MIN Function Added to the Budget Detail Worksheet").

	D15 · · (f =MIN[D3:011					The MIN function as appears in cell D15
1	A	8	C	D	E	F	appears in centry is
2	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Change	
3	Household Utilities	16.7%	\$ 250	\$ 3,000	\$ 3,000	0.0%	
ŧ.	Food	13.9%	208	2,500	2,250	11.1%	
5	Gasoline	8.4%	125	1,500	1,200	25.0%	
5	Clothes	6.7%	100	1,200	1,000	20.0%	
7	Insurance	8.4%	125	1,500	1,500	0.0%	
8	Taxes	19.5%	292	3,500	3,500	0.0%	
9	Entertainment	11.1%	167	2,000	2,250	-11.1%	
0	Vacation	8.4%	125	1,500	2,000	-25.0%	
1	Miscellaneous	7.0%	104	1,250	1,558	-19.8%	
2	Totals		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%	
3		Number of	Categories	9			
4		Ave	rage Spend	\$ 1,994			
5			Min Spend	\$ 1,200	+		MIN function output
б			Max Spend				
2							

Figure 2.24 MIN Function Added to the Budget Detail Worksheet

Let's try a different method using the AutoSum feature.

8. Click cell D16.

9. Click on the drop-down menu to the right of the AutoSum in the Editing section of the Home ribbon. (You can also use the AutoSum on the left side of the Formulas ribbon)

10. Select MAX.

11. Highlight the range D3: D11.

12. Press the ENTER key. The MAX function produces an output of \$3,500. This is the highest value in the Annual Spend column (see Figure 2.25 "MAX Function Added to the Budget Detail Worksheet").

_	016 • (* (1 =MAX(03:011					appears in cell D15
2	Category	Percent of Total	Monthly Spend	Annual Spend	LY Spend	Percent Change	
3	Household Utilities	16.7%	\$ 250	\$ 3,000	\$ 3,000	0.09	6
1	Food	13.9%	208	2,500	2,250	11.19	6
5	Gasoline	8.4%	125	1,500	1,200	25.0%	6
	Clothes	6.7%	100	1,200	1,000	20.0%	6
1	Insurance	8.4%	125	1,500	1,500	0.0%	6
	Taxes	19.5%	292	3,500	3,500	0.0%	6
7	Entertainment	11.1%	167	2,000	2,250	-11.19	6
0	Vacation	8.4%	125	1,500	2,000	-25.0%	6
1	Miscellaneous	7.0%	104	1,250	1,558	-19.8%	6
2	Totals		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%	0
3		Number of	Categories	9		-	Double line border
4		Ave	rage Spend	\$ 1,994		-	
5			Min Spend	\$ 1,200		1	
6			Max Spend	\$ 3,500	+		output
7		and the state of	A States		6	-	

Figure 2.25 MAX Function Added to the Budget Detail Worksheet

Copy and Paste Formulas (Pasting without Formats)

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.08 if starting here.) As shown in Figure 2.25 "MAX Function Added to the Budget Detail Worksheet", the COUNT, AVERAGE, MIN, and MAX functions are summarizing the data in the Annual Spend column. You will also notice that there is space to copy and paste these functions under the LY Spend column. This allows us to compare what we spent last year and what we are planning to spend this year. Normally, we would simply copy and paste these functions into the range E13:E16. However, you may have noticed the double-line style border that was used around the perimeter of the range B13:E16. If we used the regular Paste command, the double line on the right side of the range E13:E16 would be replaced with a single line. Therefore, we are going to use one of the Paste Special commands to paste only the functions without any of the formatting treatments. This is accomplished through the following steps:

- 1. Highlight the range D13:D16 in the **Budget Detail** worksheet.
- 2. Use the Fill handle and fill across to E13:16
- 3. Click cell E13.

4. Click the down arrow below the Paste button in the Home tab of the Ribbon.

5. Click the Formulas option from the drop-down list of buttons (see Figure 2.26 "Paste Formulas Option").

Figure 2.26 "Paste Formulas Option" shows the list of buttons that appear when you click the down arrow below the Paste button in the Home tab of the Ribbon. One thing to note about these options is that you can preview them before you make a selection by dragging the mouse pointer over the options. As shown in the figure, when the mouse pointer is placed over the Formulas button, you can see how the functions will appear before making a selection. Notice that the double-line border does not change when this option is previewed. That is why this selection is made instead of the regular Paste option.

Harry &	liart P	st of paste opti age Leybut Form	ions.	Data	Revie	Excel Ot	Soci	we 2.00 xlos	 Miczosoft Exce 	Fo	The paste ormulas option
	Rant	н + <u>к к</u>	8 1		t gje digne	B Wrap 1 B Merge wrff	di Ci	cue enter + \$ 4	ton. • % • 14 2 Number	Cill For	Use this option to paste only formularly and any number formats that have been applied to the output.
	• 6	Ja B		c		D		E	F		
Formulat (F)		Percent of Total	Mor	nthiy		nual	LY	Spend	Percent		
10 122 111	ities	16.7%	5	250	S	3,000	\$	3,000	0.0%		
ther Paste Options		13.9%	S	208	S	2,500	\$	2,250	11.1%		
		8.4%	\$	125	\$	1,500	\$	1,200	25.0%		
Danta Special		6.7%	\$	100	S	1,200	\$	1,000	20.0%		
mourance	1	8,4%	\$	125	\$	1,500	\$	1,500	0.0%		
Taxes		19.5%	\$	292	\$	3,500	\$	3,500	0.0%		
Entertainment		11.1%	\$	167	\$	2,000	\$	2,250	-11.1%		
Vacation		8.4%	\$	125	\$	1,500	\$	2,000	-25.0%		
Miscellaneous		7.0%	S	104	\$	1,250	\$	1,558	-19.8%		
Totals			\$	1,496	s	17,950	\$	18,258	-1.7%		
		Number of	Cat	legories		9		9	AD	eviev	w of the function outputs
Č.	Average Spen					1,994	s	2,029	app	ear in	the range E13:E16 when
			Mir	n Spend	5	1.200	5	1.000	the	mous	e pointer is dragged over
5			64m	Soand	\$	3.500	\$	3,500		the	e Formulas option.

Figure 2.26 Paste Formulas Option

Alternatively, you can use the quick format button that appears when you copy the cells across using the auto fill handle.

		1.0.70		1 1 1 1 1 1 1 1			
12	Totals		\$ 1,496	\$ 17,950	\$ 18,258	-1.7%	
13		Number of	Categories	9	9		
14		Aver	age Spend	\$ 1,994	\$ 2,029		
15			Min Spend	\$ 1,200	\$ 1,000		
16		1	Max Spend	\$ 3,500	\$ 3,500		
17						歸	
18					Copy Cells		
19				0	Fill Ecrmatting Only		
20				0	Fill Without Formatting	2	
21							
22							
*	· Budget Detail	Mortgage Payments	Car Lease Pay	ments ()		6	

080

Sorting Data (Multiple Levels)

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.09 if starting here.)

The Budget Detail worksheet shown in Figure 2.26 "Paste Formulas Option" is now producing several mathematical outputs through formulas and functions. The outputs allow you to analyze the details and identify trends as to how money is being budgeted and spent. Before we draw some conclusions from this worksheet, we will sort the data based on the Percent of Total column. As mentioned in Chapter 1 "Fundamental Skills", sorting is a powerful tool that enables you to analyze key trends in any data set. We demonstrated the process of executing a single-level sort in Chapter 1 "Fundamental Skills". For the purposes of the Budget Detail worksheet, we need to set multiple levels for the sort order. This is accomplished through the following steps:

1. Highlight the range A2:F11 in the **Budget Detail** worksheet.

2. Click the Data tab in the Ribbon.

3. Click the Sort button in the Sort & Filter group of commands. This opens the Sort dialog box, as shown in Figure 2.27 "Sort Dialog Box".



Figure 2.27 Sort Dialog Box

H + + H Budget Summary Budget Detail Mortgage Payments Car Lease Paym 4

@ 080

4. Click the down arrow next to the "Sort by" box.

5. Click the Percent of Total option from the drop-downlist.

6. Click the down arrow next to the sort Order box.

7. Click the Largest to Smallest option.

8. Click the Add Level button. This allows you to set a second level for any duplicate values in the Percent of Total column.

9. Click the down arrow next to the "Then by" box.

10. Select the Last Year option.

11. Click the OK button at the bottom of the Sort dialog box.

Figure 2.28 "Budget Detail Worksheet after Sorting" shows the **Budget Detail** worksheet after it has been sorted. Notice that there are three identical values in the Percent of Total column. Therefore, a second sort level had to be created for this worksheet. The second sort level arranges the values of 8.4% based on the values in the LY Spend column in ascending order. Excel gives you the option to set as many sort levels as necessary for the data contained in a worksheet.

Figure 2.28 Budget Detail	l Worksheet after Sor	ting
---------------------------	-----------------------	------

	й • (•)			an Aken	_	10.00	_	-	The primary sort on the values in
d	A	В		С		D		E	F
		Does not	nclu	ense P Ide mort	lan _{gag}	e and car	,		
	Category	Percent of Total	Mo	nthly and	An	nual end	La	st Year	Percent Change
	Taxes	19.5%	\$	250	\$	3,000	\$	3,000	0.0
	Household Utilities	16.7%		208		2,500		2,250	0.04
	Food	13.9%		125		1,500		1,200	11.19
1	Entertainment	11.1%		100		1,200		1,000	-11.10
	Gasoline	8.4%		125		1,500		1,500	25.0
1	Insurance	-< 8.4%		292		3,500		3,500	0.0
	Vacation	8.4%		167		2,000		2,250	-25.0
0	Miscellaneous	7.0%		125		1,500		2,000	-19.8
1	Clothes	6.7%		104		1,250		1,558	20.0
2	Totals		\$	1,496	\$	17,950	\$	18,258	-1.79
3	These duplicate	Number of	Cat	egories		9		9	
1	values are sorted based on the values in	Ave	rage	Spend	s	1,994	s	2,029	
5	the LY Spend column in ascending order.		Spend	\$	1,200	s	1,000		
5			Max	Spend	\$	3,500	S	3,500	

080

Now that the **Budget Detail** worksheet is sorted, a few key trends can be easily identified. The worksheet clearly shows that the top three categories as a percentage of total budgeted spending for the year are Taxes, Household Utilities, and Food. All three categories are necessities (or realities) of life and typically require a significant amount of income for most households. Looking at the Percent Change column, we can see how our planned spending is expected to change from last year. This is perhaps the most important column on the worksheet because it allows you to assess whether your plan is realistic. You will see that there are no changes planned for Taxes and Household Utilities. While Taxes can change from year to year, it is not too difficult to predict what they will be. In this case, we are assuming that there are no changes to the tax costs for our budget. We are also planning no change in Household Utilities. These costs can fluctuate from year to year as well. However, you can take measures to reduce costs, such as using less electricity, turning off heat when no one is in the house, keeping track of your cell's data usage so you do not go over the maximum allowed in your plan, and so on. As a result, there is no change in planned spending for Household Utilities because we will assume that any rate increases will be offset with a decrease in usage. The third item that is planned not to change is Insurance. Insurance policies for cars and homes can change, but as is true for taxes, the changes are predictable. Therefore, we are assuming no changes in our insurance policy.

The first big change that is noticeable in the worksheet is the Food and Entertainment categories in rows 5 and 6 (see definitions in Table 2.1 "Spend Category Definitions"). The Percent Change column indicates that there is an 11.1% decrease in Entertainment spending and an 11.1% increase in Food spending. This is logical because if you plan to eat in restaurants less frequently, you will be eating at home more frequently. Although this makes sense in theory, it may be hard to do in practice. Dinners and parties with friends may be tough to turn down. However, the entire process of maintaining a budget is based on discipline, and it certainly takes a significant amount of discipline to plan targets for yourself and stick to them.

A few other points to note are the changes in the Gasoline and Vacation categories. If you commute to school or work, the price of gas can have a significant impact on your budget. It is important to be realistic if gas prices are increasing, and you should reflect these increases in your budget. To compensate for the increased spending for gas, the spending plan for vacations has been reduced by 25%. Budgeting often requires a certain degree of creativity. Although the Vacation budget has been reduced, there is still money you can set aside to make plans for spring break or winter break.

Finally, the budget shows a decrease in Miscellaneous spending of 19.8%. This was defined as a group containing several expenses, such as textbooks, school supplies, software

updates, and so on (see Table 2.1 "Spend Category Definitions"). You may be able to reduce your spending in this category if you can use items such as online textbooks. This reduction in spending can free up funds for Clothes, a spend category that has increased by 20%. We will continue to develop the Personal Budget workbook further in Section 2.3 "Functions for Personal Finance".

Key Takeaways

Statistical functions are used when a mathematical process is required for a range of cells, such as

- Summing the values in several cell locations. For these computations, functions are preferable to formulas because adding many cell locations one at a time to a formula can be very time-consuming.
- Statistical functions can be created using cell ranges or selected cell locations separated by commas. Make sure you use a cell range (two cell locations separated by a colon) when applying a statistical function to a contiguous range of cells.
- To prevent Excel from changing the cell references in a formula or function when they are pasted to a new cell location, you must use an absolute reference. You can do this by placing a dollar sign (\$) in front of the column letter and row number of a cell reference.
- The #DIV/0 error appears if you create a formula that attempts to divide a constant or the value in a cell reference by zero.
- The Paste Formulas option is used when you need to paste formulas without any formatting treatments into cell locations that have already been formatted.
- You need to set multiple levels, or columns, in the Sort dialog box when sorting data that contains several duplicate values.

2.3 Functions for Personal Finance

LEARNING OBJECTIVES

- 1. Understand the fundamentals of loans and leases.
- 2. Create and use named cells and ranges in functions.
- 3. Use the PMT function to calculate monthly mortgage payments on a house.
- 4. Use the PMT function to calculate monthly lease payments for an automobile.
- 5. Learn how to summarize data in a workbook by using worksheet links to create a summary worksheet.
- 6. Understand the concept of the time value of money.
- 7. Use the FV function to calculate the future value of personal investments.
- 8. Use Goal Seek to conduct what-if scenarios.

In this section, we will discover the power of using named cells and ranges in our functions to better describe what is happening inside the function itself as we continue to develop the Personal Budget workbook. Notable items that are missing from the Budget Detail worksheet are the payments you might make for a car or a home. In addition, you may want to set and track a savings goal. This section demonstrates Excel functions used to calculate lease payments for a car, to calculate mortgage payments for a house, and to project future savings based on regular contributions and an average rate of return. This section also discusses the scenario capabilities of Excel once the Personal Budget workbook is complete. Before we continue with our Budget worksheet, we will explore how to name cells and ranges, modify them, rename them, or delete them.

Defining and using names in formulas

By using names, you can make your formulas much easier to understand and maintain. You can define a name for a cell, a range of cells, a function, a constant, or a table. Once you adopt the practice of using names in your workbook, you can easily update, audit, and manage these names. A name is a meaningful shorthand that makes it easier to understand the purpose of a cell reference, constant, formula, or table, each of which may be difficult to

comprehend at first glance. The following information shows common examples of names and how they can improve clarity and understanding.

Example Type	Example with no name	Example using a name
Reference	=SUM(C20:C30)	=SUM(FirstQuarterSales)
Constant	=PRODUCT(A5,8.3)	=PRODUCT(Price,WASalesTax)
Formula	=SUM(VLOOKUP(A1,B1:F20,5,FALSE), -G5)	=SUM(VLOOKUP(Inventory_Level,- Order_Amt,FALSE) -G5
Table	C4:G36	=TopSales06

Types of names

There are several types of names that you can create and use.

Defined name - A name that represents a cell, range of cells, formula, or constant value. You can create your own defined name, and Microsoft Office Excel sometimes creates a defined name for you, such as when you set a print area.

Table name - A name for an Excel table, which is a collection of data about a particularsubject that is stored in records (rows) and fields (columns). We will discuss Tables later.

The scope of a name - All names have a scope, either to a specific worksheet (also called the local worksheet level) or to the entire workbook (also called the global workbook level). The scope of a name is the location within which the name is recognized without qualification. For example:

• If you have defined a name, such as Budget_FY18, and its scope is Sheet1, that name, if not qualified, is recognized only in Sheet1, but not in other sheets without qualification. To use a local worksheet name in another worksheet, you can qualify it by preceding it with the worksheet name, as the following example shows: Sheet1! Budget_FY18

• If you have defined a name, such as Sales_Dept_Goals, and its scope is the workbook, that name is recognized for all worksheets in that workbook, but not for any other workbook.

A name must always be unique within its scope. You can override the local worksheet level for all worksheets in the workbook, except for the first worksheet, which always uses the local name if there is a name conflict and cannot be overridden.

Defining and entering names

You define a name by using the:

• Name box on the formula bar. This is best used for creating a workbook level name for a selected range.

• **Create a name from selection.** You can conveniently create names from existing row and column labels by using a selection of cells in the worksheet.

• New Name dialog box. This is best used for when you want more flexibility in creating names, such as specifying a local worksheet level scope or creating a name comment. *Note: By default, names use absolute cell references.*

You can select named cells and ranges to use in your functions and formulas by:

• Typing: Typing the name, for example, as an argument to a formula.

• **Using Formula AutoComplete**: Use the Formula AutoComplete drop-down list, where valid names are automatically listed for you.

• **Selecting from the Use in Formula command**: Select a defined name from a list in the *Use in Formula* command in the Defined Names group on the Formulas ribbon.

Pasting a defined names list:

You can also create a list of defined names in a workbook. Locate an area with two empty columns on the worksheet (the list will contain two columns, one for the name and one for a description of the name). Select a cell that will be the upper-left corner of the list. On the Formulas tab, in the Defined Names group, click *Use in Formula*, click *Paste Names* and then, in the Paste Names dialog box, click *Paste List*.

Naming Rules

The following is a list of naming rules that you need to be aware of when you create and edit names.

• Valid characters: The first character of a name must be a letter, an underscore character (_), or a backslash (\). Remaining characters in the name can be letters, numbers, periods, and underscore characters.

<u>Tip</u>: You cannot use the uppercase and lowercase characters "C", "c", "R", or "r" as a defined name, because they are all used as a shorthand for selecting a row or column for the currently selected cell when you enter them in a *Name* or *Go To* text box.

• **Cell references disallowed** - Names cannot be the same as a cell reference, such as Z\$100 or R1C1.

• **Spaces are not valid**: Spaces are not allowed as part of a name. Use the underscore character (_) and period (.) as word separators, such as, Sales_Tax or First.Quarter.

• Name length - A name can contain up to 255 characters.

• **Case sensitivity** - Names can contain uppercase and lowercase letters. Excel does not distinguish between uppercase and lowercase characters in names. For example, if you created the name Sales and then create another name called SALES in the same workbook, Excel prompts you to choose a unique name.

Define a name for a cell or cell range on a worksheet

1. Select the cell, range of cells, or nonadjacent selections that you want to name.

2. Click the *Name* box at the left end of the formula bar.

3. Type the name that you want to use to refer to your

selection. Names can be up to 255 characters in length.

4. Press ENTER.

Note: You cannot name a cell while you are changing the contents of the cell.

Define a name by using a selection of cells in the worksheet

You can convert existing row and column labels to names.



1. Select the range that you want to name, including the row or column labels.

2. On the Formulas tab, in the Defined Names group, click *Create from Selection*.

In the *Create Names from Selection* dialog box, designate the location that contains the labels by selecting the **Top row, Left column, Bottom row, or Right column** check



box. A name created by using this procedure refers only to the cells that contain values and does not include the existing row and column labels.

Define a name by using the New Name dialog box

1. On the Formulas tab, in the Defined Names group, click *Define Name*.

2. In the *New Name* dialog box, in the Name box, type the name that you want to use for your reference. Note: Names can be up to 255 characters in length.

3. To specify the scope of the name, in the Scope drop-down list box, select *Workbook* or the name of a worksheet in the workbook.

New Name	2	?	×
<u>N</u> ame:	Monthly_Payment		
<u>S</u> cope:	Workbook		
C <u>o</u> mment:			~
			~
Refers to:	='Mortgage Payments'!\$B\$5		Ť
	ОК	Cano	el

4. Optionally, in the *Comment* box, enter a descriptive comment up to 255 characters.

5. In the *Refers to* box, do one of the following:

o To enter a cell reference, type the cell reference.

o If a cell or range of cells has already been selected, you can leave it.

o You can use the up arrow to the right of the" Refers to:" to verify your cell or range reference.

Tip: The current selection is entered by default. To enter other cell references as an argument, click *Collapse Dialog* (which temporarily shrinks the dialog box), select the cells on the worksheet, and then click *Expand Dialog*.

o To enter a constant, type = (equal sign) and then type the constant value.

o To enter a formula, type = and then type the formula.

6. To finish and return to the worksheet, click OK.

Tip: To make the *New Name* dialog box wider or longer, click and drag the grip handle at the bottom.

Manage names by using the Name Manager dialog box

Use the **Name Manager** dialog box to work with the defined names and table names in the workbook. For example, you may want to find names with errors, confirm the value and reference of a name, view or edit descriptive comments, determine the scope, or delete a named range or cell. You can sort and filter the list of names, and easily add, change, or delete names from one location.

To open the Name Manager dialog box, on the Formulas tab, in the Defined Names group, click *Name Manager*.



View names

The *Name Manager* dialog displays the following information about each name in a list box:

1	Demour	iunius.	1011	India Additing		curcu
	Name Manager					\times
	<u>N</u> ew	Edit	Delete		<u> </u>	ter 🕶
1	Name Dog_Insurance Pet_Insurance	Value {"Embrace"," \$500.0 {"Provider ","Deduce	00 "," \$5,000.00 ","80%"," \$5 tible","Coverage","Reimburs	Refers To ='Pet Insurance'!\$A\$2: =Dog_Insurance[#All]	Scope Workbook Workbook	Commer

Icon and Name One of the following:

- A defined name, which is indicated by a defined name icon.
- A table name, which is indicated by a table name icon.

Value:

The current value of the name, such as the results of a formula, a string constant, a cell

range, an error, an array of values, or a placeholder if the formula cannot be evaluated.

Refers To:

The current cell reference or cell reference range for the name.

Scope: One of the following:

- A worksheet name, if the scope is the local worksheet level.
- "Workbook", if the scope is the global worksheet level.

Comment:

Additional information about the name up to 255 characters.

Note: You cannot use the Name Manager dialog box while you are changing the contents of the cell.

Change a name

If you change a defined name or table name, all uses of that name in the workbook are also changed.



- 1. On the Formulas tab, in the Defined Names group, click Name Manager.
- 2. In the Name Manager dialog box, click the name that you want to change, and then click

Edit.

Tip: You can also double-click the name.

3. In the *Edit Name* dialog box, in the Name box, type the new name for the reference.

4. In the *Refers to* box, change the reference, and then click OK.

5. In the Name Manager dialog box, in the Refers to box, change the cell, formula, or constant represented by the name.

o To cancel unwanted or accidental changes, click **Cancel**, or press ESC.

o To save changes, click **Commit**, or press ENTER.

The **Close** button only closes the Name Manager dialog box. It is not required to commit changes that have already been made.

Delete one or more names

1. On the Formulas tab, in the Defined Names group, click Name Manager.

2. In the Name Manager dialog box, click the name that you want to change.

3. Select one or more names by doing one of the following:

- o To select a name, click it.
- o To select more than one name in a contiguous group, click and drag the names, or press SHIFT and click the mouse button for each name in the group.
- o To select more than one name in a noncontiguous group, press CTRL and click the mouse button for each name in the group.

4. Click Delete. You can also press DELETE.

5. Click *OK* to confirm the deletion. The Close button only closes the Name Manager dialog box. It is not required to commit changes that have already been made.

The Fundamentals of Loans and Leases

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.10 if starting here.)

One of the functions we will add to the Personal Budget workbook is the **PMT** function. This function calculates the payments required for a loan or a lease. However, before demonstrating this function, it is important to cover a few fundamental concepts on loans and leases.

A **loan** is a contractual agreement in which money is borrowed from a lender and paid back over a specific period of time. The amount of money that is borrowed from the lender is called the **principal** of the loan. The borrower is usually required to pay the principal of the loan plus **interest**. When you borrow money to buy a house, the loan is referred to as a **mortgage**. This is because the house being purchased also serves as **collateral** to ensure payment. In other words, the bank can take possession of your house if you fail to make loan payments. As shown in Table 2.5 "Key Terms for Loans and Leases", there are several key terms related to loans and leases.

Term	Definition
Collateral	Any item of value that is used to secure a loan to ensure payments to the lender
Down Payment	The amount of cash paid toward the purchase of a house. If you are paying 20% down, you are paying 20% of the cost of the house in cash and are borrowing the rest from a lender.
Interest Rate	The interest that is charged to the borrower as a cost for borrowing money
Mortgage	A loan where property is put up for collateral
Principal	The amount of money that has been borrowed
Residual Value	The estimated selling price of a vehicle at a future point in time
Terms	The amount of time you have to repay a loan

Table 2.5 Key Terms for Loans and Leases



Figure 2.29 "Example of an Amortization Table" shows an example of an amortization table for a loan. A lender is required by law to provide borrowers with an amortization table when a loan contract is offered. The table in the figure shows how the payments of a loan would work if you borrowed \$100,000 from a lender and agreed to pay it back over 10 years at an interest rate of 5%. You will notice that each time you make a payment, you are paying the bank an interest fee plus some of the loan principal. Each year the amount of interest paid to the bank decreases and the amount of money used to pay off the principal increases. This is because the bank is charging you interest on the amount of principal that has not been paid. As you pay off the principal, the interest rate is applied to a lower number, which reduces your interest charges. Finally, the figure shows that the sum of the values in the Interest Payment column is \$29,505. This is how much it costs you to borrow this money over 10 years. Indeed, borrowing money is not free. It is important to note that to simplify this example, the payments were calculated on an annual basis. However, most loan payments are made monthly.



Figure 2.29 Example of an Amortization Table



A **lease** is a contract in which you, the lessee, use an asset such as a car or a piece of equipment and you agree to make regular payments to the owner or the lessor. When you lease a car, the manufacturer or a leasing company retains ownership of the vehicle and you agree to make regular payments for a specific period of time. The amount of money you pay depends on the price of the car, the terms of the lease contract, and the car's expected residual value at the end of the lease. The calculation of lease payments is like the calculation of loan payments. However, when you lease a car, you pay only the value of the car that is used. For example, suppose you are leasing a car that is priced at \$25,000. The lease contract is for 4 years at an interest rate of 5%. The residual value of the car is \$10,000. This means the car will lose \$15,000 of its value over 4 years. Another way to state this is that the car will **depreciate** \$15,000. A lease will be structured so that you pay this \$15,000 in depreciation. However, the interest charges will be based on the purchase price of \$25,000. We will look at a demonstration of leasing a car as well as buying a home in the next section.

The PMT (Payment) Function for Loans

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.10 if starting here.)

If you own a home, your mortgage payments are a major component of your household budget. If you are planning to buy a home, having a clear understanding of your monthly payments is critical for maintaining strong financial health. In Excel, mortgage payments are conveniently calculated through the PMT (payment) function. This function is more complex than the statistical functions covered in Section 2.2 "Statistical Functions". With statistical functions, you are required to add only a range of cells or selected cells within the parentheses of the function. With the PMT function, you must accurately define a series of **arguments** for the function to produce a reliable output. Table 2.6 "Arguments for the PMT Function" lists the arguments for the PMT function. It is helpful to review the key loan and lease terms in Table 2.5 "Key Terms for Loans and Leases" before reviewing the PMT function arguments.

The PMT function is: =PMT (RATE,NPER,PV,[FV],[Type])

Table 2.6 Arguments for the PMT Function

Argument	Definition
Rate	This is the interest rate the lender is charging the borrower. The interest rate is usually quoted in annual terms, so you must divide this rate by the number of payments per year.
Nper	The argument letters stand for <i>number of periods</i> . This is the term of the loan, which is the amount of time you have to repay the bank. This is usually quoted in years, so you must multiply the years by number of payments per year.
Pv	The argument letters stand for <i>present value</i> . This is the principal of the loan or the amount of money that is borrowed. When defining this argument, a minus sign must precede the cell location or value. For leases, this argument is used for the price of the item being leased.
[Fv]	The argument letters stand for <i>future value</i> . The brackets around the argument indicate that it is not always necessary to define it. It is used if there is a lump-sum payment that will be made at the end of the loan terms. This is also used for the residual value of a lease. If it is not defined, Excel will assume that it is zero.
[Type]	This argument can be defined with either a 1 or a 0. The number 1 is used if payments are made at the beginning of each period. A 0 is used if payments are made at the end of each period. The argument is in brackets because it does not have to be defined if payments are made at the end of each period. Excel assumes that this argument is 0 if it is not defined.

We will use the PMT function in the Personal Budget workbook to calculate the monthly mortgage payments for a house. These calculations will be made in the **Mortgage Payments** worksheet and then displayed in the **Budget Summary** worksheet through a named cell reference link.

The first thing we will do in this worksheet is name the cells we will be using in our functions. Next, we will discover a new method of adding functions to a worksheet. The following steps explain the new method using the Insert Function command for adding the PMT function:

1. Click the **Mortgage Payments** worksheet tab.

2. Highlight the range A2:B6. On the Formula ribbon, Defined Names section click on Create from Selection. Make sure Left Column is checked. (see Figure 2.29b "Create from Selection"). Click OK. You have now named all of the cells in the B column. (You can verify your named cells by using the drop-down arrow in the Name Box.)

File	e Home Insert	Draw Pa	ge Layout 🛛 🛛 🗛	ormulas	Data	Review	Viev	v Q Tell me wha	t you want to
fx Inse unct	AutoSum Recently Fina	ancial Logical	Text Date & Text Date & Time Time T	Lookup & Reference	θ Math & ▼ Trig ▼	More Functions •	Nar Man	Define Name Use in Formu ager Create from Defined Names	a ▼ fi ula ▼ C Selection
42	• : × .	f _x	Loan Principal						
	А		В		С	D		E	F
1	Mortgag	e Payn	nent Ana	alysis	6	Create N	lames	from Selection ?	×
2	Loan Principal	\$	165,00	0		Create n	ames f	rom values in the:	
3	Interest Rate		5.0	%			row colum	ın	
4	Terms of Loan		(30 Ye	ars	Bot	tom ro	w	
5	Payments per Y	ear							_
6	Monthly Payme	nt						OK	Cancel

Figure 2.29b Create from Selection

3. Click cell B5.

4. Click the Formulas tab on the Ribbon.

5. Click the Insert Function button (see Figure 2.30 "Mortgage Payments Worksheet"). This opens the Insert Function dialog box, which can be used for searching all functions in Excel.

6. In the "Search for a function:" input box at the top of the Insert Function dialog box, type payment (see Figure 2.31 "Insert Function Dialog Box"). Note that the current description in the "Search for a function:" input box will already be highlighted. You can begin typing and the description will be replaced with your entry.

7. Click the Go button in the upper right side of the Insert Function dialog box. This adds all the Excel functions that match your description in the "Select a function:" box in the lower half of the Insert Function dialog box (see Figure 2.31 "Insert Function Dialog Box").

8. Click the PMT option in the "Select a function:" box in the lower half of the Insert Function dialog box.

9. Click the OK button at the lower right side of the Insert Function dialog box. This will open the Function Arguments dialog box.

	Home Insert /	Page Layout Formula	s Data	Excel Of Review View	bjective 2.00	Formulas tat
f.	t DatoSum Recently Financi	af Logical Text Dat Function Library	te & Lookup ne + Reference	& Math & Mo e * Trig * Functio	re Name ons • Managi	
	85 🔹 🤄	f.		1	Inser	t Function bu
A	A	8	C	D	E	
1	Mortgage P	ayment Analy	ysis			
2	Loan Principal	\$ 165,000				
3	Interest Rate	5.0%				
4	Terms of Loan	30	Years			
5	Monthly Payment					
6	montally r dymone	1				
7				The PMT function	on will be	
8				added here to ca	Iculate the	
9			C	ioning mangage	(paping and)	
0						
11						
12						
13						
14					Mortgage Pa	iyments
16					workshee	et tab
17				1		

Figure 2.30 Mortgage Payments Worksheet

Figure 2.31 Insert Function Dialog Box



Keyboard Shortcuts – Insert Function

o Hold the SHIFT key while pressing the F3 key.

10. The cursor automatically starts in the Rate box. This will be the first argument defined for the PMT function.

11. Click cell B3 on the worksheet. This is the rate being charged on the loan. You will see your defined name Interest_Rate appear in the Rate argument box.

12. Type a forward slash (/) for division.

13. Click on cell B5. Since our goal is to calculate the monthly payments for the loan, we need to divide the rate, which is stated in annual terms, by the number of payments per year. The number of payments per year is found in cell B5. This converts the annual rate to a monthly rate. (periodic rate) Your defined name Payments_per_Year will appear after your /.

14. Click in the Nper field in the Function Arguments dialog box. This is the second argument we define in the function. Nper is the total number of payments to be made over the life of the loan. It is the loan in years * the payments per year.

15. Click cell B4 on the worksheet. This is the term or the amount of time we have to repay the loan. You will see the defined name Terms_of_Loan appear in your Nper argument box.

16. Type an asterisk (*) for multiplication.

17. Click on cell B5. Since our goal is to calculate the total number of payments for the loan, we need to multiply the term of the loan by payments per year.

18. Click in the Pv argument field in the Function Arguments dialog box. This is the third argument we will define in the function.

19. Type a minus sign (–). When defining the Pv argument of the PMT function, any cell location or value must be preceded with a minus sign.

20. Click cell B2 on the worksheet. This is the principal of the loan. Your defined name Loan_Principal will appear in the PV argument field.

21. You will now see the Rate, Nper, and Pv arguments defined for the function.

22. Click the OK button at the bottom of the Function Arguments dialog box. The function will now be placed into the worksheet. Since we are not paying any lump sums of money at the end of the loan, there is no need to define the Fv argument. Also, we will assume that the monthly mortgage payments will be made at the end of each month. Therefore, there is no need to define the Type argument.

Figure 2.32 "Function Arguments Dialog Box for the PMT Function" shows the completed Function Arguments dialog box for the PMT function. Notice that the dialog box shows the values for the Rate and Nper arguments. The Rate is divided by 12 to convert the annual interest rate to a monthly interest rate. The Nper argument is multiplied by 12 to convert the terms of the loan from years to months. Finally, the dialog box provides you with a definition for each argument. The definition appears when you click in the input box for the argument.

Function Arguments			? ×	
PMT Rate Nper PV	Interest_Rate/Payments_per_Yea Terms_of_Loan*Payments_per_Y -Loan_Principal	= 0.004166667 = 360 = .165000	The com of eacl	puted values n argument
Type	1	= number		
Calculates the payment for a lo	ction output result)			
Formula result = \$885.76		ОК	Cancel	



Integrity Check - Comparable Arguments for PMT and FV Functions

When using functions such as PMT or FV, make sure the arguments are defined in comparable terms. For example, if you are calculating the monthly payments of a loan, make sure both the Rate and Nper argument are expressed in terms of payments per year. The function will produce an erroneous result if one argument is expressed in years while the other is expressed in months.

Figure 2.33 "Mortgage Payments Worksheet with the PMT Function" shows the final appearance of the **Mortgage Payments** worksheet after the PMT function is added. The result of the function in cell B6 will be displayed in the **Budget Summary** worksheet.

Figure 2.33 Mortgage Payments Worksheet with the PMT Function



The PMT (Payment) Function for Leases

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.11 if starting here.)

In addition to calculating the mortgage payments for a home, the PMT function will be used in the Personal Budget workbook to calculate the lease payments for a car. The details for the lease payments are found in the *Car Lease Payments* worksheet. Similar to the statistical functions, we can type the PMT function directly into a cell. However, you must know the definitions for each argument of the function and understand how these arguments need to be defined based on your objective. The terms for loans and leases are in Table 2.5 "Key Terms for Loans and Leases", and the definitions for the arguments of the PMT function are in Table 2.6 "Arguments for the PMT Function". The following steps explain how the PMT function is added to the Personal Budget workbook to calculate lease payments for a car:

1. Highlight the range A2:B6. On the Formula ribbon, Defined Names section click on Create from Selection. Make sure Left Column is checked. (see Figure 2.29b "Create from Selection"). Click OK. You have now named all of the cells in the B column. (You can verify you named cells by using the drop-down arrow in the Name Box.)

Note: When we use the same names on two different worksheets, the Name Manager assigns a different scope. The first time we named Interest rate the scope was for the Mortgage

Payments worksheet. This time it is for the Car Lease Payments worksheet. See Figure 2.33a.

<u>N</u> ew	<u>E</u> dit	Delete			<u>F</u> ilter •
lame	Value		Refers To	Scope	Comment
Interest_Ra	ate 3.0%		='Car Lease Payme	Car Leas	
 Interest_Rate 3.0% Interest_Rate 5.0% Loan_Principal \$16 Monthly_Payme Monthly_Payme Payments_per_y Price_of_Car \$20, Residual_Value \$12 Terms_of_Loan 48 Terms_of_Loan 30_ 			= 'Mortgage Payme = 'Mortgage Payme = 'Car Lease Payme = 'Mortgage Payme = 'Mortgage Payme = 'Car Lease Payme = 'Car Lease Payme = 'Car Lease Payme = 'Mortgage Payme	Workbo Car Leas Workbo Workbo Workbo Workbo Car Leas Workbo	Unduplicate names
fers to:				Sco dur	ppe changes for plicated names.
Carl Contract Contract		0.000.0000			

Figure 2.33a Name Manager Named Functions.

- 2. Click cell B6 in the Car Lease Payments worksheet.
- 3. Type an equal sign (=).
- 4. Type the letters PMT. A drop-down list of Excel functions will appear. Double click PMT.

Car Lease	Payr	nents	5	
[⊃] rice of Car	\$	20,	000	
Residual Value	\$	12,	000	
_ease Interest Rate		3	.0%	
Terms of Loan			48	Months
Monthly Lease Payment	=pm	t		
	CL CL CL CL CL CL CL CL CL CL CL CL CL C	nt Jmipmt Mt Pmt Pmt	Calcul	ates the payment f

5. Click cell B4. This is the interest rate being charged for the lease.

6. Type the forward slash (/) for division.

7. Type the number 12. Since our goal is to calculate the monthly lease payments, we divide the interest rate by 12 to convert the annual rate to a monthly rate.

8. Type a comma. When you type a function containing arguments, you must separate each argument with a comma. This signals to Excel that one argument has been defined and you are ready to define the next argument in the function.

9. Click cell B5. This is the term or the length of time for the lease contract. Since the term is already expressed in months, we can just reference cell B5 and move to the next argument.

10. Type a comma. This advances the function to the Pv argument.

11. Type a minus sign (–). Remember that cell locations or values used to define the Pv argument must be preceded with a minus sign.

12. Click cell B2 on the worksheet, which is the price of the car.

13. Type a comma. This advances the function to the [Fv] argument.

14. Click cell B3 on the worksheet. This is the residual value of the car. Note that cell location and values used to define the [Fv] argument are NOT preceded by a minus sign.

15. Type a comma. This advances the function to the [Type] argument.

16. Type the number 1. We will assume that the lease payments will be due at the beginning of each month.

17. Type a closing parenthesis ()).

18. Press the ENTER key.

19. Figure 2.34 "PMT Function Constructed to Calculate Lease Payments" shows how the PMT function should appear before pressing the ENTER key. Notice the commas that separate each argument of the function. Also, the tip box will show the current argument being defined in bold font.

	А		В	С	D	E	F	G	н	1	J
1	Car Lease Payments										
2	Price of Car	\$	20,000								
3	Residual Value	\$	12,000								
4	Lease Interest Rate		3.0%								
5	Terms of Loan		48	Months							
6	Monthly Lease Payment	=PMT	(Lease_l	nterest_R	ate/12,Te	erms_of_Loa	an,-Price	_of_Car	,Residua	I_Value,	1)
7		PMT(r	ate, nper, pv, [fv],	[type])							

Figure 2.34 PMT Function Constructed to Calculate Lease Payments

Figure 2.35 "Results of the PMT Function in the Car Lease Payments Worksheet" shows the result of the PMT function. The monthly payments for this lease are \$206.56. This monthly payment will be displayed in the Budget Summary worksheet.

Figure 2.35 Results of the PMT Function in the Car Lease Payments Worksheet

Мо	nthly * : 🔀 🗸 🧳	f _x	=PMT(Interest_Rat	te/12,Terms_of	_Loan,-Price_o	f_Car,Residual_Val	ue,1)
	А		В	с	D	E	F
1	Car Lea	se	Payments				
2	Price of Car	\$	20,000				
3	Residual Value	\$	12,000				
4	Interest Rate		3.0%				
5	Terms of Loan		48	Months			
6	Monthly Payment		\$206.56				
7							

Creating an Amortization Schedule for a Loan

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.11b if starting here.)

Now that we have determined how much a loan or lease will cost per month, it is useful to determine how interest and principal will be applied from our payment each month. Figure 2.35b shows how interest and principal on a loan behave over time. You can see from this chart that it will take you over 16 years for your payments to go more toward principal than interest.

One of the advantages of preparing an amortization schedule is that you can see exactly

how much is being applied to principal and interest each time you make a payment. You can also play with the monthly payment amount and see how increasing your payment will apply more to your principal payment while reducing your loan duration.



Figure 2.35b Changes in Principal and Interest over the life of a loan

To complete the amortization schedule, we will use two financial functions; the PPMT Principal Payment function that calculates the amount of any given period's principal payment, and the IPMT Interest Payment function, which calculates the interest taken from any given period payment. The PPMT and the IPMT have the same arguments and are the same as the PMT with one exception. The exception is that you must tell the function which period you are calculating out the interest or principal.

The arguments in either function are:

RATE, Current period, NPER, PV

- Where RATE = the periodic interest rate (RATE/payments per year)
- Current period = the current period number

- NPER = total payments over the life of the loan
- PV = the original amount of the loan

Let's set up an amortization schedule. Complete the following steps:

- 1. On the Mortgage Payments worksheet enter the following column headers:
 - a. Cell A9: Payment Number
 - b. Cell B9: Beginning Balance
 - c. Cell C9: Principal Payment
 - d. Cell D9: Interest Payment
 - e. Cell E9: Ending Balance
- 2. Highlight cells B9:C9 and Wrap Text. Increase columns to letters in words stay together.

3. Highlight cells A9:E9 and apply an All Borders style from the Font section of the Home ribbon.

4. In cell A10 enter the number 1

5. In cell A11 enter the number 2

6. Highlight cells A10:A11 and use the Fill handle at the bottom right corner of A11 to drag down until you have 360 payments in column A. *Note: The Fill handle will show you what number you have filled through outside the lower right corner.*

A10	• : × • J	fx 1
	А	В
368		
369		
370		360
371		
372		
272		



8. In cell C10 enter the PPMT function =PPMT, then double click on the function in the box below the cell.

Principa		r
=ppmt		_
🛞 PPMT	Retu	ır

9. To complete the function

a. Click on cell B3 (Interest Rate) enter the / to divide the rate, click on B5 (Payment per year).

b. Enter a comma to separate the arguments.

c. Click on cell A10 to enter the current period, enter a comma,

d. Click on cell B4 to enter the Term of the loan, enter an * to multiply the term by the payments per year in cell B5

e. Enter a – minus sign and then click on B2 for the Loan Principal amount.

f. Close your PPMT function with a closing). The figure below shows the arguments after they have been entered into the function. (The cells were already named in this worksheet.)-

Figure 2.35 PPMT function arguments

 Principal
 Interest
 Balance

 =PPMT(Interest_Rate/Payments_per_year,A10,Terms_of_Loan*Payments_per_year,-Loan_Principal)

10. In cell D10 inter the IPMT function using the steps for the PPMT above, except you will type the IPMT instead of PPMT.

11. In cell E10 subtract the principal payment in cell C10 from the beginning balance in cellB10. =B10-C10

12. In cell B11 enter = and click on the ending balance in cell E10.

13. Highlight the range C10:E10 and copy down one row. (Using the fill handle makes this easy.)

14. Highlight the cells B11:E11 and use the fill handle to fill the formulas down through the 360th payment. You can do this quickly by double clicking the fill handle in the lower right corner of your highlighted area border. The balance in the last cell should = 0.

Linking Worksheets with 3-D Cell References. (Creating a Summary Worksheet)

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.12 if starting here.)

So far, we have used cell references and named cells in formulas and functions, which allows Excel to produce new outputs when the values in the cell references are changed. Cell references can also be used to display values or the outputs of formulas and functions in cell locations on other worksheets. This is how data will be displayed on the Budget Summary worksheet in the Personal Budget workbook. Outputs from the formulas and functions that were entered into the Budget Detail, Mortgage Payments, and Car Lease Payments worksheets will be displayed on the Budget Summary worksheet using 3-D cell references. The following steps explain how this is accomplished:

1. Click cell C3 in the Budget Summary worksheet.

2. Type an equal sign (=).

3. Click the Budget Detail worksheet tab.

4. Click cell D12 on the Budget Detail worksheet.

5. Press the ENTER key on your keyboard. The output of the SUM function in cell D12 on the Budget Detail worksheet will be displayed in cell C3 on the Budget Summary worksheet.

Figure 2.36 "Cell Reference Showing the Total Expenses in the Budget Summary Worksheet" shows how the cell reference appears in the Budget Summary worksheet. Notice that the cell reference D12 is preceded by the Budget Detail worksheet name enclosed in apostrophes followed by an exclamation point ('Budget Detail'!) This indicates that the value displayed in the cell is referencing a cell location in the Budget Detail worksheet.
_	G • •	A +'80	dget Detail'ID12			This indicates that the D12 cell reference is from the		
4	A	8	C		D	E	Budget Detail worksheet.	
1		Persor	nal Cash B	udg	get			
2	Net Income			\$	33,000			
3	Expenses		\$ 17,950	4				
4	Mortgage Payme	ents						
5	Car Lease Paym	ents					This is the Total Annual	
6	Total Plan Spen	d					Spend value in cell D12 from	
7	Net Change in (Cash					une budget betall worksheet	
8	-			-				
9		5	Savings Plan	\$	25,000			
10		Saving	s Projection					
11		Plan vs	Projection					
12	Years of Saving				10			
13	Rate of Return				3.5%			
14		CL	irrent Balance	\$	2,000			
15								

Figure 2.36 Cell Reference Showing the Total Expenses in the Budget Summary Worksheet

As shown in Figure 2.36 "Cell Reference Showing the Total Expenses in the Budget Summary Worksheet", the Budget Summary worksheet is designed to show the expense budget for the mortgage payments and the auto lease payments. However, you will recall that we used the PMT function to calculate the monthly payments. In the Budget Summary worksheet, we need to show the total annual payments. As a result, we will create a formula that references cell locations in the Mortgage Payments and Car Lease Payments worksheets. The following steps explain how this is accomplished:

- 1. Click cell C4 in the Budget Summary worksheet.
- 2. Type an equal sign (=).
- 3. Click the Mortgage Payments worksheet tab.
- 4. Click cell B5 in the Mortgage Payments worksheet.
- 5. Type an asterisk (*) for multiplication.

6. Type the number 12. This multiplies the monthly payments by 12 to calculate the total payments required for the year.

7. Press the ENTER key on your keyboard. The value of multiplying the monthly mortgage

payments by 12 is now displayed on the Budget Summary worksheet.

8. Click cell C5 on the Budget Summary worksheet.

9. Type an equal sign (=).

10. Click the Car Lease Payments worksheet tab.

11. Click cell B6 in the Car Lease Payments worksheet.

12. Type an asterisk (*) for multiplication.

13. Type the number 12. This multiplies the monthly lease payments by 12 to calculate the total payments required for the year.

14. Press the ENTER key on your keyboard. The value of multiplying the monthly lease payments by 12 is now displayed on the Budget Summary worksheet.

15. Highlight cells C4:C5, format Comma with no decimal places.

Figure 2.37 "Formulas Referencing Cells in Mortgage Payments and Car Lease Payments Worksheets" shows the results of creating formulas that reference cell locations in the Mortgage Payments and Car Lease Payments worksheets.

_	a •(•	(k =	Car Lease Payments'li	86"12		This indicates that the B6 ce reference is from the Car
4	A	В	0	D	ε	Lease Payments worksheet
1		Perso	nal Cash B	udget		
2	Net Income			\$ 33,000		
3	Expenses		\$ 17,950			
4	Mortgage Paym	ents	10,629			
5	Car Lease Pay	ments	2,479			
б	Total Plan Spe	nd	-			
7	Net Change in Cash					Outputs for formulas that reference cells in the
8						Lease Payments worksheets
9			Savings Plan	\$ 25,000		
10		Savir	ngs Projection			
11		Plan v	s Projection			
12	Years of Saving			10		
13	Rate of Return			3.5%		
14		C	Current Balance	\$ 2,000		
15						

Figure 2.37 Formulas Referencing Cells in Mortgage Payments and Car Lease Payments Worksheets

We can now add other formulas and functions to the Budget Summary worksheet that can calculate the difference between the total spend dollars vs. the total net income in cell D2. The following steps explain how this is accomplished:

1. Click cell D6 in the Budget Summary worksheet.

- 2. Click on AutoSum at in the Editing section of the Home ribbon
- 3. Highlight the range C3:C5
- 4. Click Enter.
- 5. Click cell D7 on the Budget Summary worksheet.
- 6. Type an equal sign (=).
- 7. Click cell D2.
- 8. Type a minus sign (–) and then click cell D6.

9. Press the ENTER key on your keyboard. This formula produces an output of \$1,942, indicating our income is greater than our total expenses.

Figure 2.38 "Formulas Added to Show Income Is Greater Than Expenses" shows the results of the formulas that were added to the Budget Summary worksheet. The output for the formula in cell D7 shows that the net income exceeds total planned expenses by \$1,942. Overall, having your income exceed your total expenses is a good thing because it allows you to save money for future spending needs or unexpected events.

A	A	8	C		D	E	F
1		Perso	nal Cash B	udg	jet		
2	Net Income			\$	33,000		This SUM function is entered into cell D6.
3	Expenses		\$ 17,950				
4	Mortgage Payme	10,629					
S	Car Lease Payn	nents	2,479				
6	Total Plan Spen	nd		\$	31,058	-	
7	Net Change in	Cash		\$	1,942	-	
8	-			-		1	
9			Savings Plan	\$	25,000	-	
10		Savin	ngs Projection				The formula in this cell is
11		Plan v	s Projection			-	subtracting cell D6 from D2
12	Years of Saving				10		
13	Rate of Return				3.5%		
14		C	Current Balance	\$	2.000		
15			1				

Figure 2.38 Formulas Added to Show Income Is Greater Than Expenses

We can now add a few formulas that calculate both the spending rate and the savings rate as a percentage of net income. These formulas require the use of absolute references, which we covered earlier in this chapter. The following steps explain how to add these formulas:

- 1. Click cell E6 in the Budget Summary worksheet.
- 2. Type an equal sign (=).
- 3. Click cell D6.

4. Type a forward slash (/) for division and then clickD2.

5. Press the F4 key on your keyboard. This adds an absolute reference to cell D2.

6. Press the ENTER key. The result of the formula shows that total expenses consume 94.1% of our net income.

7. Click cell E6.

8. Place the mouse pointer over the Auto Fill Handle.

9. When the mouse pointer turns to a black plus sign, left click and drag down to cell E7. This copies and pastes the formula into cell E7. Figure 2.39 "Calculating the Savings Rate" shows the output of the formulas calculating the spending rate and savings rate as a percentage of net income. The absolute reference shown for cell D2 prevents the cell from changing when the formula is copied from cell E6 and pasted into cell E7. The results of the formula show that our current budget allows for a savings rate of 5.9%. This is a fairly good savings rate. In the next section, we will discuss how these savings can grow over time by exploring the time value of money concepts.



Figure 2.39 Calculating the Savings Rate

Time Value of Money Concepts

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.13 if starting here.)

In reviewing the Budget Summary worksheet in Figure 2.39 "Calculating the Savings Rate", you will notice that the range B9:D14 contains data that can be used to assess a savings plan. We can project how much money can be saved over a specific period of time given set contributions and a rate of return. This calculation is accomplished through the future

value, or FV, function. We will use the FV function in cell D10 of the Budget Summary worksheet to calculate our savings plan projection. However, before we use the FV function, it is important to review a few basic concepts regarding the time value of money, as shown in Table 2.7 "Key Terms for Time Value of Money Concepts".

Argument	Definition
Annuity	An investment that is made in regular payments over a period of time. For example, depositing \$100 a month into an interest-bearing bank account or mutual fund is considered an annuity.
Bonds	An investment in which you lend money to a company or government entity. The borrower agrees to pay you interest over a specific period time. At the end of the bond agreement, the amount of money that was borrowed, or your initial investment, is returned to you. Most bonds are considered a lower risk investment but offer a lower rate of return than stocks offer.
Mutual Funds	A collection of similar investments managed by a financial professional called a fund manager. Mutual funds allow you to invest in several stocks or bonds without having to make many individual investments. They also allow you to reduce your risk and take advantage of the investment expertise of a professional.
Rate of Return	The percentage gained or lost on an investment. Investments that offer a high predicted rate of return often carry a higher risk of losing money. Investments that offer a lower predicted rate of return often carry a lower risk of losing money.
Stocks	An investment in which you own a portion of a company. The value of this investment increases as the company produces higher profits. Most stocks are expected to generate a higher rate of return than bonds generate. However, the risk of losing money on a stock investment is much greater than the risk for bonds.

Table 2.7 Key Terms for Time Value of Money Concepts

Table 2.7 "Key Terms for Time Value of Money Concepts" provides definitions for several terms used when addressing the time value of money concepts. The time value of money is the opportunity to grow your money over time given a constant or average rate of return.

For example, consider the data shown in Figure 2.40 "Time Value of Money Example for a One-Time Investment". This data assumes that a person makes a one-time investment of \$100 in a bond mutual fund that returns 5% interest per year. Notice that the interest paid in Column E increases every year. This is because the interest is reinvested in the mutual fund, which increases the total value of the investment. For example, the interest earned in year 1 is based on a \$100 investment. Therefore, the interest paid is \$5.00, or 5% of \$100. However, in year 2, when the \$5.00 interest payment is reinvested, the total investment increases to \$105. Therefore, in year 2 the interest paid increases to \$5.25, or 5% of \$105. The value of the investment at the end of 5 years is \$127.63. This is the value that can be calculated using the FV function.

		1		A one-time investment of \$100 is made at the beginning of year 1.						
2	Year	Be Ba	ginning lance	Inv	estment	Interest Rate	Inte Pai	erest d	Ending Balance	
3	1	\$	-	\$	100.00	5.00%	\$	5.00	\$105.00	
F .	2	\$	105.00	\$	1.	5.00%	\$	5.25	\$110.25	The future value
6	3	\$	110.25	\$	-	5.00%	\$	5.51	\$115.76	function can be used to calculate this number.
5	4	\$	115.76	s	•	5.00%	\$	5.79	\$121.55	
7	5	\$	121.55	\$		5.00%	\$	6.08	\$127.63	

Figure 2.40 Time Value o	f Money	Example for	a One-Time Investment
--------------------------	---------	-------------	-----------------------

Figure 2.41 "Time Value of Money Example for an Annuity Investment" shows another example demonstrating the time value of money concept. Instead of making a one-time investment, we will assume that a person invests \$100 at the beginning of every year in the same bond mutual fund. This is referred to as an annuity because the person is making reoccurring investments over a specific period of time. Notice that the value of this investment after 5 years is \$580.19. Also, the total interest earned on this investment is \$80.19 as opposed to the \$27.63 earned on the one-time investment in Figure 2.40 "Time Value of Money Example for a One-Time Investment".

12	A	Т	⁸ ime V	alu	e of M	oney Exercisestment	xa	mple	F	Reoccurring investments of \$100
13	Year Balan		ginning ance	ning ce Investmen		Interest Rate	Interest Paid		Ending Balance	every year.
14	1	\$	-	\$	100.00	5.00%	\$	5.00	\$105.00	
15	2	\$	105.00	\$	100.00	5.00%	\$	10.25	\$215.25	
16	3	\$	215.25	\$	100.00	5.00%	s	15.76	\$331.01	
17	4	\$	331.01	s	100.00	5.00%	\$	21.55	\$452.56	
18	5	S	452.56	s	100.00	5.00%	S	27.63	\$580.19	

Figure 2.41 Time Value of Money Example for an Annuity Investment

The FV (Future Value) Function

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.13 if starting here.)

Establishing a personal savings plan is one of the most important financial exercises you can do. For example, a savings plan is critical for establishing financial security for your retirement years. Many people mistakenly believe that saving for retirement is something you do when you get older. However, the greatest financial gains for your retirement can be achieved if you start saving in the earliest years of your career. Now that you understand the time value of money, you can see that the more years you can earn interest on your investments and reinvest those earnings, the more money you will have when you retire. Savings plans are also important for other key life events, such as going to college or buying a home.

FV = (RATE, NPER, PMT, [PV], [TYPE])

The FV function is a convenient tool that can help you establish savings goals and project the value of your investments over time. Like the PMT function, the FV function requires you to accurately define specific arguments in order to produce a reliable result. Table 2.8 "Arguments for the FV Function" provides definitions for each of the arguments in the FV function. It is helpful to review the time value of money terms in Table 2.7 "Key Terms for Time Value of Money Concepts" before using the FV function. Table 2.8 Arguments for the FV Function

Argument	Definition
Rate	This is the rate of return you expect to earn on an investment over time. This rate is usually quoted in annual terms, so you must divide by the number of payments made per year.
Nper	The argument letters stand for <i>number of periods</i> . This is the amount of time you are using to measure the value of an investment. The amount of time used to define this argument must be comparable to the Rate argument. For example, if the rate is stated in terms of months, the amount of time used to define this argument must be in months.
Pmt	The argument letters stand for <i>payment</i> . This argument is used if you are measuring the value of an annuity investment. The argument is defined with the value of the investment that is made for each measure of time used to define the Nper argument. For example, if the Nper argument is expressed in terms of months, you must define this argument with the investment value that is made every month.
[Pv]	The argument letters stand for <i>present value</i> . The brackets around the argument indicate that it is not always necessary to define it. Excel assumes zero if the argument is not defined. The argument is used when measuring the value of a one-time investment. Both this argument and the Pmt argument will be defined if an annuity investment has a beginning balance or includes a beginning one-time lump-sum investment.
[Type]	This argument can be defined with either a 1 or a 0. The number 1 is used if investments are made at the beginning of each period used to define the Nper argument. A 0 is used if the investments are made at the end of each period. The argument is in brackets because it does not have to be defined if your investments are made at the end of each period. Excel assumes that this argument is 0 if it is not defined.

With respect to the Personal Budget workbook, we will use the FV function to project the value of the savings plan in 10 years. We will type the function directly into the Personal Budget worksheet for this demonstration. However, you can use any of the methods demonstrated in this chapter for future use.

The following steps explain how this function is added to the worksheet:

1. Click cell D10 in the Budget Summary worksheet.

2. Type an equal sign (=).

3. Type the letters FV followed by an open parenthesis (().

4. Click cell D13. This is the expected rate of return for the investments.

5. Type a comma.

6. Click cell D12. This is the amount of time the investments are expected to grow.

7. Type a comma.

8. Type a minus sign (–). All values or cell locations used to define the Pmt argument must be preceded by a minus sign.

9. Click cell D7. This is the change in cash that was calculated by subtracting the total expenses from the net income. We are expecting to save this amount of money for the 10-year period this investment is being measured.

10. Type a comma.

11. Type a minus sign (–). All values and cell locations used to define the Pv argument must be preceded by a minus sign.

12. Click cell D14. Since the savings plan has a current balance, we use this to define the Pv argument of the function. This is equivalent to starting with a lump-sum investment.

13. Type a closing parenthesis ()). There is no need to define the last argument of the function because we will assume that the savings in cash achieved in our budget will be invested at the end of each year of the savings plan. Press the ENTER key Now we will check to see if our savings plan is over, or short of, its goal.

14. Check that cell D11 is activated.

15. Type an equal sign (=).

16. Click cell D10.

17. Type a minus sign (–) and then click cell D9. This subtracts the savings plan from the current savings plan projection.

18. Press the ENTER key.

Integrity Check - PMT and FV Functions Produce Negative Results

If the results of the PMT function or FV function are negative, check the Pv or Pmt arguments. Remember that these arguments must be preceded by a minus sign. If the minus sign is omitted, the functions produce a negative output.

Figure 2.42 "Results of the Savings Plan Projections" shows the results of the FV function. Notice that the current savings plan projection is \$25,606. This is \$606 higher than the target of \$25,000 entered into cell D9, which shows that the current budget is working to achieve the goals of this savings plan. In other words, given the current net income, we are saving enough money to achieve our savings plan goals.

4	A	В	C		D	E	F
1		Persona			y et		The FV function as it was
2	Net Income			\$	33,000		entered into cell D10.
3	Expenses		\$ 17,950				
4	Mortgage Payr	10,629					
5	Car Lease Pay	2,479					
6	Total Plan Sp		\$	31,058	94.1%	6	
7	Net Change in	Net Change in Cash		\$	1,942	5.9%	0
8							
9		1	Savings Plan	\$	25,000		
10		Savir	ngs Projection	S	25,606	1	The current savings value and
11		Plan v	s Projection	\$	606		expected rate of return is enough to slightly exceed the savings plan.
12		Years			10		
13	Rate of Retur				3.5%	•	
14	0		Current Balance	\$	2,000	ſ	his expected rate of return requires a relatively low risk investment.

Figure 2.42 Results of the Savings Plan Projections

There are two important factors to notice about this plan. The first factor is that our spending plan allows us to save enough money so that it can be invested to achieve our target of \$25,000. The second factor is that the expected rate of return is 3.5%. This is a relatively low expected rate of return and could be achieved by investing in relatively lowrisk investments such as bonds as opposed to stocks. This rate can be considered good

because we can achieve our savings goals without having to make high-risk investments that could result in a significant loss of our savings. If the results of the PMT function or FV function are negative, check the Pv or Pmt arguments. <u>Remember that these arguments</u> <u>must be preceded by a minus sign. If the minus sign is omitted, the functions produce a negative output.</u>

NPER

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.14 if starting here.)

Given the home loan example above there are other financial functions that can be used to help make financial decisions when borrowing money. For instance, if we can afford to pay \$1,000 per month for our loan and the bank will loan to us at 5% interest on a \$165,000 loan, how long will it take to pay off that loan?

The NPER function solves for the total number of payments it will take to pay off this loan. The function is:

=NPER (RATE,PMT,-PV,[FV],[Type])

Return to the Mortgage Payments worksheet and complete the following steps:

- 1. In cell E1 type: What if Analysis
- 2. In cell E2 type: Years to payoff loan if: (NPER)
- 3. In cell E4 type: Payment per month:
- 4. In cell E5 enter \$1,000
- 5. In G2 enter =NPER (

6. Click on cell B3 – the interest rate in the mortgage analysis section. Enter the divisor (/) and click on the Payments per year in cell B5 to calculate the periodic interest rate. Type a comma.

7. Click on the \$1,000 in cell F3 for the PMT argument and then enter a comma.

8. Enter a minus sign (-) and click on B2, the Loan Principal and then hit Enter. The result shows 279.74 payments.

9. To solve for the number of years we must divide the total number of payments by the

payments per year. Click in the formula bar for G3. After the closing parenthesis divide (/) the result by the payments per year in cell B5.

10. Format cell G3 for comma with one decimal place.

Figure 2.43 shows the result that being able to pay an extra \$115 per month on a 30-year loan will cut 7 years off the length of this loan.

Figure 2.43 Years to Payoff Loan at \$1,000 per Month

G2	• : × 🗸	NPER(Interes	t_Rate/Payments_	per_year,F3,-	Loan_Principal)/Payments_per_ye			
4	A	В	С	D	E	F	G	н
1	Mortgage	Payment Ana	alysis		What If Analysis		-	
2	Loan Principal	\$ 165,00	0		Years to payoff loan	if (NPER)	23.3	
3	Interest Rate	5.0	%		Payment per month	\$ 1,000		
4	Terms of Loan	3	0 Years					

RATE

Follow-along file: Continue with Excel Objective 2.00. (Use file Excel Objective 2.15 if starting here.)

Another what if analysis you can play with when making financial decisions around loans is what is the highest interest rate you can afford to pay given your financial situation. Let's assume that the most we can afford to pay monthly for the loan is \$800. Everything else will remain the same in our Mortgage analysis, but we will know before entering into a loan how much interest we can afford. We will do this by solving for the RATE.

The RATE function solves for the periodic interest rate. The arguments in the function are:

=RATE (NPER,PMT, -PV,[FV],[Type])

1. On the Mortgage Payments worksheet, in cell E5 type: Payment per month.

- 2. In F5, type: \$800
- 3. In cell E6, type Interest rate (RATE)
- 4. In cell F6 enter =RATE (
- 5. Calculate the NPER by clicking on cell B4 and multiply (*) by B5. Enter a comma
- 6. Enter the payment amount by clicking on cell F5 and enter a comma
- 7. Enter a minus sign (-) and click on the loan principal in cell B2.

8. Finish the function by typing the closing parenthesis.

9. The result in cell F6 may show 0%. Increase decimal places to show 3 decimal places.
The periodic interest rate is 0.344%. To calculate the annual interest rate, you must multiply the result of the RATE function by the number of payments per year.
10. Make cell F6 active and click in the formula bar. At the end of your RATE function multiply the function by payments per year in B5.

Figure 2.44 shows the results of the RATE function. You would have to get an interest rate of 4.125% to be able to afford the \$165,000 house at \$800 per month.

Fő	* I X V J	=RATE(Terms_of_)	.oan*Payments_pe	r_year,F5,-Loan_Principal)*Payments_per_year	
1	A	В	C	D E F	G
1	Mortgage P	ayment Analy	/sis	What If Analysis	
2	Loan Principal	\$ 165,000		Years to payoff loan if (NPER)	23.3
3	Interest Rate	5.0%		Payment per month \$ 1,000	
4	Terms of Loan	30	Years		
5	Payments per year	12		Payment per month \$ 800	
6	Monthly Payment	\$885.76		Interest rate(RATE) 4.128%	

Figure 2.44 Interest Rate Required to Pay off Loan at \$800 per Month

Key Takeaways

- The PMT function can be used to calculate the periodic mortgage payments for a house or the monthly lease payments for a car
- When using the PMT or FV functions, each argument must be separated by a comma
- When using the PMT or FV functions, the arguments must be defined in comparable terms. For example, when using the FV function, if the Pmt argument is defined using monthly payments, the Rate and Nper arguments must be defined in terms of months.
- The FV function is used to calculate the value an investment at a future point in time given a constant rate of return.
- The PMT and FV functions produce a negative output if the Pmt or Pv arguments are not preceded by a minus sign.
- The RATE function can be used to find your periodic interest rate.
- The NPER function can be used to determine total number of payments in a loan.

Chap 2 Sample Exercise

Running your own lawn care business can be an excellent way to make money over the summer while on break from college. It can also be a way to supplement your existing income for the purpose of saving money for retirement or for a college fund. However, managing the costs of the business will be critical in order for it to be a profitable venture. In this exercise you will create a simple financial plan for a lawn care business by using the skills covered in this chapter. Begin this exercise by opening the file named **Chapter 2 CiP Exercise 1**.

- 1. Click cell C5 in the Annual Plan worksheet.
- Enter a formula that calculates the average price per lawn cut. Type an equal sign (=), then click cell B3. Type the asterisk symbol (*) for multiplication, then click cell B4. Press the ENTER key.
- 3. Click cell C8 in the Annual Plan worksheet.
- 4. Enter a formula that calculates the total number of lawns that will be cut during the year. Type an equal sign (=), then click cell B6. Type the asterisk symbol (*) for multiplication, then click cell B7. Press the ENTER key.
- 5. Click cell D9 in the **Annual Plan** worksheet.
- Enter a formula that calculates the total sales for the plan. Type an equal sign (=), then click cell C5. Type the asterisk symbol (*) for multiplication, then click cell C8. Press the ENTER key.
- 7. Click cell F3 in the Leases worksheet. The PMT function will be used to calculate the monthly lease payment for the first item. For many businesses, leasing (or renting) equipment is a more favorable option than purchasing equipment because it requires far less cash. This enables you to begin a business such as a lawn care business without having to put up a lot of money to buy equipment.

- 8. Type an equal sign (=) followed by the function name PMT and an open parenthesis ((). Define the arguments of the function as follows:
 - *Rate:* Click cell B3, type a forward slash (/) for division, type the number 12, and type a comma. Since we are calculating monthly payments, the annual interest rate must be converted to a monthly interest rate.
 - Nper: Click cell C3, type an asterisk (*) for multiplication, type the number 12, and type a comma. Similar to the Rate argument, the terms of the lease must be converted to months since we are calculating monthly payments.
 - *Pv:* Type a minus sign (–), click cell D3, and type a comma. Remember that this argument must always be preceded by a minus sign.
 - *Fv*: Click cell E3 and type a comma.
 - *Type:* Type the number 1, type a closing parenthesis ()), and press the ENTER key.
 We will assume the lease payments will be made at the beginning of each month,
 which requires that this argument be defined with a value of 1.
- 9. Copy the PMT function in cell F3 and paste it into the range F4:F6.
- Click cell F10 in the Leases worksheet. A SUM function will be added to calculate the total for the monthly lease payments.
- 11. Type an equal sign (=) followed by the word **SUM** and an open parenthesis ((). Highlight the range F3:F9, type a closing parenthesis ()), and press the ENTER key. You will notice that blank rows were included in this range for the SUM function. If other items are added to the worksheet, they will be included in the output of the SUM function.
- 12. Highlight the range A2:F6 on the Leases worksheet. The data in this range will be sorted.
- 13. Click the Sort button in the Data tab of the Ribbon. In the Sort dialog box, select the Interest Rate option in the "Sort by" drop-down box. Select Largest to Smallest for the sort order. Then, click the Add Level button on the Sort dialog box. Select the Price option in the "Then by" drop-down box. Select Largest to Smallest for the sort order. Click the OK button in the Sort dialog box.

- 14. Click cell B11 on the **Annual Plan** worksheet. The monthly lease payments that are calculated in the **Lease** worksheet will be displayed in this cell.
- Type an equal sign (=). Click the Leases worksheet tab, click cell F10, and press the ENTER key.
- 16. Click cell C12 on the Annual Plan worksheet.
- 17. Type an equal sign (=) and click cell B11. Type an asterisk (*), type the number 12, and pressthe ENTER key. This formula calculates the annual lease payments.
- 18. Format the output of the formula in cell C12 so the decimal places are reduced to zero.
- 19. Click cell C14 on the Annual Plan worksheet.
- 20. Type an equal sign (=) and click cell B13. Type an asterisk (*), click cell C8, and press the ENTER key.
- 21. Click cell D16 on the Annual Plan worksheet.
- 22. Type an equal sign (=) followed by the word **SUM** and an open parenthesis ((). Highlight the range C11:C15, type a closing parenthesis ()), and press the ENTER key. This SUM function adds the total expenses for the business.
- 23. Click cell D17 on the Annual Plan worksheet.
- 24. Type an equal sign (=). Click cell D9, type a minus sign (–), click cell D16, and press the ENTER key. This formula calculates the annual profit for the business.
- 25. Click cell B10 on the **Investments** worksheet.
- 26. Type an equal sign (=) followed by the word **COUNT** and an open parenthesis ((). Highlight the range B3:B8, type a closing parenthesis ()), and press the ENTER key. This function counts the number of investments that currently have a balance. Notice that additional blank rows were included in the range for this function. The function output will automatically change if any new investments are added to the worksheet.
- 27. Click cell D3 on the **Investments** worksheet.
- 28. Type an equal sign (=). Click the Annual Plan worksheet tab. Click cell D17 and type a forward slash (/) for division. Click the Investments worksheet tab. Click cell B10 and press the ENTER key. This formula divides the profit calculated on the Annual Plan worksheet

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

by the number of investments in the **Investments** worksheet. We will assume that the profits from this business will be invested evenly among the funds listed in Column A of the **Investments** worksheet.

- 29. Before copying and pasting the formula created in step 28, absolute references must be added to the cell locations in the formula. Double click cell D3 on the **Investments** worksheet. Place the mouse pointer in front of D17 in the formula and click. Press the F4 key on your keyboard. Place the mouse pointer in front of cell B10 in the formula and click. Press the F4 key on your keyboard. Press the ENTER key.
- 30. Copy cell D3 and paste it into cells D4 and D5.
- 31. Click cell E3 on the **Investments** worksheet. The future value function will be added to project the total growth of the investments listed in Column A. We will assume that the business will be able to consistently generate the profit, which will be invested evenly in the funds every year.
- 32. Type an equal sign (=) followed by the function name **FV** and an open parenthesis ((). Define the arguments of the function as follows:
 - *Rate:* Click cell C3 and type a comma. This is the expected growth rate of the first fund.
 - *Nper:* Type the number **10** and then type a comma. We will project the growth of these investments in 10 years.
 - *Pmt:* Type a minus sign (-), click cell D3, and type a comma. Remember that this argument must always be preceded by a minus sign. We are assuming that the business will consistently generate the profits calculated in the **Annual Plan** worksheet and that these profits will be invested evenly into each fund.
 - *Pv:* Type a minus sign (–) and click cell B3. Since each fund currently has a balance, we need to add this to the Pv argument of the function. Similar to the Pmt argument, remember that this argument must also be preceded by a minus sign.
 - *Type:* Type a closing parenthesis ()) and press the ENTER key. We will assume the investments will be made at the end of each year. Therefore, it is not necessary to

define this argument since Excel will assume zero, or end of the period, if it is not defined.

- 33. Copy the FV function in cell E3 and paste it into cells E4 and E5.
- 34. Click cell B9 on the Investments worksheet.
- 35. Type an equal sign (=) followed by the word **SUM** and an open parenthesis ((). Highlight the range B3:B8, type a closing parenthesis ()), and press the ENTER key. This SUM function adds the current balance for all investments. Blank rows are added to the range for the function so additional investments will automatically be included in the function output.
- 36. Copy the SUM function in cell B9 and paste it into cells D9 and E9.
- 37. We will use Goal Seek to determine how many customers we need to service in order to reach a savings goal of \$250,000. Click cell E9 on the **Investments** worksheet. Click the What-If Analysis button in the Data tab of the Ribbon and select Goal Seek. Click in the "To value" input box on the Goal Seek dialog box. Type the number **250000**. Click the Collapse Dialog button next to the "By changing cell" input box on the Goal Seek dialog box. Click the **Annual Plan** worksheet tab and click cell B6. Press the ENTER key, and click the OK button on the Goal Seek dialog box. Click the OK button on the Goal Seek Status dialog box. View the number of customers showing in cell B6 in the **Annual Plan** worksheet.
- 38. Save the workbook by adding your name in front of the current workbook name (i.e., "*your name* Chapter 2 CiP Exercise 1").
- 39. Close the workbook and Excel.

Compare your worksheets with the illustrations on the next two pages.

	А		В		С	D
1	Lawn Care Annua	al F	inanc	ial	Plan	
2	Sales Plan:					
3	Price per Acre	\$	50.00			
4	Average Acreage per Customer		0.50			
5	Average Price per Cut			\$	25.00	
6	Number of Customers	32	697433			
7	Frequency of Lawn Cuts per Custome		22			
8	Total Lawn Cuts			_	719	
9	Total Sales					\$ 17,984
10	Expenses:					
11	Monthly Lease Payments		\$122			
12	Annual Lease Payments				\$1,461	
13	Lawn & Equipment Expenses Per Cut	\$	5.00			
14	Total Lawn & Equipment Expenses			\$	3,597	
15	Office and Other Expenses			\$	1,500	
16	Total Expenses					\$ 6,558
17	Operating Income					\$ <mark>11,426</mark>
18						
	▶ ▶ Annual Plan / Investments / Leases / 🎾	/				

Figure 2.49 Completed CiP Exercise 1 Annual Plan Worksheet

	А		В	С		D		E
1			Invest	tment Analysis	5			
		C	urrent	Target Growth		Annual		10 Year
2	Investment Fund	В	alance	Rate	In	vestments	Fut	ture Value
3	Treasury Bond	\$	10,000	4.5%	\$	3,809	\$	62,331
4	Domestic Stock Fund	\$	20,000	8.0%	\$	3,809	\$	98,353
5	Emerging Markets	\$	10,000	10.5%	\$	3,809	\$	89,316
6								
7								
8								
9	Total	\$	40,000		\$	11,426	\$	250,000
10	Number of Investments		3					
11								
12								
13								
14								
15								
16	► ► Annual Plan Investm	nents	Leases	2/				

Figure 2.50Completed CiP Exercise 1 Investments Worksheet

Figure 2.51Completed CiP Exercise 1 Leases Worksheet

	А	В	С	D	E	F
1		Equipm	ent Leasing Pl	an		
		Interest	Terms of Lease		Residual	Monthly
2	Item	Rate	in Years	Price	Value	Payment
3	Blower	6.0%	3	\$ 700	\$ 200	\$16.13
4	Commercial Lawn Mower	5.5%	4	\$ 6,000	\$ 3,000	\$83.14
5	Edger	4.0%	2	\$ 400	\$ 150	\$11.32
6	Trimmer	4.0%	2	\$ 350	\$ 100	\$11.15
7						
8						
9						
10	Total					\$121.74
11						
12						
13						
14						
15						
16						
4	▶ ▶ Annual Plan / Investments	Leases / 🖘 /		1		

Chapter 3

Logical & Lookup Functions

Going beyond the basic computational tools of Excel unlocks unlimited potential for processing and analyzing data. This chapter takes you beyond basic Excel computations by introducing logical functions and lookup functions. Logical functions are used to assess the contents within cell locations and produce custom outputs or mathematical computations. We will look at two types of logical functions in this chapter. The first is the IF function, which uses a logical test to evaluate the contents in a cell location and are often used within the IF function. The second type of logical function that we will look at are statistical IF functions. These functions combine the logical test feature of the IF function with the mathematical computations"). The last section of this chapter demonstrates the use of two lookup functions. These functions are used to find data in one worksheet and display it in another. We will demonstrate the skills for this chapter through the construction of a personal investment portfolio.

This theme builds on the personal budget project introduced in Chapter 2 "Mathematical Computations". In the personal budget project, we analyzed the impact of investing money in an account that provides a continuous rate of return. In this chapter, we look at how you can decide where to invest your money and how to analyze the performance of those investments.

3.1. Logical Functions

LEARNING OBJECTIVES

- 1. Learn how to use the Freeze Panes command to lock specific columns and rows in place while scrolling through large worksheets.
- **2.** Understand the construction and use of formulas, basic statistical functions, and financial functions.
- **3.** Learn how to construct a logical test to evaluate the contents of a celllocation.
- 4. Learn how to use the IF function to evaluate the data in a cell location using a logical test.
- 5. Learn how to use the OR function within an IF function to evaluate the data in a cell location using multiple logical tests.
- 6. Learn how to use the AND function within an IF function to evaluate the data in a cell location using multiple logical tests.
- 7. Review the construction of nested IF functions for evaluating data using more than one logical test.
- 8. Learn how to set a conditional format rule so formatting commands are automatically applied based on the value in a cell location.

This section reviews the use of logical functions in Excel through the construction of an investment portfolio. Although it may seem that managing investments is a specialized career choice, the reality is that almost everyone will become an investor at some point in their lives. Many companies offer employees retirement savings benefits through 401(k) or 403(b) plans. These plans allow you to deduct money from your paycheck every month, tax-free, and invest it. In addition to the tax benefits afforded by such plans, many employers match a percentage of your monthly savings or deposit money into your retirement account as an added form of compensation. When you sign up for these savings plans, your company will give you a list of options as to how your money can be invested, and you choose the type of investments you would like the company to make on your behalf. Because of this process, you become an investor. Excel can be an extremely valuable tool to help you make these investment decisions and analyze the performance of the money you have invested.

Figure 3.1 "Completed Personal Investment Portfolio Workbook" shows the completed investment portfolio workbook that we will complete in this chapter. Like the personal budget example in Chapter 2 "Mathematical Computations", the Portfolio Summary worksheet contains a summary of the data entered or calculated in other worksheets in the workbook. This project begins by building on the *Investment Detail* worksheet.

	A	8.	C		0	E.	F	6	.11	
		Per	sonal In	ive	estmen	t Summ	ary			
	Total Summary									Portfolio Summary
[Number of Investments	Average Months Owned	Tol Pui Co	tal rchase st	Current Value	Annual Growth	Benchmark 5 Year Growth	Benchmark	worksheet
E	Bond Fund	4	36	S	23,773	\$ 27,274	4.9%	6.0%	Barclays	
۵	omestic Stock Fund	3	34	\$	22,110	\$ 22,903	1.3%	2.5%	S&P 500	
ł	nternational Stock Fund	3	27	S	18,983	\$ 22,578	8.5%	1.3%	MSCI EAFE	
ħ	ndividual Stock	5	63	\$	31,763	\$ 45,101	8.0%	5.4%	Dow Jones	
1	TOTAL	15	40	5	96,628	\$117,857	6.6%	3,8%		
-	Poor Performing Inves	stments								
Ĩ	-	Number of Investments	Average Months Owned	Tor Pur Co	tal rchase st	Current Value	Annual Growth			
E	Bond Fund	1	10	S	5,500	\$ 5,626	2.8%			
۵	Omestic Stock Fund	3	34	S	22,110	\$ 22,903	1.3%			
1	nternational Stock Fund	1	42	\$	7,340	\$ 5,958	-5.4%			
h	ndividual Stock	2	69	\$	10,097	\$ 13,990	6.8%			
1	TOTAL	7	39	\$	45,047	\$ 48,478	2.4%			

Figure 3.1 Completed Personal Investment Portfolio Workbook

Freeze Panes

Follow-along file: Excel Objective 3.00

The Investment Detail worksheet shown in Figure 3.2 "Investment Detail Worksheet" contains the majority of the information used to create the Portfolio Summary worksheet shown in Figure 3.1 "Completed Personal Investment Portfolio Workbook". When you first open the worksheet, you will notice it is not possible to view all twenty-four columns on your computer screen. As you scroll to the right to view the rest of the columns, you will lose site of the row headings in Columns A and B. The headings in these columns show the investment that pertains to the data in Columns C through X. To solve this problem of viewing the row headings while scrolling through the remaining columns in the worksheet, we will use the Freeze Panes command.

Personal Invostment Portfolio Descriptive Information Purchase Current Investment Type Symbol Description Dividend / Shares Purchase Courrent Purchase Bond Fund VFICX 4.60% 750 \$ 9.49 \$ 9.84 Shares Purchase Purchase Purchase Bond Fund VFICX 3.20% 750 \$ 9.49 \$ 9.84 Shares Purchase Purchase Bond Fund VVEHX 3.20% 750 \$ 10.68 \$ 10.73 Shares Purchase Bond Fund VVEHX 7.20% 500 \$ 6.29 \$ 5.82 The rest of the columns in the worksheet (J through X) are not stock Fund VEIPX 2.60% 500 \$ 10.68 \$ 10.52 The rest of the columns in the worksheet (J through X) are not stock Fund VIBSX 0.30% 25.05 \$ 23.67 S 3.3.0 The rest of the columns in the worksheet (J through X) are not stock Fund VIBSX 2.00% 25.0 \$ 22.41 \$ 21.70 Visible on one screen. Domestic Stock Fund VIBX 1.00%	A	U	c	0	E	.F	G		1.1	
Descriptive Information Purchase Current Investment Type Symbol Description Vield Shares Price aer Current Purchase Bond Fund VFICX 4.60% 750 \$ 9.49 \$ 9.84 Price aer Purchase Value Purchase Bond Fund VFICX 4.60% 750 \$ 9.49 \$ 9.84 Purchase Purchase Bond Fund VFIX 3.20% 750 \$ 10.68 \$ 10.73 S 8.82 Bond Fund VUEHX 7.20% 500 \$ 10.88 \$ 10.52 The rest of the columns in the volums in the volume in the volum	Personal Inve	stment	Portfolio							
Investment Type Symbol Description Dividend / Starse Fride per Plurchased Purchase Plus per Share Courtent Price per Plus per Plus per Price per Plus per Price per Plus per P	Descriptive Information	1				Purchase	£:		Curr	
Bond Fund VFICX 4 60% 750 \$ 9.49 \$ 9.84 Bond Fund VFSTX 3 20% 750 \$ 10.68 \$ 10.73 Bond Fund VWEHX 7.20% 500 \$ 6.29 \$ 5.82 Bond Fund VUSTX 4.00% 500 \$ 10.68 \$ 10.73 Bond Fund VUSTX 4.00% 500 \$ 11.00 \$ 10.88 International Stock Fund VEIPX 2.60% 500 \$ 14.68 \$ 10.52 Domestic Stock Fund VISTX 2.60% 500 \$ 23.35 \$ 21.51 Domestic Stock Fund VISX 0.30% 250 \$ 19.33 \$ 23.67 Domestic Stock Fund VISX 1.00% 250 \$ 22.41 \$ 21.70 International Stock Fund VIIX 2.00% 250 \$ 23.37 \$ 33.30 International Stock Fund VEIEX 1.40% 250 \$ 23.74 \$ 31.80 Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94	Investment Type	Symbol	Description	Dividend / Yield	Shares Purchased	Purchase Price per Share	Cost of Purchase	Current Price	Current Purchase Value	
Bend Fund VFSTX 3 20% 750 \$ 10,68 \$ 10,73 Bond Fund VVEHX 7,20% 500 \$ 6,29 \$ 5,82 Bond Fund VUSTX 4,00% 500 \$ 10,00 \$ 10,88 International Stock Fund VDIX 4,00% 500 \$ 11,00 \$ 10,88 Domestic Stock Fund VEIPX 2,60% 500 \$ 14,68 \$ 10,52 Domestic Stock Fund VISGX 0,30% 250 \$ 19,33 \$ 23,67 Domestic Stock Fund VISGX 0,30% 250 \$ 19,33 \$ 23,67 Domestic Stock Fund VIMSX 1,00% 250 \$ 22,83 \$ 33,30 International Stock Fund VTRIX 2,00% 250 \$ 22,83 \$ 33,30 International Stock Fund VTRIX 2,00% 250 \$ 22,83 \$ 33,30 International Stock Fund VEIX 2,40% 150 \$ 38,14 \$ 55,54 Individual Stock JNJ 3,60% 150 \$ 53,30 \$ 61,94 <td>Bond Fund</td> <td>VFICX</td> <td></td> <td>4.60%</td> <td>750</td> <td>\$ 9,49</td> <td></td> <td>\$ 9.84</td> <td></td> <td></td>	Bond Fund	VFICX		4.60%	750	\$ 9,49		\$ 9.84		
Bond Fund VWEHX 7.20% 500 \$ 6.29 \$ 5.82 Bond Fund VUSTX 4.00% 500 \$ 11.00 \$ 10.88 International Stock Fund VDMIX 2.60% 500 \$ 11.00 \$ 10.88 Domestic Stock Fund VEIPX 2.50% 500 \$ 21.51 worksheet (J through X) are n visible on one screen. Domestic Stock Fund VIISX 0.30% 250 \$ 22.41 \$ 21.70 International Stock Fund VIMX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VTRIX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VTRIX 2.00% 250 \$ 23.74 \$ 31.80 Individual Stock Fund VEIEX 1.40% 2.60% 5 5.3.30 \$ 61.94 Individual Stock JNJ 3.60% 150 \$ 52.802 \$ 27.85 Individual Stock MSFT 2.50% 75 \$ 87.68 \$ 146.67	Bond Fund	VFSTX		3.20%	750	\$ 10.68		\$ 10.73		
Bond Fund VUSTX 4.00% 500 \$ 11.00 \$ 10.88 The rest of the columns in the volume set of the columns set of the c	Bond Fund	WEHX		7.20%	500	\$ 6.29		\$ 5.82		
International Stock Fund VDMIX 2.60% 500 \$ 14.68 \$ 10.52 Interfection the controls in unspected by the control of the controls in unspected by the control of the contrele control of	Bond Fund	VUSTX		4.00%	500	\$ 11.00		\$ 10.88	The	rort of the columns in this
Domestic Stock Fund VEIPX 2.50% 500 \$ 23.35 \$ 21.51 worksheet (J through X) are not stock Fund Domestic Stock Fund VISGX 0.30% 250 \$ 19.33 \$ 23.67 visible on one screen. Domestic Stock Fund VIMSX 1.00% 250 \$ 22.67 visible on one screen. International Stock Fund VIRX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VTRIX 2.00% 250 \$ 23.74 \$ 31.80 Individual Stock TRV 2.40% 150 \$ 38.14 \$ 55.54 Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.85 Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	International Stock Fund	VDMIX		2,60%	500	\$ 14.68		\$ 10.52	me	rest of the columns in the
Domestic Stock Fund VISGX 0.30% 250 \$ 19.33 \$ 23.67 visible on one screen. Domestic Stock Fund VIMSX 1.00% 250 \$ 22.41 \$ 21.70 International Stock Fund VTRIX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VEIEX 1.40% 260 \$ 23.74 \$ 31.80 Individual Stock TRV 2.40% 150 \$ 38.14 \$ 55.54 Individual Stock JNU 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock KO 2.80% 150 \$ 62.48 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.85 Individual Stock IBM 1.80% 76 \$ 87.68 \$ 148.87	Domestic Stock Fund	VEIPX		2.50%	500	\$ 23.35		\$ 21.51	work	sheet (J through X) are no
Domestic Stock Fund VIMSX 1.00% 250 \$ 22.41 \$ 21.70 International Stock Fund VTRIX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VTRIX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VEIEX 1.40% 250 \$ 23.74 \$ 31.80 Individual Stock TRV 2.40% 150 \$ 38.14 \$ 55.54 Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock KO 2.80% 150 \$ 52.46 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.95 Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	Domestic Stock Fund	VISGX		0.30%	250	\$ 19.33		\$ 23.67		visible on one screen.
International Stock Fund VTRIX 2.00% 250 \$ 22.83 \$ 33.30 International Stock Fund VEIEX 1.40% 250 \$ 23.74 \$ 31.80 Individual Stock TRV 2.40% 150 \$ 38.14 \$ 55.54 Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock KO 2.80% 150 \$ 55.50 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.85 Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	Domestic Stock Fund	VIMSX		1.00%	250	\$ 22.41		\$ 21.70	-	
International Stock Fund VEIEX 1 40% 250 \$ 23.74 \$ 31.80 Individual Stock TRV 2.40% 150 \$ 38.14 \$ 55.54 Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock KO 2.80% 150 \$ 62.46 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.85 Individual Stock IBM 1.60% 76 \$ 87.68 \$ 146.67	International Stock Fund	VTRIX		2.00%	250	\$ 22.83		\$ 33.30		
Individual Stock TRV 2.40% 150 \$ 38.14 \$ 55,54 Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock KO 2.80% 150 \$ 62.46 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 2.785 Individual Stock IBM 1.60% 76 \$ 87.68 \$ 146.67	International Stock Fund	VEIEX		1.40%	250	\$ 23.74		\$ 31.80		
Individual Stock JNJ 3.60% 150 \$ 53.30 \$ 61.94 Individual Stock KO 2.80% 150 \$ 62.46 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.95 Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	Individual Stock	TRV		2.40%	150	\$ 38.14		\$ 55,54		
Individual Stock KO 2.80% 150 \$ 62.48 \$ 65.50 Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.85 Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	Individual Stock	JNJ		3.60%	150	\$ 53,30		\$ 61.94		
Individual Stock MSFT 2.50% 75 \$ 28.02 \$ 27.85 Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	Individual Stock	KÖ		2.80%	150	\$ 62.48		\$ 65.50		
Individual Stock IBM 1.60% 75 \$ 87.68 \$ 146.67	Individual Stock	MSFT		2.50%	75	\$ 28.02		\$ 27.85		
Total	Individual Stock	IBM		1.60%	75	\$ 87.68		\$ 146.67	1	
	Total								-	1

Figure 3.2 Investment Detail Worksheet

The Freeze Panes command allows you to scroll across the Investment Detail worksheet while keeping the row headings in Columns A and B locked in place. The following steps explain how to do this:

1. Click cell C4 on the Investment Detail worksheet. We select this cell because the Freeze Panes option locks the columns to the left of the activated cell as well as the rows above the activated cell.

2. Click the View tab on the Ribbon.

3. Click the Freeze Panes button (see Figure 3.3 "Freeze Panes Command").

Figure 3.3 Freeze Panes Command

			Estal Objective 3.0	0 Micropott Exi	ei -			(Yourth	
ince lost Repildy	inst Parina	it Data Navar	e iver		and the			View tab	
Ange Deale Proview Ange D	(2 min - S SP distant S Sk	E toronda blar - E K tonaslings - 200 m	an 18% Joanta Jaar			illione a strange	in to Low Anne Location Backur Franker	Freeze Panes button	
04 · 6					A Real Property and	tion and tokeners token south the	ondrie uiter fre	Part uf	
Personal Inve	stment	Portfolio			Freeze	rop geve a top tow walkin at the workstaat Rest Column	while scripting i	(Transa Ubert Fames)	
Descriptive information	251	-			The second	a first suburier on file yield of the o	rendrika konstille rendrika di	12	
3 Investment Type	Symbol	Description		Dividend / Vield	Shares Purchased	Price per Share	Cost of Purchase	Current P	the series
Bond Fund	VEICX			4.60%	750	\$ 9.49		abuse the activated cells	and the
Bond Fund	VESTX	T		3.20%	750	\$ 10.68		columns to the left of	the
Bond Fund	VWEHX			7.20%	500	\$ 6.29		activated cell.	2012
Bond Fund	VUSTX			4,00%	500	\$ 11.00	-	1 5 10.88 (
International Stock Fund	VDMIX			2.60%	500	\$ 14.68		5 10.52	
Domestic Stock Fund	VEIPX			2.50%	500	\$ 23.35		5 21.51	
Domestic Stock Fund	VISGX	C		0.30%	250	\$ 19.33		\$ 23.67	
		Cell C4	is d					awaa dagaa dagaalay fash	

4. Click the Freeze Panes option from the drop-down list of options.

Once you click the Freeze Panes option, Columns A and B are locked in place as you scroll through the columns in the worksheet. Since this is a large worksheet, you may find it easier to navigate the columns by using the arrow keys on your keyboard. However, since rows 1 and 2 contain merged cells, make sure a cell location is activated below Row 2 before you begin using the arrow keys. Figure 3.4 "Freeze Panes Command Activated on the Investment Detail Worksheet" shows the appearance of the Investment Detail worksheet after the Freeze Panes command has been activated. To deactivate the Freeze Panes command, click the Freeze Panes button again and select the Unfreeze Panes option. *Figure 3.4 Freeze Panes Command Activated on the Investment Detail Worksheet*



Formula and Functions Review

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.01 if starting here.) We will begin developing the personal investment portfolio workbook by adding several formulas and functions. The formulas and functions we will add were illustrated in detail in Chapter 2 "Mathematical Computations". Therefore, the steps provided in this chapter will be brief. After the formulas and functions are added to the Investment Detail worksheet, we can add the logical and lookup functions.

However, before proceeding, let's review the investment type definitions in Table 3.1 "Investment Types in Column A of the Investment Detail Worksheet". Table 3.1 provides a definition for each of the investment types listed in Column A of the Investment Detail worksheet. This project assumes that the personal investment portfolio comprises four types of investments. The reason we include a variety of investment types in any portfolio is to manage our total risk, or potential of losing money. When building an investment portfolio, it is important to keep in mind that investments of all types can dramatically

increase or decrease in value over a short period of time. Managing risk requires that your money is not concentrated in one type of investment.

Table 3.1 Investment Types in Column A of the Investment Detail Worksheet

Category	Definition
Bond Fund	A mutual fund consisting of a variety of bonds. The benefit of buying shares of a fund as opposed to a specific bond is that doing so allows you to spread your investment over several bonds instead of concentrating your investment in just one bond.
Domestic Stock Fund	A mutual fund consisting of several domestic stocks. Buying shares of a stock mutual fund provides the benefit of investing your money over several stocks.
International Stock Fund	Same as a domestic stock fund but contains a variety of non-US or foreign stocks.

We will begin adding formulas and functions to the *Investment Detail* worksheet in sections. If you scroll across all the columns in the worksheet, you will notice the worksheet includes five distinct sections. Four of the five sections contain columns that need to be completed with formulas and functions before we can add the logical and lookup functions. Table 3.2 "Definitions for Columns A through G of the Investment Detail Worksheet" contains definitions for each of the columns in the Descriptive Information section (Columns A through D) and the Purchase section (Columns E through G). It will be helpful to understand the purpose of these columns as we complete this worksheet.

Category	Definition
Individual Stock	The stock for one specific company. In addition to mutual funds, this chapter's portfolio will include a few individual stocks for public companies. When you purchase shares of a specific company, such as IBM, you become a partial owner of that company.

	Keyboard Shortcuts- AutoSum
Press and hold the	e ALT key on your keyboard, then press the equal sign (=)
Category	Definition
Investment Type	The type of investment with regard to bonds and stocks. A definition for each of the investment types used in this portfolio can be found in Table 3.1 "Investment Types in Column A of the Investment Detail Worksheet".
Symbol	The symbol that represents a mutual fund or stock. This symbol can be used to research the profile or current trading price on any website that provides stock quotes.
Description	The company name for an individual stock or a description of the type of investments made by a mutual fund.
Dividend/Yield	The amount of interest earned on a bond or bond fund or the amount of earnings distributed per share for an individual stock or stock fund.
Shares Purchased	The number of shares purchased for a mutual fund or individual stock.
Purchase Price per Share	The price paid for the shares purchased for the mutual funds and individual stocks in the portfolio.
Cost of Purchase	The number of shares purchased multiplied by the purchase price per share. This represents your base investment and is used to determine how much money has been gained or lost.

The Descriptive Information section of the Investment Detail worksheet (Columns A through D) contains only one blank column, which will be completed using a lookup function. Therefore, we will proceed to the Purchase section (Columns E through G) where the Cost of Purchase column is blank. The following steps explain how to enter the formula into this column:

- 1. Click cell G4 on the Investment Detail worksheet.
- 2. Type an equal sign (=).

3. Enter a formula that multiplies the Shares Purchased (cell E4) by the Purchase Price per Share (cell F4).

4. Copy the formula in cell G4.

5. Highlight the range G5:G18.

6. Click the down arrow on the Paste button in the Home tab of the Ribbon.

7. Click the Formulas button from the list of options. This is the Paste Formulas command,

which pastes only the formula without any associated formats for the copied cell location.

8. While G5:G18 is highlighted format the cells for comma with no decimal places.

9. Click cell E19 on the Investment Detailworksheet.

10. Press and hold the ALT key on your keyboard, then press the equal sign (=). This is the shortcut for the Auto Sum feature.

- 11. Press the ENTER key on your keyboard.
- 12. Click cell G19 on the Investment Detail worksheet.

13. Repeat step 9.

14. Press the ENTER key on your keyboard.

Figure 3.5 "Completed Formula in the Cost of Purchase Column" shows the formula that was entered into cell G4 in the Purchase section of the Investment Detail worksheet. You can also see the results of the formula after it is pasted into the range G5:G18. The Paste Formulas option was used to paste the formula into this range so the borders would not be altered.

Averade • • • • • • • •	19	40	I	1	6	н	Columns A and B have been to through the Freeze Panes com
Personal Inves	stment	-					6
Descriptive Information	ļ.			Purchase			
Investment Type	Symbol	Dividend / Yield	Shares Purchased	Purchase Price per Share	Cost of Purchase	Currer C	ost of Purchase formula.
Bond Fund	VFICX	4,60%	750	\$ 9.49	=E4*F4	\$ 9.84	
Bond Fund	VFSTX.	3.20%	750	10.68	8,010	\$ 10.73	
Bond Fund	VWEHX	7.20%	500	6.29	3,145	\$ 5.82	
Bond Fund	VUSTX	4.00%	500	\$ 11.00	5,500	\$ 10.88	
International Stock Fund	VDMIX	2.60%	500	14.68	7,340	\$ 10.52	
Domestic Stock Fund	VEIPX	2.50%	500	23.35	11,675	\$ 21.51	
Domestic Stock Fund	VISGX	0.30%	250	19.33	4,833	\$ 23.67	
Domestic Stock Fund	VIMSX	1.00%	250	22.41	5,603	\$ 21,70	Results after pasting the
International Stock Fund	VTRIX	2.00%	250	22.83	5,708	\$ 33.30	Cost of Purchase formula.
International Stock Fund	VEIEX	1.40%	250	23.74	5,935	\$ 31.80	
Individual Stock	TRV	2.40%	150	38.14	5,721	\$ 55.54	
Individual Stock	JNJ	3.60%	150	53.30	7,995	5 61.94	
Individual Stock	KO	2.80%	150	62.46	9,369	\$ 65.50	
Individual Stock	MSFT	2.50%	75	28.02	2,102	\$ 27.85	
Individual Stock	IBM	1.60%	75	87.68	6,576	\$ 146.67	
Total			5.100		\$ 98 628		



Table 3.3 "Definitions for Columns H through K of the Investment Detail Worksheet" shows the definitions for the Current Value section (Columns H through K) of the Investment Detail worksheet.

Definition Category The current price of an individual stock or the current net asset value of a **Current Price** mutual fund. Current The number of shares purchased multiplied by the current price. Purchase Value The estimated amount of money paid for the interest on a bond fund or the Estimated dividends paid on a stock or stock fund. The future value function is used to Dividend estimate these payments. For an actual portfolio, real monetary distributions Payments can be added to the current purchase value of the investment to calculate the total value of an investment. Current The current purchase value plus the estimated dividend payments. The Investment current investment value is compared with the cost of purchase to determine Value how much money is gained or lost.

Table 3.3 Definitions for Columns H through K of the Investment Detail Worksheet

Before we continue with the formulas in this worksheet, we will name ranges for future use. Highlight A3:X18. On the Formulas ribbon use the Create from selection. Make sure Top Row is selected. Uncheck Left Column.

We will add a basic formula to the Current Purchase Value and Current Investment Value columns. For the Estimated Dividend Payments column, we will use the FV (future value) function to estimate the dividend payments. The rate for the dividend payments comes from the anticipated dividend yield column (D) The following explains how we add the FV function to the Estimated Dividend Payments column:

1. Click cell J4 and type an equal sign (=).

2. Type the function name FV followed by an open parenthesis (().

3. For the Rate argument, we will use the Dividend Yield divided by 12 months. From Use in Formula select Dividend Yield or start typing Dividend and double

click on the range name when it appears in the dropdown selection window. type a forward slash (/) for division, and then type 12. This divides the rate in the Dividend/Yield column by 12. The length of ownership of an investment is expressed in terms of Estimated Current Current Dividend Investment Percent Payments Value Portfoli =FV(divi FV(rate, nper, pmt, [pv], [type]) Dividend_Yald Estimated_Dividend_Payments

months in Column Q. Therefore, the rate for the FV function must be expressed in terms of months by dividing the annual rate by 12.

4. Type a comma.

5. For the Nper we will use the Months Owned from column Q, which contains the number of months owned or the term of the future value calculation. Type in Months_Owned

6. Type a comma followed by a zero (,0). We are not calculating an annuity or periodic investment in this example, so the PMT argument will be defined with a zero. Type a comma to advance the function to the Pv argument.

7. For the PV argument, we will use the Cost of Purchase previously calculated in column G. Type a minus sign (−) and start typing cost. Double click on the named range when it appears in the drop-down selection box This is the cost of the investment purchase 8. Type a closing parenthesis ()).

9. By itself, the FV function is calculating the total value of the investment with dividends or interest earned. To show only the amount of dividends or interest earned, we subtract the cost of the investment purchase in G4 from the result of the FV function. Type a minus sign (–) and click cell G4.

10. Press the ENTER key on your keyboard.

11. If necessary, adjust the decimal places for the output of the FV function to zero.

12. Copy the FV function in cell J4 and paste it into the range J5:J18 using the Paste Formulas command.

13. In J19, sum the column of estimated dividends.

Figure 3.6 "Completed FV Function in the Estimated Dividend Payments Column" shows the completed FV function in cell J4 of the Estimated Dividend Payments column. It is important to reduce the decimal places to zero after you enter the function into cell J4. Excel does not display the result of the function until the decimal places are removed because of the column width.

AVE	RAGE \checkmark : $\times \checkmark f_{\times}$ =f	V(Dividend	_Yield/12,Months	_Owned,0,-Cost_c	of_Purchase)-Cos	t_of_Purchase					*
	А	В	J	К	L	М	N	0	Р	Q	R
1	Personal Inves	stment									
2	Descriptive Information	1	t Value				Perce	ent of Portfo	olio		
3	Investment Type	Symbol	Estimated Dividend Payments	Current Investment Value	Current Percent of Portfolio	Target Percent of Portfolio	Current vs Target	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/Shoi Indicator
4	Bond Fund	VFICX	=FV(Divide	endYield	12,Months	_Owned,0,-	Cost_of_P	urchase)-Cos	st_of_Pur	chase	
5	Bond Fund	VFSTX	829	I		10.0%				37	
6	Bond Fund	VWEHX	1,046			10.0%				48	
7	Bond Fund	VUSTX	186			10.0%				10	
8	International Stock Fund	VDMIX	698			7.0%				42	
9	Domestic Stock Fund	VEIPX	547			5.0%				22	
10	Domestic Stock Fund	VISGX	40			5.0%				33	
11	Domestic Stock Fund	VIMSX	219			5.0%				46	
12	International Stock Fund	VTRIX	282			7.0%				29	
13	International Stock Fund	VEIEX	63			6.0%				9	
14	Individual Stock	TRV	885			5.0%				72	
15	Individual Stock	JNJ	2,380			5.0%				87	
16	Individual Stock	KO	132			5.0%				6	
17	Individual Stock	MSFT	230			5.0%				50	
18	Individual Stock	IBM	937			5.0%				100	
19	Total		\$ 9,911								
	Investment Detail Inve	stment List	Benchmarks	Price Data 🥼 🤆			4				Þ
Edit	1							=			+ 130%

Figure 3.6 Completed FV Function in the Estimated Dividend Payments Column

The following steps explain how to add the formulas for the Current Purchase Value and Current Investment Value columns:

1. Click cell I4 on the Investment Detail worksheet.

2. Enter a formula that multiplies the Current Price in cell H4 by the Shares Purchased in cell E4.

3. Copy the formula in cell I4 and paste it into the range I5:I18 using the Paste Formulas command. While the range is still highlighted, format for comma with zero decimal places.

4. Click cell K4 on the Investment Detail worksheet.

5. Enter a formula that adds the Current Purchase Value in cell I4 to the Estimated Dividend Payments in cell J4.

6. Copy the formula in cell K4 and paste it into the range K5:K18 using the Paste Formulas command.

7. Click cell K19 on the Investment Detail worksheet.

8. Enter a SUM function that adds the values in the rangeK4:K18.

Figure 3.7 "Completed Current Value Section of the Investment Detail Worksheet" shows the completed columns of the Current Value section in the Investment Detail worksheet. The formula used to calculate the Current Investment Value illustrates why we used the FV function to calculate the estimated dividend or interest payments for an investment. Investments that earn interest or dividends can achieve growth in two ways. The first way is through interest or dividend payments. The second way is through changes in the price paid for the investment. The formula used to calculate the Current Purchase Value is taking the number of shares purchased for each investment and multiplying it by the current market price. Therefore, the Current Investment Value takes into account any changes in the investment price by adding the purchase value at the current market price to any dividends or interest payments earned.

K20	→ : × √ Jx										
	А	В	E	F	G	н	1	J	K	L	N
1	Personal Inves	stment									
2	Descriptive Information	1		Purchase)						
3	Investment Type	Symbol	Shares Purchased	Purchase Price per Share	Cost of Purchase	Current Price	Current Purchas e Value	Estimated Dividend Payments	Current Investment Value	Current Percent of Portfolio	Target Percer Portfo
5	Bond Fund	VFSTX	750	10.68	8,010	10.73	8,048	829	8,877		1
6	Bond Fund	VWEHX	500	6.29	3,145	5.82	2,910	1,046	3,956		1
7	Bond Fund	VUSTX	500	11.00	5,500	10.88	5,440	186	5,626		1
8	International Stock Fund	VDMIX	500	14.68	7,340	10.52	5,260	698	5,958		
9	Domestic Stock Fund	VEIPX	500	23.35	11,675	21.51	10,755	547	11,302		
10	Domestic Stock Fund	VISGX	250	19.33	4,833	23.67	5,918	40	5,958		
11	Domestic Stock Fund	VIMSX	250	22.41	5,603	21.70	5,425	219	5,644		
12	International Stock Fund	VTRIX	250	22.83	5,708	33.30	8,325	282	8,607		
13	International Stock Fund	VEIEX	250	23.74	5,935	31.80	7,950	63	8,013		
14	Individual Stock	TRV	150	38.14	5,721	55.54	8,331	885	9,216		
15	Individual Stock	JNJ	150	53.30	7,995	61.94	9,291	2,380	11,671		
16	Individual Stock	KO	150	62.46	9,369	65.50	9,825	132	9,957		
17	Individual Stock	MSFT	75	28.02	2,102	27.85	2,089	230	2,319		
18	Individual Stock	IBM	75	87.68	6,576	146.67	11,000	937	11,938		
19 20	Total		5,100		\$ 96,628			\$ 9,911	\$117,857		
4	Investment Detail Inve	stment List	Benchmarks	Price Data	(+)	:	4				Þ

Figure 3.7 (Completed	Current Va	lue Section	of the	Investment	Detail	Worksheet
--------------	-----------	------------	-------------	--------	------------	--------	-----------

Table 3.4 "Definitions for Columns L through R of the Investment Detail Worksheet" provides definitions for the Percent of Portfolio section of the Investment Detail worksheet (Columns L through R).

Category	Definition
Current Percent of Portfolio	The current investment value divided by the total current value of the investment portfolio.
Target Percent of Portfolio	The planned percentage each investment is intended to have for the entire portfolio.
Current vs. Target	The difference between the Current Percent of Portfolio column and the Target Percent of Portfolio column.
Rebalance Indicator	Shows which investments do not match the target percentage of the portfolio. For example, as one investment increases in value due to an increase in market price, it will comprise a greater percentage of the portfolio. This may require that some shares of this asset be sold and invested in other areas that may have decreased in value. This is known as <i>rebalancing the portfolio</i> , and it helps you sell investments when prices are high and buy investments when prices are low.
Buy/Sell Indicator	Based on the results of the Rebalance Indicator, a logical function is used to indicate whether an investment should be purchased or sold.
Months Owned	Shows how many months an investment is owned. The length of ownership is expressed in terms of months since dividend payments on stock funds and interest payments on bond funds are distributed monthly.
Long/Short Indicator	Shows whether an investment has been owned long enough to qualify as a long-term investment, which is greater than twelve months. The amount of taxes paid on the amount of money gained for a short-term investment is greater than a long-term investment. Therefore, there is a tax incentive to hold investments for more than twelve months.

Table 3.4 Definitions for Columns L through R of the Investment Detail Worksheet

The Percent of Portfolio section of the Investment Detail worksheet (Columns L through R) requires two formulas and one function. The following steps explain how we add them to the worksheet:

1. Click on cell K19 and name the cell Total_Current_Value.

2. Click cell L4 in the Investment Detail worksheet.

3. Enter a formula that divides the Current Investment Value in cell K4 by the Total_Current_Value in cell K19.

4. Copy the formula and paste it into the range L5:L18 using the Paste Formulas command.

5. Click cell N4 in the Investment Detail worksheet.

6. Enter a formula that subtracts the Target Percent of Portfolio (cell M4) from the Current Percent of Portfolio (cell L4): L4–M4.

7. Copy the formula and paste it into the range N5:N18 using the Paste Formulas command. 8. Click cell Q19 in the Investment Detail worksheet.

9. Enter an AVERAGE function that calculates the average of the values in the range Q4:Q18.

Figure 3.8 "Percent of Portfolio Section of the Investment Detail Worksheet "shows the results of adding two formulas and a function to the Percent of Portfolio section of the Investment Detail worksheet. Notice the absolute reference added to the cell reference for K19 in the formula in the Current Percent of Portfolio column.

Figure 3.8 Percent of Portfolio Section of the Investment Detail Worksheet

AVE	RAGE \star : \times \checkmark f_{\star} =	(4/Total_Curre	nt_Value						
	А	В	L	М	N	0	Р	Q	
1	Personal Inves								
2	Descriptive Information	Percent of Portfolio							
3	Investment Type	Symbol	Current Percent of Portfolio	Target Percent of Portfolio	Current vs Target	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/: Indicat
4	Bond Fund	VFICX	=K4/Total_	Current_Va	lue			48	
5	Bond Fund	VFSTX	7.5%	10.0%				37	
6	Bond Fund	VWEHX	3.4%	10.0%				48	
7	Bond Fund	VUSTX	4.8%	10.0%				10	
8	International Stock Fund	VDMIX	5.1%	7.0%				42	
9	Domestic Stock Fund	VEIPX	9.6%	5.0%				22	
10	Domestic Stock Fund	VISGX	5.1%	5.0%				33	
11	Domestic Stock Fund	VIMSX	4.8%	5.0%				46	
12	International Stock Fund	VTRIX	7.3%	7.0%				29	
13	International Stock Fund	VEIEX	6.8%	6.0%				9	
14	Individual Stock	TRV	7.8%	5.0%				72	
15	Individual Stock	JNJ	9.9%	5.0%				87	
16	Individual Stock	KO	8.4%	5.0%				6	
17	Individual Stock	MSFT	2.0%	5.0%				50	
18	Individual Stock IBM		10.1%	5.0%	,	AVERAGE funct	ion	100	
19	Total					output		42.6	
- 4	🔹 🕨 Investment Detail Investment List Benchmarks Price Data 🕘 : 🕢 🕨								

Table 3.5 "Definitions for Columns S through X of the Investment Detail Worksheet" provides definitions for the columns in the Performance Analysis section of the Investment Detail worksheet.

Category	Definition
Unrealized Gain/Loss	The amount of money gained or lost on an investment. It is considered unrealized because the loss or gain does not actually occur until the investment is sold.
Percent Gain/Loss	The percentage increase or decrease based on the unrealized gain/loss and the purchase value of an investment.
Target Annual Growth Rate	The expected annual growth rate for an investment. All investments are expected to grow over time. The rate of growth depends on the amount of risk taken. Investments that are a higher risk are expected to pay a higher rate of return.
Actual Annual Growth Rate	The percentage gain/loss divided by the amount of time an investment is owned expressed in terms of years.
Target vs. Actual Growth Rate	The difference between the actual annual growth rate and the target annual growth rate.
Performance Indicator	A logical function will be used to indicate which investments are underperforming with respect to the target vs. actual growth rate.

Table 3.5 Definitions for Columns S through X of the Investment Detail Worksheet

Most of the columns in the Performance Analysis section of the Investment Detail worksheet will be completed with formulas and functions. The following steps explain how we add them to the worksheet:

1. Click cell S4 on the Investment Detail worksheet.

2. Enter a formula that subtracts the value in the Cost of Purchase column (cell G4) from the value in the Current Investment Value column (cellK4): K4–G4.

3. Copy the formula and paste it into the range S5:S19 using the Paste Formulas command. While the range is still selected, format for comma with not decimal places. Note that this formula will be used to calculate the output for the Total row in this column. The results of the formula are showing how much money has been earned or lost for each investment. It is important to note that these gains or losses do not actually happen unless the investment is sold.

4. Click cell T4 on the Investment Detail worksheet.

5. Enter a formula that divides the Unrealized Gain/Loss (cell S4) by the Cost of Purchase (cell G4): S4/G4.
6. Copy the formula in cell T4 and paste it into the range T5:T19 using the Paste Formulas command.

7. Click cell V4 on the Investment Detail worksheet.

8. Enter a formula that divides the Percent Gain/Loss (cell T4) by the result of dividing the Months Owned (cell Q4) by 12: T4/(Q4/12). Dividing the Months Owned value by 12 expresses the amount of time an investment has been owned in terms of years. The benchmark growth rates for most investments are expressed in terms of annual return rates. Therefore, this formula must first express the amount of time an investment has been owned in terms of years. Then the total percentage gain or loss for each investment is divided by the length of ownership in years to calculate the actual annual rate of return.
9. Copy the formula in cell V4 and paste it into the range V5:V19 using the Paste Formulas command.

10. Click cell W4 on the Investment Detail worksheet.

11. Enter a formula that subtracts the Target Annual Growth Rate (cell U4) from the Actual Annual Growth Rate (cell V4): V4–U4.

12. Copy the formula in cell W4 and paste it into the range W5:W18 using the Paste Formulas command.

Figure 3.9 "Performance Analysis Section of the Investment Detail Worksheet" shows the results of the formulas added to the Performance Analysis section of the Investment Detail worksheet. This completes the required formulas and functions necessary to add before moving on to the logical and lookup functions of the chapter.

4	A	8	Q	8	5	- T	U	V	W	X
	Personal Inves	stment								The Months expressed in dividing
	Descriptive Information	E.					Perform	ance Analys	sis	- minung
N.	Investment Type	Symbol	Months Owned	Long/Short Indicator	Unrealized Gain/Loss	Percent Gain/Loss	Target Annual Growth Rate	Actual Annual Growth Rate	Target vs Actual Growth Rate	Performance
Ľ,	Bond Fund	VFICX	48		\$ 1.697	23.85%	4.60%	=T4/(Q4/12)	1.36%	
	Bond Fund	VFSTX	37		\$ 867	10.82%	3.20%	3.51%	0.31%	
	Bond Fund	VWEHX	48	-	\$ 811	25.79%	7.20%	6,45%	-0.75%	
	Bond Fund	VUSTX	10		\$ 126	2.29%	4.00%	2.75%	-1.25%	
Ē.	International Stock Fund	VDMIX	42		\$ (1.382)	-18.82%	8.00%	-5.38%	-13.38%	
ī,	Domestic Stock Fund	VEIPX	22		\$ (373)	-3.20%	8.00%	-1.74%	-9.74%	
0	Domestic Stock Fund	VISGX	33		\$ 1,125	23.28%	10.00%	8.47%	-1.53%	
ĩ	Domestic Stock Fund	VIMSX	48		\$ 41	0.74%	10.00%	0.19%	-9.81%	
2	International Stock Fund	VTRIX	29		\$ 2,900	50.81%	10.00%	21.02%	11.02%	
3	International Stock Fund	VEIEX	9		\$ 2,078	35.01%	12.00%	46.67%	34.67%	
4	Individual Stock	TRV	72		\$ 3,495	61.09%	8.00%	10,18%	2.18%	
ŝ	Individual Stock	JNJ	87		\$ 3,676	45.98%	8.00%	6.34%	-1.66%	
Б.	Individual Stock	KO	6		\$ 588	6.28%	8.00%	12.55%	4.55%	
1	Individual Stock	MSFT	.50		\$ 218	10.36%	10.00%	2.49%	-7.51%	
8	Individual Stock	IBM	100		\$ 5,362	81.53%	10.00%	9.78%	-0.22%	
9	Total		42.6		\$21,229	21.97%		6.19%	+	The current annua growth rate for

Figure 3.9 Performance Analysis Section of the Investment Detail Worksheet

080

The Logical Test

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.02 if starting here.) A key component for the logical functions that will be demonstrated in this section is the logical test. A logical test is used in logical functions to evaluate the contents of a cell location. The results of the logical test can be either true or false. For example, the logical test C7 = 25 (read as "if the value in cell C7 is equal to 25") can be either true or false depending on the value that is entered into cell C7. A logical test can be constructed with a variety of comparison operators, as shown in Table 3.6 "Comparison Operator Symbols and Definitions". These comparison operators will be used in the logical test arguments for the logical functions demonstrated in this chapter.

Table 3.6 Comparison Operator Symbols and Definitions

Symbol	Definition	Symbol	Definition
=	Equal To	<>	Not Equal To
>	Greater Than	> =	Greater Than or Equal To
<	Less Than	< =	Less Than or Equal To

A logical test will be used to evaluate the contents of a cell location in the Investment Detail worksheet. We will first demonstrate how the logical test is used to evaluate the contents of a cell location. Then we will use this logical test in the IF function, which will be demonstrated next. The following steps explain how the logical test is constructed:

- 1. Click cell R4 on the Investment Detail worksheet.
- 2. Type an equal sign (=).
- 3. Click cell Q4.
- 4. Type the greater than sign (>) followed by an equal sign(=).

5. Type the number 12. This completes the logical test, which is shown in Figure 3.10 "Logical Test Entered into the Investment Detail Worksheet". The logical test would be stated as: "If the value in cell Q4 is greater than or equal to 12."

6. Press the ENTER key on your keyboard. Notice that the output of the logical test is the word TRUE. This is because the value in cell Q4 is 48, which is greater than 12. 7. Copy the logical test in cell R4 and paste it into the range R5:R18 using the Paste Formulas command.

	R4 • (* f	Q4>=12				-	
4	A	в	P	Q	R		
	Personal Inve	stment					
	Descriptive Informatio	n	lio				
3	Investment Type	Symbol	Buy/Sell Indicator	Months Owned	Long/Short Indicator		
1	Bond Fund	VFICX		48	TRUE	h	
	Bond Fund	VFSTX		37	TRUE	11	
	Bond Fund	VWEHX		48	TRUE	11	
	Bond Fund	VUSTX	-	> 10	FALSE	11	
5	International Stock Fund	VDMIX		42	TRUE	11	
8	Domestic Stock Fund	VEIPX		22	TRUE		
0	Domestic Stock Fund	VISGX		33	TRUE		The output of t
1	Domestic Stock Fund	VIMSX		46	TRUE		logical test is eit
2	International Stock Fund	VTRIX		29	TRUE		TRUE or FALSI
3	International Stock Fund	VEIEX		9	FALSE		
4	Individual Stock	TRV		72	TRUE		
5	Individual Stock	The output of	fthis	87	TRUE		
6	Individual Stock	logical test is l	ALSE	6	FALSE		
7	Individual Stock	less than 1	2.	50	TRUE		
8	Individual Stock	IBM		100	TRUE		
4	Total			42.6			

Figure 3.10 Logical Test Entered into the Investment Detail Worksheet

Figure 3.11 "Output of the Logical Test" shows the results of the logical test after it is pasted into the range R5:R18. Notice that for any values that are less than 12 in the range Q4:Q18, the logical test produces an output of FALSE.

Figure 3.11	Output	of the	Logical	Test
-------------	--------	--------	---------	------

X	- 19 · (9 · (9) =			Excel O	bjective 3.00	- Microsoft	Excel
1	Home Insert Page Lay	out Formula	is Data Ri	eview View			
E	3 × u	• A' A'	= = =	· ·	General	-	
Pas	[™] J B <i>I</i> <u>U</u> · <u>□</u> ·	3r A -	新会会に	家律 图-	\$ - %	* 170 .00	Formatter
Clipt	board Te Font		Alignma	ent 🖓	Neum	ber C	4
	INDEX V (* X V f. =0	24>=12					
1	A	8	0	p.	Q	R	
1	Personal Inves	stment					
2	Descriptive Information	1	nt of Port	folio			
3	Investment Type	Symbol	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/Shor Indicator	t Unre Gain
4	Bond Fund	VFICX			48	=Q4>=12	S
5	Bond Fund	VFSTX			37	4	S
6	Bond Fund	VWEHX			48		\$
7	Bond Fund	VUSTX			10		S
8	International Stock Fund	VDMIX			42		This logical test i
9	Domestic Stock Fund	VEIPX			22		cell O4 is greater
10	Domestic Stock Fund	VISGX			33		than or equal to 1
11	Domestic Stock Fund	VIMSX			46		15

IF Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.03 if starting here.) The IF function is used to produce a custom output based on the results of a logical test. If the results of the logical test are TRUE, the IF function will display a specific number or text, or perform a calculation. If the results of the logical test are FALSE, the IF function will display a different number or text, or perform a different calculation.

=IF(Logical_Test, Value_if_true, Value_if_false)

The arguments of the IF function are defined in Table 3.7 "Arguments for the IF Function". Table 3.7 Arguments for the IF Function

Argument	Definition
Logical_test	The results of the test must yield either a true or false result. For example, the test <i>C7>25</i> would be read as <i>if C7 is greater than 25</i> . If the number 30 is entered into cell C7, the logical test is true. If 20 is entered into the C7 the result would be false.
	If you are evaluating a cell that contains text data, the text in the logical test must be placed inside quotation marks. For example, if you wanted to test if the word <i>Long</i> is in cell C7, the logical test would be C7 = "Long".
[Value_if_true]	The output that will be displayed by the function or the calculation that will be performed by the function if the results of the logical test are true. This argument can be defined with a formula, function, number, or text. However, when defining this argument with a text output such as the word <i>Long</i> , it must be placed inside quotation marks (<i>"Long"</i>).
[Value_if_false]	The output that will be displayed by the function or the calculation that will be performed by the function if the results of the logical test are false. This argument can be defined with a formula, function, number, or text. However, when defining this argument with a text output such as the word <i>Long</i> , it must be placed inside quotation marks (" <i>Long</i> ").

We will use the IF function in the Percent of Portfolio section of the Investment Detail worksheet. We will use the logical test that was previously demonstrated within the IF function to determine if an investment has been held for a short or long period of time. For tax purposes, an investment is considered short-term if it is held less than twelve months. This requires the investor to pay a higher tax percentage for any profit earned on the investment. An investment held twelve months or longer is considered a long- term investment. The following explains how the IF function is used to identify which investments are long term or short term:

1. Highlight the range R4:R18 on the *Investment Detail* worksheet and press the DELETE key on your keyboard. This will remove the logical test and allow us to replace it with an IF function.

2. Click cell R4 on the *Investment Detail* worksheet.

- 3. Click the Formulas tab on the Ribbon.
- 4. Click the Logical button in the Function Library group of commands.

5. Click the IF function from the list of functions (see Figure 3.12 "Selecting the IF Function from the Function Library"). This opens the Function Arguments dialog box.

Figure 3.12 Selecting the IF Function from the Function Library

:)[¥ :	Home Insert Pa	je Lay	out. Formula	Data Revie	Excel Object	ive 3.00 -	Microsoft Excel		Click H list o	ere to select from a flogical functions.
f	κ Σ 📋 🝺	12		10	0	9	Define Name	· 3-	Trace Precedents	Show For
Insi Func	ert AutoSum Recently Financial Son * Used * *	Logic	al fest Da Thr	te & Lookup & M se * Reference * T	ath & More rig * Functions *	Name Manager	Create from 5	ielection R	Remoi Click her dialog	re to open the argume box for the IF function
-	84 • (*		AND			-	CONTRACTOR OF CONTRACT	and the second s	~	
1	A		FALSE	M	N	0	P	Q	R	s
1	Personal In		FERROR	Ellogical test valu	se if true value if	false)				
2	Descriptive Informa		NOT	Checks whether a	condition is met, a	not Por	tfolio			
3	Investment Type		OR TRUE	returns one value value if FALSE	if TRUE, and another	ier ice	Buy/Sell Indicator	Months Owned	Long/Short Indicator	Unrealize Gain/Lose
4	Bond Fund	fx	Insert Euroction.	110.0%	-2.5%			48		\$ 1.69
5	Bond Fund		VFSTX	10.0%	-2.5%			37	-	\$ 86
6	Bond Fund		VWEHX	10.0%	-6.6%			48		\$ 81
7	Bond Fund		VUSTX	10.0%	-5.2%			10		\$ 12
8	International Stock F	und	VDMIX	7.0%	-1.9%			42		\$ (1,38
9	Domestic Stock Fund	1	VEIPX	5.0%	4.6%			22		\$ (37
10	Domestic Stock Fund		VISGX	5.0%	0.1%			33		\$ 1,12
11	Domestic Stock Fund	1	VIMSX	5.0%	-0.2%			46		\$ 4
83	International Steak E	ind	VTDIV	7 0.0/	0 20%			20		E 200

6. Click in the Logical_test argument (see Figure 3.13 "Logical_Test Argument Defined").

7. From the Use in Formula select the range Months_Owned.

- 8. Type the greater than sign (>) followed by an equal sign(=).
- 9. Type the number 12.

Figure 3.13 "Logical_Test Argument Defined" shows the appearance of the IF Function Arguments dialog box after defining the Logical_test argument. Notice that next to the Logical_test input box, Excel shows that the results of the test are true. This makes sense given that the value in cell Q4 is 48, which is greater than 12.

Home Insert Page Las	put #prmulas	Clata Review	View	10		_		
ΣΘΘΘ		0 0		0	The result logical test a	s of the ppear h	ere.	ow Formulat
Function Arguments					1812	1	- n 9 0	the Checking -
F			-			P Concession	Cormits As	ution
Logical_test	Months Owned	= 12	TRUE - TRUE				Continued for	and a second sec
Value_#_true	4		1 · my			-		
Volue_if_faise			15 · 2014			Clic	k here to defi	ine the
						Valu	ue_if_true arg	jument
						-		
Checks whether a condition is met, a	nd returns one value	if TRUE, and anoth	ber value if FALSI	E		1		
Checks whether a condition is met, a Logi	nd returns one valu cal_test is any va	If TRUE, and anoth	ter value if FALSI at can be evaluat	E. Hed to TRUE or FALS	sé.	-	L.	
Checks whether a condition is met, a Logi	nd returns one valu cal_test is any va	e if TRUE, and enoting the or expression the	ter value if FALSI at can be evaluat	E. Hed to TRUE or FALS	sé.	nths	Long/Short	Unrealized
Checks whether a condition is met, a Logi	nd returns one valu cal_test is any va	W TRUE, and another or expression the	er value if FALSI at can be evaluat	E. Hed to TRUE or FALS	st.	nths ned 48	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1.697
Checks whether a condition is met, a Logi Formula result =	nd returns one value cal_test is any va	of TRUE, and another or expression th	er value if FALSI at can be evaluat	E. Hed to: TRUE or FALS	sé.	nths ned 48 37	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1,697 \$ 867
Checks whether a condition is met, a Logi Formula result = Itely on this function	nd returns one value cal_test is any va	of TRUE, and another the or expression the	ter value if FALSI at can be evaluat	E. ted to TRUE or FALS OK.	sé.	nths ned 48 37 48	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1,697 \$ 867 \$ 811
Checks whether a condition is met, a Logi Formula result = Itely on this function SONO ,=upo	od returns one valu cal_test is any va	10.0%	er value if FALSI at can be evaluat -3.2%	E. and to TRUE or FALS OK	SE.	nths med 48 37 48 10	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1,697 \$ 867 \$ 811 \$ 126
Checks whether a condition is met, a Logi Formula result = Help on this function Sono Euro Intern A definition of the a	ad returns one value cal_test is any value cal_test is any value and test is argument	10.0%	-0.2%	E. Hed to TRUE or FALS	SE.	nths ned 48 37 48 10 42	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1,697 \$ 867 \$ 811 \$ 126 \$ 1,382
Checks whether a condition is met, a Logi Formula result = Help on this function Sono = upo Intern A definition of the a being defined app	ad returns one value cal_test is any value argument ears here.	10.0% 5.0%	-0.2% -1.9% 4.6%	E. Hel to TRUE or FALS	SE.	nths ned 48 37 48 10 42 22	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1,697 \$ 867 \$ 811 \$ 126 \$ 126 \$ (1,382 \$ (373)
Checks whether a condition is met, a Logi Formula result = Held on this function Bond Human Intern A definition of the a being defined app Domestic Stock Fund	ad returns one value cal_test is any value argument ears here. VISGX	10.0% 5.0% 5.0%	-0.2% -1.9% 0.1%	E. sed to TRUE or FALS OK.	SE.	nths ned 48 37 48 10 42 22 33	Long/Short Indicator Q4>=12)	Unrealized Gain/Loss \$ 1,697 \$ 867 \$ 811 \$ 126 \$ (1,382 \$ (372) \$ 1,125

Figure 3.13 Logical_Test Argument Defined

10. Press the TAB key on your keyboard to advance to the next argument, which is Value_if_true.

11. Type the word Long in quotation marks. If you forget to put words or text in quotation marks using the Function Arguments dialog box, Excel will insert the quotation marks for you.

12. Press the TAB key on your keyboard to advance to the next argument, which is Value_if_false.

- 13. Type the word Short in quotation marks.
- 14. Click the OK button on the Function Arguments dialog box to complete the function.
- 15. Copy the IF function in cell R4 and paste it into the range R5:R18.

Integrity Check - Placing Text in Quotation Marks for Logical Functions

If you are using a logical function to evaluate text data in a cell location, or if you are using a logical function to output text data, the text must be placed inside quotation marks. For example, if you are using a logical function to evaluate whether the word *Long* is entered into cell B5, the logical test must appear as follows: *B5= "Long"*. If you omit the quotation marks, the function may produce an erroneous false result for the test.

Figure 3.14 "Completed Function Arguments Dialog Box for the IF Function "shows the completed Function Arguments dialog box for the IF function. Notice that the results of the function are displayed in the dialog box. Since the value in cell Q4 is greater than 12, the word Long will be displayed in cell R4.



Figure 3.14 Completed Function Arguments Dialog Box for the IF Function

Figure 3.15 "IF Function Output" shows the completed Long/Short Indicator column on the Investment Detail worksheet. Notice the word Short is displayed for any investment held less than twelve months.

Figure 3.15 IF Function Output

2	A	8	M	N	0	P	Q	R	5	
i	Personal Inves	itment								
2	Descriptive Information	F.	1	Perce	ent of Port	olio				
3	Investment Type	Symbol	Target Percent of Portfolio	Current vs. Target	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/Short Indicator	Unrealize Gain/Lot	
¢.	Bond Fund	VFICX	10.0%	-2.5%			48	Long	\$ 1.6	
	Bond Fund	VESTX	10.0%	-2.5%			37	Long	5 81	
5	Bond Fund	VWEHX	10.0%	-6.6%			48	Long	\$ 8	
ř.	Bond Fund	VUSTX	10.0%	-5.2%			10	Short	\$ 1:	
1	International Stock Fund	VDMIX	7.0%	-1.9%			42	Long	\$ (1.3)	
9	Domestic Stock Fund	VEIPX	5.0%	4.6%			22	Long	\$ (3	Franklin and the second second second
0	Domestic Stock Fund	VISGX	5.0%	0.1%			33	Long	\$ 1,1;	The IF function is producin
1	Domestic Stock Fund	VIMSX	5,0%	-0.2%			46	Long	>	based on the values in
2	International Stock Fund	VTRIX	7.0%	0.3%	7		29	Long	\$ 2,9	column Q.
3	International Stock Fund	VEIEX	6,0%	0.8%			9	Short	\$ 2.0	
4	Individual Stock	TRV	5.0%	2.8%			72	Long	\$ 3,4!	
5	Individual Stock	JNJ	5.0%	4.9%		1	87	Long	\$ 3,6	
6	Individual Stock	KO	5.0%	3.4%			6	Short	\$ 5	
7	Individual Stock	MSFT	5.0%	-3.0%			50	Long	\$ 2	
8	Individual Stock	IBM	5.0%	5.1%			100	Long	\$ 5.3	
9	Total						42.6		\$21,2:	

Assumption Tables

Assumption tables are set up and used in Excel worksheets to avoid entering actual numbers into a function. Instead, they provide a convenient area to enter the variables in your data that might change. For instance, payments on a mortgage could be 12 (monthly), 26 (every two weeks), 4 (quarterly), or 2 (semi-annually). By providing a cell to link to in your functions, you only need to change that one cell to change the results of your formulas. We will set up assumption tables in our Excel file. The fields in the file will be named so that the function arguments are easy to understand. Remember that naming a cell will make it an absolute cell reference. It is the equivalent of \$A\$1 where both the row and column reference are anchored.

The OR Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.04 if starting here.) The OR function is like the IF function in that it uses a logical test to evaluate the contents of a cell location. However, the OR function allows you to define several logical tests as opposed to just one.

If one of the logical tests is true, the output of the function will be the word TRUE. If all the logical tests are false, the output of the function will be the word FALSE. This differs from the IF function because the output of the function is only the word TRUE or the word FALSE. As a result, the OR function is commonly used within the IF function to enable specific outputs to be defined.

The purpose of this column is to identify any investment where either the Unrealized Gain/Loss is less than zero or the Target vs. Actual Growth Rate is less than -1%. We will use the function in the logical test of an IF function so we can define a specific output based on the results of the OR function. We will set up the assumption table and then demonstrate how the OR function works by itself, which is outlined in the following steps:

1. Click cell A21 in the Investment Detail worksheet.

2. Type Assumption Table and press Enter

3. In cell A22 type Unrealized Gain Loss <

4. In cell B22 type 0

5. In cell A23 type Actual Growth Rate <

6. In cell B23 type (-1%) (minus 1 percent)

7. Highlight cells A22:B23, on the Formula Ribbon, Defined Names section, Create from Selection. Make sure column is checked and click OK

8. Click cell X4 and type an equal sign (=).

9. Type the function name OR and double click on the function when it appears in the function list.



10. Click cell S4 on the Investment Detail worksheet. (This is the first cell we are testing in our logical test.)

11. Type the less than symbol (<) then click on cell B22. This completes the first logical test, which is evaluating if the value in cell S4 is less than zero. The named cell

Unrealized_Gain_Loss will appear in your function.

12. Type a comma. This advances the function to a second logical test.

13. Click cell W4 on the Investment Detail worksheet. (This is the second cell we are testing in our logical test.)

14. Type the less than symbol (<) then click on cell B23. (The named cell

Actual_Growth_Rate will appear in your function.) This completes the second logical test, which is evaluating if the value in cell W4 is less than -1%.

15. Type a closing parenthesis ()) and press the ENTER key on your keyboard.

16. Copy the OR function in cell X4 and paste it into the range X5:X18 using the Paste Formulas command.

Figure 3.16 Completed OR Function by Itself

E C C C C C C C C C C C C C C C C C C C	Lange A	interest in the state of the st	tanden -	Tana Arange	if the last if the last	Anna an	18	States States	11	Two logical functions are defined
A	1		5	T		. v.	w	- X	V.	for the OR function
Personal Inves	tment									-
Descriptive Information					Performa	nce Analysis				
Bood Fund	WATHK	Long	\$ 811	25 79%	7 20%	0.45%	-0.75%]=	OB(58-5.m	nation Gain	Loss WildTaroet vs Actual Growth
Bond Fund	VUSTX	Short	\$ 126	2 29%	4.00%	2.75%	-1.25%	TRUE	1-	Created and an and and an and an and
International Stock Fund	VDMIX	Long	\$ (1,382)	-18.82%	8.00%	-5.38%	-13.38%	TRUE		
Domestic Stock Fund	VEIPX	Long	\$ (373)	-3.20%	8.00%	-1.74%	-9.74%	TRUE		
Domestic Stock Fund	VISGX	Long	\$ 1,125	23.28%	10.00%	8.47%	-1.53%	TRUE		1022 N. 10 10 10 10 10 10 10 10 10 10 10 10 10
Domestic Stock Fund	VIMSX	Long	\$ 41	0.74%	10.00%	0.19%	-9.81%	TRUE		The output of the OF
International Stock Fund	VTRIX	Long	\$ 2,900	50.81%	10.00%	21.02%	11.02%	FALSE		6
international Stock Fund	VEIEX	Short	\$ 2,078	35.01%	12.00%	46.87%	34.67%	FALSE		function is the word
Individual Stock	TRV	Long	\$ 3,495	61.09%	8.00%	10,18%	2.18%	FALSE		TRUE on FALCE
Individual Stock	JNJ	Long	\$ 3,676	45.98%	8.00%	6.34%	-1.66%	TRUE		I RUE OF FALSE
Individual Stock	KO	Short	\$ 588	6.28%	8.00%	12.55%	4.55%	FALSE		NUMBER OF CONTRACTORS
Individual Stock	MGFT	Long	\$ 218	10.36%	10.00%	2.40%	-7.51%	TRUE		
individual Stock	18M	Long	\$ 5,362	81.53%	10.00%	9.78%	-0.22%	FALSE		
Total			\$21,229	21.97%		6.19%				
issumption Table Inrealized Gain Loss Farget vs Actual Growth	-1%	+	Assump	otion Ta	ble]				

Figure 3.16 "Completed OR Function by Itself" shows the construction and result of the OR function by itself. Notice that the only output of the function is the word TRUE or the word FALSE. If either the Unrealized Gain/Loss is less than zero or the Target vs. Actual Growth Rate is less than -1%, the function shows the word TRUE. However, these descriptions will not be helpful for the person using this worksheet. Displaying the words OK or Warning would be far more helpful in identifying investments that need to be evaluated. The only way we can return a text response to the result of the OR function is to nest it in an IF function. We can do this if we use the OR function as the logical test argument of the IF function.

The following steps explain how to accomplish this:

1. Highlight the range X4:X18 on the Investment Detail worksheet and press the DELETE key on your keyboard. We are going to start over by creating an IF function.

- 2. Click cell X4 on the Investment Detail worksheet.
- 3. Type an equal sign (=).
- 4. Type the function name IF followed by an open parenthesis (().

5. Type the function name OR followed by an open parenthesis ((). The OR function is being placed into the logical_test argument of this IF function.

- 6. Click cell S4 on the Investment Detail worksheet.
- 7. Type the less than symbol (<) click cell B22.
- 8. Type a comma. This advances the function to a second logical test.
- 9. Click cell W4 on the Investment Detail worksheet.

<u>@080</u>

10.Type the less than symbol (<) then click cell B23.

- 11. Type a closing parenthesis ()).
- 12. Type an equal sign (=).

13. Type the word TRUE. Do not put the word inside quotation marks.

14. Type a comma. This completes the logical_test argument of the IF function. We can now go on to define the value_if_true and the value_if_false arguments. This will allow us to specify what the output of the function should be instead, using the OR function outputs of either TRUE or FALSE.

15. Type the word Warning. Be sure to enclose the word in quotation marks.

16. Type a comma. This will advance the function to the value_if_false argument.

17. Type the word OK. Be sure to enclose the word in quotation marks.

18. Type a closing parenthesis ()) and press the ENTER key on your keyboard.

```
19. Copy the IF function in cell X4 and paste it into the range X5:X18 using the Paste Formulas command.
```

Figure 3.17 "OR Function in the Logical Test of the IF Function" shows the OR function within the logical_test argument of the IF function. The logical test of the IF function is now evaluating if the results of the OR function are true.



Figure 3.17 OR Function in the Logical Test of the IF Function

The AND Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.05 if starting here.)

The portfolio manager wants to create a function that will help him make decisions about buying, holding, or selling different investments in the portfolio. The criteria around the decision will be:

- Buy when the fund's Current vs Target percent of portfolio value is less than 1% AND the fund's Unrealized Gain/Loss is greater than 0.
- Otherwise sell or hold the fund in the portfolio.



He will do that by using the AND as the logical test to decide to buy, sell or hold the fund.

The AND function is almost identical to the OR function in that it is composed of only logical tests and produces one of two possible outputs: TRUE or FALSE. However, all logical tests defined for the AND function must be true to produce a TRUE output. If one logical test is false, the function will produce a FALSE output. We will use the AND function to complete the Buy/Sell Indicator column on the Investment Detail worksheet. This column will show either the word Buy or the words Hold or Sell based on the results of the logical test argument of an IF function. We will expand our assumption table to incorporate these new parameters and then use the AND function to define the logical test argument of the IF function. The following steps explain how to accomplish this:

1. In cell A25 Type: Hold/Sell Criteria:

2. In cell A26 type Buy Current vs Target<

3. In cell B26 enter (-1%)

4. In cell A27 type Long Term >

5. In cell B27 enter (12)

6. In cell A28 enter Sell Target vs Growth >

7. In cell B28 enter 1%

8. In cell A29 enter Unrealized Gain >=

9. In cell B29 enter (0).

10. We need to name the new cells. Name the new assumption cells by highlighting A26:B29 and on the Formula ribbon, Create from selection. Make sure left column is checked and click OK.

11. Click cell P4 on the Investment Detail worksheet.

12. Type an equal sign (=).

13. Type the function name IF followed by an open parenthesis ((). The logical test we will use is the criteria given above. We will test to see if the Current vs Target percent of portfolio value is less than 1% AND the fund's Unrealized Gain/Loss is greater than 0.

14. Type the function name AND followed by an open parenthesis ((). The AND function is being placed into the logical_test argument of this IF function.

15.Click cell N4(the fund's current vs. target value) and then type the less than symbol(<).

16. Click cell B26. Buy Current_vs_Target named cell will appear.

17. Type a comma. This advances the AND function to the second argument in the AND function.

18. TypeS4. (Unrealized gain/loss) (Your function maybe overlapping S4 and you may not be able to click on it.)

19. Type a greater than symbol (>) followed by an equal sign (=). These symbols are used to evaluate if the value in a cell location is greater than or equal to a target value.

20. Click on cell B22. This will place your named cell Unrealized_Gain into the AND.

21. Close the AND function by closing parenthesis ())

22. Type an equal sign (=) followed by the word TRUE. Do not enclose the word in quotation marks.

23. Type a comma. This advances the IF function to the value_if_true argument.

24. Type the word Buy enclosed in quotation marks as shown in Figure 3.19 "Results of the AND Function in the Logical Test Argument of an IF Function". If the Current vs. Target value is less than -1% and the Unrealized Gain/Loss is greater than or equal to zero, the function will show the word Buy. In other words, if the investment is less than the desired percentage for the total portfolio and it is currently not losing money, we will buy more of that investment, so it is in line with the target percentage of the portfolio.

25. Type a comma.

26. Type the words "Hold or Sell" enclosed in quotation marks. For all other investments that are not designated with a Buy indicator, the function will show the words Hold or Sell. This indicates that an investment could either be held or sold.

27. Type the closing parenthesis ()). Then press the ENTER key on your keyboard. You should see the result "Buy" in cell P4.

28. Copy the IF function in cell P4 and paste it into the range P5:P18 using the Paste Formulas command or the Auto fill.

29. Increase the width of Column P to 12 points.

Figure 3.18 "AND Function Placed in the Logical Test of an IF Function" shows the appearance of the AND functions that has been added to the logical test of the IF functions.

Figure 3.18 AND Function Placed in the Logical Test of an IF Function



Figure 3.19 "Results of the AND Function in the Logical Test Argument of an IF Function" shows the results of the completed AND function within an IF function after it is copied and pasted into the range P5:P18.

Figure 3.19 Results of the AND Function in the Logical Test Argument of an IF Function

4	A	8	N	0	P	Q	8	unen n	incom).
1	Personal Inves	stment							
2	Descriptive Information	i :	Perc	ent of Por	tfolio		_		
3	Investment Type	Symbol	Current vs. Target	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/Si Indicato	hort	
4	Bond Fund	VFICX	-2.5%		Buy	48	Long		
5	Bond Fund	VFSTX	-2.5%		Buy	37	Long		
6	Bond Fund	VWEHX	-6.6%		Buy	48	Long		
7	Bond Fund	VUSTX	-5.2%	1	Buy	10	Short		
8	International Stock Fund	VDMIX	-1.9%		Hold or Sell	42	Long		
9	Domestic Stock Fund	VEIPX	4.6%		Hold or Sell	22	Long		
10	Domestic Stock Fund	VISGX	0.1%		Hold or Sell	33	Long		
11	Domestic Stock Fund	VIMSX	-0.2%		Hold or Sell	>440	Long		T
12	International Stock Fund	VTRIX	0.3%		Hold or Sell	29	Long		
13	International Stock Fund	VEIEX	0.8%		Hold or Sell	9	Short	_	
14	Individual Stock	TRV	2.8%		Hold or Sell	72	Long		1
15	Individual Stock	JNJ	4.9%		Hold or Sell	87	Long	The output o	f the IF function is
16	Individual Stock	KO	3.4%		Hold or Sell	6	Short	based on the	the logical test
17	Individual Stock	MSFT	-3.0%		Buy	50	Long	an	gument.
18	Individual Stock	IBM	5.1%		Hold or Sell	100	Long		
19	Total					42.6			



Simple Nested IF Functions

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.06 if starting here.)

When constructing the IF function, the logical test can produce only two potential outcomes when evaluating the data in a cell. In addition, the function can produce only two possible outputs, which are defined in the value_if_true and value_if_false arguments. However, there may be situations when you need to test for several possible outcomes, which may require more than two possible outputs. To accomplish this, you need to create a nested IF function. A nested IF function is when either the value_if_true or value_if_false arguments are defined with another IF function.

For the Personal Investment workbook, a nested IF function is required to complete the Rebalance Indicator column (Column O) on the Investment Detail worksheet (see Figure 3.19 "Results of the AND Function in the Logical Test Argument of an IF Function"). The purpose of this column is to indicate where the portfolio needs to be rebalanced.

Looking at the Current vs. Target column (Column N) you can see that several investments have a significant negative number where the investment value has fallen below the target percentage for the portfolio. Other investments have a significant positive number where the investment has exceeded the target percentage for the portfolio. For this portfolio, a number greater than 1% or less than -1% will be considered significant. Therefore, we will need to assess three possible outcomes when creating a logical test that evaluates the values in Column N. Those are:

- The first test will be if the Current vs. Target value is greater than 1% we will Rebalance the portfolio.
- \bullet The second test will be if the Current vs. Target value is less than -1% we will Rebalance the portfolio.
- The third test will be if both the first test and the second test are false, we are OK with the portfolio.

Because this problem involves three tests, we need to construct a nested IF function to produce the outputs in the Rebalance Indicator column. The first thing we will do is add to our assumption table.

- 1. In cell A31 type Rebalance Portfolio
- 2. In cell A32 type Low Current vs. Target

3. In cell B32 type -1% (It is important to use the percent symbol (%) after the number 1. If you omit the percent symbol, Excel will test if the value in cell N4 is greater than 100%.)

4. In cell B33 type High Current vs. Target

5. In cell C33 type 1%

6. Name the new assumptions by highlighting cells A32:B33 and Create from selection on the Formula ribbon. Make sure Left Column only is checked.

Now that the assumption table has been created we can use the following steps to create the Nested IF:

1. Click cell 04 on the Investment Detail worksheet.

2. Type an equal sign (=).

3. Type the function name IF followed by an open parenthesis (().

Now the logical test:

4. Click cell N4.

5. Type the greater than symbol (>) then click on cell B33 or find the named cell (High_Current_vs_Target), in the Use in Formula drop-down from the Formulas ribbon.

6. Type a comma.

Now the Value_if_true:

7. Type the word Rebalance inside quotation marks. When using text data to define any of the arguments for the IF function, the text must be placed inside quotation marks.

8. Type a comma.

The Value_if_false argument will be another IF function.

9. Start another IF function by typing the function name IF followed by an open parenthesis (().

Second IF function's logical test.

10. Click cell N4.

11. Type the less than symbol (<) then click on cell B32 or find the named cell

(Low_Current_vs_Target), in the Use in Formula drop-down from the Formulas ribbon.

12. Type a comma.

Second IF's Value_if_true argument.

13. Type the word Rebalance inside quotation marks.

14. Type a comma.

Second IF's Value_if_false argument.

15. Type the word OK inside quotation marks.

16. Type two closing parentheses ())). Since two IF functions were started, there are two open parentheses in the function. As a result, we need to add two closing parentheses; otherwise, Excel will produce an error message stating that a closing parenthesis is missing. Excel color codes the parenthesis so you know which function you are closing with each colored parenthesis.

17. Press the ENTER key on your keyboard.

18. Copy the nested IF function in cell O4 and paste it into the range O5:O18 using the Paste Formulas command.

Integrity Check - Using Logical Functions to Evaluate Percentages

If you are using a logical function to evaluate percentages in a cell location, be sure to use the percent symbol when defining the logical test. For example, if you are testing cell location B5 to determine if the value is greater than 10%, the logical test should appear as follows: *B5>10%*. If you omit the percent sign, the logical test will evaluate cell B5 to see if the value is greater than 1000%. This may erroneously force the function to produce the *value_if_false* output. You can also convert the percentage to a decimal in the logical test. For example, in decimal form, the logical test can be constructed as follows: *B5>.10*.

Figure 3.20 "Completed Nested IF Function" shows how the completed nested IF function should appear in cell O4 of the Investment Detail worksheet. In addition, we see the results

of the function after it was pasted into the range O5:O18. Notice that for any investment where the Current vs. Target value is between plus or minus 1%, the word OK appears.

IF	\bullet : $\times \checkmark f_x = 1$	F(N4>High_Cu	rrent_VsTarget,	"Reblance", IF(N4<	Low_Current_Vs1	arget,"Rebal	ance","OK"))			
	А	В	N	0	Р	Q	R	S	Т	U
1	Personal Inves	stment								
2	Descriptive Information	1	Perc	ent of Port	folio					Perforr
3	Investment Type	Symbol	Current vs. Target	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/Short Indicator	Unrealized Gain/Loss	Percent Gain/Loss	Target Annual Growth Rate
4	Bond Fund	VFICX	-2.5%	=IF(N4>Hig	h_Current_V	sTarge	t,"Reblance'	',IF(N4 <lov< td=""><td>v_Current_</td><td>√sTarget,</td></lov<>	v_Current_	√sTarget,
5	Bond Fund	VFSTX	-2.5%	"Rebalance	","OK"))					
6	Bond Fund	VWEHX	-6.6%	Rebalance	Buy	48	Long	\$ 811	25.79%	7.20%
7	Bond Fund	VUSTX	-5.2%	Rebalance	Buy	10	Short	\$ 126	2.29%	4.00%
8	International Stock Fund	VDMIX	-1.9%	Rebalance	Hold or Sell	42	Long	\$ (1,382)	-18.82%	8.00%
9	Domestic Stock Fund	VEIPX	4.6%	Reblance	Hold or Sell	22	Long	\$ (373)	-3.20%	8.00%
10	Domestic Stock Fund	VISGX	0.1%	OK	Hold or Sell	33	Long	\$ 1,125	23.28%	10.00%
11	Domestic Stock Fund	VIMSX	-0.2%	OK	Hold or Sell	46	Long	\$ 41	0.74%	10.00%
12	International Stock Fund	VTRIX	0.3%	OK	Hold or Sell	29	Long	\$ 2,900	50.81%	10.00%
13	International Stock Fund	VEIEX	0.8%	OK	Hold or Sell	9	Short	\$ 2,078	35.01%	12.00%
14	Individual Stock	TRV	2.8%	Reblance	Hold or Sell	72	Long	\$ 3,495	61.09%	8.00%
15	Individual Stock	JNJ	4.9%	Reblance	Hold or Sell	87	Long	\$ 3,676	45.98%	8.00%
16	Individual Stock	ко	3.4%	Reblance	Hold or Sell	6	Short	\$ 588	6.28%	8.00%
17	Individual Stock	MSFT	-3.0%	Rebalance	Buy	50	Long	\$ 218	10.36%	10.00%
18	Individual Stock	IBM	5.1%	Reblance	Hold or Sell	100	Long	\$ 5,362	81.53%	10.00%
19	Total					42.6		\$21,229	21.97%	

Figure 3.20 Completed Nested IF Function

Nested Logical Functions

Let's revisit the IF(AND) function we created earlier. We will change the IF function so that it will nest a second IF and give us a Hold or Sell decision. The additional condition we are adding to our previous function is:

• Sell when

o the Current vs Target percent is greater than 1,

o the Unrealized Gain/Loss is greater than or equal to zero,

o AND the Months Owned is greater than 12.

• Otherwise Hold

Change the existing IF(AND) by:

1. Return to the Buy/Sell Indicator Column

2. Click the F2 function key to enter the edit mode. (You can also double-click in the cell.)

3. Position your cursor after the "Buy", Make sure you are on the right side of the comma.

Now we will test to see if we should Hold or Sell by inserting a second IF function as the false result for our first IF function.

4. Type the function name IF followed by an open parenthesis (().

5. Type the function name AND followed by an open parenthesis ((). The AND function is being placed into the logical_test argument of this IFfunction.

6. Click cell N4(the fund's current vs. target value) and then type the less than symbol(=).

7. Click cell B26. Your Current_vs_Target named cell will appear.

8. Type a comma. This advances the AND function to the second logical test.

9. Click cellS4. (Unrealized gain/loss)

10. Type a greater than equal to (>=). These symbols are used to evaluate if the value in a cell location is greater than or equal to a target value.

11. Click on cell B22. This will place your named cell Unrealized_Gain_Loss into the AND.

12. Type a comma.

13. Last, we will test to see if the Months Owned is greater than 12 which will put us into the long-term investment category. Click on cell R4.

14. Type a greater than (>)

15. Click on cell B27. Long Term will show in your formula.

16. Close the parenthesis for the AND function.

17. Type an equal sign (=) followed by the word TRUE. Do not enclose the word in quotation marks. Type a comma.

18. Type the word "Sell" enclosed in quotation marks.

19. Type a comma

20. Type the word "Hold" enclosed in quotation marks. For all other investments that are not designated with a Buy indicator, the function will show the words Hold or Sell. This indicates that an investment could either be held or sold.

21. Type two closing parenthesis ())) one to close the second IF function and the second to close the first IF function.

22. Then press the ENTER key on your keyboard.

Figure 3.20b AND Function Placed in the Logical Test of an IF Function

Buy/Sell Indicator	Months Owned	Long/Short Indicator	Unrealized Gain/Loss	Percent Gain/Loss	Target Annual Growth Rate	Actual Annual Growth Rate	Target vs Actual Growth Rate	Performance Indicator					
=IF(AND(N4 <buy_< td=""><td>Target_vs_</td><td>Growth,S4></td><td>Unrealized</td><td>_Gain_Loss)=</td><td>TRUE,"Buy",</td><td>IF(AND(N4>Se</td><td>I_Target_vs_</td><td>Growth,S4>Unrea</td><td>alized_Gain</td><td>Loss,Q4>Long_</td><td>Term)=TRUE,</td><td>"Sell","Hold"))</td></buy_<>	Target_vs_	Growth,S4>	Unrealized	_Gain_Loss)=	TRUE,"Buy",	IF(AND(N4>Se	I_Target_vs_	Growth,S4>Unrea	alized_Gain	Loss,Q4>Long_	Term)=TRUE,	"Sell","Hold"))
	37	Lona	Í\$ 867	10.82%	3.20%	3.51%	0.31%	OK					

	A	В	N	0	Р	Q	R	S
1	Personal Inves	tment						
2	Descriptive Information	ı	Perc	cent of Port	folio			
3	Investment Type	Symbol	Current vs. Target	Rebalance Indicator	Buy/Sell Indicator	Months Owned	Long/Short Indicator	Unreali Gain/Lo
4	Bond Fund	VFICX	-2.5%	Rebalance	Buy	48	Long	\$ 1,
5	Bond Fund	VFSTX	-2.5%	Rebalance	Buy	37	Long	\$
6	Bond Fund	VWEHX	-6.6%	Rebalance	Buy	48	Long	\$
7	Bond Fund	VUSTX	-5.2%	Rebalance	Buy	10	Short	\$
8	International Stock Fund	VDMIX	-1.9%	Rebalance	Hold	42	Long	\$ (1,
9	Domestic Stock Fund	VEIPX	4.6%	Rebalance	Hold	22	Long	\$ (
10	Domestic Stock Fund	VISGX	0.1%	ок	Hold	33	Long	\$ 1.
11	Domestic Stock Fund	VIMSX	-0.2%	ок	Hold	46	Long	\$
12	International Stock Fund	VTRIX	0.3%	ок	Hold	29	Long	\$ 2.
13	International Stock Fund	VEIEX	0.8%	ок	Hold	9	Short	\$ 2,
14	Individual Stock	TRV	2.8%	Rebalance	Sell	72	Long	\$ 3.
15	Individual Steels	INTI	4 00/	Pabalanaa	Coll	07	Long	6 2

Figure 3.20c Nested IFs and ANDs Functions completed for the Rebalance

Why?

Use AND or OR functions within IF functions

The benefit of using the AND or OR functions within the IF function is that doing so reduces the need to construct lengthy nested IF functions. It becomes increasingly difficult to manage the accuracy of lengthy nested IF functions. The AND and OR functions allow you to test for a variety of conditions in a cell location, which can reduce the need to nest multiple IF functions. Examine the nested if function in cell O4 on the **Investment Detail** worksheet. Can you recreate this without nesting the IF function?

Basic Conditional Formats

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.07 if starting here.)

A feature related to the skills used to create logical functions is conditional formatting. Conditional formats allow you to apply a variety of formatting treatments based on the contents of a cell location. A logical test like the ones used in the IF, AND, and OR functions is used to evaluate the contents of a cell and apply a designated formatting treatment. For example, looking at Figure 3.20 "Completed Nested IF Function", you will notice that the Unrealized Gain/Loss column is formatted using the accounting number format. Negative numbers are enclosed in parentheses. However, to make these numbers stand out, we can use conditional formatting to change the font color to red. We will do this for the Unrealized Gain/Loss and Percent Gain/Loss columns. The following steps explain how conditional formats are applied to the cell locations in these columns: 1. Highlight the range S4:T18 on the Investment Detail worksheet.

2. Click the Conditional Formatting button in the Styles group of commands on the Home tab of the Ribbon.

3. Click the New Rule command from the list of options. This will open the New Formatting Rule dialog box.

4. At the top of the New Formatting Rule dialog box, you will find a list of options under the Select a Rule Type heading. Click the second option that states "Format only cells that contain."

5. In the lower portions of the New Formatting Rule dialog box, you will see several dropdown boxes under the heading Edit the Rule Description. Make sure the first drop-down box is set to Cell Value.



Figure 3.21 Conditional Formatting Options List

6. Click the second drop-down box in the Edit the Rule Description section of the New Formatting Rule dialog box and select the "less than" option.

7. Click in the input box, which is next to the drop-down box that was set in the previous step and type a zero. This completes the logical test of the conditional format, which is going to evaluate if the value in any of the cells in the range S4:T18 is less than zero.

8. Click the Format button, which is near the bottom of the New Formatting Rule dialog box. This will open the Format Cells dialog box.

9. Click the drop-down box in the Color section of the Format Cells dialog box and select the red square from the color palette (see Figure 3.22 "Format Cells Dialog Box").

 Format all c 	ells based on their values	
 Format only 	cells that contain	
 Format only 	top or bottom ranked values	
 Format only 	values that are above or below average	
 Format only 	unique or duplicate values	
► Use a formu	Ia to determine which cells to format	
lit the Rule De	escription:	
lit the Rule De F <u>o</u> rmat only c	escription: ells with:	
dit the Rule De F <u>ormat only</u> c Cell Value	escription: ells with:	Ť
dit the Rule De F <u>o</u> rmat only c Cell Value	escription: ells with: v less than v 0	Ť
dit the Rule De F <u>o</u> rmat only c Cell Value	escription: ells with:	Ť
dit the Rule De F <u>o</u> rmat only c Cell Value Preview:	escription: ells with: less than less than	Ť

Figure 3.21b New Formatting Rule Dialog Box

10. Click the OK button at the bottom of the Format Cells dialog box.

11. Click the OK button at the bottom of the New Formatting Rule dialog box. This completes the Conditional Formatting rule that will be applied to cells in the range S4:T18.

12. Figure 3.22 "Format Cells Dialog Box" shows the Format Cells dialog box. This opens when the Format button is clicked on the New Formatting Rule dialog box. Notice the tabs running across the top of the dialog box. All formatting features in Excel are grouped by category, which can be accessed by clicking the related tab on the Format Cells dialog box. You will see some of the formatting commands in light grey. This indicates that these commands cannot be used with the Conditional Formatting feature. You can use the Format Cells dialog box to apply any formatting features by clicking the Format Cells dialog button on the Home tab of the Ribbon.

Keyboard Shortcuts - Open the Format Cells Dialog Box

• Hold down the CTRL key wile pressing the SHIFT key and the letter F key on your keyboard.

Figure 3.22 Format Cells Dialog Box



Figure 3.23 "New Formatting Rule Dialog Box" shows the final settings for the New Formatting Rule dialog box. It is important to note that the "Format only cells that contain" option was selected in the New Formatting Rule dialog box to set a basic logical test that can be used to apply formatting commands automatically based on the values in cell locations.





Figure 3.24 "Conditional Format Applied to the Range S4:T18" shows the results of the conditional formatting rule that was applied to the range S4:T18. Notice the font color is automatically changed to red for negative numbers.

	6 A 9 + B	4-04						
	A	Ð	Q	R	5	T		
1	Personal Inves	stment						
ż	Descriptive Information	1	-	_			P	
3	Investment Type	Symbol	Months Owned	Long/Short Indicator	Unrealized Gain/Loss	Percent Gain/Loss	Target Growti	
4	Bond Fund	VFICX	48	Long	\$ 1,697	23.85%		
5	Bond Fund	VFSTX	37	Long	867	10.82%		
6	Bond Fund	VWEHX	48	Long	811	25.79%		-
3	Bond Fund	VUSTX	10	Short	126	2.29%		The conditional format
8	International Stock Fund	VDMIX	42	Long	(1,382)	-18.82%		automatically changes the
9	Domestic Stock Fund	VEIPX	22	Long	(373)	-3.20%		font color to red because
10	Domestic Stock Fund	VISGX	33	Long	1,125	23.28%	1	these values are less than zero.
11	Domestic Stock Fund	VIMSX	46	Long	41	0.74%	1	(
		a second of a		1.	0.000	E		

Figure 3.24 Conditional Format Applied to the Range S4:T18

Key Takeaways

- The Freeze Panes command should be used to lock column and row headings in place while scrolling through large worksheets.
- The IF function is used to evaluate the contents of a cell location using a logical test. Based on the results of the logical test, you designate a custom output or calculation to be performed by the function.
- When using text, or nonnumeric data, to define any argument of the IF function, it must be placed inside quotation marks.
- A nested IF function is used when more than one logical test and more than two outputs are required for a project. Either the **Value_if_true** or the **Value_if_false** arguments can be defined with an IF function.
- When using percentages in any logical test or formula, you must use the percent symbol (%) or convert the percentage to a decimal. For example, 10% can also be expressed as .10.

- A nested IF function is used when more than one logical test and more than two outputs are required for a project. Either the **Value_if_true** or the **Value_if_false** arguments can be defined with an IF function.
- When using percentages in any logical test or formula, you must use the percent symbol (%) or convert the percentage to a decimal. For example, 10% can also be expressed as .10.
- The OR function is used when many logical tests are required to evaluate the contents of a cell location. The OR function will produce a TRUE output if one of the logical tests is true.
- The AND function is used when many logical tests are required to evaluate the contents of a cell location. The AND function will produce a TRUE output if all of the logical tests are true.
- To minimize the complexity of nested IF functions, the OR and AND functions should be used when possible to define the *logical_test* argument of the IF function.
- The OR function is used when many logical tests are required to evaluate the contents of a cell location. The OR function will produce a TRUE output if one of the logical tests is true.
- The AND function is used when many logical tests are required to evaluate the contents of a cell location. The AND function will produce a TRUE output if all of the logical tests are true.
- To minimize the complexity of nested IF functions, the OR and AND functions should be used when possible to define the *logical_test* argument of the IF function.
- The Freeze Panes command should be used to lock column and row headings in place while scrolling through large worksheets.
- The IF function is used to evaluate the contents of a cell location using a logical test. Based on the results of the logical test, you designate a custom output or calculation to be performed by the function.
- When using text, or nonnumeric data, to define any argument of the IF function, it must be placed inside quotation marks.

3.2. Statistical IF Functions

LEARNING OBJECTIVES

- 1. Use the COUNTIF function to count selected nonblank cells in a range based on one criteria argument.
- 2. Use the AVERAGEIF function to calculate the average of selected cells in a range based on the values in an alternate range of cells and one criteria argument.
- 3. Use the SUMIF function to calculate the sum of selected cells in a range based on the values in an alternate range of cells and one criteria argument.
- 4. Use the COUNTIFS function to count selected nonblank cells in a range based on more than one criteria argument that utilizes a logical test.
- 5. Use the AVERAGEIFS function to calculate the average of selected cells in a range based on the values in an alternate range of cells using more than one criteria argument that utilizes a logical test.
- 6. Use the SUMIFS function to calculate the sum of selected cells in a range based on the values in an alternate range of cells using more than one criteria argument that utilizes a logical test.

This section will demonstrate the use of statistical IF functions. Statistical IF functions provide you with the ability to evaluate the contents in a cell location before including them in a mathematical calculation. This allows you to selectively include targeted cell locations when executing statistical calculations such as sum, average, count, and so on. We will use several statistical IF functions to construct the *Portfolio Summary* worksheet shown in Figure 3.1 "Completed Personal Investment Portfolio Workbook", which contains two main sections. The Total Summary section (Rows 2 through 8) shows an overview for all investments in the portfolio by investment type. This will allow us to compare the growth performance among the Bond Funds, Domestic Stock Funds, and others. The Poor Performing Investments by investment type. For the purposes of this exercise, we will define a poor performing investment as one where the growth rate is below the target growth rate by more than 1% (see Column W on the Investment Detail worksheet). The statistical IF functions will allow us to establish criteria to select targeted investments that can be included in the calculations for each section of the *Portfolio Summary* worksheet.

The COUNTIF Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.08 if starting here.)

The COUNTIF function differs from the regular COUNT function in two ways. First, the regular COUNT function counts only the number of cells in a range that contain numeric data. The COUNTIF function counts the number of cells in a range that contain numeric or text data. Second, the COUNTIF function allows you to selectively count the cells in a range based on specific criteria.

The COUNTIF function contains two arguments: range and criteria.

- The range argument is defined with the range of cells that will be counted.
- The criteria argument is defined with the criteria that will be used to decide if a cell in the range should be included in the output of the function.

In the Portfolio Summary worksheet, we want to count the number of investments of each type without having to rearrange our source data accomplish the task. The advantage of using the COUNTIF function is that it does not matter how the source data is sorted. It will find a match for the criteria and add one to the running total it is calculating. We will also see the power of naming the ranges in the Investment Detail worksheet because it will make these functions much easier to construct.

The following steps explain how we can use the COUNTIF function to calculate the number of investments by investment type on the Portfolio Summary worksheet:

- 1. Click on the Portfolio Summary tab if the worksheet is not already active.
- 2. Click cell B4 on the Portfolio Summary worksheet.
- 3. Click the Formulas tab of the Ribbon.
- 4. Click the Insert Function button in the Function Library group of commands.

5. In the Search for a function box type COUNT, then click Go. A list of Excel functions that include the Count or an ability to count show in the Select a function box.

6. Click the scroll down arrow on the second drop-down list to find the COUNTIF function (see Figure 3.25 "Selecting the COUNTIF Function from the Function Library").

Figure 3.25 Selecting the COUNTIF Function from the Function Library

Insert Function		?	×
Search for a function:			
Count		<u>(</u>	50
Or select a <u>c</u> ategory: Recommended	~		
Select a functio <u>n</u> :			
COUNT COUNTA COUNTA FREQUENCY COUPDAYSNC COUPDAYS COUNTIF(range,criteria) Counts the number of cells within a rang	e that meet the giver	n condit	tion.
Help on this function	ОК	Ca	ncel

7. Click the COUNTIF function. This will open the Function Arguments dialog box.

8. Click in the Range argument on the Function Arguments dialog box and from the Formulas ribbon in the Defined Names section click the drop-down arrow next to Use in Formula. (see Figure 3.26 "Completed Function Arguments Dialog Box for the COUNTIF Function").

9. Select Investment Type from the drop-down list of named cells and ranges. After selecting it you will see a list of the investment types to the right of the Range box.

10. Press the TAB key on your keyboard to advance to the next argument, which is the Criteria argument. Then type the cell location A4. The criteria for the function will be the investment type entered into cell A4 on the Portfolio Summary worksheet.

Function Arguments				? X
Range Criteria	Investment_Type	1 = {"f	Bond Fund";"Bond	Fund";"Bond Fut
Counts the number of cells with	hin a range that meet the Range is the range of	= given condition. cells from which you	want to count non	ıblank cells.
- ormula result =				

<u>@ 080</u>

11. Click the OK button at the bottom of the Function Arguments dialog box. Figure 3.26 "Completed Function Arguments Dialog Box for the COUNTIF Function" shows the completed Function Arguments dialog box for the COUNTIF function. Notice the absolute references that were placed on each cell location in the range that was used to define the Range argument. The Criteria argument is defined with the cell A4, which means the function will only count cell locations in the range A4:A18 where the contents in the cell match the contents in cell A4.

Figure 3.26 Completed	d Function	Arguments	Dialog	Box	for the	COUNTIF	Function
-----------------------	------------	-----------	--------	-----	---------	---------	----------

Function Arguments				?	\times
COUNTIF					
Range	Investment_Type	Ť	= {"Bond Fund";"	Bond Fund";"Bo	ond Fur
Criteria	A4	1	= "Bond Fund"		
Counts the number of cells wit	hin a range that meet the Criteria is the condition i which cells will b	given condit n the form o e counted.	= 4 tion. of a number, express	ion, or text that	t defines
Formula result = 4					
Help on this function			C	OK Ca	ancel

12. Copy the function in cell B4 and paste it into the range B5:B7 using the Paste Formulas command. (You can copy the function because you have linked to the investment type in column A)

13. Enter a SUM function in cell B8 that sums the values in the range B4:B7.

Figure 3.27 "COUNTIF Function Output in the Portfolio Summary Worksheet "shows the results of the COUNTIF function after it is pasted into the range B5:B7. Because of relative referencing, the cell location used in the criteria argument is changed after the function is pasted into the range B5:B7. For example, in cell B6, the function is counting the cell locations in the range A4:A18 where the contents match the contents of cell A6. This allows you to use the function to count the number of investments per investment type. As shown in the figure, the range B4:B7 now shows the number of investments in this portfolio by investment type. Naming the range for the Range criteria creates an absolute range reference.

A	A	8	С	1 D	E	
1		Per	sonal l	nvestme	nt Sum	Cell location in the Criteri argument changes from relative referencing.
2	Total Summary				9 M-	
3		Number of Investments	Average Months Owned	Total Purchase Cost	Current Value	
4	Bond Fund	4				
5	Domestic Stock Fund	3	2			
6	International Stock Fund	3				
7	Individual Stock	5				_
8	TOTAL	15	4		SU	M function added here
9	Poor Performing Inves	stments				
10		Number of Investments	Average Months Owned	Total Purchase Cost	Current Value	
11	Bond Fund					-
12	Domestic Stock Fund					
13	International Stock Fund					
14	Individual Stock					
15	TOTAL					
ne.		1				

Figure 3.27 COUNTIF Function Output in the Portfolio Summary Worksheet

The AVERAGEIF Function

The AVERAGEIF Function Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.09 if starting here.) The AVERAGEIF function performs the identical mathematical calculation as the regular AVERAGE function. However, like the COUNTIF function, it allows you to define criteria that will select cells in a range that will be used in the function output. The AVERAGEIF function differs from the COUNTIF function in that it allows you to define two cell ranges instead of one.

• The first range pertains to the criteria that will be used to select cells for the function output.

• The second range contains the values that will be used to calculate the arithmetic mean.

Table 3.8 "Arguments for the AVERAGEIF and SUMIF Functions" provides definitions for the arguments contained in the AVERAGEIF and SUMIF functions.

Table 3.8 Arguments for the AVERAGEIF and SUMIF Functions

Argument	Definition
Range	Range of cells that will be evaluated by the criteria argument.
Criteria	Criteria that will be used to evaluate the range of cells that is used to define the Range argument. This argument can be defined with a cell location, formula, number, text, or logical test. Note that text and logical tests must be enclosed in quotation marks.
[Average_range] or [Sum_range]	Range of cells that will be used to calculate the average when using the AVERAGEIF function, or the sum when using the SUMIF function. This argument is enclosed in brackets because it does not always need to be defined. If this argument is omitted, the function will use the range of cells in the Range argument to calculate the output.

The AVERAGEIF function will be used in the Portfolio Summary worksheet to calculate the average length of time that investments for each investment type are held. The following steps explain how to add this function to the worksheet:

1. Go to the Portfolio Summary worksheet and click cell C4.

2. Click the Formulas tab of the Ribbon.

3. Click the Insert Function button in the Function Library group of commands.

4. In the Search for a function box type AVERAGE, then click Go. A list of Excel functions that include the AVERAGE or an ability to average show in the Select a function box.

5. Click the scroll down arrow on the second drop-down list to find the AVERAGEIF function.

6. Click in the Range argument on the Function Arguments dialog box and from the Formulas ribbon in the Defined Names section click the drop-down arrow next to Use in Formula. (see Figure 3.26 "Completed Function Arguments Dialog Box for the COUNTIF Function").

7. Select Investment Type from the drop-down list of named cells and ranges. After selecting it you will see a list of the investment types to the right of the Range box.

8. Press the TAB key on your keyboard to advance to the Criteria argument and type the cell location A4. The criteria for the function will be the investment type entered into cell A4 on the Portfolio Summary worksheet.

9. Click in the Average_Range box and from the Formula Ribbon, Defined Names section, click on the Use in Formula drop down arrow and select Months_Owned. (see Figure 3.28 "Defined Arguments for the AVERAGEIF Function").

10. Click the OK button at the bottom of the Function Arguments dialog box.

Figure 3.28 "Defined Arguments for the AVERAGEIF Function" shows the Function Arguments dialog box for the AVERAGEIF function that will be input into cell C4. Use of named ranges creates absolute cell references in the Range and Average_range arguments. The function will evaluate the cells in the range A4:A18 using the value that exists in cell A4 on the Portfolio Summary worksheet. When a cell in the range A4:A18 meets the criteria, the function will pull the cell location in the same row from the range Q4:Q18 and include it in the average calculation.

nction Arguments				?	\times
/ERAGEIF					
Range	Investment_Type	<u>+</u> =	{"Bond Fund";"Bond	Fund";"Bo	nd Fu
Criteria	A4	<u>+</u> =	"Bond Fund"		
Average_range	Months_Owned	<u>+</u> =	{48;37;48;10;42;22;33	;46;29;9;72;	87;6;
		=	35.75		
ds average(arithmetic mea	an) for the cells specified t age_range are the actual	by a given condit cells to be used	to find the average. If	f omitted, ti	h

Figure 3.28 Defined Arguments for the AVERAGEIF Function

11. Copy the function in cell C4 and paste it into the range C5:C7 using the Paste Formulas option.

12. In cell C8 create an AVERAGE function that will average the months owned for all the investments in the portfolio by typing =AVERAGE(Months_Owned). Note: You cannot add averages together because it creates a nonsense number. A number that has no meaning because it is out of context.

Figure 3.29 "AVERAGEIF Function Output on the Portfolio Summary Worksheet" shows the output of the AVERAGEIF function in the Average Months Owned column on the Portfolio Summary worksheet.

The function calculates the average months owned in Column Q on the Investment Detail worksheet where the investment type is equal to the description entered in the range A4:A7 on the Portfolio Summary worksheet.

• • • • • • • • • • • • • • • • • • •	ISTINENT DETENII (CL)			22	11		100	100	Investo
Ą	0			-D	Group and Distance	and the second second	6	н	
	Per	sonal Ir	ive.	stmer	nt Sumn	nary			
Total Summary									
	Number of Investments	Average Months Owned	Tota Pure Cos	d chase t	Current Value	Annual Growth	Benchmark 5 Year Growth	Benchmar	ĸ
Bond Fund	4	36						Barclays	
Domestic Stock Fund	3	34		Output	from the			S&P 500	
International Stock Fund	3	27	F	AVERAGI	BF function			MSCI EAF	E
Individual Stock	5	63		_				Dow Jone	5
TOTAL	15	43					-		
Poor Performing Inves	stments								
	Number of Investments	Average Months Owned	Tota Pure Cos	il chase t	Current Value	Annual Growth			
Bond Fund									
Domestic Stock Fund									
International Stock Fund									
Individual Stock									
TOTAL							1		

Figure 3.29 AVERAGEIF Function Output on the Portfolio Summary Worksheet

The SUMIF Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.10 if starting here.)

The SUMIF function performs the same mathematical calculation as the regular SUM function. However, like the AVERAGEIF function, this function allows you to select specific cells from a range that will be used in the output. The arguments for the SUMIF function are identical to the AVERAGEIF function except instead of averaging the result, Excel will be adding the result. (see Table 3.8 "Arguments for the AVERAGEIF and SUMIF Functions").

We will use the SUMIF function in two columns on the Portfolio Summary worksheet. The first column will show the total investment cost for each investment type. The second column will show the total current value for each investment type. This will allow us to

calculate the total annual growth rate for each investment type. The following steps explain how we will use this function to complete the first column:

1. On the Investment Detail worksheet highlight the Cost of Purchase range G3:G18. From the Formula ribbon, Defined Names section, Click on Create from Selection. Make sure top row is selected and OK.

2. Go to the Portfolio Summary worksheet and click cell D4.

3. In cell D4 type an = sum. You will see a list of functions or named cells that start with the

letters sum. Double click on the SUMIF from the list of functions.

4. The first argument in the function is the range that will be used to find a match to the criteria. In this case it will be the named range Investment_Type. We will access this named range by typing the name in the function. When you see the named range appear in the drop-down list of Function and named ranges, double click the named range to insert it into your function.



5. Type a comma.

6. The next argument is the Criteria, click in cell A4 and then type another comma.

7. From the Use in Formula drop down on the Formulas ribbon, select the named range Cost_of_Purchase.

8. Type your closing parenthesis ()).

=SUMIF(Investment_Type,A4,Cost_of_Purchase)

9. Copy the function in cell D4 and paste it into the range D5:D7.

10. While the range D5:D7 is selected, format Comma with zero decimal places.

11. Use AutoSum to total the column in cell D8.

12. Format the top and total row with a \$ and zero decimal places. Format the cells D5:D7 comma style with zero decimal places.

To complete the Current Value data on the Portfolio Summary worksheet, follow the steps above except we will use the Current Investment Value range K3:K18 from the Investment Detail worksheet and use that range in our new SUMIF.

1. On the Portfolio Summary worksheet and click cell E4.

2. In cell E4 type an = sum. You will see a list of functions or named cells that start with the letters sum. Double click on the SUMIF from the list of functions.

3. The first argument in the function is the range that will be used to find a match to the criteria. In this case it will be the named range Investment_Type. We will access this named range by typing the name in the function. When you see the named range appear in the drop-down list of Function and named ranges, double click the named range to insert it into your function.

4. Type a comma.

5. The next argument is the Criteria, click in cell A4 and then type another comma.

6. From the Use in Formula drop down on the Formulas ribbon, select the named range Current_Investment_Value.

7. Type your closing parenthesis ()).

=SUMIF(Investment_Type,A4,Current_Investment_Value)

8. Copy the function in cell E4 and paste it into the range E5:E7.

9. Use AutoSum to total the column in cell E8.

10. Format the top and total row with a \$ and zero decimal places.

11. Format the cells E5:E7 comma style with zero decimal places.

Figure 3.31 "SUMIF Function Outputs in the Portfolio Summary Worksheet" shows the results of the SUMIF function in the Total Purchase Cost and Current Value columns in the Portfolio Summary worksheet.
Figure 3.31 SUMIF Function Outputs in the Portfolio Summary Worksheet

Total Summary											
		Average	Average Total								
	Number of	Months	Pur	chase	Current	An					
	Investments	Owned	Cos	st	Value	Gr					
Bond Fund	4	36	\$	23,773	\$ 27,274						
Domestic Stock Fund	3	34		22,110	22,903						
International Stock Fund	3	27		18,983	22,578	\square					
Individual Stock	5	63		31,763	45,101						
TOTAL	15	43	\$	96,628	\$117,857						

Personal Investment Summary

Integrity Check - Formula Results

The result formulas in cells D8:E8 for the Total Purchase Cost and Current Values on the Portfolio Summary must equal the totals from the Investment Detail worksheet cells G19 and K19. If they don't your named ranges may be incorrect.

A formula can now be added to show the annual growth for each investment category. The following steps explain how to add this formula to the Portfolio Summary worksheet:

A few things to know before you begin. When creating a percent change between an old value (in this case the Purchase Cost) and the new value (Current Value) you always subtract the old from the new, then divide by the old. The formula would look like: =(new value-old value)/old value. The (new value – old value) is the amount of change that has occurred.

Remember back to the order of operations. For this formula to work correctly Excel must subtract before it does the division. We will force our formula to do that by enclosing the subtraction inside parenthesis which will tell Excel to do the subtraction first.

The steps to accomplish this are:

- 1. Click cell F4 on the Portfolio Summary worksheet.
- 2. Type an equal sign (=) followed by two open parentheses ((().
- 3. Click cell E4 and type a minus sign (-).

4. Click cell D4 and type a closing parenthesis ()).

5. Type a slash (/) for division and click cellD4.

6. Type a closing parenthesis ()). This completes the first part of the formula, which is calculating the growth rate between the Total Purchase Cost (cell D4) and the Current Value (cell E4).

7. Type a slash (/) for division followed by an open parenthesis (().

8. Click cell C4, which is the Average Months Owned.

9. Type a slash (/) for division and the number 12. This part of the formula converts the number of months owned to years by dividing it by 12. This result is being divided into the growth rate, which will then show the average growth per year.

10. Type a closing parenthesis ()) and press the ENTER key on your keyboard.

Pe	rsonal I	nvestme	nt Summ	ary	Average year	s owned
					Average Mor	nths/12
of ents	Average Months Owned	Total Purchase Cost	Current Value			Bench
4	36	\$ 23,773	\$ 27,274	=(E4-D4)/	D4/(C4/12)	Barcla
3	34	22,110	22,903	-	X	S&P {
3	27	18,983	Change in valu			MSCI
5	63	31,76	New-Old	16	Old Value	Dow 、
4 6	40	¢ 00 000	\$447 OF7			1

11. Copy the formula in cell F4 and paste it into the range F5:F8 using the Paste Formulas command.

Figure 3.32 "Completed Annual Growth Column in the Portfolio Summary Worksheet" shows the results of the statistical IF functions that were added to the Total Summary section of the Portfolio Summary worksheet. The statistical IF functions used on this worksheet allowed us to group the details in the Investment Detail worksheet by investment type. Once this was accomplished, we added a formula to show the annual growth rate by investment type.

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

	F4 • (164 +(164	04)/04)/(C4/12) 🗲						-
4	A	8	C	D	ε	, F	6	н
1		Per	sonal Ir	nvestmen	t Summa	ary	Formu	la that was
2	Total Summary						enteres	THILD CON PA
		Number of Investments	Average Months Owned	Total Purchase Cost	Current Value	Annual Growth	Benchmark 5 Year Growth	Benchmark
4	Bond Fund	4	36	\$ 23,773	\$ 27,274	4.9%		Barclays
5	Domestic Stock Fund	3	34	22,110	22,903	1.3%		S&P 500
6	International Stock Fund	3	27	18,983	22,578	8.5%		MSCI EAFE
7	Individual Stock	5	63	31,763	45,101	8.0%		Dow Jones
8	TOTAL	15	43	\$ 96,628	\$117,857	6.2%		
9	Poor Performing Inves	stments						
10		Number of Investments	Average Months Owned	Total Purchase Cost	Current Value	Annual Growth	Formula calc annual growt F4 is pasted in	ulating the h rate in cell to this range.

Figure 3.32 Completed Annual Growth Column in the Portfolio Summary Worksheet

The COUNTIFS Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.11 if starting here.)

Up to this point, the statistical IF functions that were demonstrated provided the ability to define one criteria or logical test used to select cells from a targeted range. The next set of statistical functions that will be demonstrated provides the ability to define multiple sets of criteria for selecting cells from a targeted range. These multiple sets of criteria act like an AND function. All the criteria have to be TRUE to be included in the function results. We will begin with the COUNTIFS function.

It is easy to distinguish the difference between a statistical IF function that allows one criteria argument to be defined and one that allows multiple criteria arguments. If the IF at the end of the function name is plural, you can define multiple sets of criteria arguments. Therefore, the COUNTIFS function provides the option of defining multiple sets of criteria for selecting cells from a targeted range that will be used in the function output.

The arguments for the COUNTIFS function are established in pairs. For example, the first arguments for the function are Criteria_range1 and Criteria1. The function will use the Criteria1 argument to select cells in the Criteria_range1 argument. A second pair of arguments, Criteria_range2 and Criteria2, can be defined to select a subset of cell locations that were selected in the Criteria_range1 and Criteria1 arguments. This process can be repeated for several pairs of criteria arguments.

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

We will continue to work on the Portfolio Summary worksheet by adding the COUNTIFS function to count the number of poor performing investments by investment type. The criteria for determining if an investment is poor performing is if the Targeted vs. Actual Growth rate is less than -1%. The following steps explain how to add this function to the worksheet:

1. First, we will establish our assumption table. In cell A17 type Poor Performing Investment Criteria

2. In cell A18 type "Target vs Actual Growth <".

3. In cell B18 type -1% (Note: This is for informational purposes only).

4. Click cell B11 on the Portfolio Summary worksheet.

5. Click the Formulas tab of the Ribbon.

6. Click the More Functions button in the Function Library group of commands.

7. Place the mouse pointer over the Statistical option from the drop-down list.

8. Click the scroll down arrow on the second drop-down list to find the COUNTIFS function.

9. Click the COUNTIFS function. This will open the Function Arguments dialog box.

10. Click in the Criteria_range1 argument on theFunction Arguments dialog box and then from the Use in Formulas option on the Formulas ribbon select the named range Investment_Type.

11. Press the TAB key on your keyboard to advance to the Criteria1argument and click on cell A11 (Bond Fund). The criteria for the function will be the investment type that is entered into cell A11 on the Portfolio Summary worksheet. Notice that when you define this argument, theCriteria_range2 argument will appear on the Function Arguments dialog box.

12. Click in the Criteria_range2 argument on he Function Arguments dialog box.

13. From the Use in Formula drop down select the named range

Target_vs_Actual_Growth_Rate. You should see a string of numbers to the right of the range box.

14. Press the TAB key on your keyboard to advance to the Criteria2 argument.

15. Type an open quotation mark followed by the logical test.

Figure 3.33 Defined Arguments for the COUNTIFS Function

Function Arguments				?	×					
COUNTIES										
Criteria_range1	Investment_Type	Ť	=	{"Bond Fund";"Bond Fund";"Bond Fur	^					
Criteria1	A11	Ť	=	"Bond Fund"						
Criteria_range2	Target_vs_Actual_Growth_Rate	Ť	=	{0.0136184985144624;0.003103261474						
Criteria2	"<-1%"	Ť	=	"<-1%"						
Criteria_range3		Ť	=	reference	~					
= 1 Counts the number of cells specified by a given set of conditions or criteria. Criteria2: is the condition in the form of a number, expression, or text that defines which cells will be counted.										
Formula result = 1 Help on this function				OK Canc	el					

16. Click the OK button at the bottom of the Function Arguments dialog box.

17. Copy the function in cell B11 into the range B12:B14.

18. Enter a SUM function in cell B15 on the Portfolio Summary worksheet that sums the values in the range B11:B14.

Why? **Use Statistical IF Functions for a Summary Worksheet** When creating a summary worksheet that summarizes detailed data from other worksheets it is best to use statistical IF functions. If data is added to the detailed worksheet that is being summarized, the statistical IF functions will automatically include the new data in the summary worksheet. For example, suppose a row is added below Row 7 on the **Investment Detail** and another bond investment is added. The statistical IF functions will automatically pick up the new investment and include it in the Portfolio Summary worksheet. If regular statistical functions or formulas are used, the summary worksheet can easily become inaccurate if new data is added to the detailed worksheet or if the sort order is changed.

-	A	B	C		D	E	F	
4	Bond Fund	4	36	\$	23,773	\$ 27,274	4.9%	
5	Domestic Stock Fund	3	34	\$	22,110	\$ 22,903	1.3%	
6	International Stock Fund	3	27	\$	18,983	\$ 22,578	8.5%	
7	Individual Stock	5	63	\$	31,763	\$ 45,101	8.0%	
8	TOTAL	15	43	s	96,628	\$117,857	6.2%	
9	Poor Performing Inves	stments		-				
10		Number of Investments	Average Months Owned	Total Purchase Cost		Current Value	Annual Growt	
11	Bond Fund	1	4	-			CO	UNTIFS fund
12	Domestic Stock Fund	3						In sear of t
13	International Stock Fund	1						
14	Individual Stock	2						
15	TOTAL	7						
		4	_					
16								

Figure 3.34 Outputs for the COUNTIFS Functions

The AVERAGEIFS Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.12 if starting here.)

The AVERAGEIFS function is like the COUNTIFS function in that multiple sets of criteria can be defined instead of one. However, the arguments for the AVERAGEIFS function are slightly different from those for the COUNTIFS function. Table 3.9 "Arguments for the AVERAGEIFS and SUMIFS Functions" provides definitions for the arguments of the AVERAGEIFS and the SUMIFS functions.

Argument	Definition
Average_range or Sum_range Criteria_range1	Range of cells that contain values to be averaged when using the AVERAGEIFS function or summed when using the SUMIFS function. Note that the AVERAGEIFS or SUMIFS functions will only select values from the range used to define this argument if all criteria pairs are true. Range of cells that will be evaluated based on the Criteria1 argument to determine which cells in the Average_range or Sum_range arguments will be included in the output of the function.
Criteria1	Criteria that will be used to evaluate the range of cells used to define the Criteria_range1 argument. This argument can be defined with a cell location, formula, number, text, or logical test. Note that text and logical tests must be enclosed in quotation marks.
Criteria_range2	Optional argument that defines a second range of cells that will be evaluated based on the Criteria2 argument to determine which cells in the Average_range or Sum_range arguments will be included in the output of the function. Additional Criteria_range arguments can be defined as needed.
Criteria2	Criteria that will be used to evaluate the range of cells used to define the Criteria_range2 argument. This argument can be defined with a cell location, formula, number, text, or logical test. Note that text and logical tests must be enclosed in quotation marks. Additional Criteria N arguments can be defined as needed.

Table 3.9 Arguments for the AVERAGEIFS and SUMIFS Functions

The AVERAGEIFS function will be used to calculate the average months of ownership for poor performing investments in the portfolio. The following steps explain how to add this function to the Portfolio Summary worksheet:

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

1. Click cell C11 on the Portfolio Summary worksheet.

2. Click the Formulas tab on the Ribbon.

3. Click the More Functions button in the Function Library group of commands.

4. Place the mouse pointer over the Statistical option from the drop-down list.

5. Click the AVERAGEIFS function near the top of the list of functions. This will open the Function Arguments dialog box.

6. Click in the Average_range argument on the Function Arguments dialog box.

7. From the Use in Function on the Functions Ribbon select the named range Months_Owned. Selected cells from this range will be averaged by the function based on the defined criteria in ensuing arguments.

8. Click in the Criteria_range1 argument on the Function Arguments dialog.

9. From the Use in Function on the Functions Ribbon select the named range Investment_Type.

10. Press the TAB key on your keyboard to advance to the Criteria1 argument and click on cell A11. The criteria for the function will be the investment type entered into cell A11 on the Portfolio Summary worksheet. You will notice that as you define this argument, the Criteria_range2 argument will appear on the Function Arguments dialog box.

11. Click in the Criteria_range2 argument on the Function Arguments dialog box.

12. From the Use in Function on the Functions Ribbon select the named range Target_vs_Actual_Growth_Rate.

13. Press the TAB key on your keyboard to advance to theCriteria2argument.

14. Type an open quotation mark followed by the logical test <-1% and then type a closing quotation mark ("<-1%"). The second criterion for this function is a logical test that will identify cell locations where the value is less than -1%. For the purposes of this exercise, a poor performing investment is one that is below the target growth rate by more than 1%.

15. Click the OK button at the bottom of the Function Arguments dialog box.

16. Copy the function in cell C11 and paste it into the range C12:C14 using the Paste Formulas command.

Figure 3.35 "Completed Arguments for the AVERAGEIFS Function" shows the defined arguments for the AVERAGEIFS function. Notice that two sets of criteria arguments are defined. Values that meet all criteria defined in the function will be selected from the named range Months_Owned.

Months_Owned	1	= {48;37;48;10;42;22;33;46;29;9;72;87;6;5	^
Investment_Type	1	= {"Bond Fund";"Bond Fund";"Bond F	-
A11	1	= "Bond Fund"	
Target_vs_Actual_Growth_Rate	1	= {0.0136184985144624;0.003103261474	
<-1%	1	= *<-1%*	~
c mean) for the cells specified by a Criteria2: is the condition that defines whi	a given or crite ch cells	 To set of conditions or criteria. ria in the form of a number, expression, o s will be used to find the average. 	r te
	Months_Owned Investment_Type A11 Target_vs_Actual_Growth_Rate "<-1%" c mean) for the cells specified by a Criteria2: is the condition	Months_Owned Investment_Type A11 Target_vs_Actual_Growth_Rate	Months_Owned 48;37;48;10;42;22;33;46;29;9;72;87;6;5 Investment_Type (Bond Fund"; Bond Fund"; Bond Fund"; Bond F A11 Bond Fund"; Bond Fund"; Bond F (0.0136184985144624;0.003103261474

Figure 3.35 Completed Arguments for the AVERAGEIFS Function

17. Enter an AVERAGEIF function in cell C15 by typing an equal sign (=) followed by the function name AVERAGEIF followed by an open parenthesis (().

18. Use the named range Target_vs_Actual_Growth_Rate to define the Range argument. Type a comma.

19. Type the following to define the criteria argument: "<-1%". Type a comma.

20. Use the named range Months_Owned to define the [Average_range] argument. Then type a closing parenthesis ()) and press the ENTER key on your keyboard.

Figure 3.36 "Results of the AVERAGEIFS Function" shows the results of the AVERAGEIFS function in the Portfolio Summary worksheet. The function shows the average months of

ownership for the poor performing investments by investment type.

Figure 3.36 Results of the AVERAGEIFS Function

n	Б	C		D	E	1 1	F	G	н
Individual Stock	5	63		31,763	45,101		8.0%		Dow Jones
TOTAL	15	43	\$	96,628	\$117,857		6.2%		
Poor Performing Inves	tments								
	Number of Investments	Average Months Owned	Tota Pure Cos	al chase t	Current Value	Anni Grov	ual vth		
Bond Fund	1	10							
Domestic Stock Fund	3	34							
International Stock Fund	1	42				_			
Individual Stock	2	69				Δ	VFR	AGEIE 6	unction
TOTAL	7	41	+			e	entered here		
Poor performing critera:						-			
Target vs. actual growth rat	e <- 1%								

The SUMIFS Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.13 if starting here.) The SUMIFS function is like the AVERAGEIFS function in that multiple criteria arguments can be defined to select cells from a targeted range. The function will use the selected cells from this targeted range to calculate a total or sum.

The SUMIFS function will be used to complete the Total Purchase Cost and Current Value columns in the Poor Performing Investments section of the Portfolio Summary worksheet. The following steps explain how to construct this function for the Total Purchase Cost column:

1. Click cell D11 on the Portfolio Summary worksheet.

2. Click the Formulas tab on the Ribbon.

3. From the Insert Function select SUMIFS. This will open the Function Arguments dialog box.

4. In the Sum_range argument on the Function Arguments dialog box use the Use in Formulas to select the named range Cost_of_Purchase. Selected cells from this range will be summed based on the defined criteria in ensuing arguments.

5. Click in the Criteria_range1 argument on the Function Arguments dialog and use the named range Investment_Type from the Use in Formulas on the Formulas ribbon. Once the Criteria_range1argument is defined, the Criteria1 argument will appear in the Function Arguments dialogbox.

6. Press the TAB key on your keyboard to advance to the Criteria1argument and type the cell location A11. The criteria for the function will be the investment type that is entered into cell A11 on the Portfolio Summary worksheet. You will notice that as soon as you

define this argument, theCriteria_range2 argument will appear on the Function Arguments dialog box.

7. In the Criteria_range2 argument on the Function Arguments dialog box use the named range Target_vs_Actual_Growth_Rate

8. Press the TAB key on your keyboard to advance to theCriteria2argument.

9. Type an open quotation mark followed by the logical test <-1% and then type a closing quotation mark ("<-1%"). The second criterion for this function is a logical test that will identify cell locations where the value is less than -1%. For the purposes of this exercise, a poor performing investment is one that is below the target growth rate by more than-1%.

10. Click the OK button at the bottom of the Function Arguments dialog box.

11. Copy the function in cell D11 into the range D12:D14. Format the cells D12LD14 with a comma style and no decimal places.

12. Enter a regular SUM function in cell D15 on the Portfolio Summary worksheet that sums the values in the range D11:D14.

13. Figure 3.37 "Completed Arguments for the SUMIFS Function" shows the defined arguments for the SUMIFS function. Values that meet all criteria defined in the function will be selected from the named range Cost_of_Purchase which is the range G4:G18. From the Investment Detail worksheet. Notice that the results for each argument of the function are shown along the right side of the Collapse Dialog buttons.

Function Arguments				?	\times
SUMIFS					
Sum_range	Cost_of_Purchase	Ť	=	{7117.5;8010;3145;5500;7340;11675;	^
Criteria_range1	Investment_Type	Ť	=	{"Bond Fund";"Bond Fund";"Bond F	-
Criteria1	A11	Ť	=	"Bond Fund"	
Criteria_range2	Target_vs_Actual_Growth_Rate	Ť	=	{0.0136184985144624;0.0031032614	
Criteria2	*<-1%*	1	=	"<-1%"	~
Adds the cells specified	by a given set of conditions or cr Sum_range: are the actual ce	iteria IIs to	= sum	5500 1.	
Formula result = \$	5,500				
Help on this function				OK Canc	el

Figure 3.37 Completed Arguments for the SUMIFS Function

<u>000</u>

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Figure 3.38 "SUMIFS Function Output for the Total Purchase Cost Column" shows the results of the SUMIFS function used to complete the Total Purchase Cost column. In total, over \$45,000 was invested in funds and stocks that are not meeting the performance goals of the portfolio.

D11	>11 * : × fx =SUMIFS(Cost_of_Purchase,Investment_Type,A11,Target_vs_Actual_Growth_Rate,"<-1%")											
	А	В	С	D	E	F	G					
7	Individual Stock	5	63	31,763	45,101	8.0%						
8	TOTAL	15	43	\$ 96,628	\$117,857	6.2%						
9	Poor Performing Inves	tments										
			Average	Total								
		Number of	Months	Purchase	Current	Annual						
10		Investments	Owned	Cost	Value	Growth						
11	Bond Fund	1	10	\$ 5,500								
12	Domestic Stock Fund	3	34	22,110								
13	International Stock Fund	1	42	7,340								
14	Individual Stock	2	69	10,097								
15	TOTAL	7	41	\$ 45,047								
16												
17	Poor performing critera:											
18	Target vs. actual growth rat	e <- 1%										
19												
20												
4	Portfolio Summary Investr	nent Detail Invest	ment List Be	nchmarks P	(+) : [4]							
Read	y 🛅						E 💾					

Figure 3.38 SUMIFS Function Output for the Total Purchase Cost Column

In addition to the Total Purchase Cost column, the SUMIFS function will also be used to complete the Current Value column for the Poor Performing Investments section on the Portfolio Summary worksheet. Notice that the Sum ranges change, but the criteria ranges and the criteria remain the same as the other functions looking at the poor performance based on the criteria outlined in cell A18.

The following steps explain how to add the function to the worksheet to complete this column:

1. Click cell D11 on the Portfolio Summary worksheet.

2. Click the Formulas tab on the Ribbon.

3. From the Insert Function select SUMIFS. This will open the Function Arguments dialog box.

4. In the Sum_range argument on the Function Arguments dialog box use the Use in Formulas to select the named range Current_Investment_Value. Selected cells from this range will be summed based on the defined criteria in ensuing arguments.

5. Click in the Criteria_range1 argument on the Function Arguments dialog and use the named range Investment_Type from the Use in Formulas on the Formulas ribbon. Once the Criteria_range1argument is defined, the Criteria1 argument will appear in the Function Arguments dialog box.

6. Press the TAB key on your keyboard to advance to the Criteria1argument and type the cell location A11. The criteria for the function will be the investment type that is entered into cell A11 on the Portfolio Summary worksheet. You will notice that as soon as you define this argument, the Criteria_range2 argument will appear on the Function Arguments dialog box.

7. In the Criteria_range2 argument on the Function Arguments dialog box use the named range Target_vs_Actual_Growth_Rate.

8. Press the TAB key on your keyboard to advance to theCriteria2 argument.

9. Type an open quotation mark followed by the logical test <-1% and then type a closing quotation mark ("<-1%"). The second criterion for this function is a logical test that will identify cell locations where the value is less than -1%. For the purposes of this exercise, a poor performing investment is one that is below the target growth rate by more than 1%.

10. Click the OK button at the bottom of the Function Arguments dialog box.

11. Copy the function in cell D11 into the range D12:D14. Format the cells D12LD14 with a comma style and no decimal places.

12. Enter a regular SUM function in cell D15 on the Portfolio Summary worksheet that sums the values in the range D11:D14.

• : × √ fe =\$UN	/IIFS(Current_Investm	ent_Value,Inves	itment_Ty	pe,A11,Ta	arget_v	rs_Actual_G	rowth_Rate,*<-1	%*)		
A	В	С		D		E	F			
Individual Stock	5	63	3	1,763		45,101	8.0%			
TOTAL	15	43	\$ 9	6,628	\$1	17,857	6.2%			
Poor Performing Inves	Poor Performing Investments									
		Average	Total							
	Number of		Purchase		Cur	rent	Annual			
	Investments	Owned	Cost		Val	ue	Growth			
Bond Fund	1	10	\$	5,500	\$	5,626				
Domestic Stock Fund	3	34	2	2,110		22,903				
International Stock Fund	1	42		7,340		5,958				
Individual Stock	2	69	1	0,097		13,990				
TOTAL	7	41	\$ 4	5,047	\$	48,478				
6										
7 Poor performing critera:										
8 Target vs. actual growth rat	te <- 1%									
9										

Figure 3.40 SUMIFS Function Output for the Current Value Column

Now that the Total Purchase Cost and Current Value columns are completed for the Poor Performing Investments section on the Portfolio Summary worksheet, we can add a formula to show the annual growth rate by investment type. Since this is the same formula that was used in the Total Summary section of the Portfolio Summary worksheet, we can just copy and paste it. The following steps explain how to do this:

- 1. Copy the formula in cell F4 on the Portfolio Summary worksheet.
- 2. Highlight the range F11:F15 on the Portfolio Summary worksheet.
- 3. Paste the formula using the Paste Formulas command.

Integrity Check - Error Message for Statistical IF Functions

If you receive an error message when attempting to enter a statistical IF function into a cell location, check to make sure any criteria using a comparison operator is enclosed in quotation marks. For example, if you are assessing a range of cells to see if the values are greater than or equal to zero, you must define the **Criteria** argument as follows: ">=0". If you do not use the quotation marks, Excel will not accept the function in the cell location and will display an error message.

Figure 3.41 "Completed Poor Performing Investments Section of the Portfolio Summary Worksheet" shows the completed Poor Performing Investments section on the Portfolio Summary worksheet. Notice that even though an investment is considered "poor performing" it does not mean that money is lost on the investment. As shown in the figure, only one investment in the International Stock Fund category is losing money, with an

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

annual growth rate of –5.4%. However, the total annual growth rate for all investments in the Poor Performing section is 2.2% (see cell F15). This is less than half the growth rate for the overall portfolio, which is 6.2% (see cell F8). A final observation is that all the investments in the Domestic Stock Fund category are "poor performing." The same number of investments in the Total Summary section appears in the Poor Performing Investments section. This completes the Portfolio Summary worksheet except for one column. We will complete this column in the next section with a lookup function.

Figure 3.41 Completed Poor Performing Investments Section of the Portfolio Summary Worksheet

EII	1 · · · · · · · · · · · · · · · · · · ·											
	А	В	С	D	E	F	G					
7	Individual Stock	5	63	31,763	45,101	8.0%		Dow				
8	TOTAL	15	43	\$ 96,628	\$117,857	6.2%						
9												
			Average	Total								
		Number of	Months	Purchase	Current	Annual						
10		Investments	Owned	Cost	Value	Growth						
11	Bond Fund	1	10	\$ 5,500	\$ 5,626	2.8%						
12	Domestic Stock Fund	3	34	22,110	22,903	1.3%						
13	International Stock Fund	1	42	7,340	5,958	-5.4%						
14	Individual Stock	2	69	10,097	13,990	6.8%						
15	TOTAL	7	41	\$ 45,047	\$ 48,478	2.2%						
16												
17	Poor performing critera:											
18	Target vs. actual growth rat	e <- 1%										

Key Takeaways

- The COUNTIF, SUMIF, and AVERAGEIF functions can select specific cell locations from a range to compute an output using one criteria argument.
- The COUNTIFS, SUMIFS, and AVERAGEIFS functions can select specific cell locations from a range to compute an output using multiple sets of criteria arguments.
- When using the AVERAGEIF and SUMIF functions, the row numbers used in the ranges to define the **Range** argument and the **Average_range** or **Sum_range** arguments must be identical.
- The benefit of using statistical functions when creating a summary worksheet is that if rows of data are added to the detail worksheet, the new data will automatically be included in the function output.
- When using statistical IF functions, the logical test used to define a criteria argument must be enclosed in quotation marks

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

3.3. Data Validation

LEARNING OBJECTIVES

- 1. Learn the types of data validation
- 2. Use data validation to control data entry into fields.

Some of the documents you will prepare for your business will be what are called templates. A template is simply a pre-made form that others can use to complete the work for a company. A common template would be a sales invoice form. On the invoice, you would want your salespeople to be able to select from a drop down of products and have the resulting selection fill in the price per unit and the product description. The salespeople could enter the number of units, but could not change the description fields or the price fields. We will look at the use of data validation to help limit what can be entered into fields. For this conversation, we will describe a cell as a field.

When a data validation rule is created, you can specify what kind of data is allowed. You can also prohibit the entry of anything other than the allowed data, you can warn that the data is not what is expected, or you can just let the data be entered with an explanation of what is expected to be in the field.

Any value	This is the default when no data validation is applied
Whole number	Limit entries to whole numbers (no decimal places allowed.) a range of acceptable whole numbers (integers) can be specified.
Decimal	Any type of number, including percentages, a range of acceptable values can be specified.
List	Amy value in a range or entered in the Data Validation dialog box separated by commas
Date	Limited to dates only; you can specify acceptable date ranges
Time	Times only; you can specify acceptable time ranges
Text length	Text limited to a specific number of characters – for instance a phone number would be considered text and be a specific length.
Custom	Values based on the results of a logical formula.

Table 3.71 Allowable options for data validation.

Data Validation List - Created Source

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.14 if starting here.)

@ 080

We will use data validation to create a buy/sell form for the various investments. The steps we will use to do this are:

1. Activate the Buy/Sell worksheet. We use a different data validation rule in each of the cells in the range B3:B7.

2. In cell B3, we will create text data validation rule that describes the type of transaction this will be. Click in cell B3. From the Data Tools section of the Data ribbon, use the drop-down button to select Data Validation.

Figure 3.40b Data Validation Button

⊟ ⁵	• 0 •	÷						Excel_Ob	jective_3.15	5 - Ex	cel			
File	Home	Insert	Draw	Page Layout	Formulas	Data	Review	View	🖓 Tell m	ne wha	it you	want to do		
Get External Data -	New Query *	Show C	Queries able Sources	Refresh All -	Data V bu	alidati tton	on	Clear Peapply Advanced	Text to Columns		€9 00 m	What-If Analysis •	Forecast Sheet	Group + Ungroup Subtotal
	G	et & Transfo	rm	Connection	s	5	Sort & Filter		Data	1	Data	Validation		Outline
B 3		: ×	~ 1			- 1				臣	Circle	linvalid Dat Validation (a Circles	
A	A		B	C	D	E	F	G	н		1	,	r.	L

3. In the Data Validation dialog box, use the drop-down button next to the Allow: box and choose List.

4. In the Source field, type Buy, Sell. Make sure the two words are separated by a comma.

5. Click on the Input Message tab. In the tile *Figure 3.40c Data Validation Dialog Box* type Buy/Sell.

6. In the Input message field type: Select the type of transaction you are ordering.

7. Click the Ok button.

8. Note that cell B3 now has a drop-down arrow next to the cell. When the cell is active, the input message you just entered will show below the cell. When clicked, the drop down will show the choices available for what can go in the cell.

Data Validat	tion		?	×
Settings	Input Message	Error Alert		
Validation	criteria			
Allow:				
List		✓ Ignore <u>b</u> lank		
Data:		In-cell dropdown		
betwee	n	\sim		
Source:				
Buy,Sell		Î		
Apply t	hese changes to a	ll other cells with the same	settings	
<u>C</u> lear All		ОК	Canc	el



Figure 3.40c Data Validation Results in the Cell

Data Validation List Named Range

Data validation can also be used to create a list using a range of cells. If you are going to use a range of cells there are two rules you must follow:

- The range of cells must be on the same worksheet as the data validation cell, OR
- Use a named range of cells from a different worksheet. The named range must be one column or one row of data only.

The steps we will follow to create a drop-down list for the investment symbols are: 1. Select Sell from the drop-down list.

2. Cell B4 will contain the stock symbol for the investment to be traded. We will use a named range to create the data validation list for this cell. Go to the Investment List worksheet. Highlight the range B3:B22 From the Defined Names section of the Formula Ribbon, select Define Name.

3. In the Define Name section, type in Trade_Symbol. (Don't forget to use the underscore between the words Trade and Symbol. Defined names cannot contain spaces.)

4. Go back to the BuySell Order worksheet and make cell B4 active.

5. From the Data ribbon click the data validation drop-down list and select List in the Allow box.

6. Click in the Source box. From the Defined Names section of the Formula ribbon, select Use in Formula. Scroll down the list of names until you see Trade_Symbol. Click on Trade_Symbol. (Excel will insert an = sign before the named range.)

7. Click on the Input Message and type: Select the investment symbol from the list.

8. Click on the Error Alert.

Data Validation		?	\times
Settings Input Messa	ge Error Alert		
Validation criteria			
Allow:			
List	✓ ✓ Ignore <u>b</u> lank		
Data:	In-cell dropdown	n	
between	\sim		
Source:			
=Trade_Symbol	1]	
Apply these changes	to all other cells with the sam	e settings	
<u>C</u> lear All	ОК	Cance	el

9. There are three options for the error alert dialog box. Stop: the data that is being input must match the data allowed. Alert: the data does not match, and the user must choose to proceed or not, and Information: the user will be alerted that the data does not match, but no choice will be given before the data can be entered.

Integrity Check - Data Validation Input Message

Every cell that has data validation should have an input message to alert the user as to what should be entered into the cell and the types of data the cell will accept.

Settings	Input Message	Error Alert		
Show (error alert after inv	alid data is entered		
Style:	r enters invalid da	ta, show this error ale	rt:	
Stop		~		
Stop	9	Error message:		
Informa	tion			^
				~

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

10. Because this is a buy/sell situation, we may be buying an investment that is not already in the portfolio. We will select a Warning message that will alert the user that the symbol is not in the list of currently owned investments.

11. On the Error message box type: That investment symbol is not in the list of owned investments.

12. Click OK.



13. Try typing a symbol into B4 that is not in the list. You will get an error message, but you will also get the choice to proceed or not. Choose to not proceed. Delete the characters you entered from B4 and select VFICX from the drop-down list.

14. Select cells A3:C3. Right click and Insert. Shift cells down, and then click OK.

Data Validation - Date

Next, we will validate the transaction date to ensure the date of the order will be today or later. The steps we will use are:

1. Insert a row at A3 by highlighting A3: C3. Then use the Ctrl and + keys to insert cells. Select Shift Cells Down.

2. In Cell A3 type: Today's Date:

3. In cell B3 type the formula =TODAY() Note: this will insert a dynamic formula that will change each time the workbook is opened to reflect the current date.

4. Activate cell B6. Open the data validation dialog box and select Date from the list of options.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

5. New Data choices will be given:

Between	Enter a start and end date
Not between	The date entered cannot be between the dates indicated.
Equal to	Must be the exact date entered.
Not equal to	Can be any date but the date designated.
Greater than	Must be after the specified date.
Less than	Must be before the date entered.
Greater than or equal to	Can be equal to or after the designated date
Less than or equal to	Must be the designated date or before.

6. Select greater than or equal to. We can't tell the broker to sell something yesterday-only today or later.

7. Tab to the Start date box. Click on cell B3 as the start date. This will dynamically link your valid date the TODAY() function.

Data Validation	?	\times
Settings Input Message Error Alert		
Validation criteria		
<u>A</u> llow:		
Date 🗸 Ignore <u>b</u> lank		
Data:		
greater than or equal to 🗸		
Start date:		
=83 1		
Apply these changes to all other cells with the same s	settings	
Clear All OK	Cano	el

8. Click on the input message tab and in the Input message box type: Trade date must be today or after today's date.

9. Click the Error Alert tab, select Stop as the alert. In the Error message type: Date entered is before today's date. Note: your error message should always inform the user why the error has occurred.

10. Put yesterday's date into the cell. Excel will stop you and tell you why the entry is invalid.

11. Enter tomorrow's date into B6.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Data Validation - Number

1. Click on cell B7. In this cell, the price will be entered. We will control the entry to be a number with 0 decimal places.

2. From the data validation settings dialog box, select Whole Number.

3. In the Data box select greater than

4. In the Minimum box type in 0.

5. In the Input Message tab type: Enter the buy/sell price in whole numbers. We won't have an error message for this cell.

6. On the Home ribbon format cell B7 for \$ with 0 decimal places.

Data Validation - Text

The last validation we will add to our worksheet it a text validation to limit the number of characters the user can add when explaining why the investment is being bought or sold. The steps we will use to do that are:

1. Make cell B8 active. Because we are looking for a buy/sell reason, we will make cell B8 accept text input only.

2. From the data validation Settings Allow drop-down, select Text length.

3. In the Data box select: less than.

4. In the Maximum box type: 100. Note: this will limit the number of characters to less than 100.

5. For the input message type: Enter reason for buying/selling.

6. Do not put in an error alert.

7. In cell B8 type: Not hitting target

Data Validation	?	\times
Settings Input Message Error Alert		
Validation criteria		
Allow:		
Text length 🗸 🗸 Ignore <u>b</u> lank		
Data:		
less than 🗸		
Ma <u>x</u> imum:		
100 1		
Apply these changes to all other cells with the same se	ttings	
<u>C</u> lear All OK	Cano	el.

Figure 3.40d Completed Data Validation Worksheet

6	∃ 5 -											Excel_Ob	
	ile H	ome	Insert	Draw	Page	e Layout	Formu	las	Data	Revie	ew	View	Q
Get I D	External ata + C	New Juery + Get	Show Qu From Tab Recent So & Transform	eries Ie ources	Refresi All •	Connection	ections rties nks s	2↓ ∡↓	Sort	Filter	Te Ci Te Re Te A	lear eapply dvanced	[1 Ca
A2	23	•	×	/	*								
		А			в	с	D		Е	F		G	
1	Pers	onal	Invest	men	t Por	tfolio							
2			Buy/Sell	Orde	r								
3	То	day's l	Date	9/14	2017								
4	Buy/Sell			Sell									
5	Stock Syr	nbol		VFICX									
6	Buy/Sell	Date		9/1	5/2017								
7	Buy/Sell	Price		\$	1,000								
8	Reason f	or sellir	ng:	Not h	itting ta	arget							
9													
10													
11													
12													
13													
	• ⊢ .	In	vestment D	etail	Inve	stment Lis	t Be	nchr	narks	BuySe	II Ord	ler	÷
Rea	dy 🔝												

Data Validation - Calculated Field

While not using a specific example in this worksheet, we can create a data validation based on a calculation. For example: We can have the data validation test to see if the value entered is at least 5% of a value in another cell. The calculation must begin with an =.

Data Validat	tion		?	×
Settings	Input Message	Error Alert		
Validation	criteria			
Decimal		V Ignore bla	nk	
Data:				
greater	than or equal to	~		
Minimun	1:			
=0.05*B	9		Ť	
=0.05*B	9 hese changes to a	Il other cells with th	• same settin	igs
	-			đ
Clear All		(ОК	Cancel

Key Takeaways

- Always include an input message for cells containing data validation.
- Protect the types of information that can be entered into a cell by using data validation.
- A data validation list can help eliminate spelling and data input errors.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

3.4. Lookup Functions

LEARNING OBJECTIVES

- 1. Use the VLOOKUP function to search and display the contents of a cell location for data that is organized in columns.
- 2. Use the HLOOKUP function to search and display the contents of a cell location for data that is organized in rows.
- 3. Create a web query that imports stock price data into a worksheet from a website.

The final section of this chapter addresses lookup functions. Lookup functions are typically used to search for and display data located in other worksheets or workbooks. The two lookup functions we will use in our example of the personal investment portfolio are the VLOOKUP and HLOOKUP functions. In addition to demonstrating these functions, we will also show how we can enhance the personal investment portfolio workbook with a web query. Web queries are used to bring live or current data into a worksheet from a website.

The VLOOKUP Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.15 if starting here.) The VLOOKUP function is typically used to access and display data located in another worksheet or workbook. The function can also be used to access and display data located in the same worksheet. This is a very powerful and versatile function because it eliminates the need to copy or recreate data that exists in other worksheets or workbooks. It is called a VLOOKUP function because the function will search vertically down the first column of a range of cells to find what is called a lookup value. This process is very similar to the statistical IF functions in Section 3.2 "Statistical IF Functions". You will recall that these functions used criteria to select cells from a range that was used in the mathematical output. The VLOOKUP function is essentially performing the same process; however, instead of selecting multiple cells from a range, the function is only looking for one specific cell location. Once the function finds the specific cell location, it will display the contents of that cell location or another cell location in the range. Before using the VLOOKUP function in the personal investment portfolio workbook, it is strongly recommended that you carefully read the definitions for the function arguments listed in Table 3.10 "Arguments for the VLOOKUP Function".

=VLOOKUP(lookup_value,table_array,row_index_num,[range_lookup])

Argument	Definition
Lookup_value	This argument is typically defined with a cell location, number, or text. Text data must be enclosed in quotation marks for this argument. The function will search for the criteria in the <i>first column</i> of the range used to define the Table_array argument. For example, if the word <i>Hat</i> is used to define this argument, the function will always search for the word <i>Hat</i> in the first column of the range used to define the Table_array argument.
Table_array	A range of cells that contain data you wish the VLOOKUP function to search though (Lookup_value) and display. This cell range <i>must</i> contain the criteria used to define the Lookup_value in the first column.
Col_index_num	This is the column index number argument. It is defined as the number of columns to the right of the first column in the range used to define the Table_array., argument that contains the data you wish to display. For example, suppose the data you wish the function to display is contained in Column C. If the range used to define the Table_array argument is A2:D15, then the column index number will be 3. Counting the columns to the right of the first column in this range, Column A would be 1, Column B would be 2, and Column C would be 3. It is important to remember to count the first column in the table array range as 1.

Table 3.10 Arguments for the VLOOKUP Function

[Range_lookup]	This argument is defined with either the word <i>TRUE</i> or the word <i>FALSE</i> . When this argument is defined with the word <i>FALSE</i> , the function will look for an exact match to the criteria used to define the Lookup_value argument in the first column of the table array range. It is important to note the function will search the entire range to find an exact match.
	If this argument is defined with the word <i>TRUE</i> , the function will look for a value that is an exact match or the closest match that is <i>less than</i> the lookup value.
	Examples:
	If f the lookup value is 80 and the highest value in the first column of the table array range is a 78, the function will consider 78 a match for the number 80.
	If the lookup value is 78 and the range is 70,80,90,100, The function will consider 78 to be a match for 70 (the lower value).
	However, if the lookup value is 80 and the lowest number in the first column of the table array range is 85, the function will produce an error. This is because the number 80 and any value less than 80 do not exist in the first column of the table array range.
	It is important to note that if you define this argument with the word TRUE, the data in the table array range must be sorted in ascending order. This is because the function will stop searching for a match once the value in the first column exceeds the lookup value. If the data in the table array range is not sorted, the function can either produce an error code or display an erroneous result. This argument is in brackets because if it is not defined it will automatically be defined with the word <i>TRUE</i> .

Integrity Check

Using a TRUE Range Lookup for VLOOKUP and HLOOKUP

If you are defining the **Range_lookup** argument with the word *TRUE* for either the VLOOKUP or HLOOKUP function, the range used to define the **Table_array** argument must be sorted in ascending order. For the VLOOKUP function, the table array range must be sorted from smallest to largest or from A to Z based on the values in the first column. For the HLOOKUP function, the table array range must be sorted from left to right based on the values in the first row, from smallest to largest or A to Z.

You may have noticed that on the Investment Detail worksheet, the Description column is blank. Descriptions for several investments are included in the workbook in the Investment List worksheet as shown in Figure 3.42 "Investment List Worksheet". The VLOOKUP function will be used to search for a specific symbol in Column A of the Investment List worksheet and display the description for that symbol located in Column B. It is important to note that once the Table_array has been defined, the VLOOKUP can return any column number within that array. For example, to return the investment type you would select column 3. For 5-year growth, you would select column 6.

	A	8		C	D	E	F.	Col index num argument must be define
		Inve	stment List		with the number 2.			
	Symbol	Description	In	vestment Type	Risk Level	Growth Last Year	5 Year Growth	
	VMMXX	Prime Money Market	N/I c	oney Market	1	0.07%	2.45%	
	VUSTX	Long Term Treasury	80	and Fund	3	0.68%	3.51%	
	VFSTX	Short Term Investment Grade	V Bo	and Fund	1	3.79%	4.92%	
	VWEHX.	High Yield Corporate	Bo	nd Fund	3	12.37%	6.74%	
	VFICX	Intermediate Investment Grade	80	and Fund	2	7.88%	6.63%	
	VFISX	Short Term Treasury	Bo	and Fund	1	1.74%	4,39%	
	VBISX	Short Term Bond Index	Bo	and Fund	1	2.85%	4.98%	
	VEIPX	Equity Income	Do	mestic Stock Fund	4	17.10%	3.59%	
	VIMSX	Mid Cap	De	mestic Stock Fund	5	24.94%	4.39%	
	VISGX	Small Cap Growth	Do	mestic Stock Fund	5	32.55%	5.92%	
	VFINX	S&P 500 Index	Do	mestic Stock Fund	4	15,49%	2.54%	
	VEIEX	Emerging Markets	Int	ernational Stock Fund	5	17.18%	10.01%	
	VDMIX	Developed Markets	Int	ernational Stock Fund	5	10.49%	1,41%	
	VTRIX.	International Value	int	ernational Stock Fund	5	7.69%	1.93%	
	MSFT	Microsoft Corporation	ind	dividual Stock	5	-10.05%	3.49%	
	AAPL	Apple Inc.	Inc	lividual Stock	5	50.97%	324.19%	
	IBM	International Business Machine	Inc	dividual Stock	5	12.09%	72.65%	
	GOOG	Google Inc.	Inc	dividual Stock	5	-4.03%	28.60%	
	JNJ	Johnson and Johnson	ind	dividual Stock	5	-3.11%	-1.05%	
	VO I	Case Cale	1 Parts	Initial and Charalt	Cont Carl	10.0.01	20.171/	
1	A AL POR	folio Summary Investment Detail Inv	vestment	Last Benchemarks (/ Price	Dat. 4	() (<u>)</u> (1700		

Figure 3.42 Investment List Worksheet

Naming a Table_array:

VLOOKUP function.

To name a Table_array select all the columns and rows in the array EXCEPT the column headers. If you include the column headers Excel will treat them as values in your array and may return erroneous results.

The following steps explain how to accomplish this:

1. First, we will name our table_array. It is much easier to name the array and use the named range than to constantly have to re-select the data for a different VLOOKUP function.

2. Click on the Investment List worksheet.

3. Select the range A3:F23 (this range excludes the column headers.)

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

E	5 -∂-∓		Excel_Objective_3.14 - Excel		Kaaren McGiynn - É	≖ – ⊡ ×
Fil	e Home I	nsert Draw Page Layout Formulas Data Re	view View Q Tell me what you wan	t to do		유 Share
f; Inse	AutoSum Recently Us in Financial *	e Logical * E Lookup & Reference * ed - Text * Math & Trig - Date & Time * More Functions * Function Library	Define Name * \$ So Trace Preceden Cuse in Formula ~ Cuse in Formula Create from Selection Sc Remove Arrow Defined Names	nts 🖾 Show Formu nts 👈 Error Checkin s 👻 & Evaluate Form Formula Auditing	las mula Watch Window Calcu Opti Cal	Ilation Constraints
A3	•	× ✓ fr VMMXX				~
1	Α	В	С	D	E	F 🔺
1		In	vestment List			
2	Symbol	Description	Investment Type	Risk Level	Growth Last Year	5 Year Growth
3	VMMXX	Prime Money Market	Money Market	1	0.07%	2.45%
4	VUSTX	Long Term Treasury	Bond Fund	3	0.68%	3.51%
5	VFSTX	Short Term Investment Grade	Bond Fund	1	3.79%	4.92%
6	VWEHX	High Yield Corporate	Pond Fund	3	12.37%	6.74%
7	VFICX	Intermediate Investment Grade	E New Name	ŕ ^ 2	7.88%	6.63%
8	VFISX	Short Term Treasury	E Name: Investment_List	1	1.74%	4.39%
9	VBISX	Short Term Bond Index	E Scope: Workbook	1	2.85%	4.98%
10	VEIPX	Equity Income	Comment:	^ 4	17.10%	3.59%
11	VIMSX	Mid Cap	C C	5	24.94%	4.39%
12	VISGX	Small Cap Growth	I I	. 5	32.55%	5.92%
13	VFINX	S&P 500 Index	Befers to: -'Investment List'ISAS3:SF\$23	± 4	15.49%	2.54%
14	VEIEX	Emerging Markets	ОК	Cancel 5	17.18%	10.01%
15	VDMIX	Developed Markets	International Stock Fund	5	10.49%	1.41%
16	VTRIX	International Value	International Stock Fund	5	7.69%	1.93%
-	Port	folio Summary Investment Detail Investment List	Benchmarks P (+)	-	40.050	
Read	v 🛍		Average: 1.396550425 Count: 126 S	um: 87.9826768	II I I	+ 130%

4. On the Formulas ribbon in the Defined Names section click on Define Name.

5. In the Name box type in Investment_List. Notice that the Refers to: box at the bottom shows the worksheet name and range of cells this name will apply to. Make sure it shows the correct range. The \$ indicate that naming this range will create an absolute reference to these cells in your workbook.

6. In the Investment Detail worksheet, click on cell C4.

7. Click the Formulas tab on the Ribbon.

8. Click the Lookup & Reference button in the Function Library group of commands.

9. Select the VLOOKUP function from the list of functions. Use the scroll bar to scroll down to the bottom of the list. This will open the Function Arguments dialog box for the VLOOKUP function.

10. Click in the Lookup_value argument on the Function Arguments dialog box.

11. Click cell B4. The symbol in cell B4 is the lookup value that will be searched in the first column of the range defined for the Table_array argument.

12. Click in the Table_array argument on the Function Arguments dialog box.

13. From the Formulas ribbon click on Use in Formula and select Investment_List.

14. Press the TAB key on your keyboard to advance to the Col_index_num argument and type the number 2. Once the function finds the lookup value in the first column of the range Investment_List, it will display the description that is in the second column of the same row.

15. Press the TAB key on your keyboard to advance to the Range_lookup argument and type the word FALSE. This will direct the function to search for only exact matches to lookup value.

16. Click the OK button at the bottom of the Function Arguments dialog box.

17. Copy the VLOOKUP function in cell C4 and paste it into the range C5:C18

Figure 3.43 "Completed Function Arguments Dialog Box for the VLOOKUP Function" shows the completed Function Arguments dialog box for the VLOOKUP function. Notice that the Range_lookup argument is defined with the word FALSE. This will direct the function to search for an exact match to the lookup value and will also direct the function to search the entire first column of the table array range.

Finally, it is important to note the absolute reference on the table array range. This will prevent the table array range from changing when the function is pasted into other cell locations.

Function Arguments					?	\times	
VLOOKUP							
Lookup_value	B4	Î	=	"VFICX"			
Table_array	Investment_List	1	=	{"VMMXX", "Prime Money	Market	-,	
Col_index_num	2	1	=	2			
Range_lookup	FALSE	Ť	=	FALSE			
= "Intermediate Investment Grade" Looks for a value in the leftmost column of a table, and then returns a value in the same row from a column you specify. By default, the table must be sorted in an ascending order.							
Range	ascending	order) = TRUE or	om	itted; find an exact match	= FALS	E.	
Formula result = Intermediat	e Investment Grade						
Help on this function				ОК	Car	ncel	

Figure 3.43 Completed Function Arguments Dialog Box for the VLOOKUP Function

Figure 3.44 "Results of the VLOOKUP Function in the Investment Detail Worksheet" shows the results of the VLOOKUP function in the Investment Detail worksheet. The function is

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

searching for each symbol in Column B of the Investment Detail worksheet in Column A of the Investment List worksheet.

When the function finds a match, it will display whatever is in the cell location two columns to the right, or Column B, in the Investment List worksheet. For example, the symbol VDMIX, which is in cell B8 on the Investment Detail worksheet (see Figure 3.44 "Results of the VLOOKUP Function in the Investment Detail Worksheet"), is also in cell A15 on the Investment List worksheet. As a result, the function is displaying whatever is in cell B15 on the Investment List worksheet, which is the description "Developed Markets."

4	A.	B	¢	D	E	Ł	8	
	Personal Inves	stment	Portfolio				VLOOKUP functi	ion as it
14	Descriptive Information	i		(Purchase	appears in ce	4I C4.
	Investment Type	Symbol	Description	Dividend / Yield	Shares Purchased	Purchase Price per Share	Cost c Purchi	
4	Bond Fund	VFICX	Intermediate Investment Grade	4.60%	750	\$ 9.49	\$ 7	
	Bond Fund	VFSTX	Short Term Investment Grade	3.20%	750	\$ 10.68	\$ 8	
5	Bond Fund	VWEHX	High Yield Corporate	7.20%	500	\$ 6.29	\$ 3	
1	Bond Fund	VUSTX	Long Term Treasury	4.00%	500	\$ 11.00	\$ 5	
3	International Stock Fund	VDMIX	Developed Markets	2.60%	500	\$ 14.68	\$ 7	
2	Domestic Stock Fund	VEIPX	Equity Income	2.50%	500	\$ 23.35	\$ 11	
0	Domestic Stock Fund	VISGX	Small Cap Growth	0.30%	250	\$ 19.33	\$ 4	
1	Domestic Stock Fund	VIMSX	Mid Cap	1.00%	250	\$ 22.41	This descriptio	n is in cell f
2	International Stock Fund	VTRIX	International Value	2.00%	250	\$ 22.83	on the Investmen	it List work
3	International Stock Fund	VEIEX	Emerging Markets	1.40%	250	\$ 23.74	\$ 5	
4	Individual Stock	TRV	The Travelers Companies, Inc.	2.40%	150	\$ 38.14	\$ 5	
5	Individual Stock	JNJ	Johnson and Johnson	3.60%	150	\$ 53.30	\$ 7	
6	Individual Stock	KO	Coca Cola	2.80%	150	\$ 62.46	\$ 9	
7	Individual Stock	MSFT	Microsoft Corporation	2.50%	75	\$ 28.02	\$ 2	
8	Individual Stock	IBM	International Business Machine	1.60%	75	\$ 87,68	\$ 6	
9	Total				5,100		\$ 96	

Figure 3.44 Results of the VLOOKUP Function in the Investment Detail Worksheet

Integrity Check - Absolute References on the Table Array Range for the VLOOKUP and HLOOKUP Functions

If you have not named your Table_array for the VLOOKUP or HLOOKUP functions and will be copying and pasting the VLOOKUP or HLOOKUP function, you will most likely need to place an absolute reference on the range used to define the **Table_array** argument. If you do not, the table array range will change because of relative referencing once the function is pasted to new cell locations. This could result in an error output for either the VLOOKUP or HLOOKUP function. This is because the function will not be able to find the lookup value since the range has been adjusted. If you are defining the **Range_lookup** argument with the word *TRUE*, an adjustment in the table array range may result in an erroneous output.

The HLOOKUP Function

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.15 if starting here.) The HLOOKUP function serves the same purpose as the VLOOKUP function. The HLOOKUP function can be used to display data from another worksheet or workbook. However, instead of searching for the lookup value vertically down the first column of the table array range, the HLOOKUP function searches horizontally across the first row of the table array range. When the function finds a match for the lookup value, it will display the contents in a cell location based on a row index number. This number designates which row in the table array range the function should display.

=HLOOKUP(lookup_value,table_array,row_index_num,[range_lookup]) Table 3.11 "Arguments for the HLOOKUP Function" provides a definition for each argument of the HLOOKUP function. It is best to review the definitions of these arguments carefully before using the function.

Argument	Definition
Lookup_value	This argument is typically defined with a cell location, number, or text. Text data must be enclosed in quotation marks for this argument. The function will search for the criteria entered into this argument in the <i>first</i> <i>row</i> of the range used to define the Table_array argument. For example, if the word <i>Hat</i> is used to define this argument, the function will search for the word <i>Hat</i> in the first row of the range used to define the Table_array argument.
Table_array	Range of cells that contain data you wish the HLOOKUP function to search though (Lookup_value) and display. This cell range <i>must</i> contain the criteria used to define the Lookup_value in the first row. For example, if the range A2:D15 is used to define this argument, the criteria used to define the Lookup_value argument must exist in Row 2.
Row_index_num	This is the row index number argument. It is defined with the number of rows below the first row in the range used to define the Table_array argument that contains the data you wish to display. For example, suppose the data you wish the function to display is contained in Row 5. If the range used to define the Table_array argument is A2:D15, then the column index number will be 4. Counting the rows below the first row in this range, Row 2 would be 1, Row 3 would be 2, Row 4 would be 3, and Row 5 would be 4. It is important to remember to count the first row in the table array range as 1.

Table 3.11 Arguments for the HLOOKUP Function

Definition
This argument is defined with either the word <i>TRUE</i> or the word <i>FALSE</i> .
When this argument is defined with the word <i>FALSE</i> , the function will
look for an exact match to the criteria used to define the Lookup_value
argument in the first row of the table array range. It is important to note
the function will search the entire range to find a match. If this argument
is defined with the word <i>TRUE</i> , the function will look for a value that is an
exact match or the closest match that is <i>less than</i> the lookup value. For
example, if the lookup value is 80 and the highest value in the first row of
the table array range is a 78, the function will consider 78 a match for the
number 80. However, if the lookup value is 80 and the lowest number in
the first row of the table array range is 85, the function will produce an
error. This is because the number 80 and any value less than 80 do not
exist in the first row of the table array range. It is important to note that if
you define this argument with the word TRUE, the data in the table array
range must be sorted based on the values in the first row in ascending order
<i>from left to right.</i> This is because the function will stop searching for a
match once the value in the first row exceeds the lookup value. If the data
in the table array range is not sorted, the function can either produce an
error code or display an erroneous result. This argument is in brackets
because if it is not defined it will automatically be defined with the word
TRUE.

The HLOOKUP function will be used on the Portfolio Summary worksheet to display the benchmark growth rates in the range G4:G7. A benchmark is a value that can be used as a standard point of comparison. The Benchmarks worksheet contains growth rates at different year intervals for the benchmarks that will be used to compare the performance for each investment type (see Figure 3.45 "Benchmarks Worksheet"). For the purposes of this workbook, we will be comparing the growth rates for each investment type to the 5-year average growth rate for the benchmarks categories listed in the range H4:H7. The following steps explain how to construct the HLOOKUP function to display the 5-year benchmark values in the Portfolio Summary worksheet:

Figure 3.45 Benchmarks Worksheet

	cs • (*	J v 6.03%								
A	A	В	C	D	E					
1	Financial Benchmarks									
2		S&P 500	Barclays	Dow Jones	MSCI EAFE					
3	1 Year Growth	15.65%	5.14%	16.53%	10.42%					
4	3 Year Growth	2.35%	5.31%	3.21%	-3.01%					
5	5 Year Growth	2.54%	6.03%	5.35%	1.30%					
6	10 Year Growth	3.29%	5.57%	5.92%	5.39%					
7										

If the table array range is set to B2:E6, to display this value for the Barclays benchmark the row index number must be set to 4.

1. Go to the Benchmarks worksheet by clicking on the Benchmarks tab.

2. We will name the Benchmarks range for use in the HLOOKUP function. The range we will name is B2:E6. The top row contains the look up values the function will use to find a match. The remaining rows will be the results returned once a match is found.

3. Highlight B3:B6 and name the range Benchmarks by typing the name in the Cell address block on the left side of the formula bar.

4. Click cell G4 in the Portfolio Summary worksheet.

5. Click the Formulas tab on the Ribbon.

6. Click the Lookup & Reference button in the Function Library group of commands.

7. Select the HLOOKUP function from the list of functions. This will open the Function

Arguments dialog box for the HLOOKUP function.

8. Click in the Lookup_value argument on the Function Arguments dialog box.

9. Click cell H4. The description in cell H4 will be the lookup value that will be searched in

the first row of the range defined for the Table_array argument.

10. Click in the Table_array argument on the Function Arguments dialog box.

11. From the Formulas ribbon, Use in Formula, select the named range Benchmarks.

12. Press the TAB key on your keyboard to advance to the Row_index_num argument and type the number 4.

Ben	chmarks 🔻 : 🗙 🗸	f _x S&P	500			
	А		В	С	D	E
1			Financia	l Benchmar	ks	
2		S&P 5	00	Barclays	Dow Jones	MSCI EAFE
3	1 Year Growth		15.65%	5.14%	16.53%	10.42%
4	3 Year Growth		2.35%	5.31%	3.21%	-3.01%
5	5Year Growth 🔨		2.54%	6.03%	5.35%	1.30%
6	10 Year Growth		3.29%	5.57%	5.92%	5.39%
7			E V and Ca	the in the Devent	1	
8			5 Year Gro the l	owth is in Row 4 (ookup array.		
9				. ,		

Remember that the Excel row number from the left side of the worksheet window is irrelevant in table arrays. It is the number of rows in the array itself that are counted.

13. Press the TAB key on your keyboard to advance to the Range_lookup argument on the Function Arguments dialog box and type the word FALSE. This will direct the function to search for only exact matches of the lookup value. Without an exact match, the results may be erroneous because Excel will stop looking when it finds an approximate match, or one higher in value.

14. Click the OK button at the bottom of the Function Arguments dialog box.

15. Copy the HLOOKUP function in cell G4 and paste it into the range G5:G7 using the Paste Formulas command.

Figure 3.46 "Completed Function Arguments Dialog Box for the HLOOKUP Function" shows the completed Function Arguments dialog box for the HLOOKUP function. The row index number 4 indicates that the function will display the contents of the cell location in the fourth row of the table array range.

a manufactory and a manufactory		-V-	C
HLOOKUP Lookup_value	H4	1 = "Bardays"	An absolute reference is placed on the table array range.
Table_array	Benchmarks	1 = ("SE Ser,"Barclays","Dow Jones","MSCI E	AF
Row_index_num	4	1 = 4	Contents of the lookup value
Range_lookup	FALSE	1 = FALSE	cell reference are shown here.
Looks for a value in the top row of a	table or array of values and ret	 = 0.0603 urns the value in the same column from a row you specify. find the closest match in the top row (socied in ascending ord) 	er) =
Range	TRUE or omitted; fin	d an exact match = FALSE.	

Figure 3.46 Completed Function Arguments Dialog Box for the HLOOKUP Function
Figure 3.47 "Completed Portfolio Summary Worksheet" shows the output of the HLOOKUP function. Notice that the output of the function in cell G4 is 6.0%. This is because the lookup value was defined with the entry in cell H4, which is the Barclays index. Looking at Figure 3.45 "Benchmarks Worksheet", if you count the first row of the table array range as Row 1, the value 6.03% is the fourth row in the Barclays column. Since the values in Column G on the Portfolio Summary worksheet are set to 1 decimal place, the value is displayed as 6.0%.

đ	A	B	C	0	E	Æ	6	H
R	Personal Investment Summary							
	Total Summary							
1		Number of Investments	Average Months Owned	Total Purchase Cost	Current Value	Annual Growth	Benchmark 5 Year Growth	Benchmark
4	Bond Fund	4	36	\$ 23,773	\$ 27.274	4.9%	6.0%	Barclays
5	Domestic Stock Fund	3	34	\$ 22,110	\$ 22,903	1.3%	2.5%	S&P 500
5	International Stock Fund	3	27	\$ 18,983	\$ 22,578	8.5%	1.3%	MSCI EAFE
1	Individual Stock	5	63	\$ 31,763	\$ 45,101	8.0%	5.4%	Dow Jones
8	TOTAL	15	43	\$ 96,628	\$117,857	6.2%	1	
	Poor Performing Inves	tments						
0		Number of Investments	Average Months Owned	Total Purchase Cost	Current Value	Annual Growth	The output in this c 4 th row	ut of the HLOOKUP fur olumn can be found in of the range B2:E6 on
1	Bond Fund	1	10	\$ 5,500	\$ 5,626	2.8%	Be	ochmarks worksheet.
2	Domestic Stock Fund	3	34	\$ 22,110	\$ 22,903	1.3%		
3	International Stock Fund	1	42	\$ 7,340	\$ 5,958	-5.4%		
4	Individual Stock	2	69	\$ 10,097	\$ 13,990	6.8%		
5	TOTAL	7	41	\$ 45,047	\$ 48,478	2.2%	1	

Figure 3.47 Completed Portfolio Summary Worksheet

Integrity Check - #N/A and #REF! Errors with Lookup Functions

If you receive the **#N/A** error code when using the VLOOKUP or HLOOKUP function, it indicates that Excel cannot find the lookup value in the table array range. Check that the lookup value exists in the first column for the VLOOKUP, or the first row for the HLOOKUP, in the range used to define the **Table_array** argument. You may also see this error code if you copy and paste the function and forget to put an absolute reference on the range used to define the **Table_array** argument. The **#REF!** error code indicates that the column index number or row index number exceeds the number of columns or rows in the range used to define the **Table_array** argument.

IFERROR

Follow-along file: Continue with Excel Objective 3.00. (Use file Excel Objective 3.16 if starting here.) Suppose your spreadsheet formulas have errors that you anticipate and don't need to correct, but you want to improve the display of your results. For example, when creating an invoice template you will want the invoice to look blank, but have the functions set up, so that when data is entered into the invoice, the invoice will correctly calculate the amount due. You will want the errors in the functions to not show as errors and not keep Excel from being able to perform the mathematical operations necessary in the invoice.

There are many reasons why formulas can return errors. For example, division by 0 is not allowed, and if you enter the formula =1/0, Excel returns #DIV/0. Error values include #DIV/0!, #N/A, #NAME?, #NULL!, #NUM!, #REF!, and #VALUE!.

Error Value	Description of Error
#DIV/0!	The formula or function contains a number divided by zero.
#NAME?	Excel doesn't recognize text in the formula or function, such as when the function name is misspelled.
#NULL!	A formula or function requires two cell ranges to intersect, but they don't.
#NUM!	Invalid numbers are used in a formula or function, such as text entered in a function that requires a number.
#REF!	A cell reference used in a formula or function is no longer valid which can occur when a cell used by the function was deleted from the worksheet.
#VALUE	The wrong type of argument is used in a function or formula, which can occur when you supply a range of values to a function that requires a single value.

There are several ways you can hide error messages you are expecting in a worksheet. You can hide error values by converting them to a number such as 0, and then applying a conditional format that hides the value, or by having what looks like a blank cell returned when an error is encountered.

Create an example error

1. Open a blank workbook, or create a new worksheet.

2. Enter 3 in cell B1, enter 0 in cell C1, and in cell A1, enter the formula =B1/C1. The #DIV/0! error appears in cell A1.

3. Select A1, and press F2 to edit the formula.

4. After the equal sign (=), type IFERROR followed by an opening parenthesis. IFERROR(

5. Move the cursor to the end of the formula.

6. Type ,0) – that is, a comma followed by a zero and a closing parenthesis. The formula =B1/C1 becomes =IFERROR(B1/C1,0).

7. Press Enter to complete the formula. The contents of the cell should now display 0 instead of the #DIV! error.

Apply the conditional format

1. Select the cell that contains the error, and on the Home tab, click Conditional Formatting. 2. Click New Rule.

3. In the New Formatting Rule dialog box, click Format only cells that contain.

4. Under Format only cells with, make sure Cell Value appears in the first list box, equal to appears in the second list box, and then type 0 in the text box to the right.

5. Click the Format button.

6. Click the Number tab and then, under Category, click Custom.

7. In the Type box, enter ;;; (three semicolons), and then click OK. Click OK again. The 0 in the cell disappears. This happens because the ;;; custom format causes any numbers in a cell to not be displayed. However, the actual value (0) remains in the cell.

Hide error values by turning the text white

Use the following procedure to format cells that contain errors so that the text in those cells is displayed in a white font. This makes the error text in these cells virtually invisible.

1. Select the range of cells that contain the error value.

2. On the Home tab, in the Styles group, click the arrow next to Conditional Formatting and then click Manage Rules. The Conditional Formatting Rules Manager dialog box appears.

- 3. Click New Rule. The New Formatting Rule dialog box appears.
- 4. Under Select a Rule Type, click Format only cells that contain.
- 5. Under Edit the Rule Description, in the Format only cells with list, select Errors.
- 6. Click Format, and then click the Font tab.
- 7. Click the arrow to open the Color list, and under Theme Colors, select the white color.

Hide error values by making the cell look empty

In the error example given above the formula =B1/C1, where the #DIV/0! error appeared in cell A1 we can use quoted in the IFERROR to show a blank cell. The function would then look like =IFERROR(B1/C1,""). The two quotes at the end of the IFERROR will make the cell look blank.

Key Takeaways

- Lookup functions are powerful and versatile tools because they eliminate the need to copy or recreate data that exists in other worksheets or workbooks.
- The VLOOKUP function will look vertically down the first column of the table array range to find the lookup value. The lookup value must exist in the first column of the table array range when using the VLOOKUP function.
- The HLOOKUP function will look horizontally across the first row of the table array range to find the lookup value. The lookup value must exist in the first row of the table array range when using the HLOOKUP function.
- If the **Range_lookup** argument for the VLOOKUP function is defined with the word *TRUE*, the data in the table array range must be sorted in ascending order (smallest to largest) based on the values in the first column.
- If the **Range_lookup** argument for the HLOOKUP function is defined with the word *TRUE*, the data in the table array range must be sorted in ascending order (smallest to largest), left to right, based on the values in the first row.
- If you are copying and pasting a VLOOKUP or HLOOKUP function to other cell locations on a worksheet, make sure there is name or an absolute reference placed on the table array range.
- IFERROR can be used in templates to hide the results of formulas that are in cells but not currently being used.

Sample VLOOKUP Exercise from Microsoft Copilot:

Scenario:

You are given a list of employees with their departments and salaries. You need to find the salary of an employee based on their name and department using the VLOOKUP function combined with the CONCATENATE function.

The CONCATENATE function in Excel is used to join two or more text strings into one string. This function is particularly useful when you need to combine data from different cells into a single cell.

Syntax:

CONCATENATE(text1, [text2], ...)

- text1 is the first text string to be joined.
- [text2], ... are additional text strings to be joined. You can include up to 255 text arguments.

Step-by-Step Instructions:

1. Create the Employee List Table:

• In cells A1 to C6, enter the following data:

	Α	В	С
1	Employee	Department	Salary
2	John Doe	HR	\$50,000
3	Jane Smith	IT	\$60,000
4	Emily Davis	Finance	\$55,000
5	Michael Brown	IT	\$65,000
6	Sarah Wilson	HR	\$52,000

2. Create the Lookup Tables:

• In cells F1 to H3, enter the following data:

	F	G	Н
1	Employee	Department	Salary
2	John Doe	HR	
3	Michael Brown	IT	

• In cells F6 to H8, enter the following data:

	F	G	Н
6	Employee	Department	Salary
7	John Doe	HR	
8	Sarah Wilson	HR	

3. Combine Employee and Department Columns:

- In cell D2, enter the following formula and drag it down to D6:
- =A2 & " " & B2
- This will create a combined column with the format "Employee Department".
- Autofit the column widths as appropriate.
- 4. Sort the table in ascending order by Employee. Your data in A1:D6 should now appear as:

Employee	Department	Salary	
Emily Davis	Finance	\$55,000	Emily Davis - Finance
Jane Smith	IT	\$60,000	Jane Smith - IT
John Doe	HR	\$50,000	John Doe - HR
Michael Brown	IT	\$65,000	Michael Brown - IT
Sarah Wilson	HR	\$52,000	Sarah Wilson - HR

5. Add Salary data to column E.

• Since the lookup value must be in the leftmost column of a table, and column D will be our lookup values, we must copy & paste the Salary data to cells E2:E6.

6. Use the VLOOKUP Function <u>without</u> CONCATENATE:

- In cell H2, enter the following formula:
- =VLOOKUP(F2, \$A\$1:\$C\$6, 2, FALSE)
- Drag the formula down from H2 to H3 to fill in the salaries for the employees.

7. Use the VLOOKUP Function <u>with</u> CONCATENATE:

- In cell H7, enter the following formula:
- =VLOOKUP(F7 & " " & G7, \$D\$1:\$E\$6, 2, FALSE)
- Drag the formula down from H7 to H8 to fill in the salaries for the employees.

Explanation:

- F7 & " " & G7 combines the employee name and department to match the format in the combined column.
- \$D\$1:\$E\$6 is the table array (the range of cells that contains the combined data and the salaries).

- 2 is the column index number (the column number in the table array from which to retrieve the value).
- FALSE specifies that you want an exact match.

Expected Result:

After completing the exercise, the salaries for the employees in the lookup table should be filled in as follows:

F	G	Н
Employee	Department	Salary
John Doe	HR	50000
Michael Brown	IT	65000
Employee	Department	Salary
John Doe	HR	50000
Sarah Wilson	HR	52000

This exercise demonstrated how to use VLOOKUP with multiple criteria by combining columns.

Chapter 4

Presenting Data with Charts

Chapter 1 "Fundamental Skills" provided a brief introduction to creating charts in Excel. This chapter provides more details for enhancing the appearance of your charts and addresses how to choose the best chart type for your data.

One of the most important things to consider when using charts in Excel is that they are intended to be used for communicating an idea to an audience. Your audience can be reading your charts in a written document or listening to you in a live presentation. In fact, Excel charts are often imported or pasted into Word documents or PowerPoint slides. This serves the purpose of communicating ideas to an audience. Although there are no rules set in stone for using specific charts for certain data types, some chart types are designed to communicate certain messages better than others. This chapter explores numerous charts that can be used for a variety of purposes. In addition, we will examine formatting charts and using those charts in Word and PowerPoint documents.

4.1 Choosing a Chart Type

LEARNING OBJECTIVES

- 1. Decide which chart type to use.
- 2. Construct a line chart to show a time series trend.
- 3. Learn how to adjust the Y axis scale.
- 4. Construct a line chart to present a comparison of two trends.
- 5. Learn how to use a column chart to show a frequency distribution.
- 6. Create a separate chart sheet for a chart embedded in a worksheet.
- 7. Construct a column chart that compares two frequency distributions.
- 8. Learn how to use a pie chart to show the percent of total for a data set.
- 9. Construct a stacked column chart to show how a percent of total changes over time.

This section reviews the most commonly used Excel chart types. To demonstrate the variety of chart types available in Excel, it is necessary to use a variety of data sets. Therefore, instead of addressing a specific theme, we will use a variety of themes. This is necessary not only to demonstrate the construction of charts but also to explain how to choose the right type of chart given your data and the idea you intend to communicate.

Before we begin, let's review a few key points you need to consider before creating any chart in Excel.

- The first is identifying your idea or message. It is important to keep in mind that the primary purpose of a chart is to present quantitative information to an audience. Therefore, you must first decide what message or idea you wish to present. This is critical in helping you select specific data from a worksheet that will be used in a chart. Throughout this chapter, we will reinforce the intended message first before creating each chart.
- The second key point is selecting the right chart type. The chart type you select will depend on the data you have and the message you intend to communicate. The table below describes how each chart type is used.

Line Chart:	The line chart is one of the most frequently used chart types because it is used to show trends over time. If your data is depicting changes over time, use a line chart.
Column Chart:	Column charts are typically used to compare several items in a specific range of values. Column charts should be used when comparing a single category of data between individual sub-items, such as, for example, when comparing revenue between products.
Clustered Column Chart:	A clustered column chart can be used when comparing multiple categories of data within individual sub-items as well as between sub-items. For instance, you can use a clustered column chart to compare sales for each quarter within each region, as well as between regions.
Stacked Column Chart:	A stacked column chart allows you to compare items in a specific range of values as well as show the relationship of the individual sub-items with the whole. For instance, a stacked column chart can show not only the overall revenue for each year, but also the proportion of the total revenue made up by each region.

Table 4.1 How to choose a chart type:

Pie Chart:	A frequently used chart is the pie chart. A pie chart represents the distribution or proportion of each data item over a total value (represented by the overall pie). A pie chart can only be used for one data series. i.e. sales by product for March or total sales for 2017 by product, etc.			
Combo Chart:	A combo chart is a visualization that combines two or more chart types into a single chart. Combination charts are an ideal choice when you want to compare two categories of each individual sub- item that would otherwise not present good visual data. They are commonly used to create visualizations that show the difference between targets versus actual results.			

- The third key point is identifying the values that should appear on the X and Y axes. One of the ways to identify which values belong on the X and Y axes is to sketch the chart on paper first. If you can visualize what your chart is supposed to look like, you will have an easier time using Excel to construct an effective chart that accurately communicates your message. Table 4.2 "Key Steps before Constructing an Excel Chart" provides a summary of these points.
- The fourth key point is determining how you can best label your chart to clearly explain to your audience the meaning of the message you are presenting. Your reader should be able to understand what the chart is presenting without having it explained to them.

Integrity Check - Carefully Select Data When Creating a Chart

Just because you have data in a worksheet does not mean it must all be placed onto a chart. When creating a chart, it is common for only specific data points to be used. To determine what data should be used when creating a chart, you must first identify the message or idea that you want to communicate to an audience.

Table 4.2 Key Steps before Constructing an Excel Chart

Step	Description				
1. Define your message.	Identify the main idea you are trying to communicate to an audience. If there is no main point or important message that can be revealed by a chart, you might want to question the necessity of creating a chart.				
2. Identify the data you need.	Once you have a clear message, identify the data on a worksheet that you will need to construct a chart. In some cases, you may need to create formulas or consolidate items into broader categories.				
3. Select a chart type.	The type of chart you select will depend on the message you are communicating and the data you are using.				
4. Identify the values for the X and Y axes.	After you have selected a chart type, you may find that drawing a sketch is helpful in identifying which values should be on the X and Y axes. (The X axis is horizontal, and the Y axis is vertical.)				

Line Chart

Follow-along file: Excel Objective 4.00

The first chart we will demonstrate is a line chart. Figure 4.1 "52 Week Data for the S&P 500 and Microsoft" shows part of the data that will be used to create two-line charts. The first line chart will show the trend of the S&P 500 stock index. This is an aggregate price index of five hundred of the largest publicly traded companies. This chart will be used to communicate a simple message: to show how the index has performed over a fifty-two-week period. We can use this chart in a presentation to show whether stock prices have been increasing, decreasing, or remaining constant over the designated period.

Before we create the line chart, it is important to identify why it is an appropriate chart type given the message we wish to communicate and the data we have. When presenting the trend for any data over a designated time period, the most commonly used chart type is the line chart. A column chart could be used, but is typically used to show comparative data rather than data over time. Given the four steps outlined above, let's determine how we will set up our line chart.

• **Define the message**: Our line chart will show the closing price for the S&P 500 over a 52-week period.

• **Define the data needed**: The data needed is the week and the closing price of the S&P 500.



5 20 A	rial	- 16 -)	A' A' =	- 2	1	General	4	
- Ja- 1	B I U -	⊞- ⊉-			-	\$ - % ,	€.8 .00 8.€ 00.	Cond Forma
A1	10	f Stork Tr	and Comparison	Augument	1. ja	Number	5.	
A	B	E	D E	F	G	н	1	1
52 W	Closing	June 20 Price	16 to June Change	in Price				
Week	S&P 500	MSFT	S&P 500	MSFT				
Wk1	1,091.60	25.05	0%	0%				
Wk2	1,117.51	25.82	2,4%	3.1%				
Wk3	1,076.76	23.95	-1,4%	-4.4%				
Wk4	1,022.58	22.72	-6.3%	-9.3%				
Wk5	1,077.96	23.70	-1.2%	-5.4%				
Wk6	1,064.88	24.30	-2.4%	-3.0%				
Wk7	1,102.66	25.20	1.0%	0.6%				
Wk8	1,101.60	25.20	0.9%	0.6%				
Wk9	1,121.64	24.95	2.8%	-0.4%				
Wk10	1,079.25	23.82	-1.1%	-4.9%				
Wk11	1,071.69	23.78	-1.8%	-5.1%			-	
Wk12	1,064.59	23,49	-2.5%	-6.2%			0	Data in 1
14/1-12	1,104.51	23.84	1.2%	-4.8%			be	e used to
VVKIJ								

Figure 4.1 52 Week Data for the S&P 500 and Microsoft

• **Select a chart type**. Since we are looking at the changes in closing price over a designated time period we will use a line chart which most clearly conveys changes over time.

• Identify the values on the X and Y axis. We will put the week number on the X axis because the audience is used to see a time-line progress horizontally and the closing price on the Y axis because it will show the price changes at each point in time.

The following steps explain how to construct this line chart:

1. Highlight the range A3:B55 on the Stock Trend worksheet. Note: Do not select more data than that needed to create a specific chart.

2. Click the Insert tab of the Ribbon. Note: When constructing a chart, you want to have the data labels included. The data labels in A3:B3 will be displayed on the chart and will help identify the data being presented.

3. Click the Line button in the Charts group of commands (see Figure 4.2 "Selecting the Basic Line Chart").

4. Click the first option from the list, which is a basic line chart. This adds, or embeds, the line chart to the worksheet, as shown in Figure 4.3 "Embedded Line Chart in the Stock Trend Worksheet".



Figure 4.2 Selecting the Basic Line Chart

Figure 4.3 "Embedded Line Chart in the Stock Trend Worksheet" shows the embedded line chart in the Stock Trend worksheet. Notice that three additional tabs, or contextual tabs, are added to the Ribbon. We will demonstrate the commands in these tabs throughout this chapter. These tabs appear only when the chart is activated.



Figure 4.3 Embedded Line Chart in the Stock Trend Worksheet

As shown in Figure 4.3 "Embedded Line Chart in the Stock Trend Worksheet", the embedded chart is not placed in an ideal location on the worksheet since it is covering several cell locations that contain data. The following steps demonstrate common adjustments that are made when working with embedded charts:

1. Moving a chart: Click and drag the upper left corner of the chart to the center of cell H2.

2. **Resizing a chart**: Place the mouse pointer over the left middle sizing handle, hold down the ALT key on your keyboard, and click and drag the chart so it "snaps" to the left side of Column H. Repeat step 2 to resize the chart so the top "snaps" to the top of Row 2, the bottom "snaps" to the bottom of Row 17, and the right side "snaps" to the right side of Column P.

3. **Adjusting the chart title**: Click the chart title once. In the formula bar type: 52 Week Closing Price Trend for the S&P 500. Hold the Alt key down and press Enter. This will add a second row to your title. Type June 2017to May 2018. Click Enter.

4. **Removing the legend**: (If the chart you just inserted does not contain a legend, skip this step.) Because the chart contains only one data series (the Closing Price) we will remove the legend because it is unnecessary. Click the legend once and press the DELETE key on your keyboard. This removes the legend from the chart. Once you remove the legend, the plot area automatically expands.

Figure 4.4 "Line Chart Moved and Resized" shows the line chart after it is moved and resized. You can also see that the title of the chart has been edited to read 52 Week Trend for the S&P 500. Also notice that the sizing handles do not appear around the perimeter of the chart. This is because the chart has been deactivated. To activate the chart, click anywhere inside the chart perimeter.



Figure 4.4 Line Chart Moved and Resized

Adjusting the Y Axis Scale

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.01 if starting here.) After creating an Excel chart, you may find it necessary to adjust the scale of the Y axis. Excel automatically sets the maximum value for the Y axis based on the data used to create the chart. However, the minimum value is usually set to zero. Depending on the data you are using to create the chart, setting the minimum value to zero can substantially minimize the graphical presentation of a trend. For example, the trend shown in Figure 4.4 "Line Chart Moved and Resized" appears to be increasing slightly. However, the S&P 500 increased by over 20% during this period, which is substantial. The presentation of this trend can be improved if the minimum value started at eight hundred. While it is certainly possible for the S&P 500 to fall below eight hundred, it is most likely remote. The following steps explain how to make this adjustment to the Y axis:

1. Right click anywhere on the Y axis on the 52 Week Trend for the S&P 500 line chart (Stock Trend worksheet) and select Format Axis.

2. The Format Axis dialog box will appear on the right of your worksheet.

3. In the Axis Options Window, click in the Minimum box and change the minimum value to be displayed on the Y axis from 0 to 1000. This will eliminate white space on your chart that adds no visual value. Press the tab key to display the change in your chart.

4. Because we are dealing in whole numbers we will adjust the values on the Y axis to display with no decimal places. Click on the Number label to expand the Number menu. Under Decimal places, change the value from 2 to 0.

Figure 4.5 Format Axis Dialog Box



Figure 4.6 "Adjusted Y Axis for the S&P 500 Chart" shows the change in the presentation of the trendline. Notice that with the Y axis starting at 1,000, the trend for the S&P 500 is more pronounced and reflects the substantial increase over the 52-week period. This adjustment makes it easier for the audience to see the magnitude of the trend. *Figure 4.6 Adjusted Y Axis for the S&P 500 Chart*



Skill Refresher - Adjusting the Y Axis Scale

- 1. Right click anywhere along the Y axis to activate it and select Format Axis from the drop-down quick menu.
- 2. In the Format Axis dialog box, click in the input box next to the desired axis option and then type the new scale value.
- 3. Click on the Number format to expand the Number format options. Change the number of decimal places, or number format to better convey your information.
- 4. Click the X button at the top of the Format Axis dialog box.

Line Chart 2: Trend Comparisons Over Time

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.02 if starting here.) We will now create a second line chart using the data in the Stock Trend worksheet. The purpose of this chart is to compare two trends:

- the change in value for the S&P 500 and
- the change in value of a single stock Microsoft common stock.

Chapter 3 "Logical and Lookup Functions" presented a personal investment portfolio where the investments were compared to a benchmark. The S&P 500 is a benchmark that is commonly used to judge the performance of individual stocks. The purpose and message of this chart is to show whether Microsoft is performing better or worse than the S&P 500 index. This type of analysis can be used as a visual tool to determine whether a stock should be sold, purchased, or held.

Before creating the chart to compare the S&P 500 and Microsoft, it is important to review the data in the range E4:F55 on the Stock Trend worksheet. For a simple line chart, we cannot use the price data for Microsoft and the S&P 500 because the values are not comparable. That is, the data for Microsoft is in a range of \$22.00 to \$28.00, but the data for the S&P 500 is in a range of \$1,022 to \$1,363. If we used these values to create a chart, we would not be able to see any substantial change in the trend for either the S&P 500 or Microsoft. Therefore, formulas were used to calculate the percent change in value for the S&P 500 and Microsoft for each week. For example, looking at cells E5 and F5 on the Stock Trend worksheet, you see that the S&P 500 increased 2.4% in week 2, whereas Microsoft increased 3.1%. The percent change calculations now provide an appropriate method of comparison. This is a very important step to consider when comparing trends.

```
The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted
```

The construction of this second line chart will be like the first line chart. The X axis will be the 52 weeks in the range A4:A55. However, the Y axis will be the percentages in the range E4:F55. This creates a problem because Columns B, C, and D will not be used in this chart. Therefore, we cannot simply highlight one contiguous range of cells to create the chart. In this chapter, we will demonstrate two options for charting data that is not in a contiguous range. The following steps demonstrate the first option:

- 1. Highlight the range A3:A55 on the Stock Trend worksheet.
- 2. Hold down the CTRL key on your keyboard and highlight the range E3:F55.
- 3. Click the Insert tab of the Ribbon.
- 4. Click the Line button in the Charts group of commands.
- 5. Click the first option from the list, which is a basic line chart.

Figure 4.7 "Trend Comparison Line Chart" shows the appearance of the line chart comparing the S&P 500 and Microsoft before it is moved and resized.



Figure 4.7 Trend Comparison Line Chart

6. Move the chart so the upper left corner is in the middle of cell H20.

7. Resize the chart so the left side is locked to the left side of Column H, the right side is locked to the right side of Column P, the top is locked to the top of Row 20, and the bottom is locked to the bottom of Row 35.

8. Click the Design tab in the Chart Tools section of the Ribbon.

9. Click the drop-down next to the Add Chart Element. Select Chart Title from the dropdown list. Chart. Because there is a lot of white space above the line chart we will select the Above Chart option from the drop-down list (see Figure 4.8 "Adding a Title to a Chart"). This adds a generic title above the plot area of the chart.

10. While the title box is selected, click in the formula bar and type 52 Week Trend - S&P 500 and Microsoft Comparison, alt Enter to add a new row to the chart title and then type June 2016 – June 2017. When you hit enter the new chart title will appear in the Chart Title box.

⊟্চ্∙∂⊸ Excel_Objective_4.02 - Excel File Home Insert Draw Page Layout Formulas Data dn ••• . Add Chart Quick Change Element * Layout * Colors Chart Styles Axes dh db Axis Titles ► Chart Title None Idin н dib Data Labels ⊧ 1,400 Data Table Above Chart Error Bars 1,350 Gridlines Centered Overlay 1,300 -¶h[⊞] <u>L</u>egend More Title Options... 1,250 2 Lines Title -3.0% Trendline 1,200 0.6% Axis . 0.6% 1,150 0.9% 11

Figure 4.8 Adding a Title to a Chart

11. To reposition the X axis labels so that the trend lines are not over lapping the axis and hiding the weeks, click anywhere on the weeks to activate the X axis. Right click and select Format Axis from the drop-down menu. Click on Labels, then Label Position. Choose Low to position the weeks below the lowest value in the chart.

Figure 4.9 "Final Trend Comparison Line Chart" shows that Microsoft has not performed as well as the S&P 500 benchmark. From week 31 to week 52, Microsoft is showing a significant decline compared to the S&P 500, which continues to grow. What makes this chart effective is that an audience can quickly see how Microsoft compares with the S&P 500 over the 52-week period.





Column Chart 1: Frequency Distribution

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.03 if starting here.)

A professor at the school wants to chart the performance of his students in his class based on the grades earned during the class. He decides to use a column chart to show the results because column charts are typically used to compare several items, (in this case the grade distribution,) over a specific range of values, (the number of students in his class.). Column charts should be used when comparing a single category of data between individual subitems.

In column charts, categories are typically organized along the horizontal axis and values along the vertical axis. For example, in Chapter 1 "Fundamental Skills" we showed a sales trend over a twelve-month period.

Another common use for column charts is frequency distributions. A frequency distribution shows the number of occurrences by established categories. For example, a common frequency distribution used in most academic institutions is a grade distribution. A grade distribution shows the number of students that achieve each level of a typical grading scale (A, A–, B+, B, etc.). The Grade Distribution worksheet contains the final grades for the professor's academic class. To show the grade frequency distribution, the numbers of students appear on the Y axis and the grade categories appear on the X axis. The following steps explain how to create this chart:

1. Highlight the range A3:B8 on the Grade Distribution worksheet. Column B shows the number of students that achieved a grade within the grade category shown in Column A.

2. Click the Column button in the Charts group section on the Insert tab of the Ribbon. Select the first format from the drop-down list of options, which is the Clustered Column format.

3. Click and drag the chart so the upper left corner is in the middle of cell H2.

4. Resize the chart so the left side is locked to the left side of Column H, the right side is locked to the right side of Column P, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 16.

5. From the Chart Tools Design ribbon add a Y axis title to explain what the Y axis is referring to. Click the drop-down arrow next to Add a Chart Element and select Axis Titles, then select Primary Vertical Axis. While the axis title is still selected, click in the Formula bar and type Number of Students. Then click Enter.

6. Click the title of the chart to activate the title box.

7. In the formula bar type the following in front of the word Class: Final Grades for the Class.

8. Click any cell location on the Grade Distribution worksheet to deactivate the chart.

Figure 4.10 "Grade Frequency Distribution Chart" shows the completed grade frequency distribution chart. By looking at the chart, you can immediately see that the greatest number of students earned a final grade in the B+ to B- or the C+ to C- categories.



Figure 4.10 Grade Frequency Distribution Chart

Why?

Column Chart vs. Bar Chart

When using charts to show frequency distributions, the difference between a column chart and a bar chart is really a matter of preference. Both are very effective in showing frequency distributions. However, if you are showing a trend over a period of time, a column chart is preferred over a bar chart. This is because a period of time is typically shown horizontally, with the oldest date on the far left and the newest date on the far right. Therefore, the descriptive categories for the chart would have to fall on the X axis, which is the configuration of a column chart. On a bar chart, the descriptive categories are displayed vertically along the Y axis.

Moving a Chart to a Chart Sheet

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.04 if starting here.)

The charts we have created up to this point have been added to, or embedded in, an existing worksheet. Charts can also be placed in a dedicated worksheet called a chart sheet. It is called a chart sheet because it can contain only an Excel chart. Chart sheets are useful if you need to create several charts using the data in a single worksheet. If you embed several charts in one worksheet, it can be cumbersome to navigate and browse through the charts. It is easier to browse through charts when they are moved to a chart sheet because a separate sheet tab is added to the workbook for each chart. The following steps explain how to move the grade frequency distribution chart to a dedicated chart sheet:

1. Click anywhere on the Final Grades for the Class chart on the Grade Distribution worksheet.

2. Click the Move Chart button in the Design tab of the Chart Tools set of commands. This opens the Move Chart dialog box. You can use this dialog box to move the chart to a different worksheet or create a dedicated chart sheet.

3. Click the New sheet option on the Move Chart dialog box.

4. The entry in the input box for assigning a name to the chart sheet tab should automatically be highlighted once you click the New sheet option (see Figure 4.11 "Moving a Chart to a Chart Sheet"). Type Class Grades. This replaces the generic name in the input box.

5. Click the OK button at the bottom of the Move Chart dialog box. This adds a new chart sheet to the workbook with the name Class Grades.

Figure 4.11 Moving a Chart to a Chart Sheet

⊟ 5 • ♂ - ∓	Excel_Objective_4.03 - Excel	Chart Tools Design Tab -
File Home Insert	Draw Page Layout Formulas Data Review Vie	w Design Format o A
Add Chart Quick Element * Layout* Chart Layouts	Chart Styles	Switch Row/ Select Column Data Data 7 ×
D E ibution	Choose where you want the chart to be placed:	L M N O P Click here to move a
2 Percent Compariso 3 Class Coll	C Qbject in: Grade Distribution	Cancel Select New Sheet and

Figure 4.12 "Chart Sheet Added to the Workbook" shows the Final Grades for the Class column chart in a separate chart sheet. Notice the new sheet tab added to the workbook matches the tab name entered into the Move Chart dialog box. Since the chart is moved to a separate chart sheet, it no longer is displayed in the Grade Distribution worksheet.



Figure 4.12 Chart Sheet Added to the Workbook

Clustered Column Chart: Frequency Comparison

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.05 if starting here.)

Next, the professor would like to see how the students in his class students compared to all the students taking the course at the school. We will create a second column chart to show a comparison between two frequency distributions. Column C on the Grade Distribution worksheet contains data showing the number of students who received grades within each category for the entire college. We will use a clustered column chart to compare the grade distribution for the class (Column B) with the overall grade distribution for the college (Column C).

However, since the number of students in the class is significantly different from the total number of students in the college, we must calculate percentages to make an effective comparison. The following steps explain how to calculate the percentages:

1. Highlight the range B9:C9 on the Grade Distribution worksheet.

2. Click the AutoSum button in the Editing group of commands on the Home tab of the Ribbon. This automatically adds SUM functions that sum the values in the range B4:B8 and C4:C8.

3. Activate cell E4 on the Grade Distribution worksheet.

4. Enter a formula that divides the value in cell B4 by the total in cell B9. Add an absolute reference to cell B9 in the formula =B4/\$B\$9.

5. Copy the formula in cell E4 and paste it into the range E5:E8 using the Paste Formulas command.

6. Activate cell F4 on the Grade Distribution worksheet.

7. Enter a formula that divides the value in cell C4 by the total in cell C9. Add an absolute reference to cell C9 in the formula =C4/\$C\$9.

8. Copy the formula in cell F4 and paste it into the range F5:F8 using the Paste Formulas command.

Z	1-17-0					1	Excel Ob	jective 4.00	- Micros	oft Ex	Hon	ne tab				
	Re H	2073 - 1 15	ert Page 1.6)	Nunt Form	ulas Data	Review	View									۵ 🕜
A	X	Arial	+ 12	- A' A	= = ,	.	B	General			1			Ewinsert *	E · A	A 1
	- 3	BZ	<u>u</u> • 🖾 •	3-A		= i# i#	圈.	\$ - %	• *.0	.48 4.5	Conditional Formatting	Format as Table *	Cell Styles +	Forma -	2. Sor	tás ∓ind ás r ≠ Select ≠
CR	oboard 🖓	-	Fant	1.5	40	grument	- Se	Jaun	ber	164		Styles		fin	Ed	iting
-	C9	- (Ja u	SUM(C4:C8)				1		-			Auto	oSum button		1
4	A	P	C L	1	5	6	.11	1	1		6 1				(P)	Q
1		Gra	de Distrit	oution		Sum f	unction	in cell C9								
2		Num	iber of dents	Pe Com	rcent parison	addec	d using A	lutoSum.								
3	Grade	Class	College	Class	College											
4	A to A-	16	500	19.5%	25.0%											
5	B+ to B-	26	600	31.7%	30.0%	The	percenta	iges added	in the							
6	C+ to C-	25	500	30.5%	25.0%	> ran	ige E4:F8	3 will be use	d to							
7	D+ to D-	10	300	12:2%	15.0%	0	reate the	column ch	art.							
8	F	5	100	6,1%	5.0%											
.9		82	2000													
10																

Figure 4.13 Completed Grade Distribution Percentages

Figure 4.13 "Completed Grade Distribution Percentages" shows the completed percentages added to the Grade Distribution worksheet. The column chart uses the grade categories in the range A4:A8 on the X axis and the percentages in the range E4:F8 on the Y axis. Like the trend comparison line chart, this chart uses data that is not in a contiguous range. This method is more cumbersome then the first method presented but provides an excellent learning example of how to edit your chart data. The following steps explain a second method for creating charts with data that is not in a contiguous range:

1. Activate cell H2 on the Grade Distribution worksheet. It is important to note that this is a blank cell that is not adjacent to any data on the worksheet.

2. Click the Insert tab of the Ribbon.

3. Click the Column button in the Charts group of commands. Select the first option from the drop-down list of chart formats, which is the Clustered Column. This adds a blank chart to the worksheet.

4. Click and drag the blank chart so the upper left corner is in the middle of cell H2.

5. Resize the blank chart so the left side is locked to the left side of Column H, the right side is locked to the right side of Column P, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 16.

6. Click the Select Data button in the Design tab of the Chart Tools section of the Ribbon. This opens the Select Data Source dialog box.

7. Click the Add button on the Select Data Source dialog box. This opens the Edit Series dialog box.

8. In the Series name input box on the Edit Series dialog box, type the word Class.

9. Press the TAB key on your keyboard to advance to the Series values input box on the Edit Series dialog box.

10. Highlight the range E4:E8 on the Grade Distribution worksheet. This automatically adds the range to the Series values input box. You also see bars added to the column chart (see Figure 4.14 "Completed Data Series for the Class Grade Distribution").

11. Click the OK button on the Edit Series dialog box.

Ed	dit Series ialog box	-		Frit Serie			e	10100	1	Bars will appear on the chart
1		Gra	de l	Series par	*					to the Edit Series dialog box.
		Nurr	iber c	Class		19	= Cietel			Class
2		Stu	dents	Series yalu	es:					Class
3	Grade	Class	Coll	='Grade D	intribution'igEg4.5	E\$8 1	= 19.5%, 31.7%,			
4	A to A-	16					OK N	Cancel	-	*
5	B+ to B-	26	1	000	91.1.90		- Her	1		
6	C+ to C-	25		500	30.5%	25.0%	25.0%			
1	D+ to D-	10		300	12.2%	15.0%	20.0%			
8	F	5		100	6.1%	5.0%	10.04			
9		82		2000			15.0%			
10	1						10.0%	-		

Figure 4.14 Completed Data Series for the Class Grade Distribution

12. Click the Add button on the Select Data Source dialog box.

13. In the Series name input box on the Edit Series dialog box, type the word College.

14. Press the TAB key on your keyboard to advance to the Series values input box on the Edit Series dialog box.

15. Highlight the range F4:F8 on the Grade Distribution worksheet. This automatically adds the range to the Series values input box. You also see bars added to the column chart.

16. Click the OK button on the Edit Series dialog box.

17. Click the Edit button on the right side of the Select Data Source dialog box under the Horizontal (Category) Axis Labels section. This is used to define the labels that will appear on the X axis of the chart and opens the Axis Labels dialog box.

18. Highlight the range A4:A8 on the Grade Distribution worksheet. This adds the range to the Axis Labels dialog box, and the labels appear on the X axis on the column chart (see Figure 4.15 "Final Settings for the Select Data Source Dialog Box").

19. Click the OK button on the Axis Labels dialog box.

20. Click the OK button on the Select Data Source dialog box.



Figure 4.15 Final Settings for the Select Data Source Dialog Box

21. Click the drop-down next to the Add Chart Element. Select Chart Title from the dropdown list. Chart. Because there is a lot of white space above the line chart we will select the Above Chart option from the drop-down list (see Figure 4.8 "Adding a Title to a Chart"). This adds a generic title above the plot area of the chart.

22. Click in the text box containing the chart title. Delete the generic chart title and replace it with the following: Grade Distribution Comparison.

23. From the Add Chart Element drop-down, select Legend, Bottom. This places the legend below the chart which does not compress the chart size as much as if it were placed on the sides.

Figure 4.16 "Completed Grade Distribution Column Chart" shows the final appearance of the clustered column chart. The clustered column chart is an appropriate type for this data because there are fewer than twenty data points and we can easily see the comparison for each category. An audience can quickly see that the class issued fewer A's compared to the college. However, the class had more B's and C's compared with the college population.



Figure 4.16 Completed Grade Distribution Column Chart

Selecting Non-Contiguous Ranges:

The previous steps walked you through how to create a chart "from scratch" by building all the data series within the Select Data Source dialog box. A quicker method to build a chart using non-contiguous ranges is to select the first range, typically the row with labels, hold down the Ctrl key and select any other cells you want to chart.

Figure 4.16b Selecting Non-contiguous Ranges



Integrity Check - Too Many Bars on a Column Chart?

Although there is no specific limit for the number of bars you should use on a column chart, a general rule of thumb is twenty bars or less. Figure 4.17 "Poor Use of a Column Chart" contains a total of thirty-two bars. This is considered a poor use of a column chart because it is difficult to identify meaningful trends or comparisons. The data used to create this chart might be better used in two or three different column charts, each with a distinct idea or message.



Figure 4.17Poor Use of a Column Chart

Combo Chart: Non-comparative values

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.06 if starting here.) Remember, when building the second frequency chart above we created percentages to create a chart that had comparative value. However, we do have a chart type that can take disparate values like those of comparing a class to the college as a whole. This chart is the Combo chart. It uses both columns and lines to display data in such a way that it can be meaningful. The combo chart uses the vertical Axis to convey meaning to the data being presented. We will create a Combo chart to show a comparison between two frequency distributions. Column C on the Grade Distribution worksheet contains data showing the number of students who received grades within each category for the entire college. We will use a column chart to compare the grade distribution for the class (Column B) with the overall grade distribution for the college (Column C).

However, since the number of students in the class is significantly different from the total number of students in the college, we will make the class grades a column chart and the college grades a line chart. The steps to do this are:

1. On the Grade Distribution worksheet, highlight the range B3:C8

2. From the Insert ribbon click on Recommended Charts, then select the All Charts tab, and then Combo Chart.

Insert Chart		? ×
Recommended Ch	arts All Charts	
 ✓ Recent ✓ Template ✓ Column ✓ Line ④ Pie ⑥ Bar ▲ Area ※ Area ※ X Y (Scatt ▲ Stock Ø Surface ※ Radar ① Treemap ④ Sunburst ➡ Histogram 	r) Clustered Column - Line Chart Title Chart Title Chart Title Chart Chart Char	
iii Box & Wh 回 Waterfall 〒 Funnel	sker Series Name Choose the chart type and axis for your data series: Chart Type Clustered Column Clustered Column Line V	Secondary Axis
	ОК	Cancel

Figure 4.18 Insert Combo Chart

3. You'll notice that our chart example looks a bit strange. We need to define which series will be the line and which will be the clustered column. We will take the default selected here, but the chart types can be change by using the drop-down next to each chart type.

4. Next, we need to tell Excel which series we want to be our secondary vertical axis. The values for this axis will show on the left side of the chart and the values for the primary will show on the right. We will select the line chart to be our secondary axis.

5. You will see the chart example change so that now there is a meaningful chart showing. Click the OK button.

6. Next, we will put in our vertical axis titles so the chart is easier to read. From the Chart Tools Design ribbon, Add Chart Element, select Axis Titles and Primary Vertical Axis.

7. With the Axis Title box active, type Class Students in the Formula bar and hit Enter.

8. Now we will add the secondary vertical axis following the same steps above, excepting selecting Secondary Vertical Axis.

9. With the Axis Title box active, type College Students in the Formula bar and hit Enter.

10. We will rotate the College Students axis label by going to the Home ribbon and in the Alignment section rotate the text down.

E	5 •∂-		Đ	cel_Objective_4.0	6 - Excel			Cha	rt Tools	
Fil	e Home	Insert	Draw Page Lay	out Formula	ıs Data	Review	View	Design	Format	© Tel
Past	Calib	rri (Body) ▼ I <u>U</u> ▼ Font	10 • A A •		Angle Court Angle Clock Angle Clock	ap Text Iterclockwise cwise t	Gene	eral % Number	▼ .00 0.09 .00 ⇒.0	⊂ ≠ Condition Formatting
Cha	A A	E _ × √	f _x C) E	Rotate Text	<u>U</u> p <u>D</u> own		н	I.	J
7 8	D+ to D- F	10 5	300 100	12.29 6.1%	Format Cell	Alignment	20.0	%		
9		82	2000				15.0	%		
10							10.0	%		_
11 12 13							5.0	%		
14							0.0	/0	A to A	-

Figure 4.19 Rotating Text in Secondary Axis



Figure 4.19 Completed Clustered Column and Combo Charts



Pie Chart: Percent of Total

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.07 if starting here.) The Health Care worksheet contains data that shows total spending in the United States for the years 1975 and 2015. In 1975, the total amount spent in the United States for health-related expenses was over \$135 billion. The total amount spent in 2015 was over \$3.2 trillion.

The next chart we will demonstrate is a pie chart. A pie chart is used to show a percent of total for a data set at a specific point in time. In the case of our health care data, you can choose either the 1975 data, the 2015 data, or the total spent for the two time periods. You cannot use a pie chart to chart all three columns.

The data we will use to demonstrate a pie chart is related to the overall spending activity in the health-care industry for 1975. The pie chart shows how this \$135 billion was funded. The following steps explain how to accomplish this:

	А		В	С
	US Health Care Sp	oend	ding by So	ource
1	(in mil	lion	s)	
2			1975	2015
3	Out of pocket	\$	37,262	\$ 338,150
4	Health Insurance		66,330	2,384,525
5	Other Third Parties		14,547	247,224
6	Public Health Activity		2,967	80,926
7	Investment		12,177	154,732
8	Total	\$	135,258	\$ 3,207,572

1. Highlight the range A2:B7 on the Health Care worksheet.

2. Click the Insert tab of the Ribbon.

3. Click the Pie button in the Charts group of commands.

4. Select the "3-D Pie chart" option in the middle section of drop-down list of options.

5. Click and drag the pie chart so the upper left corner is in the middle of cell E2.

6. Resize the pie chart so the left side is locked to the left side of Column E, the right side is locked to the right side of Column M, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 17 (see Figure 4.18 "Pie Chart Moved and Resized").

rigure 4.16 Fie Chart Movea and Resize	Figure 4.18 Pie	Chart	Moved	and	Resized
--	-----------------	-------	-------	-----	---------

E	. რ.	<i>∂</i> - ∓						Excel_Objec	tive_4.07 - Excel				Kaaren McC	ilynn 🖭
File		Home Inser	t Draw	Page Layout	Formulas	Data	Review	View	Q Tell me what y	you want to c				
Past Clipto	eard n	Arial B I U	- 12 - ⊞ - ⊅ Font	A* A* ≡ • ▲ • ≡		- 🔐 V • 🖬 🖬 N Jignment	/rap Text flerge & Cente	Gene s - \$ -	ral	Conditio Formattin	nal Format as ng * Table * Styles	Cell Ins Styles *	ert Delete Form Cells	at ∑ · A Z Sort Filte Edit
		В	C		D	E	F	G	Н	I	J	K	L	М
1	ions)	ing by So)	ource											
2 3	\$	1975 37,262	\$ 33	2015 8,150						1975				
4 5		66,330 14,547	2,38	4,525 7,224										
6		2,967	8	0,926										
8	\$	135,258	\$ 3,20	7,572										
10														
11														
13 14														
15 16 17						= Out	ofpocket	Health In	surance • Oth	er Third Par	rties = Publ	ic Health Act	ivity Investr	nent
18	Þ	Class Gr	ades Gra	de Distributio	n Health	Care	Supply & Der	nand	(+)	: 4	•			

7. Click the chart legend once and press the DELETE key on your keyboard. A pie chart typically shows labels next to each wedge. Therefore, the legend is not needed.

8. Click the Add Chart Element button on the Design tab of the Chart Tools section of the Ribbon and select Data Labels from the drop-down list.

9. Select More Data Label Options from the drop-down list. This opens the Format Data Labels dialog box.

10. Click the box next to the Value option under the Label Options section in the Format Data Labels dialog box. This removes the check mark.

11. Click the Percentage option under the Label Options section in the Format Data Labels dialog box. A green check should appear in the box next to this option.

12. Click the Category Name option under the Label Options section in the Format Data Labels dialog box. A check should appear in the box next to this option.

13. Click the Close button at the top of the Format Data Labels dialog box.

14. Click the Home tab of the Ribbon and then click the Bold button. This should bold the data labels on the pie chart.



Figure 4.19 Final Settings in the Format Data Labels Dialog Box

15. This is looking better, but some of our data labels are overlapping. We will correct that by rotating our 3-D chart. While the chart is still selected, right click and select 3-D rotation from the drop-down menu. Note: Only 3-D charts can be rotated.

	678			
	NCM .			
4 3-D Rotation	n			
Presets				- [
X Rotation	180*	0	$\mathbf{>}$	2
Y Rotation	30*	0	÷	$\widehat{\Psi}$
Z Rotation	0*	0	ð	G,
	T. cont.			

16. From the 3-D Rotation format area, rotate the X rotation by 180 degrees. Close the Format Chart Area options.

17. Make the chart title active by clicking on the 1975.

18. Click in front of the year 1975 and type Health Care Spending by Source.
Figure 4.20 "Final Health Care Pie Chart" shows the completed pie chart. You can quickly see that Health Insurance and Out of Pocket made up the majority of health-care spending in 1975. Like the column chart, the key to creating an effective pie chart is the number of categories presented on the chart.

Although there are no specific limits for the number of categories you can use on a pie chart, a good rule of thumb is ten or less. As the number of categories exceeds ten, it becomes more difficult to identify key categories that make up the majority of the total. In this example, it is easy to see that two categories compose 75% of the total. *Figure 4.20 Final Health Care Pie Chart*



Skill Refresher - Inserting a Pie Chart

- 1. Highlight a range of cells that contain one set of data you will use to create the chart.
- 2. Click the Insert tab of the Ribbon.
- 3. Click the Pie button in the Charts group.
- 4. Select a format option from the Pie Chart drop-down menu.

Stacked Column Chart: Percent of Total Trend:

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.07 if starting here.) The last chart type we will demonstrate is the stacked column chart. We use a stacked column chart to show how a percent of total changes over time. For example, the data on the Health Care worksheet shows spending by source for 1975 and 2015. A stacked column chart can show whether there is any change in the percent of total for each source between the two years. Remember that with a pie chart we are limited to one data series only. In a stacked column chart, we can have multiple data series and use them for comparative purposes.

On the stacked column chart the Y axis of the chart shows the percentage from 0% to 100%. The X axis shows the two years: 1975 and 2015. The following steps explain how to create this chart:

1. Highlight the range A2:C7 on the Health Care worksheet. Note: never include the total row or column unless that is the only data you are charting.

2. Click the Insert tab of the Ribbon.

3. Click the Column button in the Charts group of commands. Select the 100% Stacked Column format option from the drop-down list (see Figure 4.21 "Selecting the 100% Stacked Column Format").

E	1 St 1 1			Excel, Objective, 4.07 - Excel
	a Hore Inert Daw Pagel	eyind formulas 0	iata Review Varie	Q Tell me what you want to do
Paret	Table Reconvenient Table Profiles Online States	Shapen dhe shapen dhe ditters	dd ino - 🖬 Factorian dd no	All Long and All L
Ch.	A ≻ < 1 * €H			3-0 Cohame 1005 Sockad Conversion 1005 Sockad Type the Compare the percentage that Sockad Type the Compare the percentage that
4	A	B	C	2-D Bar each value contributes changes invertience
1	US Health Care S (In m	pending by So (Illions)	ource	288
2		1970	2015	3-0 Bar
3	Out of pocket	\$ 37,262		6 9 9
4	Health Insurance	66.330	100%	
5	Other Third Parties	14,547	30%	More Column Charts
6	Public Health Activity	2,967	80%	
7	Investment	12,177	70%	
8	Total	\$ 135,258	50%	
9		0	40%	
10			20%	
11			10%	
12			0%	
13		1	Out of pocket	Health Insurance Other Third Public Health Investment
14	and the second se			cariata arcanth
12	Source: CMS.Roy			■ 1975 ■ 2015

Figure 4.21 Selecting the 100% Stacked Column Format

Figure 4.22 "Initial Construction of the 100% Stacked Column Chart" shows the column chart that is created after selecting the 100% Stacked Column format option. As mentioned, the goal of this chart is to show the percentages on the Y axis and the years 1975 and 2015

on the X axis. However, notice that Excel places the spend sources on the X axis. The remaining steps explain how to correct this problem and complete the chart: *Figure 4.22 Initial Construction of the 100% Stacked Column Chart*

	Excel_Ot	jective_4.07 - Exc	el	a	hart Tools					Kaaren McGlyn
Draw	Page Layout	Formulas (Data Review Vie	w Design	n Format	🛛 Tell me what you	want to do			
ШĮ	III		Chart Styles	<u>]</u>	UŢU I		Swite Co	h Row/ Select lumn Data	Change Chart Type Type Locatio	
√ fx		R	6	Click	k here to gories to	move the l the X axis	egend and the],		K 1
alth Ca	are Spend (in million:	ding by So	ource	o Yax	is catego	ries to the	o o art Title			°+
	1	1975	2015			en	are mee			1
	\$	37,262	\$ 338,150	90%						
		66,330	2,384,525	80%	_					Y
95		14,547	247,224	70%						
ivity		2,967	80,926	60%						
		12,177	154,732	0 40%						
	\$	135,258	\$ 3,207,572	30% 20% 10%						
				0%	Out of pocket	Health Insurance	Other Third Parties	Public Health Activity	Investment	
				0		2079	975 Excel on t	l placed th he X axis intention	e spend ca which is N of this cha	tegories OT the art

4. Click the Switch Row/Column button in the Design tab on the Chart Tools section of the Ribbon. This reverses the legend and current X axis categories.

5. Click and drag the chart so the upper left corner is in the middle of cell E19.

6. Resize the chart so the left side is locked to the left side of Column E, the right side is locked to the right side of Column N, the top is locked to the top of Row 19, and the bottom is locked to the bottom of Row 37.

7. Click the legend one time and press the DELETE key on your keyboard.

8. Click the Layout tab on the Chart Tools section of the Ribbon.

9. Click the Add Chart Element and select Data Table with Legend Keys option from the drop-down menu. This is another way of displaying a legend for a column chart along with the numerical values that make up each component. Note: It is generally better to not include the data table in your charts as it clutters more than helps. In this example, it is appropriate.

1	Fil	e Home		Insert	Draw	Page Layout	For
	Add Elem	Chart Quick	Cł	hange			10000
	ldh	A <u>x</u> es	۲				
5	Ш	<u>A</u> xis Titles	۲	×	√ f×		
	đb	<u>C</u> hart Title	۲				
1	dis	<u>D</u> ata Labels	۲				
	<u>ldh</u>	Data Ta <u>b</u> le	۲	Idos	Nene		F
1	άb	Error Bars	۲	HE X	None		
ł	11	<u>G</u> ridlines	۲	hin	With Leas	and Keys	
ł	db ^{III}	Legend	۲	:22	<u></u>		
	Ø	L <u>i</u> nes	۲	dh	No <u>L</u> egen	d Keys	
	1	Trendline	×				
1	04	<u>U</u> p/Down Bars	×	M	ore Data Ta	ble Options	
	10						

10. Click in the chart title button in the Layout tab of the Chart Tools section of the Ribbon.

11. Select the Above Chart option for the drop-down menu.

12. Click the chart title two times. Delete the generic chart title name and type Change in Health Care Spend Source.

Figure 4.23 "Final 100% Stacked Column Chart" shows the final stacked column chart. Notice that the Out-of-Pocket category, or the amount of cash people paid for health-care expenses, decreased significantly from 1975 to 2015. However, the Health Insurance category increased significantly from 1975 to 2015.

Overall, the chart shows that the total out-of-pocket and health insurance expense increased significantly from 1975 to 2015. These two categories made up approximately 77% of total health-care spending in 1975. By 2015, these two categories increased to over 85% of total health-care spending.

Figure 4.23 Final 100% Stacked Column Chart



@ 080

Skill Refresher - Inserting a Stacked Column Chart

- 1. Highlight a range of cells that contain data that will be used to create the chart.
- 2. Click the Insert tab of the Ribbon.
- 3. Click the Column button in the Charts group.
- 4. Select the Stacked Column format option from the Column Chart drop-down menu to show the values of each category on the Y axis. Select the 100% Stacked Column option to show the percent of total for each category on the Y axis.

Key Takeaways

- Identifying the message you wish to convey to an audience is a critical first step in creating an Excel chart.
- Both a column chart and a line chart can be used to present a trend over a period of time. However, a line chart is preferred over a column chart when presenting data over long periods of time.
- The number of bars on a column chart should be limited to approximately twenty bars or less.
- For column, line, and bar charts, the X axis can be used only for labels, not for numeric values. The exception is dates in the X axis.
- When creating a chart to compare trends, the values for each data series must be within a reasonable range. If there is a wide variance between the values in the two-data series (two times or more), the percent change should be calculated with respect to the first data point for each series, or use a Combo chart.
- When working with frequency distributions, the use of a column chart or a bar chart is a matter of preference. However, a column chart is preferred when working with a trend over a period of time.
- A pie chart is used to present the percent of total for a single data set.
- A stacked column chart is used to show how a percent total changes over time.

4.2 Formatting Charts

LEARNING OBJECTIVES

- 1. Apply formatting commands to the X and Y axes.
- 2. Enhance the visual appearance of the chart title and chart legend by using various formatting techniques.
- 3. Assign titles to the X and Y axes that clarify labels and numeric values for the reader.
- 4. Apply labels and formatting techniques to the data series in the plot area of a chart.
- 5. Apply formatting commands to the chart area and the plot area of a chart.
- 6. Employ series lines and annotations to enhance trends and provide additional information on a chart

There are a variety of formatting techniques to enhance the appearance of a chart once you have created it. Formatting commands are applied to a chart for the same reason they are applied to a worksheet: to make the chart easier to read. However, formatting techniques can help you qualify and explain the data in a chart. For example, you can add footnotes explaining the data source as well as notes that clarify the type of numbers being presented (i.e., if the numbers in a chart are truncated, you can state whether they are in thousands, millions, etc.). These notes are also helpful in answering questions if you are using charts in a live presentation. These formatting techniques will be demonstrated using the column chart and stacked column chart from the previous section.

Getting to Know the Elements of a Chart

A chart has many elements. Some of these elements are displayed by default, others can be added as needed. You can change the display of the chart elements by moving them to other locations in the chart, resizing them, or by changing the format. You can also remove



[©] Microsoft Corporation

chart elements that you do not want to display. 1. The chart area of the chart.

2. The plot area of the chart.

3. The data points of the data series that are plotted in the chart.

4. The horizontal (category) and vertical (value) axis along which the data is plotted in the chart.

5. The legend of the chart.

6. A chart and axis title that you can use in the chart.

0000

7. A data label that you can use to identify the details of a data point in a data series.

X and Y Axis Formats

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.08 if starting here.) There are numerous formatting commands that can be applied to the X and Y axes of the chart. Although adjusting the font size, style, and color are common, many more options are available through the Format Axis dialog box (see Figure 4.5 "Format Axis Dialog Box"). The following steps demonstrate a few of these formatting techniques on the Grade Distribution Comparison chart:

1. Click anywhere along the X axis (horizontal axis) of the Grade Distribution Comparison chart on the Grade Distribution worksheet.

2. Click the Home tab of the Ribbon.

3. Change the font style to Arial. Notice that as the mouse pointer hovers over a font style, you can preview the change on the chart before you make a selection.

4. Change the font size to 11 points and bold the font. The final appearance of the X axis is shown in Figure 4.24 "Formatted X Axis".

5. Click anywhere along the Y axis to activate it.

6. Repeat steps 3 and 4.

Figure 4.24 Formatted X Axis



080

7. Click the Format tab in the Chart Tools section of the Ribbon.

8. Click the Format Selection button in the Current Selection group of commands. This opens the Format Axis dialog box. Note: you can access any of the formatting dialog boxes by right clicking on the area you wish to format. Then select format (whichever area you chose).

E	₽ ५ • ∂	÷ =		Excel_O	bjective_4.08 ·	• Excel			Chart	Tools		
li	File Home	Insert	Draw	Page Layout	Formulas	Data	Review	View	Design	Format	Q Tel	l me wł
yl	Vertical (Value) Axis	n Style)))]]]]]]]]]]]]]]]]]	Change Shape *	$\langle \rangle$	\mathbf{i}	 ▲ Shap ▼ ▲ Shap ▼ ▲ Shap ▼ ▲ Shap 	pe Fill + pe Outline pe Effects +	Α	Α	A	- 4 - 6 - 6
	Current Selecti	on	Insert Sha	bes		Shape Styl	es		5	WordArt	Styles	
	Show the Format fine-tune formatt selected chart ele	task pane to ing for the ment.	f_{∞}									
	Δ	R	C	D F	F	G	н	1	1	к	1	
	Format Ax AXIS OPTIONS AXIS OPTI AXIS OPTI TICK MAR LABELS NUMBER Fill & Line	is TEXT OF ONS KS	PTIONS Axis Op Effect e & Properti	× × tions								

© Microsoft Corporation

9. Click Number from the bottom of the Axis (see Figure 4.25 "Formatting Numbers on the Y Axis"). The commands in this section of the Format Axis dialog box are used to format numbers that appear on the X and Y axes of a chart.

10. Click in the Decimal places input box and change the value to 0.

11. Click the X button at the top right of the Format Axis dialog box. The formatting adjustments are shown in Figure 4.26 "Completed X and Y Axis Formats".



Figure 4.25 Formatting Numbers on the Y Axis

Figure 4.26 Completed X and Y Axis Formats



Skill Refresher - Formatting the X and Y Axes

- 1. Click anywhere along the X or Y axis to activate it.
- 2. Click either the Home tab or Format tab of the Ribbon.
- 3. Select any of the available formatting commands on these tabs.

Skill Refresher - X and Y Axis Number Formats

- 1. Click anywhere along the X or Y axis to activate it.
- 2. Click the Layout tab in the Chart Tools section of the Ribbon. (You can also right click on the X or Y axis and select Format Axis from the drop-down list. Double clicking the axis will also open the Format dialog box)
- 3. Click the Format Selection button in the Current Selection group of commands.
- 4. Click Number from the list of options in the Format Axis dialog box.
- 5. Select the Number format and set decimal places to the desired number.
- 6. Click the X button at the top right of the Format Axis dialog box to close the Format Axis.

Chart Legend and Title Formats

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.09 if starting here.) The next items we will format on the Grade Distribution Comparison chart are the chart legend, axis titles and chart title. Similar to how we formatted the X and Y axes, we can format these items by activating them and using the formatting commands in the Home tab or the Format tab of the Ribbon. We will use the Quick Layout button on the Chart Tools Design ribbon to add axis titles and move the legend. The following steps explain how to add these formats:

1. Activate the Grade Distribution chart on the Grade Distribution worksheet. From the Chart Tools Design ribbon click on the Quick Layout button. AS you scroll through the different layouts you will see your chart change. Select Layout 9. This will add your axis titles, keep the chart title and move the legend to the right side of the Plot area. (Note: if you accidently select a quick layout that eliminates the title, you will have to redo your title text.)

Figure 4.27 Quick Layout

.	5- ¢-	÷		Excel_Ot	bjective_4.10	- Excel			Charl	t Tools		Kaaren Mc	Glynn 🖽	ı –	
File	Home	Insert	Draw	Page Layout	Formulas	Data	Review	View	Design	Format	© Tell r	ne what you	want to do		, A, Sh
Add Charl	Quick Layout •	Change Colors •	<u>t I h</u> a	• III i	. 111	a. I	lh.	ull.	. di	ļ u. ;	Switch R Colum	ow/ Select	Change Chart Type	Move Chart	
Chart I Chart 6	í in				0	hart Styles						Data	Type	Location	
			Ē			6	ц			×		м	N	0	P
1			-	ution			0			K		m		0	
2 3 Gra	66		Lay Sho - C	yout 9 ows the following hart Title	chart elemen	ato	35%		➡ Gr	ade Distr	ibution	Compari	son		
4 A to 5 B+t	A- 0 B-	26	о - Ц о - Н 6 - V	egend (Right) Iorizontal Axis Titl ertical Axis Title Iorizontal Axis	e	-	30%								-
6 C+t 7 D+t 8 F	0 C-	25 10 5	5 - V 3 - N	ertical Axis fajor Gridlines			원 1 20%								-
9 10		82	2000				2 15%	_							Class College
11 12 13							5%							L.	
14								A to	A- B+	to B- C	+ to C-	D+ to D-	F		

2. Click and drag the legend so the top of the legend aligns with the 35% line next to the plot area (see Figure 4.27-2 "Moving the Legend").



Figure 4.28 Moving the Legend

3. Click and drag the lower center sizing handle so the bottom of the legend is aligned with the 25% line of the plot area.

4. Click and drag the left sizing handle so the legend is against the plot area.

- 5. Change the font style in the Home tab of the Ribbon to Arial.
- 6. Change the font size to 12 points.
- 7. Click the bold and italics commands in the Home tab of the Ribbon.
- 8. Click the chart title to activate it.
- 9. Click the Format tab in the Chart Tools section of the Ribbon.

10. Click the More down arrow in the Shape Styles group of commands to open the complete set of preset format styles.



11. Click the Subtle Effect - Blue, Accent 1 option, which is in the fourth row, second style from the left. As the mouse hovers over a style, you can preview the appearance on the chart.

12. In the Home tab of the Ribbon, change the font style to Arial and reduce the font size to 14 points (see Figure 4.29 "Chart Legend and Title Formatted").



Figure 4.30 Chart Legend and Title Formatted

X and Y Axis Titles

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.10 if starting here.)

Titles for the X and Y axes are necessary for defining the numbers and categories presented on a chart. For example, by looking at the Grade Distribution Comparison chart, it is not clear what the percentages along the Y axis represent. In the last section, we added axis titles by using the Quick Layout button. To add titles without using a Quick Layout, the following steps explain how to add titles to the X and Y axes to define these numbers and categories:

1. If you have axis titles already on your chart proceed to step 5.

2. Click anywhere on the Grade Distribution Comparison chart in the Grade Distribution worksheet to activate it.

3. Click the Add Chart Element button.

4. Click the Axis Titles button in the Labels group of commands and select Primary Vertical Axis. This adds a title next to the Y axis. Repeat the above to add the Primary Horizontal Axis.

5. Click the Format tab in the Chart Tools section of the Ribbon.

6. Click the Colored Outline - Blue, Accent 1 preset style option in the Shape Styles group of commands.

7. Change the font style in the Home tab to Arial. Change the font size to 11 points and apply the bold format.

8. While the vertical Axis Title box is selected type Percent of Enrolled Students in the formula bar. Hit Enter when finished.

9. Click on the horizontal Axis Title.

10. Click the Format tab in the Chart Tools section of the Ribbon.

11. Click the Colored Outline - Blue, Accent 1 preset style option in the Shape Styles group of commands.

12. Change the font style in the Home tab to Arial. Change the font size to 11 points and apply the bold format.

13. While the vertical Axis Title box is selected type Final Course Grade in the formula bar. Hit Enter when finished.

Figure 4.31 "X and Y Axis Titles Added" shows the added titles for the X and Y axes. The titles provide definitions for the grade categories along the X axis as well as the percentages on the Y axis.



Figure 4.31 X and Y Axis Titles Added

Data Series Labels and Formats

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.11 if starting here.) Adding labels to the data series of a chart is a formatting feature that may aide in bringing clarity to a chart. However, caution should be used so the chart does not become cluttered and hard to read. A data series is the item that is being displayed graphically on a chart. For example, the blue bars on the Grade Distribution Comparison chart represent one data series. We can add labels at the end of each bar to show the exact percentage the bar represents. In addition, we can add other formatting enhancements to the data series, such as changing the color of the bars or adding an effect. The following steps explain how to add these labels and formats to the chart:

1. Click any red bar representing the College data series on the Grade Distribution Comparison chart in the Grade Distribution worksheet. Clicking one bar automatically activates all bars in the data series. If you click a bar a second time, only that bar is activated.

2. Click the Format tab in the Chart Tools section of the Ribbon.

3. Click the down arrow on the Shape Fill button in the Shape Styles group of commands.

4. Click the orange color square from the drop-down color palette (see Figure 4.32" Changing the Color of a Data Series"). As you move the mouse pointer over colors on the palette, you can preview the change on the data bars.



Figure 4.32 Changing the Color of a Data Series

5. Click the Design tab in the Chart Tools section of the Ribbon.

6. Click the Add Chart Element. button in the Labels group of commands. Select Data Labels, and then Outside End from the options in the drop-down list.

7. Right click on any of the labels and select Format Data Labels from the drop-down list.

8. Select Number in the Text Options Format window. Then, select Percentage in the Category box. Then change the decimal places to 0. (see Figure 4.33 "Adding Labels to a Data Series").

9. Click in the Decimal Places input box and change the number of decimal places to zero.

10. Click the Close button at the bottom of the Format Data Labels dialog box.

11. Click the Home tab of the Ribbon.

12. Change the font style to Arial, change the font size to 9 points, and select the Bold command.

13. Click any blue bar in the Class data series.

14. Repeat steps 5 through 12.



Figure 4.33 Adding Labels to a Data Series

Figure 4.34 "Completed Formatting Adjustments for the Data Series" shows the Grade Distribution Comparison chart with the completed formatting adjustments and labels added to the data series. Note that we can move each individual data label. This might be necessary if two data labels overlap or if a data label falls in the middle of a grid line. To move an individual data label, click it twice, then click and drag.



Figure 4.34 Completed Formatting Adjustments for the Data Series

Formatting the Plot and Chart Areas

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.12 if starting here.)

The next items to format on the Grade Distribution Comparison chart are the plot and chart areas. We can format these areas primarily to enhance the visibility of the data series. The following steps explain how to add these formatting enhancements to the chart:

1. Click anywhere in the chart area of the Grade Distribution Comparison chart in the Grade Distribution worksheet.

2. Click the Format tab in the Chart Tools section of the Ribbon.

3. Click the down arrow on the Shape Fill button in the Shape Styles group of commands.

4. Select the Tan, Background 2, Darker 25% option from the color palette (see Figure 4.36 "Formatting the Chart Area").

8	5 - C			Excel_0	bjective_4.12	ficel								Kaaren N
File	Hom	e Inseit	Draw	Page Layout	Formulas	Deta	Review	View	Design	Format	Q Tell	me what you	want to do	
hart Are Form	to Match	+ E h Style	100.	Change Cha	c Abc	Abc	Sha	pe Fill = utomatic	1.	A	A	• <u>A</u> • • <u>A</u> • • <u>A</u> •	Bring For	rward • 👘 A kward • 🖽 (Pane 🏨 (
Cum	unt piec	tion	Insert Stu	upes.		Shape Shie				WordA	at Styles	ra		Arrange
hart 6	1.		v f.	«SERIES(*C	ollege",'Gra	de Distri	100							
4			c	DE		6	- 11			к	L	M	N	0
	1	Grad	e Distri	bution			Stand	lard Colors						
		Numb	er of ents	Perc Compa	ent rison			io Fill		le Dis	o	n Comp	arison	
Gra	de	Class 0	College 500	Class 10 545	25.0%	_		fore Fill Co	lors	1.00%	30%			= Cla
B+1 C+1 D+1 F	to B- to C- to D-	26 25 10 9	600 500 300 100	31.7% 30.5% 12.2% 6.1%	30.0% 25.0% 15.0% 5.0%			exture			25.00%	15.0	0%	- Col
		The	serie ntly ad	s name t ctivated here.	hat is appear	s	Dercent of E	-	A 84	to B.	Chin	12%	6%50	0%

Figure 4.36 Formatting the Chart Area

5. Click anywhere in the plot area to activate it. Be sure not to click a grid line or one of the data series.

6. Click the Format tab in the Chart Tools section of the Ribbon.

7. Click the Shape Effects button in the Shape Styles group of commands.

8. Place the mouse pointer over the Bevel option from the drop-down list. Then select the Round bevel option from the second drop-down list (see Figure 4.37 "Putting a Bevel Effect on the Plot Area").

						Carto -										
File	Home	e insert	Draw	Page Layout	Formulas	Data	Review	View	Design	Format	Q Tell n	ne what you	want to do			
flot Area	at Selection	• ► an □ Style △	00.	Change Shape *	c Abc	Abc	 Shi Shi Shi Shi Shi 	ape Fill * ape Outline * ape Effects *	A	А	A	- A - A - & -	Bring For Send Bac	rward - 🖡 Rward - 🖟 Pane 🏾	Align •] Group • Rotate •	1]] 3.47 [][6"
Cun	ent Select	ion	Insert Sha	pes		Shape Style	· 🗆	Preset		WordArt	t Styles	: 12		Arrange		Size
Charte	-	1 ×	$\sqrt{-f_{\rm ff}}$	1				Dear	-							
4	A	8	C	DE	F	G		Shadow		к	L	м	N	0	P	Q
		Grade	Distri	bution				Beflection			-					
2		Numbe Stude	r of nts	Perc Compa	ent rison	Ĭ		Glow	, àra	de Dist	ribution	Compar	rison			+
Gra	de	Class C	ollege	Class (25.0%		I o	Coft Edgard	32	50.00%	30%			= C	lass	1
5 B+	B-	26	600	31.7%	30.0%			Son Euges			5.00%		_	- C	ollege	Y
5 C+	to C-	25	500	30.5%	25.0%		1	Bevel	> N	o Bevel						_
1 D+	D-	10	300	6.1%	15.0%	-	1		_					1		-
		82	2000	0.176	0.010	9	10	3- <u>D</u> Rotati	on F 🖌	_						P
0		02	2000				2 10%		B	evel	_			1		
1	P	lot area	مامه	ntod		-	ercer 5%						^{0%} 5.0	0%		-
3			a Sele	cieu			ď (%			Round	-			-J		
4								to A	4 J	파티			F		1	_
6 7 8					Bevel	style	Roun	d	Gra	3-D Optio) in	The si dicate a	zing h the P ctivate	andle lot ar ed	es re is

Figure 4.37 Putting a Bevel Effect on the Plot Area

Figure 4.38 "Grade Distribution Comparison Chart with Formats Applied" shows the completed Grade Distribution Comparison chart. The darker shade on the chart area along with the bevel effect on the plot area make the data series the main focal point of the chart.



Figure 4.38 Grade Distribution Comparison Chart with Formats Applied

Adding Series Lines and Annotations to a Chart

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.13 if starting here.)

The last formatting features we will demonstrate are adding series lines and annotations to a chart. To demonstrate these skills, we will use the Change in Health Care Spend Source stacked column chart. Series lines are commonly used in stacked column charts to show the change from one stack to the next. Annotations are useful for clarifying the data presented in a chart or for identifying data sources. In addition to demonstrating these skills, we will review several of the formatting skills that were covered in this section. The following steps include the skills review as well as the new formatting features:

1. Locate the Change in Health Care Spend Source chart on the Health Care worksheet. Activate the chart by clicking anywhere inside the chart perimeter.

2. Move the chart to a separate chart sheet by clicking the Move Chart button in the Design tab of the Ribbon. Type the following sheet tab label in the New sheet input box: Health Spending Chart. Click the OK button.

3. Click anywhere on the X axis to activate it. In the Home tab of the Ribbon, change the font style to Arial, change the font size to 12 points, and select the bold command.

4. Activate the Y axis and apply the same formatting adjustments as stated in step 3.

5. Add a Y axis title by Clicking on Add Chart Element for the Chart Tools Design ribbon and selecting Axis titles, then Primary Vertical Axis.

6. In the Format tab under the Chart Tools section of the Ribbon, select the first preset style option, Colored Outline - Black, Dark 1, in the Shape Styles group of commands. Then, in the Home tab of the Ribbon, change the font style to Arial and the font size to 14 points.

7. While the Axis Title is still selected, type Percent of Total Annual Spend in the Formula bar and then hit enter to save your changes.

8. Click and drag the vertical axis so it is closer to the plot area.

9. Activate the title of the chart by clicking it once. In the Format tab under the Chart Tools section of the Ribbon, select the first preset style option, Colored Outline - Black, Dark 1, in the Shape Styles group of commands. Then, in the Home tab of the Ribbon, change the font style to Arial.

10. Activate the Chart Area by clicking on the down arrow next to the Format Selection box on the Format tab of the Chart Tools ribbon, and selecting Chart Area.



11. Click the Format tab in the Chart Tools section of the Ribbon and click the down arrow on the Shape Fill button. Select the Olive Green, Accent 3, Lighter 60% option on the color palette. Note: This will change the entire chart background to the color selected.

12. Activate the plot area using the method in step 10.

13. Change the plot area shape fill to white.

14. Click the Shape Effects button in the Format tab of the Ribbon. Place the mouse pointer over the Bevel option from the drop-down menu. Select the first option from the Bevel format list, which is the "Round" bevel option.

15. Click and drag down the top center sizing handle of the plot area approximately 1/2 inch (see Figure 4.39 "Adjusting the Size of the Plot Area").

16. Click and drag up the bottom center sizing handle approximately three-quarters of an inch This step and step 15 are necessary to create space at the top and bottom of the chart to add annotations.

Figure 4.39 "Adjusting the Size of the Plot Area" shows the Change in Health Care Spend Source chart prior to adding the series lines and annotations. The remaining steps will focus on adding lines and annotations:



Figure 4.39 Adjusting the Size of the Plot Area

17. Click the Design tab in the Chart Tools section of the Ribbon.

18. Click the Add Chart Element, Lines, Click the Series Lines option from the drop-down list. This adds lines to the chart, connecting each data series between the two stacks (see Figure 4.40 "Selecting the Series Lines Option").

⊟্ঞা	Ŧ			Excel_Ob	jective_4.14 -	Excel			Chart	Tools
File Home		Insert	Draw	Page Layout	Formulas	Data	Review	View	Design	Format
Add Chart Quick Element + Layout +	Cł	hange plors +				Ŀ	ļ			
th Axes	۲				Cha	rt Styles				
http://www.actionary.com/actio	۲	×	√ f _x							
db Chart Title	۲									
di Data Labels	۲									
Data Table	۲			5	hango i		alth Ca	ro Sn	and So	urooc
i <u>E</u> rror Bars	►			<u> </u>	nangei	ппеа		ire spi	enu 30	urces
Gridlines	۲									
di ^{III} Legend	۲		100%							
🔊 Lines	•	Ind.	Neze							
<u>∠</u> <u>T</u> rendline	÷.		None							
Dp/Down Bars	•		<u>S</u> eries Lir	nes 🗸						

Figure 4.40 Selecting the Series Lines Option

19. Click any of the series lines added to the chart. Clicking one line will activate all lines on the chart. Note: you can select the series lines the way you did earlier. Chart Tools, Format, select Series Line1 from the Format Selection box.

Figure 4.41 Adding the Series Lines



20. Click the Shape Outline button in the Format tab of the Ribbon. Place the mouse pointer over the Weight option and select the "2¼ line weight" option.

Figure 4.42 "Series Lines Added to the Stacked Column Chart" shows the appearance of the chart with the series lines connecting the two stacks. This formatting enhancement is common for stacked column charts. The lines help focus the audience's attention on changes in the percent of total trend. In this case, the audience can quickly see the decline in the Out-of-Pocket category (blue) and the increase in the Health Insurance category (red).





- 21. Click anywhere in the chart area of the Change in Health Care Spend Source chart.
- 22. Click the Text Box button in the Chart Tools Format Ribbon.



23. Position the mouse pointer on the left edge of the chart area approximately one-quarter inch from the top. Click and drag a rectangle approximately one and a half inches wide and one-quarter inch high (see Figure 4.43 "Adding Annotations to the Stacked Column Chart").

24. Click the Home tab of the Ribbon and change the font style to Arial, change the font size to 10 points, and select the bold and italics commands.

25. Type Dollars in Millions. This tells the audience that the numbers have been truncated and represent denominations in millions. This means you would add six zeros to the end of each number on the chart. Therefore, the Out-of-Pocket value for 1975 is shown as \$22,617 but is \$22,617,000,000, or \$22.6 billion.





26. Repeat steps 19–22 to add a second text box to the chart. Begin drawing this text box below the first box approximately one inch in from the left edge of the chart Complete the formatting changes in step 22 and select the Align Text Right command.

27. Type 100% = in the second text box.

28. Repeat steps 19–22 to add a third text box to the chart. Center this text box over the 1975 stack. In addition to the formatting commands in step 22, select the Center align command and the Underline command.

29. Type \$66,172 in the third text box.

30. Repeat steps 19–22 to add a fourth text box to the chart. Center this text box over the 2015 stack. In addition to the formatting commands in step 22, select the Center align command and the Underline command.

31. Type \$2,486,293 in the fourth textbox.

32. Repeat steps 19–22 to add a fifth text box to the chart. Begin drawing this text box at the bottom left edge of the chart, just below the data table. The text box will need to be at least four inches wide.

33. Type Source: CMS Centers for Medicaid and Medicare Services in the fifth text box.

Figure 4.44 "Completed Stacked Column Chart with Annotations" shows the completed Change in Health Care Spend Source stacked column chart. The lines and annotations provide key information for understanding the data and interpreting the trends presented on the chart.



Figure 4.44 Completed Stacked Column Chart with Annotations

Integrity Check - Annotations and Axis Titles

Although adding annotations and axis titles can be a tedious process, doing so maintains a high level of integrity for your charts. People can misinterpret the message being conveyed by the chart if they make inaccurate assumptions about the values displayed. Axis titles and annotations help prevent readers from making false assumptions and ensure that readers see the most accurate representation of the message being conveyed by the chart.

4.3 The Scatter Chart

LEARNING OBJECTIVES

- 1. Construct a scatter chart to show the supply and demand curves for a market.
- 2. Learn how to adjust the scale of the X and Y axes of a scatter chart.
- 3. Add a trendline and line equation to a data series on a scatter chart.

This section focuses on the scatter chart type. What makes this chart different from the other charts demonstrated in this chapter is that values are used on both the X and Y axes. So far, the charts we have demonstrated in this chapter use categories or qualitative labels for the X axis. This means that the distance between each category on the X axis will always be the same, even if numbers are used. In a scatter chart, the X axis operates just like the Y axis. In other words, the distance between the values on the X axis will vary depending on the value of the number. Depending on the format, we can create the scatter chart to look just like a line chart. Since both the X and Y axes contain quantitative values, the scatter chart is a valuable tool for studying various shapes or functional forms for a line chart. In fact, a common feature used with the scatter chart is the trendline and equation. Excel can evaluate the line that is produced on a scatter chart and produce a mathematical equation. We will demonstrate these features in this section.

The Scatter Chart: Supply and Demand

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.14 if starting here.) A common use for a scatter chart is the study of supply and demand curves. This is because the data points for both the supply and demand lines require quantitative values on both the X and Y axes. The Y axis contains the price of a certain good or item; the X axis contains the quantity sold for that good or item. Fundamental economic laws state that as prices rise, sellers are willing to increase supply and sell more goods. However, the reverse is true for consumers. As prices rise, consumers purchase fewer goods. The **Supply & Demand** worksheet contains hypothetical data for the supply and demand of breakfast cereal. There are ten data points to show the change in supply and demand as the price changes in Column A. The values you see in Columns A through C are formula outputs that are driven by the percentage in cell C14. For example, if the percentage in cell C14 is changed to 10, each price listed in Column A will increase, as shown in Figure 4.45 "Hypothetical Supply and Demand Data".

X	ile I	7 • (*	ne Insert	Page Layout Fr	ermi	ulas D	lata	Review	Excel Ob View	jective 4.00
Par		× 	rial	• 12 • A	A	= ,	-	8)		Accounting
Clip	boar	3	B I U *	soft		= 1	Alio	nment		A = 70 Numb
		A4	• (*	f =A3*(1+\$C\$	(14)	-	199(62)		Forr	nula entered
1	1	A	в	С		D		E	"	nto cell A4.
1	Pri	for B	Demand Quantity	Cereal Supply Quantity						
3	\$	1.50	400	75	Π					
4	\$	1.65	340	86						
5	\$	1.82	289	99		-			Stores La	
6	\$	2.00	246	114		As th	e pric	e increas	es 10% for	
7	\$	2.20	209	131	ļļ	- den	hand c	uantity o	decreases	
8	\$	2.42	177	151		wh	ile the	supply	quantity	
9	5	2.66	151	173			1	ncreases		
10	3	2.92	128	200						
11	9 6	3.22	109	229						
12	2	3.54	93	204	1			6		
14	Pri	ice Ch	ange	10%	•		_		price will each cell i	er indicates that the increase by 10% for n the range A3:A1

Figure 4.45 Hypothetical Supply and Demand Data

The formula =A3*(1+\$C\$14) is multiplying the Price in A3 by 1 + the percent change in cell C14. Using 1 + % is the same as multiplying A3 by 110% (given the example in Figure 4.45.) If you only multiply by the price change percent, you will get just the percent increase amount. Not the price but the percent increase. In the above example, if you multiply by the price change percent only, you will get \$.15. Not the new price after the increase has been applied.

We will use the scatter chart to study the change in quantity supplied and demanded as the price increases over ten data points, as shown in Figure 4.45 "Hypothetical Supply and Demand Data". For many of the charts demonstrated in this chapter, we could highlight a range of cells and insert the chart type we needed. This was especially the case when the data was in a contiguous range of cells. However, this method rarely works when creating a scatter chart, even if the data are in a contiguous range. As a result, the method we present

here starts with a blank chart and demonstrates how each data series is added to the chart individually. The following steps explain how we create this chart:

1. Change the value in cell C14 on the Supply & Demand worksheet to zero.

2. Activate cell E1 on the Supply & Demand worksheet. It is important to note that this cell location is not adjacent to any data on the worksheet.

3. Click the Scatter button from the Charts group of commands on the Insert tab of the Ribbon.

4. Select the Scatter with Smooth Lines and Markers format from the drop-down list of options (see Figure 4.46 "Selecting a Scatter Chart Format"). This adds a blank chart to the worksheet.

E	35	- ¢ -				Excel_Obje	ctive_4.15	- Excel		
Fil	e	Home	Insert Drav	w Page Layout	Formulas	s Data	Review	View	Ω Tell me u	
Pivot	5 Table	Recomme	nded Table IIIu	strations Add- Re		ulu • 111 • 110 i • 110 • 100 ₀	4 (]a*	Click h scat	iere to add tter chart	la
		PivotTal Tables	bles	 ins * 	Charts	Cha Scatt	er	•	Map • 🖾 Win Spark	
E1		٣	I X V	f _N				i Iv	d	
1		Α	В	С	D			ι L		
	5	Supp	ly and D	Demand		28	(📈	()		
1	1	for B	reakfast	Cereal		Bubb	le			
			Demand	Supply						
2	Pri	ce	Quantity	Quantity				catter	with smoo	oth
3	\$	1.50	400	75		<u>1 188</u>	fore S	ines a	nd marke	rs.
4	\$	1.50	400	75						
5	\$	1.50	400	75					_	
6	\$	1.50	400	75		The active	e cell is	not		
7	\$	1.50	400	75	:	adjacent t	o any o	data		
8	\$	1.50	400	75		_				
9	\$	1.50	400	75						
10	\$	1.50	400	/5		_				
11	\$	1.50	400	75						
12	\$	1.50	400	/5		This v	alue w	as		
13	Dri	ce Ch	anga	0%		chang	ged to	0.		
			anue	0 /0						

Figure 4.46 Selecting a Scatter Chart Format

5. Click and drag the chart so the upper left corner is in the center of cell E2.

6. Resize the chart so the left side is locked to the left side of Column E, the right side is locked to the right side of Column M, the top is locked to the top of Row 2, and the bottom is locked to the bottom of Row 17.

7. Click the Design tab in the Chart Tools section of the Ribbon. Then click the Select Data button in the Data group of commands. This opens the Select Data Source dialog box.

8. Click the Add button on the left side of the Select Data Source dialog box. This opens the Edit Series dialog box. Notice on this dialog box there are inputs for defining values for both the X and Y axes. Charts that we previously created using this method only had an input for putting values on the Y axis.

9. Type the series name Demand. This should appear in the Series name input box.

10. Press the TAB key on your keyboard to advance to the Series X values input box on the Edit Series dialog box.

11. Highlight the range B3:B12 on the Supply & Demand worksheet. You will see this range appear in the Series X values input box after it is highlighted.

12. Press the TAB key on your keyboard to advance to the Series Y values input box on the Edit Series dialog box.

13. Highlight the range A3:A12 on the Supply & Demand worksheet.

14. Figure 4.47 "Defining the Demand Data Series" shows the final settings in the Edit Series dialog box for the Demand data series. You will see that as the X and Y axis values are defined in the dialog box, they appear on the chart. The chart in this figure shows the price along the Y axis and quantity along the X axis.

	5.0								Char	t Tiools			
File	Hor	ne Insert	Draw P	age Layout	Formulas	Data	Review	View	Design	Format	V Tell me	what you	want to do
	4	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0								-	a		11
Jeme	inars Qui int - Layou	t Colors	Edit Series			?	×			1	Column	Data	Chart Typ
Ch	art Layouts		Series pamer								Dat		Type
F1		• I X	Demand		±	= Demand		_					
-			Series 🛽 valu	es:				F	inal set	tings fo	or the	1	
4	A	B	= Supply &	Demand ISB\$3:5	8512 1	= 400, 400,	400,	-	Dom	and sori	or me	L	M
0	Supply	and De	Series <u>Y</u> value Supply & De	es: mand15A\$23	±	= \$1.50, 5	i1.5		Dema	and sen	es	J	
			T	[OK	Can	cel						
	intere.	Demand	Ounntitue						Deman	d			
2 1	1 50	duanuty	Quantity	15	\$1.60								
4 4	\$ 1.50	400	7	5	\$1.40								
5 9	\$ 1.50	400	7	15	21.40								
6	\$ 1.50	400	7	'5	\$1.20								
7 5	\$ 1.50	400	7	'5	\$1.00								
8 9		aluos ad	dad to th	1	¢0.00								
10		alues au		ie /	20.80								
11	s u	alog box	appear		\$0.60								
12 5	5	the c	enart.		50.10								
13 14 P	rice Ch	ange	09	%	50.20								
15													
16					5- L	50	100	100	200	250 0	50 BEG	400	450

Figure 4.47 Defining the Demand Data Series

15. Click the OK button at the bottom of the Edit Series dialog box.

16. Click the Add button on the left side of the Select Data Source dialog box.

17. Type the series name Supply. This should appear in the Series name input box.

18. Press the TAB key on your keyboard to advance to the Series X values input box on the Edit Series dialog box.

19. Highlight the range C3:C12 on the Supply & Demand worksheet. This range appears in the Series X values input box after it is highlighted.

20. Press the TAB key on your keyboard to advance to the Series Y values input box on the Edit Series dialog box.

21. Highlight the range A3:A12 on the Supply & Demand worksheet.

22. Click the OK button at the bottom of the Edit Series dialog box.

23. Click the OK button at the bottom of the Select Data Source dialog box.

Figure 4.48 "Scatter Chart Showing One Price" shows the appearance of the scatter chart before any formatting enhancements are applied. Notice only two plot points are located on the chart. This is because the price change value in cell C14 is still zero. Therefore, the data are not reflecting any change in price, quantity demanded, or quantity supplied. The

chart shows that at the current price of \$1.50, suppliers are willing to provide fewer units compared with the number of units consumers are willing to buy.



Figure 4.48 Scatter Chart Showing One Price

The following steps explain the formatting enhancements we will apply to the scatter chart shown in Figure 4.48 "Scatter Chart Showing One Price":

1. Add titles to the chart by clicking the Quick Layout drop down button on the Chart Tools Design Tab. Choose Layout 1

2. Click on the Chart Title to activate it. Select Subtle Effect - Orange, Accent 6 from the Theme Styles list in the Shape Styles group of commands on the Format tab of the Ribbon.

3. Change the font style of the chart title to Arial, bold, and the font size to 14 points.

4. Change the wording of the chart title as follows: Supply and Demand for Breakfast Cereal.

- 5. Click on the vertical Axis Title
- 6. Repeat steps 2 and 3 to format the Y axis title. However, change the font size to 12 points.
- 7. Change the wording of the Y axis title as follows: Price per Unit.
- 8. Click on the X Axis Title.
- 9. Repeat steps 2 and 3 to format the X axis title. However, change the font size to 12 points.

10. Change the wording of the X axis title as follows: Quantity in Units.

11. Change the color of the plot area back to white. Note: if you don't change the color to white, when you do step 12 the entire chart will be Aqua Accent 5. You can always come back and change the plot area back to white if that happens.

12. Change the color of the chart area to Aqua, Accent 5, Lighter 40% (see Figure 4.49 "Formatting Enhancements Added to the Scatter Chart").

₽	5.0	5- F		Excel_Obje	ective_4.15 -	Excel				Cha	t Tools	Kaare	n McGlynn
File	Hor	ne Insert	Draw Page	Layout	Formulas	Data	Res	new	View	Design	Format	♀ Tell me what	you want t
For Re	Area rmat Select set to Mate urrent Sele	tion ch Style ction	Chang Chang Shape Insert Shapes	Abc	Abc	Abc	ies	C Shi	ape Fill • Automatic ne Colors	A	A • A • A •	Bring Forward - Send Backward - Selection Pane Arrange	■ 回 34-
Char d S	A Supply Bre	and the second s	his option w to format the and axis ti	as used chart tles	E	F		Stan	dard Colors		Aqu Accer	K I	
P	rice	Demand Quantity	Supply Quantity	C	51.60		Su		<u>N</u> o Fill <u>M</u> ore Fill Col	ors	Bre	his color was o for the chart a	chosen area.
5	1.50	400	75		51.00				Gradient				
1 2	1.50	400	75		51.40		1	Pa 1	Texture				
4	1.50	400	75		\$1.20		-						
5	1.50	400	75		51.00								
5	1.50	400	75										
5	1.50	400	75	9	Q 30.00								Der
0 5	1.50	400	75		-iz \$0.60								
1 5	1.50	400	75		50.40	_							
2 5	1.50	400	75								Make	plot area whi	te
3 4 P	rice Ch	ange	0%		\$-		60	100	150 2	00 350	or it color	will be the san as the chart ar	rea
5						U	30	100	Quan	tity in U	nits		

Figure 4.49 Formatting Enhancements Added to the Scatter Chart

13. Apply a bevel effect to the plot area. Use the Circle format option from the Bevel dropdown list of options.

14. Change the font style of the legend to Arial and bold the font.

15. Change the value in cell C14 to 2. Then change it to 4 and then to 8. Change the value one more time to 14. As you change the values in cell C14, you will see the lines change on the chart.

Figure 4.50 "Scatter Chart with Price Change at 2%" shows the completed scatter chart when the Price Change is set to 2%, and Figure 4.51 "Scatter Chart with Price Change at 14%" shows the same chart when the Price Change is set to 14%. The point at which the

demand and supply lines intersect on Figure 4.51 "Scatter Chart with Price Change at 14%" is known as the market equilibrium point.

The market equilibrium is where the quantity demanded equals the quantity supplied at a specific price. The price where quantity demanded equals quantity supplied is referred to as the equilibrium price.



Figure 4.50 Scatter Chart with Price Change at 2%

Why?

For Scatter Charts, Start with a Blank Chart

When creating a scatter chart, it is best to start with a blank chart and add each data series individually. This is because Excel will not always guess correctly which values belong on the X and Y axes since both contain numbers. For other chart types, such as column or line charts, the X axis contains nonnumeric data so it's easy for Excel to configure the chart you need.



Figure 4.51 Scatter Chart with Price Change at 14%

Changing the Scale of the X and Y Axes

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.15 if starting here.)

For all the charts demonstrated in this chapter, Excel has automatically established the scale for the Y axis. For scatter charts, Excel has also established the scale for the X axis. The axis scale is the minimum and maximum value that appears on an axis. For example, in Figure 4.51 "Scatter Chart with Price Change at 14%", the Y axis scale is set to a minimum value of zero and a maximum value of 6.00. Although this is a very convenient feature of Excel, you may want to change the scale in some instances. If you change the value in cell C14 on the Supply & Demand worksheet, the lines jump or shift on the plot area of the chart. This is because Excel keeps rearranging the scale of both the X and Y axes. When studying the shape of lines, it is best to set the scale so it does not change. The following steps explain how to accomplish this:

1. Change the value in cell C14 on the Supply & Demand worksheet to zero.

2. Right click anywhere on the Y axis of the chart and select Format Axis.

3. Click in the Maximum setting under the Axis Options in the Format Axis dialog box.

4. Click in the input box next to the Maximum setting. Remove the 1.6 and enter the number 5.0.

5. We will not be studying the behavior of supply and demand beyond a \$5.00 price point, so there is no need to extend the Y axis beyond this point.

6. Click in the input box next to the Major Unit setting and change the value to 0.5 if not already set to 0.5. (see Figure 4.52 "Setting the Y Axis Scale"). This allows us to measure the plot points in \$0.50 intervals along the Y axis.

E	5 • c			Excel_Objective_4.15 - Excel					Chart Tools			Kaaren McGlynn				
F	ie Hor	ne insert	Draw Page	Layout	Formulas	Data	Review	View	Design	Format	♀ Tell m	e what you want to	o do		я	. Share
Vert	ical (Value) A Format Selec Reset to Mati Current Sele	tion Ch Style	Chang Chang Shape Insert Shapes			Shape Sty	- 0 Sh - 2 Sh - 0 Sh Ies	ape Fill • ape Outline • ape Effects •	Quick Styles	▲ • · · · · · · · · · · · · · · · · · ·) Bring Forw) Send Back Selection P Arran	and · 译· 1 vard · 图 · ane 选 ·] 3.64*] 6* Size	0 0 6		~
Ch	art 2	• I ×	√ fx													~
1	A Supply Bre	8 and De eakfast C	c mand for Cereal	D	E	F	G H		1	L	К •	Format A Axis Options	vxis ▼ Tert	Options	•	×
2	Price	Demand Quantity	Supply Quantity				Supply	and Den	nand fo	r Breakfa	st Cere	○ 1/				
3 4 5 6	\$ 1.50 \$ 1.50 \$ 1.50 \$ 1.50 \$ 1.50	400 400 400 400	75 75 75 75 75		55.00 54.50 \$4.00	s	et the s reset b	scale of outton	f the a when	xis. No change	Axis Options Bounds Migimum 0.0 Auto				•	
7 8 9	\$ 1.50 \$ 1.50 \$ 1.50	400 400 400	75 75 75		S3.00							Units Major		ŝ	Auto	
10 11 12	\$ 1.50 \$ 1.50 \$ 1.50	400 400 400	75 75 75		51.50		•		e incremental steps at will be displayed on the axis			Minot Historital	0.1 axis cross	es	Auto	
13 14 15 16 17	Price Change		0%		50.50	-	50 100	that				Autgmatic Aus valug Maximum axis value Display units Nor			0.0 Ne *	
18												Show	display u	nits label	on chart	

Figure 4.52 Setting the Y Axis Scale

7. Click the X button at the top of the Format Axis dialog box.

8. Click anywhere along the X axis of the chart.

9. Click the Format Selection button in the Layout tab of the Chart Tools section of the Ribbon. This opens the Format Axis dialog box for the X axis.

10. Click the Fixed option next to the Minimum setting under the Axis Options in the Format Axis dialog box. This ensures that the minimum value for the X axis will always be zero.

11. Click the Fixed option next to the Maximum setting under the Axis Options in the Format Axis dialog box.

12. Click in the input box next to the Maximum setting. Remove the 500.0 and enter the number 450.0. The number of units supplied or demanded will not exceed 450 based on the price points in our study. There is no need to extend the X axis to 500.

13. Click the Fixed option next to the Major Unit setting under the Axis Options in the Format Axis dialog box.
14. Click in the input box next to the Major Unit setting and change the value from 100.0 to 50.0. This allows us to measure the plot points in 50-unit intervals along the X axis.

15. Click the Close button at the bottom of the Format Axis dialog box.

16. Change the value in cell C14 to 2. Then change it to 4 and then to 8. Change the value one more time to 14. As you change the values in cell C14, the lines change but they no longer jump or shift since the scale of both axes is fixed.

Figure 4.53 "Final Appearance of the Scatter Chart" shows the final appearance of the scatter chart after the scale is set for both the X and Y axes. Notice that market equilibrium is achieved at a price of approximately \$2.50.



Figure 4.53 Final Appearance of the Scatter Chart

Adding a Trendline and Equation

Follow-along file: Continue with Excel Objective 4.00. (Use file Excel Objective 4.16 if starting here.) A trendline can be applied to a chart to estimate or predict where plot points may occur at various points along the X and Y axes. Excel enables you to add a trendline to a chart and provides the equation you can use to plot additional points. The following steps explain how to accomplish this:

1. Set the value in cell C14 on the Supply & Demand worksheet to 14.

2. Click anywhere in the chart area of the scatter chart to activate it.

3. Click the Add Chart Element button in the Design tab of the Chart Tools and select Trendline from the drop-down menu. Select the Linear Trendline option from the dropdown list.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

4. Select the Demand option from the Add Trendline dialog box and click the OK button. This adds a new line to the plot area of the chart as well as the legend.

5. Figure 4.54 "Adding a Linear Trendline" shows the scatter chart after adding a linear trendline.

Notice that the line goes through only two points on the demand line. This indicates that this trendline may not be a good fit for the line that has been created on the chart.





6. Finding the right shape for a trendline may require trying a few different options. As shown in Figure 4.54 "Adding a Linear Trendline", the linear trendline is not a good fit for the shape of the demand line. The remaining steps will demonstrate how to remove a trendline and access more trendline options:

7. Click the Trendline button in the Layout tab of the Ribbon. Select the None option from the drop- down list. This removes the trendline from the chart.

8. Click the Trendline button in the Layout tab of the Ribbon again. Note: You must remove a trendline because clicking on other trendlines will add them to your chart with the one you already have created. This time, select More Trendline Options from the drop-downlist.

9. Select the Demand option from the Add Trendline dialog box and click OK. This opens the Format Trendline dialog box.

10. Select the Power option from the Format Trendline dialog box.

11. Click the "Display Equation on chart" option at the bottom of the Format Trendline dialog box (see Figure 4.55 "The Format Trendline Dialog Box").

12. Click the Close button at the bottom of the Format Trendline dialog box.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Figure 4.55 The Format Trendline Dialog Box



Figure 4.56 "Scatter Chart with a Power Trendline" shows the scatter chart with the Power trendline added for the demand series. Notice that the line fits perfectly over the demand series in the plot area. In fact, it may be difficult to see the line in the figure. This indicates that the trendline is an excellent fit for the demand line. As a result, we can be confident in using this line to predict other demand values along the X and Y axes. You can also see that the equation for this trendline has been added to the plot area of the chart. We can use the equation to calculate the price for each quantity value substituted for X. For example, if the number 150 is substituted for X in the equation, the result is a price of \$2.59. Based on the values used to create the chart, this result appears to be accurate.

Figure 4.56 Scatter Chart with a Power Trendline



The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

4.4 Using Charts with Microsoft® Word® and PowerPoint®

LEARNING OBJECTIVES

- 1. Learn how to paste an image of an Excel chart into a Word document
- 2. Learn how to paste a link to an Excel chart into a PowerPoint slide.

Charts that are created in Excel are commonly used in Microsoft Word documents or for presentations that use Microsoft PowerPoint slides. Excel provides options for pasting an image of a chart into either a Word document or a PowerPoint slide. You can also establish a link to your Excel charts so that if you change the data in your Excel file, it is automatically reflected in your Word or PowerPoint files. We will demonstrate both methods in this section.

Pasting a Chart Image into Word

Follow-along Word file: Excel Objective 4.17

Excel charts can be valuable tools for explaining quantitative data in a written report. Reports that address business plans, public policies, budgets, and so on all involve quantitative data. For this example, we will assume that the Change in Health Care Spend Source stacked column chart (see Figure 4.44 "Completed Stacked Column Chart with Annotations") is being used in a written policy report. The following steps demonstrate how to paste an image, or picture, of this chart into a Word document:

1. Click below the figure heading in the Word document that reads: Figure 6: Health Care Spending in the U.S. The image of the stacked column chart will be placed below this heading.

2. Open the Excel Objective 4.16 follow-along file.

3. Activate the Change in Health Care Spend Source chart in the Health Spending Chart worksheet.

4. Click the Copy button in the Home tab of the Ribbon.

5. Go back to the Excel Objective 4.17 Word document by clicking the file in the taskbar.

6. Click the drop-down arrow below the Paste button in the Home tab of the Ribbon. Click the Picture option from the drop-down list, which is the last option on the far right (see Figure 4.57 "Paste Picture Option for Word").

7. Click anywhere on the picture of the chart to activate it.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

8. Click the Format tab under the Picture Tools section of the Ribbon (see Figure 4.58 "Changing the Size of a Picture in Word").



Figure 4.57 Paste Picture Option for Word

9. Click the down arrow on the Shape Width button in the Size group of commands (see Figure 4.58 "Changing the Size of a Picture in Word"). Continue to click the down arrow until the width of the picture is 5.5. As you reduce the width of the picture, the height is automatically reduced as well.

Figure 4.58 Changing the Size of a Picture in Word



The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Figure 4.59 "Final Appearance of Pasting a Chart Image into Word" shows the final appearance of the Change in Health Care Spend Source chart pasted into a Word document. It is best to use either the Shape Width or Shape Height buttons to reduce the size of the chart. Using either button automatically reduces the height and width of the chart in proper proportion. If you choose to use the sizing handles to resize the chart, holding the SHIFT key while clicking and dragging on a corner sizing handle will also keep the chart in proper proportion.



Figure 4.59 Final Appearance of Pasting a Chart Image into Word

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

Skill Refresher - Pasting a Chart Image into Word

- 1. Activate an Excel chart and click the Copy button in the Home tab of the Ribbon.
- 2. Click on the location in the Word document where the Excel chart will be pasted.
- 3. Click the down arrow of the Paste button in the Home tab of the Ribbon.
- 4. Click the Picture option from the drop-down list.
- 5. Click the Format tab in the Picture Tools section of the Ribbon.
- 6. Resize the picture by clicking the up or down arrow on the Shape Width or Shape Height buttons.

Integrity Check

Remember when copying and pasting an image into Word or PowerPoint that the image is not dynamically linked to your Excel document. If your numbers change in your Excel document, you must copy and paste the image again.

Pasting a Linked Chart Image into PowerPoint

Follow-along PowerPoint file: Excel Objective 4.18

Microsoft PowerPoint is perhaps the most commonly used tool for delivering live presentations. The charts used in a live presentation are critical for efficiently delivering your ideas to an audience. Like written documents, a wide range of presentations may require the explanation of quantitative data. This demonstration includes a PowerPoint slide that could be used in a presentation for setting prices for a hypothetical breakfast cereal company. We will paste the scatter chart showing the supply and demand for breakfast cereal into this PowerPoint slide. However, instead of pasting an image, as demonstrated in the Word document, we will establish a link to the Excel file. As a result, if we change the chart in the Excel file, the change will be reflected in the PowerPoint file. The following steps explain how to accomplish this:

- 1. Open the Excel Objective 4.16 follow-along file.
- 2. Activate the scatter chart in the Supply & Demand worksheet.
- 3. Click the Copy button in the Home tab of the Ribbon.
- 4. Go back to the Excel Objective 4.18 PowerPoint file by clicking the file in the taskbar.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

5. Click the down arrow below the Paste button in the Home tab of the Ribbon in the PowerPoint file.

6. Select the Keep Source Formatting & Link Data option from the drop-down list (see Figure 4.60 "Creating a Link to an Excel Chart in PowerPoint"). This pastes an image of the Excel chart into the PowerPoint slide. In addition, a link is created so that any changes made to the chart appear on the PowerPoint slide.



Figure 4.60 Creating a Link to an Excel Chart in PowerPoint

7. Click anywhere in the plot area of the scatter chart pasted into the PowerPoint slide. You will see the same Excel Chart Tools tabs added to the Ribbon (see Figure 4.61 "Modifying an Excel Chart Pasted into a PowerPoint Slide").

Figure 4.61 Modifying an Excel Chart Pasted into a PowerPoint Slide

日 ち・び 堕:		Excel_Objective_4.18 - Po	werPoint	Kaaren McGlynn	a – b	
File Home Insert	Draw Design Transitions	Animations Slide Show	Review View Add-ins ACROB	2.1 Design Form	at Q vellime A	, p
hart Area ◆ Format Selection Current Selection	Insert Shapes	Abc Abc Abc Shape Shyles 3 I 2 PRICE TAR	Standard Colors Standard Colors Standard Colors Standard Colors Standard Colors Do Fil More Fil Colors Systemper Dicture Gradient Leture Iesture	Bring Forward	same Excel Cl Tools appearin werPoint when hart is activate	hart the ed

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

8. Click the down arrow next to the Shape Fill button in the Format tab of the Ribbon. Select the white color block from the palette (see Figure 4.61 "Modifying an Excel Chart Pasted into a PowerPoint Slide").

9. Go back to the Excel Objective 4.16 file by clicking it in the taskbar.

10. In the Supply & Demand worksheet, change the value in cell C14 to 6.

11. Go back to the Excel Objective 4.18 PowerPoint file by clicking it in the taskbar.

12. Click the Design tab in the Chart Tools section of the Ribbon. Click the Refresh Data button (see Figure 4.62 "Refreshing a Linked Excel Chart Pasted into a PowerPoint Slide"). The change made in the Excel workbook is now reflected on the PowerPoint slide.

Integrity Check - Refreshing Linked Charts in PowerPoint and Word

When creating a link to a chart in Word or PowerPoint, you must refresh the data if you make any changes in the Excel workbook. This is especially true if you make changes in the Excel file prior to opening the Word or PowerPoint file that contains a link to a chart. To refresh the chart, save the Excel file after the changes, in PowerPoint, activate the chart, then click the Refresh Data button in the Design tab of the Ribbon. Forgetting this step can result in old or erroneous data being displayed on the chart.

Figure 4.62 "Refreshing a Linked Excel Chart Pasted into a PowerPoint Slide "shows the appearance of the scatter chart in the PowerPoint slide after the color of the plot area was changed back to white. Figure 4.63 "Final Chart Linked to a PowerPoint Slide" shows the appearance of the scatter plot after the change was made in the Supply & Demand worksheet in the Excel file. The change that was made in the Excel file will appear in the PowerPoint file after clicking the Refresh Data button.

Figure 4.62 Refreshing a Linked Excel Chart Pasted into a PowerPoint Slide

dd-ins ACR	OBAT	Design	For	rmat	Q Tell	me	Д	\Box
af Grande for Stadiot Cond I and I and I and I and I I and I and I and I and I and I I and I and I and I and I and I I and I and I and I and I and I and I I and I and I and I and I and I and I I and I and I and I and I and I and I I and I and I and I and I and I and I I and I and I and I and I and I and I and I I and I and	Switch	h Row/ S	Select Data	idit Data v	Refresh Data	han	ange t Type	
0 · · · I · · ·	1	· · 2 · · ·	Data	3 · · · I	· · · 4 · ·	i ly	,	^
	:	:						
2.50	•	•						
	•	•		• • •	-			
O d for Breakfas	t Cereal		(+]		•	

Figure 4.63 Final Chart Linked to a PowerPoint Slide



The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Key Takeaways

- When pasting an image of an Excel chart into a Word document or PowerPoint file, use the Picture option from the Paste drop-down list of options.
- When creating a link to a chart in Word or PowerPoint, you must refresh the data if you make any changes in the Excel workbook.

Integrity Check - Severed Link?

When creating a link to an Excel chart in Word or PowerPoint, you must keep the Excel workbook in its original location on your computer or network. If you move or delete the Excel workbook, you will get an error message when you try to update the link in your Word or PowerPoint file. You will also get an error if the Excel workbook is saved on a network drive that your computer cannot access. These errors occur because the link to the Excel workbook has been severed. Therefore, if you know in advance that you will be using a USB drive to pull up your documents or presentation, move the Excel workbook to your USB drive before you establish the link in your Word or PowerPoint file.

Skill Refresher - Pasting a Linked Chart Image into PowerPoint

- 1. Activate an Excel chart and click the Copy button in the Home tab of the Ribbon.
- 2. Click in the PowerPoint slide where the Excel chart will be pasted.
- 3. Click the down arrow of the Paste button in the Home tab of the Ribbon.
- 4. Click the Keep Source Formatting & Link Data option from the drop-down list.
- 5. Click the Refresh Data button in the Design tab of the Ribbon to ensure any changes in the Excel file are reflected in the chart.

Chapter 5

Tables and PivotTables

Until now in this text we have dealt with small amounts of data. However, the more common situation in businesses today is having very large data sets to manipulate and make sense of. For example, large amounts of data can come from Access databases, data mining on the web, exporting from an accounting program, or many other places. The data can be thousands upon thousands of rows of raw data. How can we efficiently manipulate that kind of overwhelming data? In this chapter, we will explore the built-in tools in Excel that allow us to easily manipulate large data sets. Excel will easily condense, sort, filter, and subtotal data. Using PivotTables and PivotCharts we will see the power of Excel to condense raw data into easily manipulated reports.

5.1 Creating an Excel Table

LEARNING OBJECTIVES

- 1. Create an Excel Table
- 2. Rename the table
- 3. Change the table style
- 4. Add records to the table
- 5. Delete records from the table.
- 6. Add a total row and change the results.
- 7. Add columns to the table.

Creating a Table

Suni works in the accounting department for Great Education College. She is given the task of condensing the data around vehicles owned by the college. She must condense the information into easily understandable reports to be provided to the college board's finance committee.

Follow-along file: Excel Objective 5.00.

Suni examines the data in the College Vehicles worksheet. She notes that each has an Asset number, the year vehicle was made, the make and style of the vehicle, which department has control of the vehicle, its purchase price and estimated annual maintenance cost. She will use this data to create her various reports.

A few things to know about data in tables before we begin.

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

• Data must be in contiguous cells – no breaks in rows or columns

• Headers must be next to the first row of data – no break in rows between headers and the start of your data.

We will create an Excel table to manipulate her data. The steps we will use to do that are: 1. Click on any cell within the list of data.

2. From the Insert ribbon, select Table. Excel will automatically determine the absolute range of cells that will be placed in your table. See Figure 5.01

Figure 5.1 Excel's Selection of Data

File	Ho	me Inse	ert Draw	Page	Layout Forr	mulas Dai	ta Review	View Ç	7 Tell me v	vhat you
ot Ta	able Reco Piv Ta	mmended otTables bles	Table Pic	tures Onlin Pictur	e Shapes Smar Illustrations	ntArt Screensh	ot 🎒 My Add	I-ins Bing Maps Add-ins	People Graph	Recomi
1		• : 3	x V	f _x For	rd					
1	A	В	С	D	E		F	G	н	
A	sset #	Year	Make	Style	Odometer	De	Marquee	around	Ann	ual nance
1	87	2012	Ford	Sedan	37780	Campus Se	selecte	d data	\$	1,933
	195	2014	Ford	Truck	19870	Telecomm		\$18,682	\$	1,331
	503	2013	Chevrolet	Sedan	8900	Campus See	curity	\$ 20,904	\$	939
	678	2005	Ford	Pickup	73419	Campus Ho	using	\$11,866	\$	507
	696	2010	Dodge	Van	43907	Campus See	curity	\$15,844	\$	566
	798	2013	Ford	Van	24575	Campus Ho	using	\$ 19,846	\$	168
	817	2014	Chevrolet	Van	16896	Campus Ho	Create Table	?	×	705
1	818	2010	Chevrolet	Pickup	37786	Campus Ho	Where is the stor	to far much to	.2	1,594
	829	2005	Ford	Pickup	32765	Campus Ho	where is the da	ta for your tabl		1,370
	834	2001	Chevrolet	Van	138456	Property	=3A51:5H5	264	T	1,235
	841	2009	Data ra	ange sele	cted 59378	Drinting Se	My table	e has headers		473
	865	2010	b	y Excel	2313	Campus Ho				30
	866	2011	Ford	Sedan	49973	Campus Se		OK	Cancel	567
	874	2014	Ford	Van	43678	Telecomm		5 21,580	5	28

1. From the Create Table dialog box check to make sure it is including all the data table. You will see a marquee around your table and the range selected will be in the dialog box. You can use the dialog box to select the correct data if the range is not correct.

2. Click Ok

Excel will automatically apply a color style with banded rows. We will eliminate the banded rows, because it only adds visual clutter to the data. Remember our data needs to tell a

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

story without clutter. The banded row format will lose the ability to maintain the banded row colors when the table is converted back to a range. *Note: we will cover converting back to a range later.*

3. In the Table styles section of the Table Tools Design ribbon, use the drop-down in the styles and select None. (Top row, first column) See Figure 5.2. The *None* style will revert the appearance of your table back to a normal spreadsheet, except that now you will have drop-down arrows next to each of the column headers.

Figure 5.2 Selecting the None Style for the Excel Table.

8				lacel_Objective_5.0	- Excel		Table Tools		Kaaren Mc	siyan tti		u ×
File	Horr	ve Insert Draw	Page La	ryout Formula	i Data Review	r Vie	Design	🖗 Tell me what you want to do				A Share
able Na	me	Summarize with P	ivotTable		Properties		Hader Row	inst Column 🕢 Filter Button	LieM			
able2 Prop E26	ce Table eitles	Select th to th	ie dro ie Tab	op down ole Style	next s		Sotal Row 1 Banded Rows 1 Tab	ast Column landed Columns in Style Options	/			
4	A	8 C	D	E	F		G	н				
A	sset =	Year • Make •	Style +	Odomete *	Department		urchase Pric -	Annual Maintenanci •				
£	87	2012 Ford	Sedan	7780 Ca	mpus Security	\$	20,888	\$ 1,933				
<u> </u>	195	2014 Ford	Truck	19870 Te	lecomm	5	18,682	\$ 1,33	88888			
4 5 5 7 8	503 678 696	2013 Chevrolet 2005 Ford 2010 Dodge Drop-do	yan yan yan	8900 Ca 73419 Ca 43907 Ca OXES	mpus Security mpus Housing pus Security pus Housing pus Housing	5 5 5 5 5 5 5	20,904 11,864 15,844 19,844 20,824 12,285	Select the "I Style from th styles	None" e list of			
0	- 1	applied	to col	umn	ous Housing	4	5.000	01,100				
		hor	dore		arty		11 445	6 1.215				
2		nea	auers		ing Services	5	20.315	\$ 473				
3	865	2010 GMC	Van	42313 Ca	mpus Housing	5	12,500	\$ 30				
4	866	2011 Ford	Sedan	49973 Ca	mpus Security	5	15,090	\$ 567	COLOR COLOR			STATE STATE
5	874	2014 Ford	Van	43678 Te	lecomm	5	21,580	\$ 28				
6	877	2006 Chevrolet	Pickup	50580 Pr	operty	5	14,130	\$ 279				manager manager
7	888	2009 Ford	Sedan	62743 Ca	mpus Security	5	22,413	\$ 112	Dark			
8	897	2015 Ford	Truck	12703 Ca	mpus Housing	\$	22,724	\$ 1,591	CARGO CARGO	-	100000	
2	904	2006 Chevrolet	Sedan	53383 Ca	mpus Security	\$	16,539	\$ 1,641				
0	1016	2007 Ford	Pickup	52728 Ca	mpus Housing	5	14,757	\$ 2,000		-		
1	1055	2014 Ford	Van	3500 DI	ning Services	5	22,438	\$ 695				
2	1071	2003 Ford	Van	93484 Pr	inting Services	\$	12,149	\$ 378				
3	1140	2013 Ford	Truck	29781 Pr	operty	\$	19,634	\$ 575	📓 New Table Style			
4	1167	2010 Ford	Truck	39292 Ca	mpus Housing	\$	15,366	\$ 3,491	Dia Clear			
5	1172	2005 Ford	Sedan	78740 Ca	mpus Security	5	15,871	\$ 724				
4	1196	2008 Chevrolet	Van	53560 Ca	mpus Housing	5	12,493	\$ 1,299				
7	1374	2005 Chevrolet	Sedan	137534 Ca	mpus Security	\$	20,453	\$ 2,235				
8	1375	2009 Fond	Pickup	45608 Ca	mpus Housing	\$	15,866	\$ 72				1 N N N N N N N N N N N N N N N N N N N
		College Vehicles	(+)					3 (4)				
-	***								Date: 1	000		A 1075

4. Rename the table to Vehicles_Source by clicking in the Table Name Box on the Table Tools ribbon. *Note: the same rules that you learned for naming cells and ranges applies to naming tables.*

Figure 5.3: Renaming the Excel Table.



Integrity Check- Creating a table when your worksheet has a title directly above the column headers

If the worksheet has a title, i.e. a company name, purpose of the worksheet, or any data etc. in the row directly above the data range you will be converting to a table, you must insert a blank row between the data above the table data and the column headers for the data table. Excel will not be able to determine the correct data range that will be converted to a table they are adjacent to each other.

Adding Records

Maintaining data in an Excel tables means that you will most likely be adding or deleting records from the table. The simplest way to add a record to an Excel table is to add it at the first blank row at the bottom of the table.

The school recently purchased another vehicle for the maintenance department. The record for the vehicle needs to be added to the Vehicle_Source table. The data for the new vehicle is:

- Asset # 4625
- Year 2023
- Make: Ford
- Style: Pickup

- Odometer: 15
- Department Maintenance
- Purchase price: \$44,250
- Annual Maintenance: 2,532

1. From anywhere in the worksheet hold the Ctrl key down and click the End key.

2.Click the Home key to move you to column A.

3. Hit Enter once to move you to the first blank row.

4.Enter the data above. Use the tab key to move you across the cells as you enter the data. *Note: as you enter the new data, the table will continue the formatting from the data in the column above the new entry.*

Finding and Editing Records

You need to update the records for the 2008 Chevrolet van, asset number 1196, and the 2013 Ford van, asset number 1678. They have been reassigned from Campus Housing to the Athletics department. You'll use the Find command to locate the records. Then, you will edit the record to change the assigned departments to Athletics.

1. Press the Ctrl+Home keys to move to the top of the worksheet, and then click cell A2 to make it the active cell. You will search on the asset number because it is a distinguishing number in the table.

2. In the Editing group on the Home tab, click the Find & Select button, and then click Find. The Find and Replace dialog box opens.

3. Type 1140 into the Find what: dialog box. Then click Find Next. Leave the Find and Replace dialog box open while you edit the first record.

4. Click F26 and change the department to Athletics. *Note: As you type the A, the Athletics department will appear in the auto complete. Hit enter to accept the department.*

5. In the Find and Replace dialog box, delete the 1196 asset number and enter the next record number that must be updated, 1678. Click Find Next. Then close the dialog box.

6. Change the department to Athletics.

Deleting Records

The last update required is to delete a record for a sold vehicle. Asset number 1040, a 2003 Ford van was sold and needs to be removed from the asset list.

The steps you will use to delete the record are:

1. Press the Ctrl+Home keys to move to the top of the worksheet, and then click cell A2 to make it the active cell. You will search on the asset number because it is a distinguishing number in the table.

2. In the Editing group on the Home tab, click the Find & Select button, and then click Find. The Find and Replace dialog box opens.

3. Type 1040 into the Find what: dialog box. Then click Find Next. Close the Find and Replace Dialog box.

4. In the Cells group of the Home tab, click the Delete button and select Delete Table Rows from the drop down. *Note: If a different record was deleted, the active cell was not in the record for the Asset 1140. Click the Undo button and select the correct record.*

Figure 5.4: Deleting a Table Row.

8 5	• ¢*			Excel_Objective	5.1 - Excel			Table Tools				Kas	ren McGlynn		-
File	Home	Insert Draw	Page L	ayout Form	nulas Dat	a Review	View	Design	0	Tell me what you want to do					
X	Calibr	s - 11	• A A	==	彩. 日	Wrap Text	1	Seneral			■ 静	1	< Th	Σ· Α.	. 5
Paste	B /	r µ • [⊞ •]	0 · 4 ·	R R 3	11111	Merge & Center		\$ - % + %	8 43	Conditional Format as Formatting * Table * St	Cell Insert	Dele	le Format	Sort 8	k Fir - Sel
Reboard	15	Font	6		Alignment		-	Number		s Styles	-	100	Delete Cells.	-	10
A22	-	× ×	6 114	3								305	Delete Sheet	Bews	
11000000			144.4	1.	-	200 B	1 1000		-		w	×	Delete Sheet	Columns	
A Asset	# Year	+ Make +	Style +	Odometer -	Departmen	t	+ Pur	chase Price	Ace	nual Maintenance +	1 1	5	Delete Table	Rout	M
3	865	2010 GMC	Van	42,313	Campus Ho	ousing	5	12,500	\$	30		1.04			×
4	866	2011 Ford	Sedan	49,973	Campus Se	curity	\$	15,090	\$	567		×	Delete Table	Columns	
5	874	2014 Ford	Van	43,678	Telecomm		\$	21,580	\$	28		150	Delete Sheet		
6	877	2006 Chevrolet	Pickup	50,580	Maintenan	ce	\$	14,230	\$	279		-			-
7	888	2009 Ford	Sedan	62.245	Campus Se	curity	- 5	22,413	\$	112					
8	897	2015 Ford	Truck	12,703	Camput	asing	\$	22,724	\$	1.591					
9	904	2006 Chevrolet	Can	12407	Campus Se	curity	\$	16,539	s	1.641					
0 1	016	2007 5	Distanto	\$2 728	Campus Ho	witting	¢	14.757	e.	2 000					
1	055	2011 FORd	Van	3,500	Dining Sen	vices	s	22,438	¢	695					
2	140	2013 Ford	Touck	39 791	Maintenan	60 C	-	19 634	e.	575					
	Carrier Carrier	2020 -010	er orch	4.0,104	the state of the s	~~		A.7,9,94	18	415					

Adding a Total Row

Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.01 if starting here.) Suni would like to see a count of how many vehicles the college owns. She wants to have the count be dynamically linked to the table contents.

The steps we will use to create a total row, and then change it to a count are:

1. From the Table Style Options on the Table Tools Deign tab, check the box for Total Row. *Note: you can uncheck the box to turn off the total row.*

Figure 5.5 Adding a Table Row

cel_C)bjective	_5.02 - 1	Excel			Table Too	ols	
out	Form	nulas	Data	Review	View	Design	♀ Tell me wha	at you want '
sert	Export	Refresh •	E Prop Oper Unlir al Table D	erties n in Browser nk vata	Head Tota	Her Row	 First Column Last Column Banded Column Table Style Options 	√ Filter
# Ddon	neter 👻	Depar	tment		Total Turn o table.	Row (Ctrl on or off th	+Shift+T) he total row of the	nance 🔽
1	103,123 Campus Housing				The to	tal row is	a row at the end of	1,350
	43,912 Campus Housing		the tal	the table which displays totals for				
3,670 Campus Housing			each o	each column.				
12 702 Compute Housing				ć	22	704 Ć	1 501	

2. Excel will drop you down to the newly created total row. It will automatically put in a total for Annual Maintenance. We will accept that for now. Click on the total row for the Style. From the drop-down select count.

Figure 5.6: Adding the Count

_										
58	1071	2003	Ford	Van	93,484	Printing Services	\$	12,149	\$	378
<u>i9</u>	195	2014	Ford	Truck	19,870	Telecomm	\$	18,682	Ş	1,331
0	2142	2015	GMC	Truck	2,800	Telecomm	Ś	13,410	\$	257
71	2153	2011	Chevrolet	Van	32,315	Telecomm	\$	14,109	\$	732
12	1445	2006	Dodge	Van	56,788	Telecomm	\$	10,105	\$	345
73	874	2014	Ford	Van	43,678	Telecomm	\$	21,580	\$	28
74	Total				*				\$	73,918
15				None						
16				Count						
77				Count Numl	ber					
8				Min						
19				Sum						
30				Var						
31				More Functi	ion					

3. Delete the word Total from the A column and type Total number of vehicles. (Don't worry about overlapping cell walls.)

4. In column g: type Total maintenance.

Remember: Your worksheet must tell a story all by itself!

Adding a New Column

Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.02 if starting here.) Suni would like to see the monthly maintenance cost for each vehicle. She has asked you to add a column next to the Annual Maintenance column.

A unique feature of having your data in a table, versus just a range of data, is the ability to add a column, have the formatting applied, and the formulas added in the top row of the data will automatically copy down the worksheet.

We will add a new column by:

1. Click in cell I1. Type: Monthly Maintenance and hit Enter. The bold and center formatting will automatically be applied to the column header and a drop-down box will appear next to the column header.

2. Resize column I to fit the new header.

3. In I2 enter a formula to divide the Annual Maintenance by 12. Type = and click on cellH2. Notice that when you click on H2 you see something new in your formula. Instead ofH2 you now see = [@[Annual Maintenance]]. This only occurs in a table. It will allow the formula to be copied down the range of cells in the table automatically. Type /12 after clicking on cell H2.

	Н	1	J	к
C(👻	Annual Maintenance	Maintenance 💌		
530	\$ 2,257	=[@[Annual Mainte	enance]] /1	2
197	Ś 1.975			

4. Hit enter to complete the formula.

5. Format the column by clicking on the column header to select it, then click on the lower border of the cell. This will highlight the column data. On the home ribbon select the Accounting format.

5.2 Sorting and Filtering Data

LEARNING OBJECTIVES

- 1. Sort data by one column
- 2. Perform a multi-level sort involving data in different columns
- 3. Filter data using column headers
- 4. Filter data using a custom filter
- 5. Create custom lists.

Sorting One Column

Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.03 if starting here.)

Integrity Check - Sorting and Filtering Data Without a Table

Sorting and filtering data **does not require** your data be in a table. Any range of contiguous data can be filtered by clicking on the Sort button from the Data tab. When selected, the same column header drop-down boxes will appear in your data range.

The records in the Asset record table appear in the order they were entered. There will be times when you are working in a data table, or creating reports, that you will want to see records sorted in a different order. For example, you may want to sort records by department, by make of car, or by odometer reading.

Data can be sorted in:

- Ascending order: lowest to highest, dates oldest to newest, or A to Z.
- Descending order: highest to lowest, dates newest to oldest, or Z to A

Data can be quickly sorted by using the drop-down arrows to the right of each of the column headers. When you click on the arrow you will see the sort functions A to Z, or Z to A. *Note: you cannot use the sort for more than one column. If you want to sort by multiple columns you must use the Sort button from the Data ribbon tab.*

Suni wants to see the table sorted by department to see how many vehicles are in each department. The steps to accomplish this are:

1. We want to maintain the integrity of our raw data, so we will copy the Raw Data worksheet and make our changes in the new worksheet. While holding the Ctrl key down, left click the worksheet tab and drag to the right. You will see a little image of a piece of paper with a +. Drop the worksheet to the right of the original worksheet. The new worksheet will have the name Raw Data (2)

2. Rename the new worksheet College Vehicles by double clicking on the worksheet tab, eliminating the title there and entering the new title.

3. Click on the drop-down next to the Department column header. See Figure 5.4

4. Select the A to Z sort. Data is sorted with Athletics first, ending with Telecom.

	∃ 5-∂				Excel_0	bjective_5.02 -	Excel			Table Tools
	File Home	Inse	rt Draw	Pag	e Layout	Formulas	Data	Review	View	Design
1	Ari	ial	- 10	* A*	A* = 1	= - »·	👺 Wra	ip Text	Ger	reral
Pa	ste B	I U	· [=]	8 - A	· =	= = = =		roe & Center	- 5	- 96 - 1
	· · · ·					_				
CI	pboard 5		Font		Ga i	Depa	artment	drop-		Number
A	1 *	3 >	< ./	f _x A	sset#	do	wn sele	cted.		
A	A	в	с	D		E	F			G
1	Asset -	Year -	Make -	Style	• Odo	mete -	Depart	ment	Pure	hase Price
2	▶ 87	2012	Ford	Sedan	91 Sor	t A to Z		compositions)	\$	20,888
3	195	2014	Ford	Truck	ZI Sor	ZtoA		C		18,682
4	503	2013	Chevrolet	Sedan		hu Color		Sorto	rders	20,904
		05	Ford	Pickup	501	E by Color			\$	11,866
	Active Ce	11 10	Dodge	Van	T _K ⊆le	ar Filter From "	Department		\$	15,844
_		13	Ford	Van	Filt	er by Color			\$	19,846
8	817	2014	Chevrolet	Van	Tex	t Eilters			\$	20,824
9	818	2010	Chevrolet	Pickup	5.00	rela		0	\$	13,783
10	829	2005	Ford	Pickup	360	1011		*	\$	5,000
11	834	2001	Chevrolet	Van		Select All)			\$	11,449
12	841	2009	Ford	Sedan		Campus Ho	using		\$	20,315
13	8	Denar	tmentl	iet		Campus See	curity		\$	12,500
14	8	Depai	unonei	131		Dining Serv	ices		\$	15,090
15	874	2014	Ford	Van		Printing Sec	ce wices		\$	21,580
16	877	2006	Chevrolet	Pickup		Telecomm			\$	14,130
17	888	2009	Ford	Sedan	I T				\$	22,413
18	897	2015	Ford	Truck					\$	22,724
19	904	2006	Chevrolet	Sedan					\$	16,539
20	1016	2007	Ford	Pickup					\$	14,757
21	1055	2014	Ford	Van					\$	22,438
22	1071	2003	Ford	Van					\$	12,149
23	1140	2013	Ford	Truck		_	_		\$	19,634
24	1167	2010	Ford	Truck			OK	Cancel	\$	15,366
25	1172	2005	Ford	Sedan					.: \$	15,871

Figure 5.5: Table Drop-Down Sort Feature.

Notice that the active cell in Figure 5.5 is A1. However, the drop-down selected was for the Department as indicated by the department names at the bottom of the list.

Multi-Column Sort

Using the drop-down in a table column makes a one series sort very quick and easy. However, trying to sort by multiple columns does not work using this method. As soon as you click on another column and perform a new sort, the original sort you created in the first column is overwritten by the new sort applied. You were briefly introduced to the Sort dialog box in Chapter1 for a single column sort. In this section, we will be dealing with performing a multi-column sort using the Sort dialog box.

The first thing that must be decided when performing a multi-column sort is what will be the primary sort, secondary, and so on.

Suni, after looking at the sort, decides that a better view would be to sort by Department, then by Style, by Make, and finally by year purchased with the latest models first. To perform this multi-column sort, we will perform the following steps:

1. Have an active cell anywhere within your table or range.

2. From the Sort & Filter section of the Data ribbon, select Sort.



3. The sort dialog box will appear.

4. The first dialog box in the Sort is the Column. Whichever column contains your active cell will be the default Sort by in the column. The drop-down next to the column will have all of the column headings. Remember that Suni wants to sort by department first. From the drop down select Department. *Note: My data has headers at the top right of the dialog box must be checked or Excel will treat your headers as part of the table data.*

5. In the Sort On field, select what cell contents the sort will focus on. The choices in the list are:

- Values this is the default. Whatever value is in the cell will be used for the sort.
- Cell color if cells have a conditional formatting, or highlighting, that fills a cell with color, it can be used in the sort. When selecting this option, a color selection box will be added to the Add level row. A second new selection box will appear that asks if the cell color should be on top of the other items in the column, or at the bottom.
- Font color – if contents of cells have a font color other than black, it can be used in the sort. When selecting this option, a color selection box will be added to the Add level row. This choice will also get the second box that asks where the cells containing color should be place in the sort order.
- Icons Excel 2016 allows the placement of icons in a cell. This concept is not covered in this book, but if placed in a cell can be used as a sort.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

6. The last field in the Sort is the Order field. You can sort in Ascending, Descending, or by a Custom List. (See Creating a Custom List in Section 5.2 Sorting and Filtering.) The default sort for text is A to Z. We will accept the default.

7. Click on Add level at the top right of the Sort dialog box. A new level will be added to the sort dialog box. In the dialog box for the Then by, select Style from the drop-down list. *Note: you can change a level by re-selecting from the drop-down. You can also delete a level by clicking on the row and clicking on Delete Level.*

8. Add another level for the Make.

9. Add a final level for the year purchased. Change the Order for the Year to Largest to Smallest, so the newest vehicles are displayed first.

10. Click OK.

Figure 5.5: Creating a Multi-Level Sort in the Sort Dialog Box.

Sort					? ×
⁺ A <u>A</u> dd	Level 🗙 <u>D</u> elete L	evel	E Copy Level	Option	ns My data has <u>h</u> eaders
Column			Sort On		Order
Sort by	Department	\sim	Values	\sim	A to Z 🗸
Then by	Style	\sim	Values	\sim	A to Z 🗸
Then by	Make	\sim	Values	\sim	A to Z 🗸
Then by	Year	\sim	Values	\sim	Largest to Smallest 🗸 🗸
					01
					OK Cancel

Figure 5.5: Sort Results.

-11	A	B	C	D	E	F		G	
1	Asset 💌	Year -1	Make -1	Style -1	Odomete -	Department	ΨĪ	Purchase Price	Annua
2	2364	2000	Crevrolet	edan	92,419	Athletics		¢ 11 630	\$
3	2128	2004	Ford	/an	99,880	Athletics		Level 1 97	\$
4	2084	2007	GINC	/an	74,309	Athletics		87	\$
5	1462	2007	GINC	/an	8:	125		\$ 20,882	\$
6	1415	2007	GINC	Van		vel·21		\$ 16,748	\$
7	1680	2013	Chevrolet	Pickup	23,915	Campus Housing		\$ 16,763	S
8	2131	2011	Chevrolet	Pickup	31 394	Campus Housing		\$ 15,613	\$
9	818	2010	Chevrolet	Pickur I	evel.3¶ 5	Campus Housing		\$ 13,783	\$
10	2132	2008	Chevrolet	Picku	4	Campus Housing		\$ 14,019	\$
11	1375	2009	Ford	Pickup	45,608	Campus Housing		\$ 15,866	\$
12	1016	2007	Ford	Pickun	52,728	Campus Housing		\$ 14,757	\$
13	829	2005	Ford I	evel-4¶	32,765	Campus Housing		\$ 5,000	\$
14	678	2005	Ford		73,419	Campus Housing		\$ 11,866	\$
15	1776	1997	chevrotet	Sedan -	81,802	Campus Housing		\$ 14,993	S
16	2112	1996	Ford	Sedan	103,123	Campus Housing		\$ 12,007	\$
17	1643	2008	Chevrolet	Truck	43,912	Campus Housing		\$ 7,200	\$
18	2126	2015	Ford	Truck	3 670	Campus Housing		\$ 9.471	\$

Note that after a sort is applied you will see arrows in the filter buttons next to the column headers indicating the column has been sorted and in which order (up or down) the sort was performed.



Sort Using a Custom List

Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.04 if starting here.) There may be times when entering repetitive entries like days of the week, or sorting alphabetically or numerically in descending or ascending order doesn't give you the results you want to see. An example of this that we use often is sorting by the days of the week, or by months in the year. If we sorted those alphabetically, we would come up with the jumbled orders you see in Table 5.1.

Table 5.1 Sorting Days and Months Alphabetically

Friday	April
Monday	August
Saturday	December
Sunday	February
Thursday	January
Tuesday	July
Wednesday	June
	March
	May
	November
	October
	September

There may also be times where you would sort by a specific part number order, or name. In cases like these, you need to sort using a custom list. There are several custom lists already established in Excel. They include the days of the week and the months in the year. You saw the custom lists in action when we filled the months down a column using the auto fill feature. The auto fill feature will also draw on any custom lists established in Excel. You may even want to edit a custom list that is already set up. For instance, if you only want to fill Monday – Friday as the days of the week, you can edit the days of the week list to eliminate Saturday and Sunday from the list. *Note: custom lists apply in all your workbooks. If you edit the days of the week list, it will be available in all your workbooks.*

Suni wants to see the departments sorted in the following order:

- Athletics
- Campus Housing
- Campus Security
- Printing Services
- Dining Services
- Telecom
- Maintenance

We will look at the custom lists already set up and set up a custom list for sorting the departments in an order different than alphabetically.

1. From the Sort & Filter section of the Data tab, click on the Sort button. The sort you established in the last section will be displayed.

2. In the Department row, click on the drop down next to the Order box.

3. Select Custom List. The Custom Lists dialog box will be activated.

Figure 5.6: Custom Lists Dialog Box.



4. The NEW LIST option is automatically highlighted. Press Enter to create a new list or click in the List Entries box.

5. Type the departments in the order that Suni gave you, or you can copy the list and paste if from another source if available.

6. When finished, click OK. Note: Pressing enter will only move you down to a new row in your list.

7. Your custom list now shows in the Order box.

8. Resort the list by clicking OK. Your table is now sorted according to your custom list in the order Suni wanted.

Before we wrap up the **Sort** section, let's put a good title on our worksheet that describes what we have done to the worksheet. Remember, that each worksheet must tell a story to the reader. To describe out story for this worksheet, we will describe the sort we did in the worksheet and what data the worksheet represents.

1. Merge and center cells A1:J1.

2. Click in the grey area of row 1, when you see the black arrow pointing right, hold your left mouse button down and drag down to row 2. Both rows 1 and 2 should be selected.

3. Using keyboard commands, hold down the Ctrl key and click the + key on your ten-key keypad if you have one. If you don't have one then hold down the Ctrl key, the shift key, and the + keys. This will add two rows at the top of your document.

4. Insert the following title in row 1. Remember to hold the Alt key and press enter at the end of each row to wrap the text in the cell.

Minnesota State College

Vehicles Sorted by Department

Report date: 3/1/2025

Integrity Check–Leave a blank row between report title and column headers

Remember that for a range of data to be able to sort, filter, create a table, that data cannot have cells containing other information immediately adjacent to the data headers.

As we progress through the rest of Chapter 5, we will modify the report title to reflect how we have modified our data.

Key Takeaways

- When creating a multi-level sort, decide your sort order first.
- Create a multi-level (column) sort by using the Sort button in the Sort & Filter section of the Data tab.
- A custom sort can be created from the Sort button, Order box, and typing a new list.
- Custom sort lists are available across all your worksheets.

5.3 Filtering Data

LEARNING OBJECTIVES

- 1. Duplicate worksheets.
- 2. Apply number and text filters to a data range.
- 3. Clear Filters

Suni now wants to determine which vehicles should be considered for replacement. She is going to base her decision to replace a vehicle based on the age of the vehicle and the odometer reading. She wants you to filter so that only the vehicles that were purchased before 2008 and have an odometer reading greater than 100,000 miles are shown in the list.

Apply Filters

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted You could accomplish by coping the worksheet and deleting all the rows of vehicles that don't meet her criteria, or you can filter the list to only show those vehicles that meet the given criteria. We will use filters to accomplish our goal.

When you create an Excel table, or turn on the Filter from the Data tab, the filter arrows appear next to the column headers. You can use the options on the AutoFilter to create three types of filters. You can filter a column of data by its cell colors or font colors, by a specific text, number or date filter, (although the choices depend upon the type of data in the column,) or by selecting the exact values by which you want to filter in the column. After you filter a column, the Clear Filter command becomes available so you can remove the filter and redisplay all the records. *Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.05 if starting here.)* We will set up the filter for Suni, but we want to maintain the first worksheet sort. We will accomplish this by duplicating our worksheet and performing the filter on the new worksheet. 1. While holding the Ctrl key down, left click the worksheet tab and drag to the right. You will see a little image of a piece of paper with a +. Drop the worksheet to the right of the original worksheet. The new worksheet will have the name College Vehicles (2).

2. Rename the worksheet Vehicle Filter.



3. Make sure the Vehicle Filter worksheet is active by clicking on the worksheet tab at the bottom of the worksheet.

4. We will filter on the year first. It doesn't matter which category you decide to filter on first, the end results will be the same. Click the Category Filter arrow next to Year.



5. The AutoFilter menu opens as shown in Figure 5.7. It lists all the unique entries in the category. The list will differ based upon which column you select to filter.

Figure 5.7: Filter Menu for the Year Column.



6. We could go through and uncheck all the years we don't want to filter on. In this case vehicle newer than 2008, or we can use the number filter feature. Click on the Number Filter directly above the Search box. Because we are filtering on all cars older than 2008, we will Select Less Than from the drop-down menu.

Figure 5.8: Number Filters Selection Menu.

	Clipboard	Gi		Font	5	Align	m
	С9	•		X 🗸	<i>f</i> _x Che	vrolet	
	Asset =	# 👻 Year	ΨÌ	Make 🖵	Style 🖵	Odometer 👻	1
A Sort Smallest t	o Largest			Chevrolet	Van	43,038	Ī
Z Sort Largest to	Smallest			Chevrolet	Van	53,560	
<u>Aw</u> S <u>o</u> rt Longest to	orriditest			Chevrolet	rolet Van		
Sort by Color			•	Chevrolet	Van	101,712	
🕵 <u>C</u> lear Filter Fro	m "Year"			Dodge	Van	33,321	1
Filter by Color			Þ	Ford	Van	5,721	1
Number Filter			Þ	Equals		39	1
Number Litters	, 		-	Equals		75	1
Search			ρ	Does N	lot Equal	26	1
(Select /	AII)		^	Greate	r Than	37	1
🗹 1996				Greate	r Than Or Fo	ual To 13	
✓ 1997				Less TI		72	
2000				Less II	nan	10	
2002				Less T	han Or E <u>q</u> ual	To 20	
2003				Betwee	en	55	
				Top 10		54	
2005				10010		50	
2008				<u>A</u> bove	Average	/3	
2008			Т.	Bel <u>o</u> w	Average	11	+
2009				Custor	n Filter	13	4
						04	4
2011			~	Ford	Sedan	78,740	1
				Chevrolet	Van	8,993	1
	OK	Cancel		Dodge	Van	43,907	1
			.:	Chevrolet	Pickup	2,250	
	40	041	1000	Canal .	Contain	F0 170	h

7. In the Custom AutoFilter dialog box, type 2008 and click OK.

Figure 5.9: Custom AutoFilter Dialog Box.



8. The next filter we will apply will be for the odometer reading greater than 100,000 miles. Click on the Category Filter arrow next to Odometer and choose Number Filters, Greater than. Type 100000 (no commas) into the criteria value box. Click OK. Figure 5.10 shows the results of the number filters applied to the Year and Odometer columns.

Suni decides that only the Maintenance department will get new vehicles this round, so she wants you to only show Maintenance in your report.



9. Click on the Category Filter next in the Department column. Note that the selection only shows those departments that are included in the filters that have been applied so far. Click the Select All so it is unchecked and then check Maintenance.

10. Click OK to save the filter.

Figure 5.10: Selecting Departments.



Figure 5.11 shows the results of the custom filters applied to the data. Note that the count of vehicles and the sum of the annual maintenance has changed to reflect only those vehicles included in the filter.

Figure 5.11: Worksheet After Filters Applied.

E	1.0.						Excel_Objective	5.06 - E	icel		Kaaren Me	Glynn	•		
Fil	e H	ome	sert Draw	Page La	iyout Form	iulas Data	Review	View	🖓 Tell me wi	hat you want to do					, А , я
Past	Board G	Calibri B I	+ 11 U + 🖽 + Font	• A* A* • <u>A</u> •	프 프	 <lp>. </lp> <lp>. </lp>	General \$ - % * Numbe	58 48	Conditiona	ai Format as Cell • Table • Styles • Styles	En Insert Delete Format Cells	· Σ	Sort 8 Filter	Find & Select *	
A1		• 1	x v	<i>f</i> _x Vehi	icles Sorted b	y Department									
all	4	8	The				¢		G	н		1			1
the second se															
2 3	Asset 7	Year	T Make -	Style -1	Odomete .7	Depa	rtment if	r Purch	ase Price	Annual Maintena	inc(+ N	laintena	nce 👻	Month	y Mainte
2 3 70	Asset	Year	Make - 3 Chevrolet	Style -1 Sedan	Odomete .7 110,863	Depa Maintenance	rtment (1	r Purch \$	ase Pric - 11,041	Annual Maintena \$	nci - N 964 \$	laintena	nce -	Month \$	ly Mainte
2 3 70 73	Asset 173	Year 5 20 4 20	Make - Make -	Style -1 Sedan Van	Odomete .* 110,863 138,456	Depa Maintenance Maintenance	rtment [f	F Purch S S	ase Pric - 11,041 11,449	Annual Maintena S S	964 \$ 1,235 \$	laintena	80.30 102.94	Month \$ \$	ly Maint
2 3 70 73 76 1	Asset 173 834 fotal num	Year 5 20 4 20 hber of v	Make - O3 Chevrolet O1 Chevrolet chicles	Style +1 Sedan Van 2	Odomete .* 110,863 138,456	Depa Maintenance Maintenance	rtment	F Purch S S Total M	ase Pric - 11,041 11,449 laintenance	Annual Maintena S S S	964 \$ 1,235 \$ 2,199	laintena	80.30 102.94	Month \$ \$	ly Maint
2 3 70 73 76 1 e bl	Asset 173 834 Total num ue nu	Year 20 20 10 10 10 10 10 10 10 10 10 10 10 10 10	Make - 3 Chevrolet 1 Chevrolet chicles	Style -1 Sedan Van 2	Odomete .¥ 110,863 138,456	Depa Maintenance Maintenance	rtment []	F Purch S S Total M	ase Price 11,041 11,449 laintenance	Annual Maintena S S T S	964 \$ 1,235 \$ 2,199	laintena	80.30 102.94	Month \$ \$	ly Maint
2 3 70 73 76 1 e bl	Asset 173: 834 Total num ue nu e hidd	Year 20 1 20 1 20 1 20 1 20 1 20 1 20 1 20 1	T Make - 33 Chevrolet 31 Chevrolet thicles 5 VS	Style - Sedan Van 2	Odomete .¥ 110,863 138,456	Depa Maintenance Maintenance	rtment [F Purch S S Total M	ase Prici - 11,041 11,449 Naintenance	Annual Maintena s s s totals chang	964 \$ 964 \$ 1,235 \$ 2,199 ged to	laintena	nce * 80.30 102.94	Month \$ \$	ly Mainte
2 3 70 73 76 1 e bl	Asset 173: 834 Total num ue nu hidd	Year 20 20 ber of ve mber en rov	T Make - 33 Chevrolet 11 Chevrolet thicles 5 VS	Style +1 Sedan Van 2	Odomete 7 110,863 138,456	Depa Maintenance Maintenance	rtment (r Purch S S Total M Con	unt and	Annual Maintena S S totals chang ly data displ	964 \$ 1,235 \$ 2,199 ged to layed	laintena	nce * 80.30 102.94	Month \$ \$	ly Mainte
2 3 70 73 76 1 e bl	Asset 173: 83- fotal num ue nu e hidd	Year 20 a 20 aber of we mber en rov	T Make - 33 Chevrolet 21 Chevrolet 21 Chevrolet 23 Chevrolet 24 Chevrolet 25 Chevrolet 26 Chevrolet 27 Chevrolet 27 Chevrolet 27 Chevrolet 28 Chevrolet 29 Chevrolet 20 Che	Style -1 Sedan Van 2 Vehicle I	Odomete	Depa Maintenance Maintenance	rtment (1	r Purch \$ \$ Total M Cot re	unt and	Annual Maintena S S totals chang ly data displ	964 \$ 1,235 \$ 2,199 ged to layed		nce 💌 80.30 102.94	Month \$ \$	ly Maint

11. The title of the worksheet must be corrected to reflect the data filters applied. We will change the second row of the title to reflect this change. Click in the A1, the worksheet title. Use the down arrow at the right side of the formula bar to show the entire title.

12. Click in the second row and delete the text currently there. Replace that text with Maintenance Dept. Vehicles Bought before 2008 with > 100,000 miles.

Figure 5.12: Worksheet Title Changed.



Clearing Filters

To redisplay all the data in a filtered table or data range, you need to clear or remove the filters. When you clear a filter from a column, all the other filters still applied will remain in place. To redisplay the entire data table, all the filters must be removed. You can remove filters one at a time, or clear all filters.

To remove one at a time, click on the AutoFilter button next to the category you want to restore. From the drop-down select Clear Filter from...

To remove all filters, click on Clear Filters from the Sort & Filter section of the Data tab.

<u>The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025)</u> by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Key Takeaways

When you are working with a range of data or an Excel table that contains hundreds of thousands of records, filters help you find information quickly and efficiently without having to look at each individual record. For example, you could narrow the search to one student out of a student population of 40,000.

Filtering limits the data to display only the specific records that meet the criterial you set, enabling you to more effectively analyze the data. The following examples further illustrate how filtering can narrow the data to only that data needed.

- Looking for customers in a specific zip code, or range of zip codes.
- Finding those records that have been highlighted by a specific color.
- Searching by customers who purchased from you before a certain date so you can target them for a marketing campaign.

5.4 Subtotals

LEARNING OBJECTIVES

- 1. Convert a table to a normal range
- 2. Sort data based on desired subtotal categories
- 3. Create subtotals
- 4. Create multi-level subtotals
- 5. Subtotal views
- 6. Remove subtotals

Creating Subtotals

Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.06 if starting here.) Suni is helping the college president prepare her budget, and she needs a report she can give to the college president showing the number of each style of vehicle and the total annual maintenance cost by department. Using the total row in your table would mean creating a filter for each department and Style. Then printing each out in a separate report. You can create this report for her by creating subtotals in your worksheet.

We will summarize the data in our range by inserting subtotals. The subtotal command offers many kinds of summary commands. These include:

- Count
- Sum
- Average
- Maximums

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

• Minimums

There are a few major rules that must be followed before we can use the subtotal command. These are critical and include:

- Your data must be sorted in the order(s) you wish to create subtotals on. For instance, we want to create subtotals by department and by style within the department. Our sort levels would be department, then Style.
- If you have your data in an Excel table, that data must be converted to a range. You cannot perform subtotals on data in a table.

We will create these subtotals using the following steps.

1. Copy the Raw Data worksheet by holding the Ctrl key down while left clicking the Raw Data worksheet tab and dragging the worksheet to the right of the Vehicle Filter worksheet.

2. Rename the new worksheet Vehicle Subtotals.

3. Create a multi-level sort by department and then by Style.

Figure 5.13: Multi-Level Sort for Subtotals.

Sort						?	\times
⁺ <u>A</u> ↓ <u>A</u> dd	Level X Delete Level	E Copy Level	<u>O</u> ption	ns	My dat	ta has <u>h</u>	eaders
Column		Sort On		Order			
Sort by	Department 🗸	Values	\sim	A to Z			\sim
Then by	Style 🗸	Values	\sim	A to Z			\sim
					ОК	Can	cel

4. Convert your Excel table to a range, (*Note: you would skip this step if your data is not in an Excel table.*) by clicking anywhere within the data. If your table has a total row, remove it by clicking on the check box in the Table Design ribbon. From the Table Tools Design click on Convert to Range in the Tools section.

Figure 5.14: Convert to a Range.

Excel_Objective_5.07 - Excel									Table Tools		Kaaren		
F	ile Hor	me Ins	ert Draw	Page L	ayout.	Form	ulas	Data	Review	View	Design	♀ Tell me what y	ou want to d
Tabl Veh √⊕• F	e Name: icle_table5 Resize Table Properties	🗗 Sumi	marize with P ove Duplicate /ert to Range Tool	ivotTable s	Insert Slicer	Export Externa	Refresh I Table Da	∷ [⊡ [∷⊃ [ta	 ✓ Header Row ☐ Total Row ✓ Banded Row 	/s Eable Table	rst Column st Column inded Columns Style Options	✓ Filter Button	
F2	0 A	Convert	rt to Range rt this table in of cells.	ito a normal		ousing E			F		G	н	
1	Asset 💌	All of t	he data is pre	served.		mete -		Depa	artment		chase Price	Annual Maint	enance
2	2364	2000	Chevrolet	Sedan		92419	Athleti	cs		\$	11,630	\$	2,257
3	1415	2007	GMC	Van		89006	Athleti	s		\$	16,748	\$	755
4	1462	2007	GMC	Van		82091	Athleti	cs		\$	20,882	\$	980
5	2084	2007	GMC	Van		74309	Athleti	cs		\$	14,187	\$	559
6	2128	2004	Ford	Van		99880	Athleti	cs		\$	15,197	\$	1,975
7	678	2005	Ford	Pickup		73419	Campu	s Hou	sing	Ś	11.866	Ś	507

5. Click Yes when the warning box appears.

6. From the Outline section of the Data tab, click on Subtotal. The first subtotal we will insert is the cost of annual maintenance by department.

7. From the Subtotal dialog box, in the At each change in: select Department from the drop-down. (This determines how the subtotals will be grouped.)

8. In the Use function box, select Sum. (This determines what operation will be performed.)

9. In the Add subtotal to: click on Annual Maintenance. Uncheck any box that may be selected because we only want a subtotal for Annual Maintenance.

10. Click OK.

Figure 5.15: Completed Subtotal Dialog Box for Annual Maintenance by Department.

Subtotal		?	\times
<u>A</u> t each change	in:		
Department			\sim
Use function:			
Sum			\sim
A <u>d</u> d subtotal to			
Make Style Odometer Department Purchase Pri	ce		^
Annual Mair	ntenance		~
✓ Replace <u>curre</u> Page break b ✓ Summary bel	ent subtotals petween groups ow data	5	
<u>R</u> emove All	OK	Ca	ncel

Next, we will add the count of vehicles by style to our subtotals. We will do that using the following steps.

1. Make any cell in your data range active. Click on Subtotal in the Outline section of the Data ribbon.

2. IMPORTANT: uncheck the box that says Replace current subtotals. If you do not, the new subtotal you create will erase the first one you did earlier.

3. We need to count the number of vehicles by style in each department. In the At each change in: select Style.

4. In the Use function: select Count. We want the number of each style vehicle in the department.

5. In the Add subtotals to: select Style and uncheck Annual Maintenance.

6. Click OK.
Figure 5.16: Subtotal Dialog Box for Count of Style.

Subtotal	?	×
<u>At each change in:</u>		
Style		\sim
Use function:		
Count		\sim
A <u>d</u> d subtotal to:		
☐ Make ✓ Style ☐ Odometer ☐ Department		^
Purchase Price Annual Maintenance Replace current subtotals		Replace current subtotals box is NOT checked.
Page break between groups		
Summary below data		
Remove All OK	Cance	tel

Next, we will add an appropriate title for our subtotal worksheet.

1. Click in the grey area of row 1 and drag down through row 2. This will select the entire rows 1 and 2. Hold the Ctrl key and click on the + key on your ten-key keypad, or Ctrl, Shift and the +, to insert two new rows.

2. Merge and center across cells A1:H1.

3. Type the following title in A1. Remember to use Alt and Enter to move down a row inside cell A1.

Minnesota State College

Vehicles Sorted by Department

Report date: 3/1/2025

4. Enter to save the contents of the cell.

5. Resize row 1 so the entire title shows.

J4	-	: ×	√ f _×									
1 2 3 4		Α	В	С	D	E		F	(3		н
		*				Great	Education Co	llege				
			Outline	e		Annual Mair	ntenance by D	epartment				
	1		button	s		Rep	ort Date 7/1/2	2018				
	2											
	3	Asset #	Year	Make	Style	Odometer	Depa	rtment	Purchas	se Price	Annual	Maintenance
[[·]]]	4	2364	2000	Chevrolet	Sedan	92419	Athletics		\$	11,630	\$	2,257
-	5			Sedan Count	1							
	6	1415	2007	GMC	Van	89006	Athletics		\$	16,748	\$	755
· · ·	7	1462	2007	GMC	Van	82091	Athletics		\$	20,882	\$	980
	8	2084	2007	GMC	Van	74309	Athletics		\$	14,187	\$	559
· · ·	9	2128	2004	Ford	Van	99880	Athletics		\$	15,197	\$	1,975
-	10			Van Count	4	+						
-	11						Athletics Tot	al			\$	6,526
	12	678	2005	Ford	Pickup	73419	Campus Hou			11,866	\$	507
	13	818	2010	Chevrolet	Pickup	37786	Campus Hou	New rows v	vitn d below	13,783	\$	1,594
	14	829	2005	Ford	Pickup	32765	Campus Hou	each catego	orv.	5,000	\$	1,370
	15	1016	2007	Ford	Pickup	52728	Campus Hou			14,757	\$	2,000
	16	1375	2009	Ford	Pickup	45608	Campus Hou	sing	\$	15,866	\$	72
	17	1680	2013	Chevrolet	Pickup	23915	Campus Hou	sing	\$	16,763	\$	1,775
	18	2131	2011	Chevrolet	Pickup	31394	Campus Hou	sing	\$	15,613	\$	450
	19	2132	2008	Chevrolet	Pickup	77104	Campus Hou	sing	\$	14,019	\$	594
-	20			Pickup Count	8							
	21	1776	1997	Chevrolet	Sedan	81802	Campus Hou	sing	\$	14,993	\$	1,820
$ \perp \cdot$	22	2112	1996	Ford	Sedan	103123	Campus Hou	sing	\$	12,007	\$	1,350
-	23			Sedan Count	2							
	24	897	2015	Ford	Truck	12703	Campus Hou	sing	\$	22,724	\$	1,591
· · ·	25	1167	2010	Ford	Truck	39292	Campus Hou	sing	\$	15,366	\$	3,491
	26	1455	2008	Ford	Truck	76681	Campus Hou	sing	\$	12,850	\$	81
·	27	1643	2008	Chevrolet	Truck	43912	Campus Hous	sing	\$	7,200	\$	499
$ \perp$	28	2126	2015	Ford	Truck	3670	Campus Hou	sing	\$	9,471	\$	105
-	29			Truck Count	5							
[·	30	798	2013	Ford	Van	24575	Campus Hous	sing	\$	19,846	\$	168
· · ·	31	817	2014	Chevrolet	Van	16896	Campus Hou	sing	\$	20,824	\$	705

Figure 5.17: Worksheet with Completed Subtotals.

Subtotal Outline View

In addition to displaying subtotals your Subtotal feature creates outline views. Figure 5.17 shows the outline buttons that are created when a worksheet has the subtotal feature applied. It will show or hide different levels of detail in your worksheet.

1. Level 1: only the grand total shows.

Figure 5.18a: Grand Total View.



2. Level 2: totals for each of the main categories will show.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

Figure 5.18b: Department Annual Maintenance Subtotals.

	1 2 3	3 4		Α	В	С	D	E	F	G	Н	
								Great Annual Mai	Education College			
			1					Rep	ort Date 7/1/2018			
			2									
			3	Asset #	Year	Make	Style	Odometer	Department	Purchase Price	Annual Mainten	ance
	+		11						Athletics Total		\$	6,526
Ш	+		43						Campus Housing Total		\$ 2	25,230
Ш	+		59						Campus Security Total		\$ 1	L3,667
Ш	+		69						Dining Services Total		\$	6,952
Ш	+		78						Printing Services Total		\$	6,153
Ш	+		94						Property Total		\$ 1	L0,465
	+		102						Telecomm Total		\$	2,694
-	-		103			Grand Count	71					
			104						Grand Total		\$ 7	71,686

3. Level 3: will show if you have secondary subtotals. In the case of the college's vehicles, we have a secondary sort by style, so our level 2 view shows the subtotals for both Department and Style.

Figure 5.18c: Department and Style Subtotals.

1	2	3 4		Α	В	С	D	E	F	G	Н	
								Grea	t Education College			
								Annual Ma	intenance by Department			
			1					Rep	oort Date 7/1/2018			
			2									
			3	Asset #	Year	Make	Style	Odometer	Department	Purchase Price	Annual Maintenance	e
Γ	[]	+	5			Sedan Count	1					
Ι.	Ш	+	10			Van Count	4					
	-		11						Athletics Total		\$ 6,52	26
	[]	+	20			Pickup Count	8					
		+	23			Sedan Count	2					
		+	29			Truck Count	5					
Ι.	Ц	+	42			Van Count	12					
	-		43						Campus Housing Total		\$ 25,23	0
		+	45			Pickup Count	1					
		+	55			Sedan Count	9					
Ι.	Ц	+	58			Van Count	2					
	-		59						Campus Security Total		\$ 13,66	57
		+	61			Pickup Count	1					
		+	63			Truck Count	1					
Ι.	Ц	+	68			Van Count	4					
	-	_	69						Dining Services Total		\$ 6,95	52
		+	71			Pickup Count	1					
		+	73			Sedan Count	1					
Ι.	Ц	+	77			Van Count	3					
	-		78						Printing Services Total		\$ 6,15	63
		+	83			Pickup Count	4					
		+	86			Sedan Count	2					
		+	88			Truck Count	1					
Ι.	Ц	+	93			Van Count	4					
	-	_	94			_			Property Total		\$ 10,46	i5

4. Level 4: shows the entire data set with subtotals. (Figure 5.17) In short, the higher the level showing the more condensed the data will be. As you move higher, more and more of the data will be revealed.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

- Level 1 shows the grand total only
- Level 2 shows the main category subtotal
- Level 3 shows subtotals for each major and secondary subtotals (if more than one subtotal applied.)
- Level 4 (in this example) shows all the data and subtotals.

Removing Subtotals

To remove the subtotal from a worksheet you must use the Subtotal button from the Outline section of the Data tab. *Note: Clicking on Undo will not remove subtotals*.

Click Remove All from the lower left corner of the Subtotal Dialog box. See Figure 5.19.

Figure 5.19: Removing Subtotals.

Subtotal		?	×
<u>At each c</u>	hange in:		
Style			~
Use funct	ion:		
Count			~
Add subt	otal to:		
Year Make			^
Style Odon Depar Purch	neter rtment ase Price		~
Replace	ce <u>c</u> urrent subtot oreak between gr ary below data	als roups Ca	ncel

5.6 PivotTables and PivotCharts

LEARNING OBJECTIVES

- 1. Create a PivotTable
- 2. Format the PivotTable
- 3. Rearrange a PivotTable.

An Excel worksheet can contain thousands upon thousands of rows and columns of data. The amount of data can be overwhelming to try to assimilate and make sense of. There is a wealth of information that can be obtained by using the right tools to condense and organize your data. A PivotTable summarizes data using the COUNT, SUM, AVERAGE, MIN and MAX functions. For example, Suni wants you to prepare a presentation for the budget committee that will summarize the college vehicles data. She wants her report to show total cost of annual maintenance by department and age of the vehicles.

Creating a PivotTable

Follow-along file: Continue with Excel Objective 5.00. (Use file Excel Objective 5.07 if starting here.) We will create a PivotTable to reflect Suni's report needs. The steps to complete the PivotTable are:

1. Click on the Raw Data worksheet tab to activate the worksheet. Make any cell active in your data range or table.

2. Click on PivotTable from the Tables section of the Insert tab. The Create PivotTable dialog box will appear.

Figure 5.20: Create PivotTable Dialog Box.



3. Accept the defaults and click OK.

4. A new worksheet is created to the right of your Raw Data worksheet. Click and drag the worksheet tab to the right of the Vehicle Subtotal worksheet. Rename the worksheet Vehicle PivotTable.



Figure 5.21: New PivotTable Worksheet Elements.

Figure 5.21 shows the PivotTable elements. We are going to create the PivotTable by dragging fields from the field list into the design area in the lower right section.

5. The first field we will drag down is the department field. Drag the field into the Rows area by clicking on the field name, holding left mouse, and dragging to Rows. As soon as you release the mouse you will see the departments appear in the PivotTable area.

6. We will put the vehicle year field into the columns section of the pivot table by dragging it to Columns.

7. Suni is looking for annual maintenance on the vehicles, so drag the annual maintenance field to the Values section of the design area.

Rearranging a PivotTable

In evaluating the layout for the PivotTable, Suni determines she would rather see the years going down the rows and the departments as the columns. We will drag and drop the fields to recreate the chart.

8. Click on Department in the Rows section and drag it up into the Columns area.

9. Click on the Year in the Columns section and drag it down to rows. This makes the information easier to read.

In looking at the data, it is difficult to determine how many vehicles the data applies to. Suni asks you to include a count of the vehicles in your layout.

10. Drag the Style field into the Values section. Since the Style field contains text, Excel automatically applies a COUNT to the data.

Suni likes this layout, but now it needs to be formatted and titled for a professional presentation.

Value Field Settings

11. Click any cell in the Sum of Annual Maintenance column of the PivotTable report.

12. Left click the Sum of Annual maintenance field in the Values section. Select Value Field Settings from the drop-down menu.





13. The field name is too wide and makes the PivotTable look long and drawn out. Change the Custom Name to Maint. Cost.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

14. Click on Number Format and change the number format to Currency. In the symbol box select None from the drop-down. See Figure 5.23.

Number	: A
<u>Category:</u> General Number <u>Currency</u> Accounting Date Time Percentage Fraction Scientific Text Special Custom	Sample 1,640.71 Decimal places: 2 ↓ Symbol: None Negative numbers: 1,234.10 (1,234.10) (1,234.10) (1,234.10)
Currency formats ar points in a column.	e used for general monetary values. Use Accounting formats to align decimal

- 15. Click OK to accept the Format Cells changes.
- 16. Click Ok to accept all changes to the Annual Maintenance field in the PivotTable.
- 17. Left click on the Count of Style field in the Values layout. Select Value Field Settings.
- 18. Change the Custom Name to No. of Vehicles. Click OK to close the dialog box.

PivotTable Formatting

PivotTables are inherently ugly and require a bit of formatting to make them easily understandable to the reader. Remember, it must tell its own story. 19. Click in cell B3. In the formula bar type; Department: Hit Enter.

20. Click in cell A5. In the formula bar type: Vehicle Age. Hit Enter.

21. Suni wants to see the No. of vehicles before the maintenance cost. In the Values section of the Pivot table design area, drag and drop the No. of Vehicles field above the Maint. Cost.

22. Highlight B4:C24 and apply an outside border. Repeat this step for each of the departments across the page.

23. The last formatting change we will make to out PivotTable is the worksheet title. We already have a blank row in row 1, so adding a row is not needed.

24. Select the range A1:Q1. Merge and Center the row.

25. Type the following title into A1.

Minnesota State College Annual Maintenance by Department Report Date 3/1/2025

26. Resize Row 1 to fit the 3-line title.

Recommended PivotTables

If you have limited experience with PivotTables, or are not sure how to get started, a Recommended PivotTable is a good choice. When you use this feature, Excel determines a meaningful layout by matching the data with the most suitable areas in the PivotTable. This helps give you a starting point for additional experimentation. After a recommended PivotTable is created, you can explore different orientations and rearrange fields to achieve your specific results. The Recommended PivotTables feature was added in Excel 2013, so if you have an earlier version, follow the instructions below for how to manually create a PivotTable instead.

Manually create a PivotTable

Click a cell in the source data or table range.

Go to **Insert > Tables > PivotTable**.



PivotTable fron	n table or range		?	×
Select a table or r	range			
Table/Range:	'Timber Creek'!\$A\$1:\$F\$228			±
Choose where yo	ou want the PivotTable to be pla	ced		
New Work	sheet			
O Existing Wo	orksheet			
Location:				<u>+</u>
Choose whether	you want to analyze multiple ta	bles		
Add this da	ata to the Data <u>M</u> odel			
		ОК	Cano	cel .

In the **Choose where you want the PivotTable report to be placed** section, select **New Worksheet**, or **Existing Worksheet**. For **Existing Worksheet**, you'll need to select both the worksheet and the cell where you want the PivotTable placed.

If you want to include multiple tables or data sources in your PivotTable, click the **Add this data to the Data Model** check box.

Click **OK**, and Excel will create a blank PivotTable, and display the **PivotTable Fields** list.

Recommended PivotTable

Click a cell in the source data or table range.

Go to Insert > Tables > Recommended PivotTable.



Excel analyzes your data and presents you with several options, like in this example using the household expense data.

Recommended PivotTa	ables	
Sum of AMOUNT by	CATEGORY	
Row Labels 👻 Sum o	f AMOUNT	
Entertainment	345	
Grocery	735	
Household	600	
Transportation	279	
Grand Total	1959	
Sum of AMOUNT b	y MONTH	1
	~	
Row Labels 💌 Sum of	f AMOUNT	
January	584	
February	705	
March	670	
Grand Total	1959	

Select the PivotTable that looks best to you and press **OK**. Excel will create a PivotTable on a new sheet, and display the **PivotTable Fields** List.



Slicers

Slicers are a tool in Excel Pivot tables and Excel tables that allows you to insert a slicer on the face of the worksheet that easily filters out data. You can select a slicer from any field in the PivotTable, or table.

Now that we have the PivotTable report finalized, we will add a slicer that will make it easy to filter data by Department. The steps we will use are:

1. Click anywhere in the PivotTable to activate the PivotTable Tools Ribbon.

2. Click on Insert Slicer from the Filter section of the Analyze tab of the PivotTable Tools.

3. The Insert Slicers dialog box will appear. Click on Department to create a slicer for the department.

Insert Slicers		?	\times
 Asset # Year Make Style Odometer ✓ Department Purchase Price Annual Mainten 	ance		
OK		Canc	el

Figure 5.24: Insert Slicer Dialog Box.

4. Click OK.

5. Move the slicer so it is positioned below the PivotTable.

6. Click on a department to filter out all the other departments. You can select multiple departments by holding down the Ctrl key and clicking on department names.

Figure 5.25: Completed PivotTable.

								Great Educati	on College								
							A	Report Date	2/1/2018	nent							
								Report Date	//1/2010								
	Departmen	t -															
																Total No. of	
	Athletics			Campus Housing		Campus Security		Printing Services		Dining Services		Property		Telecomm		Vehicles	Total Maint. Cost
	No. of											No. of		No. of		1	
Vehicle Age: 🔻	Vehicles	N	Aaint. Cost	No. of Vehicles	Maint. Cost	No. of Vehicles	Maint. Cost	No. of Vehicles	Maint. Cost	No. of Vehicles	Maint. Cost	Vehicles	Maint. Cost	Vehicles	Maint. Cost		
1996				1	1,350.00											1	1,350.00
1997				1	1,820.00											1	1,820.00
2000		1	2,257.16	i												1	2,257.16
2001												1	1,235.29			1	1,235.29
2002				1	664.34											1	664.34
2003								1	378.22	2		1	963.62			2	1,341.84
2004		1	1,974.79													1	1,974.79
2005				3	3,259.90	2	2,958.70									5	6,218.60
2006						1	1,640.71	1	2,932.83	3		1	279.12	1	345.47	4	5,198.13
2007		3	2,293.62	1	2,000.00											4	4,293.62
2008				5	3,673.48											5	3,673.48
2009				1	72.07	2	601.79	1	472.68	2	3,774.25	1	159.90			1	5,080.69
2010				4	5,306.07	1	565.82					1	602.71				6,474.60
2011				2	567.64	2	1,318.31			1	1,255.00			1	/31.96		3,872.91
2012					0.007.00	1	1,932.70	1	2,000.00	'l	000.00	1	2,000.00			3	5,932.76
2013				4	2,997.20	2	2,809.73	1	200.00	1	202.30		3,577.10		1 350 34	10	9,580.47
2014					705.00		1 030 77	-	369.55	" ²	1,/19.89	2	1,646.94	2	1,359.34		5,800.72
2015 Croad Total			6 1 31 13	3	2,814.05	1	1,838.77		6 4/3 36		6 011 10		10 464 68	1	257.37	3	4,910.14
Grand Total		5	0,525.57	21	25,229.81	12	13,000.50	5	0,153.28	9 0	0,951.50		10,404.08	5	2,094.14	11	/1,085.54
Department	¥= '	× -															
Athlatics																	
Admetics																	
Campus Hou	using	-															
Campus Sec	urity																
Printing Ser	vices																
Dining Servi	ices																
Property																	
Telecomm		5															
H																	
P		-															

Group or ungroup data in a PivotTable

Grouping data in a PivotTable can help you show a subset of data to analyze. For example, you may want to group an unwieldy list of dates or times (date and time fields in the PivotTable) into quarters and months, like this:

country (All)	-	
Row Labels 🛛 💌 Sum	of Order Amount	
Amy Dodsworth	75048.04	List of dates before
7/15/2006	2490.5	grouping
7/31/2006	1873.8	
10/10/2006	5275.71	
10/21/2006	88.5	
12/25/2006	166	
Country (All)		
Country (All) Row Labels 💽 Sum	▼ of Order Amount	List of dates arouned
Country (All) Row Labels 💽 Sum 🖻 Amy Dodsworth	of Order Amount 75048.04	List of dates grouped by guarters and
Country (All) Row Labels 💽 Sum Amy Dodsworth @Qtr1	of Order Amount 75048.04	List of dates grouped by quarters and months
Country (All) Row Labels Sum Amy Dodsworth Qtr1 Jan	▼ of Order Amount 75048.04 6660.62	List of dates grouped by quarters and mon th s
Country (All) Row Labels 💽 Sum Amy Dodsworth Qtr1 Jan Feb	▼ of Order Amount 75048.04 6660.62 20418.34	List of dates grouped by quarters and mon t hs
Country (All) Row Labels 💽 Sum Amy Dodsworth Qtr1 Jan Feb Mar	▼ of Order Amount 75048.04 6660.62 20418.34 5401.05	List of dates grouped by quarters and months
Country (All) Row Labels 💽 Sum Amy Dodsworth Qtr1 Jan Feb Mar Otr2	▼ of Order Amount 75048.04 6660.62 20418.34 5401.05	List of dates grouped by quarters and months
Country (All) Row Labels Sum Amy Dodsworth Qtr1 Jan Feb Mar Qtr2 Apr	▼ of Order Amount 75048.04 6660.62 20418.34 5401.05 10881.61	List of dates grouped by quarters and months
Country (All) Row Labels Sum Amy Dodsworth Qtr1 Jan Feb Mar Qtr2 Apr May	▼ of Order Amount 75048.04 6660.62 20418.34 5401.05 10881.61 555.6	List of dates grouped by quarters and months

Note: The time grouping feature is new in Excel 2016. With time grouping, relationships across time-related fields are automatically detected and grouped together when you add rows of time fields to your PivotTables. Once grouped together, you can drag the group to your Pivot Table and start your analysis.

Group fields

- 1. In the PivotTable, right-click any numeric or date and time field, and click **Group**.
- 2. In the **Starting at** and **Ending at** box, enter this (as needed):

Starting at:	7/10/2006	
Ending at:	5/2/2008	
у		
Seconds Minutes Hours Days		^
Quarters Years		Ţ
Nu	mber of days: 1	1

- The smallest and largest number to group numeric fields.
- The first and last date or time you want to group by.

The entry in the **Ending at** box should be larger or later than the entry in the **Starting at** box.

- 3. In the **By** box, do this:
 - For numeric fields, enter the number that represents the interval for each group.
 - For date or time fields, click one or more date or time periods for the groups.

You can click additional time periods to group by. For example, you can group by **Months** and **Weeks**. Group items by weeks first, making sure **Days** is the only time period selected. In the **Number of days** box, click **7**, and then click **Months**.

Tip: Date and time groups are clearly labeled in the PivotTable; for example, as **Apr**, **May**, **Jun** for months. To change a group label, click it, press F2, and type the name you want.

Group date and time columns automatically (time grouping)

Note: The time grouping feature is available in Excel 2016 only.

• In the **PivotTable Fields** task pane, drag a date field from the Fields area to the Rows or Columns areas to automatically group your data by the time period.

PivotTable Fi	elds 🔹 🗙
Choose fields to add to	o report: 🗘 🔻
Search	٩
Date	
✓ Airport Passenger	s
Quarters	
Vears	
MORE TABLES	
Drag fields between a	reas below:
T FILTERS	
	Σ VALUES
	Sum of Airpor 🔻

PivotTable Field List before time grouping

Excel automatically adds calculated columns to the PivotTable used to group the date or time data. Excel will also auto collapse the data to show it in its highest date or time periods. For example, when the Date field is checked in the Fields list above, Excel automatically adds Year, Quarter, and month (Date) as shown below.

PivotTable Fie	elds 🔹 🗙
Choose fields to add to	report: 🗘 🔻
Search	Q
✓ Date	
Airport Passengers Quarters	5
✓ Years	
MORE TABLES	
Drag fields between ar	eas below:
T FILTERS	
	2 1/41/157
ROWS	2: VALUES
Quarters -	samor Anpoint .
Date 🔻	

PivotTable Field List after time grouping

Notes:

• When you drag a date field from the Field List to the Rows or Columns area where a field already exists, and then put the date field above the existing field, the existing date field is removed from the Row or Columns area and the data won't be automatically collapsed so you can see this field when collapsing the data.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

• For a data model PivotTable, when you drag a date field with over one thousand rows of data from the Field List to the Rows or Columns areas, the Date field is removed from the Field List so Excel can display a PivotTable that overrides the one million records limitation.

Group selected items

You can also select specific items and group them, like this:

Row Labels	🖵 Sum o	f Order Amount	
🗆 Canada		333330.91	
Amy Dodswo	orth		
Amy Dods	worth	75048.04	
🗏 Susan King			
🗄 Susan King	g	116962.99	List of names before
🗏 Joe Buchana	n		grouping
🗄 Joe Bucha	nan	68792.25	
ELee Suyama			
. Eee Suyam	na	72527.63	
Grand Total		333330.91	
Row Labels	J Sum o	f Order Amount	
🗆 Canada		333330.91	
Group1		Contraction of the second	Africa and stars the
Amy Dods	worth	75048.04	names are listed in
🗄 Susan King	3	116962.99	groups
			a construction
	nan	68792.25	
🗄 Lee Suyam	na	72527.63	
Grand Total		333330.91	

1. In the PivotTable, select two or more items to group together, holding down Ctrl or Shift while you click them.

2. Right-click what you selected, and click **Group**.

When you group selected items, you create a new field based on the field you are grouping. For example, when you group a field called **SalesPerson**, you create a new field called **SalesPerson1**. This field is added in the field section of the Field List, and you can use it like any other field. In the PivotTable, you'll see a group label, like **Group1** for the first group you create. To change a group label to something more meaningful, click it, > **Field Settings**, and in the **Custom Name** box, type the name you want.

Tips:

• For a more compact PivotTable, you might want to create groups for all the other ungrouped items in the field.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

• For fields that are organized in levels, you can only group items that all have the same nextlevel item. For example, if the field has levels Country and City, you can't group cities from different countries.

Ungroup grouped data

To remove grouping, right-click any item in the grouped data, and click **Ungroup**. If you ungroup numeric or date and time fields, all grouping for that field is removed. If you ungroup a group of selected items, only the selected items are ungrouped. The group field won't be removed from the Field List until all groups for the field are ungrouped. For example, suppose you have four cities in the City field: Boston, New York, Los Angeles, and Seattle. You group them so that New York and Boston are in one group you name Atlantic, and Los Angeles and Seattle are in a group you name Pacific. A new field, City2, appears in the Fields area and is placed in the Rows area of the Fields List.

As shown here, the City2 field is based on the City field, and is placed in the Rows area to group the selected cities.

PivotTable Fi	elds	- ×
Choose fields to add to	o report:	- (h - m
 Region City Date Sales City2 MORE TABLES 		T
Drag fields between a	reas below:	
T FILTERS		MNS
	Σ value	s
City2 • Date • City •	Sum of Sa	iles 🔻
Defer Layout Upda	ite	UPDATE

As shown below, the four cities are arranged under the new groups, Atlantic and Pacific.

Row Labels	-	Sum of Sale	2S
Atlantic			
□ 2010		\$10,104,6	04
Bost	on	\$4,914,7	96
New	York	\$5,189,80	08
Pacific			
■ 2010		\$9,990,8	51
Los A	ngele	s \$4,842,5	99
Seat	le	\$5,148,2	52
Grand Tota	I	\$20,095,4	55

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

Note: When you undo time grouped or auto collapsed fields, the first undo will remove all the calculated fields from the field areas leaving only the date field. This is consistent with how PivotTable undo worked in previous releases. The second undo will remove the date field from the field areas and undo everything.

About grouping data in a PivotTable

When you group data in a PivotTable, be aware that:

- You can't add a calculated item to an already grouped field. You first need to ungroup the items, add the calculated item, and then regroup the items.
- You can't create slicers for grouped fields.
- Excel 2016 only: You can turn off time grouping in PivotTables (including data model PivotTables) and Pivot Charts by editing your registry.

PivotCharts

Suni would like you to create a chart for her that graphically shows the cost by department. Because of the disparate vales between maintenance cost and number of vehicles for each department, the data in the Vehicle PivotTable would not create a clear and informative PivotChart. We will make a copy of the Vehicle PivotTable worksheet and use the copy to build our PivotChart.

1. Click on the Vehicle PivotTable tab, hold the Ctrl key down while dragging to the right.

2. Rename the new Vehicle PivotTable(2) to Vehicle PivotChart.

3. If the PivotTable Field list is not showing, click anywhere in the PivotTable, from the Show section of the Analyze PivotTable Tools tab, click the FieldList button.

4. On the copied PivotTable, in the PivotTable name box on the Analyze tab of the PivotTable tools, rename the PivotTable1 to PivotTable 2. Note: if you don't rename the PivotTable, it will be linked to the first PivotTable.

5. To eliminate the number of vehicles from our PivotTable so we can create a meaningful chart, drag the No. of Vehicles field out of the Values section. Your PivotTable will now just show the annual maintenance cost by department and year.

6. Click the PivotChart button from the Analyze PivotTable Tools tab.

7. Select the Clustered Column chart type.

8. From the PivotTable Tools Design tab, click the Move Chart button. Move the PivotChart to its own chart sheet called Maint PivotChart.

PivotChart Tools Q Tell me what you want to do Data Review Format View Analyze Design db à Switch Row/ Select Change Move Column Data Chart Type Chart Chart Styles Data Location Type Move Chart ? × Choose where you want the chart to be placed: D F ĸ Maint PivotChart New sheet: \sim Vehicle PivotChart Object in: OK Cancel

Figure 5.26: Move the PivotChart to a New PivotChart Sheet.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

м

9. Close the PivotChart field list.

10. From the Design tab of the PivotChart Tools, apply Style 9 to the PivotChart.

11. From the Quick Layout button select Layout 3 which will put the legend below the chart and insert a Title.

12. Click in the title box. In the Formula bar insert the same title you used for the PivotTable.

Great Education College Annual Maintenance by Department Report Date 7/1/2018

13. From the Add Chart Element button, add a primary vertical axis.

14. Click in the vertical axis. In the formula bar type: Annual Maintenance Cost

Integrity Check – Pivot Chart

Your PivotChart is dynamically linked to your PivotTable. This means that any changes you make in your PivotTable will change your PivotChart.





Import data from a database

We start this tutorial with a blank workbook. The goal in this section is to connect to an external data source, and import that data into Excel for further analysis.

The data we will import describes Olympic Medals, and is a Microsoft Access database.

1. Download the OlympicMedals.accb Access database file from the text files and save it where you will be able to find it again for the next steps.

2. In Excel 2016, open a blank workbook.

3. Click **DATA > Get External Data > From Access**. The ribbon adjusts dynamically based on the width of your workbook, so the commands on your ribbon may look slightly different from the following screens.

XI .	5	ð	~ .				
FILE	но	OME	INSERT	PAGE LAYOUT	FORM	IULAS	DATA
From Access	From Web	From Text	From Other Sources *	Existing Connections	Refresh All -	Connect Propertie	tions 2 es 2 s 2
		Get Ex	ternal Data		Con	nections	
Get D	Get Data From Access Import data from a Microsoft						
Acces	s databa	se.		D	E	F	G
1							

4. Select the OlympicMedals.accdb file you downloaded and click **Open**. The following Select Table window appears, displaying the tables found in the database. Tables in a database are similar to worksheets or tables in Excel. Check the **Enable selection of multiple tables** box, and select all the tables. Then click **OK**.

		Select Table		?	×
Enable selection of	<u>m</u> ultiple tables	5			
✓ Name	Description	Modified	Created	Туре	
✓ Ⅲ Disciplines		4/3/2013 3:13:29 PM	4/2/2013 3:55:45 PM	TABLE	
✓ Ⅲ Events		4/3/2013 3:13:29 PM	4/2/2013 3:57:55 PM	TABLE	
🖌 🎹 Medals		4/3/2013 3:13:30 PM	4/2/2013 3:51:44 PM	TABLE	
S_Teams		4/3/2013 3:12:42 PM	4/2/2013 4:02:29 PM	TABLE	
✓ Ⅲ W_Teams		4/3/2013 3:13:06 PM	4/2/2013 4:01:56 PM	TABLE	
<					>
			ОК	Cancel	

5. The Import Data window appears.

Select the **PivotTable Report** option, which imports the tables into Excel and prepares a PivotTable for analyzing the imported tables, and click **OK**.

Import Data ?	×
Select how you want to view this data in your w	orkbook.
=\$A\$1	
<u>N</u> ew worksheet	
✓ Add this data to the Data Model	
P <u>r</u> operties OK C	ancel

6. Once the data is imported, a PivotTable is created using the imported tables.

XI .	5 •∂•	Ŧ	Bo	ok1 - Exce	3		PIVOTTABL	TOOLS	? 🗇 -	- - ×
FILE	HOM INSER	PAGE FOR	DATA REV	IE VIEW	POW DAT	A Tean	ANALYZE	DESIGN	David Ise	. 🔮 🙂
PivotTabl	Active Group Field -	Insert S	licer imeline onnections ter	Refresh (Change Data Source *	Actions	Calculations	Tools	E Show	^
A1	* 1	$\times \checkmark$	f _x							~
	A	в	с	D	E	*				
1							PivotTa	ble Fie	elds	- ×
2	Pivo	tTable1				_	ACTIVE /	ALL .		
3		CTODIC 1				-11	Choose fields	to add to	report:	- 45 - F
4 To	build a report,	choose field	ds from			-11			i cporte.	
5	the PivotTa	able Field Lis	t			-11	Discipl	ines		*
7						-11	Events			
8							b 🖂 Medal	-		
9							V E	-		
10						- 11	Image: S_Tear	ns		
11						- 11	♭ 🔚 W_Tea	ms		
12		i				- 11				
13						- 11	Drag fields b	etween are	eas below:	
15			- -			- 11	_			
16							T HETERS		III COLUM	NS
17										
18										
19						- 11			Σ. VALUES	
20						- 11	= 1005		2 VALUES	
21						- 11				
23						- 111				
24						-				
4	Shee	t1 (+	:	•		Þ	Deter Lay	out Updat	c	UPDATE
READY						Ħ	∎ ∎			+ 100%

With the data imported into Excel, and the Data Model automatically created, you're ready to explore the data.

Understanding Different File Formats Supported by Excel

Understanding different file formats supported by Excel is crucial for efficient data import and export. Excel provides support for a variety of file formats, each with its own unique characteristics and advantages. Acquiring an understanding of these formats will enable you to seamlessly work with diverse data sources.

Below is a summary table of the file formats that Excel supports:

File Format	Description
CSV	A file format called Comma-Separated Values, commonly used for data interchange.
Text	A plain-text file that stores data in a straightforward format.
Databases	Enables you to connect to and import data from different database management systems.
Web Sources	Allows importing data from websites through web queries or by connecting to web services.
PDF	Permits exporting data to a portable document format that is widely used for sharing and preserving document integrity.
Other File Formats	Excel supports numerous other file formats, including XLSX, XLS, XML, and more.

Considering both the file format and the purpose of import or export, it is essential to select the appropriate format to ensure compatibility and data integrity. Additionally, it is important to stay updated with the latest features and enhancements of Excel in order to fully leverage its capabilities and effectively manage different file formats.

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License, except where otherwise noted

Importing Data from Text Files

When importing data from text files into Excel, follow these steps:

- 1. Open Excel and create a new workbook.
- 2. Click on the "File" tab and select "Open" to open the file you want to import.
- 3. In the "Open" dialog box, locate and select the **text file** you want to import.
- 4. Click on the **"Open" button**.
- 5. Excel will display the Text Import Wizard. Select the appropriate options for your text file, such as the *file origin, delimiter*, and *text format*.
- 6. Preview the data to ensure it is **correctly formatted**.
- 7. Click on the **"Load" button** to import the data into Excel.

By following these steps, you can easily import data from text files into Excel for further analysis and manipulation.

Importing Data from Databases

Importing Data from Databases is a crucial task for professionals who need to analyze and manipulate large datasets. Here is a table with different approaches to **Importing Data from**

Databases:

Approach	Method
Direct connection	Use Excel's built-in functionality to directly connect to a database and import data.
ODBC connection	Set up an ODBC connection to establish a link between Excel and the database, allowing for data import.
Query import	Write a query using SQL or a database specific language to extract specific data from the database and import it into Excel.
Import wizard	Use Excel's import wizard to set up a connection, specify tables or queries, and import data.

To ensure smooth Importing Data from Databases, verify that the *database credentials* are correct, and test the *import process* with a sample dataset. Remember to properly format the imported data in Excel to ensure it aligns with your analysis needs.

Importing Data from Web Sources

- Importing data from web sources is a valuable method to gather information for analysis in Excel, making it essential to know how to incorporate the keywords "Importing Data from Web Sources" in the given text.
- 2. When it comes to importing data from web sources, there are several steps to consider:
- 3. **Identify the data source:** Begin by determining the website or webpage that contains the information you need to import into Excel.
- 4. Access the data: To input the URL of the webpage, utilize the "From Web" option found in the Data tab of the Excel ribbon.
- 5. **Select and preview the data:** Excel will generate a preview of the data on the webpage, allowing you to choose the specific data elements you wish to import.
- 6. **Specify import settings:** Customize the way the data is imported by utilizing options such as data type, delimiter, headers, and more.
- 7. **Refresh and update:** It is crucial to regularly refresh the imported data to ensure it remains up-to-date. This can be performed manually or automatically at regular intervals.

By effectively following these steps, you can effortlessly import data from web sources into Excel, enabling analysis and manipulation of the data.

Chapter X

What's New & Overlooked in Excel?

Do you now consider yourself an Excel expert? While you may definitely be much more comfortable using Excel than prior to this course, there are still many features that while a bit obscure, might be the solution to your data analysis problem. Challenge yourself to continue to advance your Excel skills and keep up to date on new features as they get released.

One of the hottest topics in technology in modern times is the proliferation of artificial intelligence (AI) functionality in our daily lives. Excel has utilized elements of AI for several years, and the latest releases continue to integrate AI throughout Excel and other Microsoft applications.

Copilot What Al features exist in Micr	Work Web		→						
	October 21, 2024 at 02:22 PM								
		What AI features exist in Microsoft	Excel?						
Microsoft Excel offers a variety of AI features desig some of the key AI features available: From your company	ned to enhance productivity and d	ata analysis. Here are							
 Copilot in Excel: This feature acts as a personal sheets, adding filters, splitting text, and applyin with complex formulas like XLOOKUP and SUM Generative AI for Excel Power Users: This featu 	Excel expert, helping with tasks sur g formula-based conditional forma IF 1. re enables faster content creation a	ch as formatting data atting. It can also assist and data analysis,							
Can you explain	Can you explain more about the 'Ideas' feature? How can I use the 'Insert Data								
	What are some examples of h	ow 'Dynamic Arrays' can be used? 🔀 View pro	ompts						

In the realm of Excel, artificial intelligence is about utilizing advanced algorithms and machine learning techniques to automate data analysis, reduce errors, and improve efficiency. AI in Excel enables the software to understand complex patterns in data, make predictions, and suggest optimized solutions. While one could simply ask Copilot or another generative-AI tool to deduce which AI features exist in Excel, it may be easier to read this short summary.

Artificial Intelligence in Excel

Some introductory artificial intelligence functionality has been in Excel for years. For example, when inserting a chart, Excel will provide a suggestion of appropriate charts based on your data. **Recommended Charts and Recommended PivotTables** are examples of AI because they use algorithms to analyze the data you select and suggests the most suitable chart type for effectively visualizing that data. By understanding the data's nature and relationships, the AI identifies patterns and trends, recommending the chart that best communicates the insights in a meaningful way.

	Recommen Charts	uded 0 ~ [→ ~ 0 → ~ 1	□- /\- - /\- 	Map V	s PivotCha	rt –	3D Map Y	
al	Recomm	ended Char	ts				Iours	
	Want us t chart to s	to recommer howcase yoι	nd a good ir data?		Н		I	
					MSRP	S	ales Price	
	Select dat	data in your worksheet and			13163	5	1316	3
	click this l	button to ge ad act of cha	t a rts that we	s	5423	5	5274	4
	think will	fit best with	vour data	s	5454	5	470	9
		in best with	your dutu.	s	4699	5	4694	4
	2024	Car	Ely		5333	5	503	3
	2024	SUV	Ely		5454	5	424	4
	2024	Truck	Ely		9421	5	734	3
	2024	Truck	Ely		5722	5	506	4

Excel data entry AI is a game changer regarding data input as it saves time and reduces the chance of errors. This is facilitated through functionality that replaces human data entry with machine learning features like AutoComplete, AutoCorrect, AutoFill or **Flash Fill**, which works by recognizing patterns of filled data and filling out the rest. Try using AutoFill by typing Sunday in

one cell, then type Monday in the next cell. Select the two cells and drag the fill handle to see Excel's artificial intelligence fill the neighboring cell with "Tuesday". Usually Flash Fill starts automatically, and you only need to provide a pattern.

- 1. Insert a new column adjacent to the column with your source data.
- 2. In the first cell of a newly added column, type the desired value.
- 3. Start typing in the next cell, and if Excel serses a pattern, it will show a preview of data to be auto filled in the cells below.
- 4. Press the Enter key to accept the preview.

If Excel doesn't identify a pattern, click the Flash Fill button to complete the pattern.

Clear Reapply Advances	Text to Columns	#⊒ ∑ ∑ ~		W Ana	hat-If lysis ~	Forecast Sheet	
	Data	Tools			Fore	cast	
		Flas	h Fill ((Ctrl+	E)		
	Q	Auto coup outp the	omatic ple of out and colum	ally fil examp d keep n you	l in val ples yo p the ad want f	ues. Enter a u want as ctive cell in illed in.	3
Participa	nts		Cour	try			
Ed Sheer	an, UK		UK	•			
Justin Bie	ber, Canac	la	Cana	da			
Taylor Sw	/ift, USA						
Keith Urb	an, Austra						
Sabrina C	arpenter,						
The Wee	The Weeknd, Canada						
Sam Smit	h, UK						
Shawn M	endes, Car	nada					

The Most Excellent OER Spreadsheets Textbook Ever Published (in 2025) by Marcus Lacher is licensed under a <u>Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License</u>, except where otherwise noted

Another AI data entry feature is the **Insert Data from Picture** feature which allows users to insert data from a screen capture on their clipboard, or an image file from their computer. One can even screen capture a table from a web site and convert the picture into Excel data. Copying data from websites into Excel will never be the same! Try it below!

Import data from a sample image file or clipboard Right-click the following image and "Save image as..." a local copy, then click **Data > From Picture > Picture From File (or Clipboard)** and follow the on-screen instructions to convert the picture to data.

Provider	Deductible	Coverage	Reimburse %	Cost/month	Туре	Notes
Embrace	\$500.00	\$5,000.00	80%	\$57.10	Accident/Illness	
Fetch	\$500.00	\$10,000.00	80%	\$48.72	Accident/Illness	add Wellness for \$11.29/mo
Pumpkin	\$500.00	\$10,000.00	90%	\$53.82	Accident/Illness	
Healthy Paws	\$500.00	Unlimited	80%	\$59.07	Accident/Illness	
PetsBest	\$500.00	Unlimited	80%	\$39.92	Accident/Illness	add Wellness for \$21.75/mo
Spot	\$500.00	\$5,000.00	80%	\$34.02	Accident/Illness	
Figo	\$500.00	\$10,000.00	80%	\$23.82	Accident/Illness	add Vet exams for \$4.86/mo
Prudent Pet	\$500.00	\$10,000.00	80%	\$26.23	Accident/Illness	add Vet exams for \$5.26/mo

Analyze Data in Excel (formerly known as Ideas) empowers users to understand their data through natural language queries that allow users to ask questions about their data without having to write complicated formulas. In addition, Analyze Data provides high-level visual summaries, trends, and patterns. Simply select a cell in a data range > select the Analyze Data button on the Home tab. Analyze Data in Excel will analyze your data and return interesting visuals about it in a task pane.

Linked data types connect to reputable sources of data, such as Bing, Power BI and more, so users can access information about a variety of subjects without ever leaving Excel. Real-time stock quote integration, geography and currencies are three new data types that use AI to connect to online data in return real-time data into Excel for further analysis. To get current data for the data types, right-click a cell with the linked data type and select **Data Type > Refresh**. That will refresh the selected cell, plus any other cells that have that same data type.

Without artificial intelligence, users must write a formula for every value they want. However, the **AI dynamic arrays** feature allows users to write a formula, hit the enter key, and immediately see an array of values. Using dynamic arrays, any formula that returns an array of values will seamlessly "spill" into neighboring unoccupied cells, making it as easy to get an array of values returned as it is to work on a single cell. Users can immediately harness the power of dynamic

arrays by using one of the new FILTER, UNIQUE, SORT, SORTBY, SEQUENCE, SINGLE, and RANDARRAY functions to build spreadsheets that would previously have been nearly impossible. Several AI functions began appearing in some versions of Excel 365 for Windows in 2024. If you have the right Excel, try typing **=ai** in the formula bar, and if the AI functions are available you'll see something like this.

=ai					
ALASK	The function a	llows you to	submit a qu	lestion to O	penAl.
(x) AI.CHOICE					
🕼 AI.FILL					
(x) AI.FORMAT					
(x) AI.LIST					
(x) AI.TABLE					
(x) AI.TRANSLATE					
AI.FILL AI.FORMAT AI.LIST AI.TABLE AI.TRANSLATE					

One might be surprised to see the reference to OpenIA in the screentip! The current version of Excel utilizes the OpenAI server/API to connect the AI functionality to their data. This might be a short-term solution until a complete Microsoft Copilot solution is released.

Current AI functionality in Excel requires add-on functionality to be installed, such as the ChatGPT for Excel add-in which introduces five key AI functions — AI.ASK, AI.FILL, AI.TABLE, AI.EXTRACT, and AI.TRANSLATE.

How to Add ChatGPT in Excel

- 1. Start Microsoft Excel on your computer.
- 2. Click on the Home tab.
- 3. Select Get Add-ins from the Add-ins group.
- 4. In the Office Add-ins window, use the search bar to type "ChatGPT For Excel" and click Add to install it.

The AI.ASK function allows users to query their data in natural language. This simplifies complex data analysis by interpreting questions and providing answers directly within Excel. It can be used to write text, summarize, analyze data, and more—like having a virtual assistant inside Excel! It's Clippy on Steroids!



For example, the formula:

=AI.ASK("Identify the highest selling model of Ford vehicles in 2024") will return the result:

As of 2024, the highest selling model of Ford vehicles is the Ford F-Series, particularly the Ford F-150. The F-Series has consistently been one of the best-selling vehicle lines in the United States for many years, and it continues to dominate the market in 2024.

Copilot in Excel

The future of artificial intelligence integration in Excel rests with Microsoft's Copilot functionality, which was released in late 2024, but might not be live for all Excel users right away. Web versions of Excel are more likely to reveal AI functionality before the desktop version licenses are updated. Copilot in Excel is built into your workbook, enabling users to iterate with it quickly and easily. This integration allows users to continually prompt as they work, making it feel like users have an Excel expert right by their side. Copilot in Excel can help you go from a blank page to a finished document in a fraction of the time it would take to compose text on your own. Copilot can now reason over structured data, not just tables, and it can complete tasks such as adding filters or splitting text. It can respond to prompts to help users analyze data trends. For example, in the following illustration, a prompt was asked to determine "How many different "Dealership" are there (in the worksheet)?

	\sim \times	✓ f _X														
А	В	С	D	E		F	G	н	L	J	К	L	М		🗖 Conilat	
	Model		Fuel			ategory	Dealership		Sales Price	Sales Date	Salesperso					
Chevrolet	Corvette	Z06	Gas	20	025 Ca	ar	Detroit Lakes	131635	131635	5/1/2024	Adam Thie	len				
Ford	Mustang	Mach-E	Electric	20	024 Ca	ar	Detroit Lakes	54235	52744	4/12/2024	Adam Thie	len				_
Chevrolet	Blazer	RS	Electric	20	024 SL	JV	Detroit Lakes	54545	47095	3/20/2024	Adam Thie	len				
Chevrolet	Silverado	RST	Electric	20	024 Tr	uck	Detroit Lakes	46995	46945	4/23/2024	Adam Thie	len		11	How many different 'Dealership'	are
Ford	Mustang	Mach-E	Electric	20	024 Ca	ar	Ely	53335	50335	3/24/2024	Jessica Bie	1			there?	
Chevrolet	Blazer	RS	Electric	20)24 SL	JV	Ely	54545	42445	5/4/2024	Jessica Bie	1				
Ford	F350	Lariat	Diesel	20)24 Tr	uck	Ely	94215	73434	4/5/2024	Jessica Bie	1			(
Ford	F150	XL	Gas	20	024 Tr	uck	Ely	57225	50641	5/2/2024	Jessica Bie	1			I analyzed data in A1:K31, and here's what I found:	
Ford	Bronco	Raptor	Gas	20)24 SL	JV	Frostbite Falls	94420	81466	5/2/2024	Rocky & B	ullwinkle			'Dealership'	
Ford	Bronco	Big Bend	Gas	20)24 SL	JV	Frostbite Falls	83340	76333	5/3/2024	Rocky & B	ullwinkle				
Ford	F150	Raptor	Gas	20	024 Tr	uck	Frostbite Falls	93540	84340	5/3/2024	Rocky & B	ullwinkle			William to the standard and an evidenchic dealer	
Ford	F150	Lightning	Electric	20	024 Tr	uck	Frostbite Falls	67445	60445	5/7/2024	Rocky & B	ullwinkle			what is the total sales price by dealer	snip
Ford	F150	XLT	Gas	20)23 Tr	uck	Frostbite Falls	54344	43400	3/23/2024	Rocky & B	ullwinkle			List all models available at each dealership	6
Ford	F150	XLT	Gas	20)23 Tr	uck	Frostbite Falls	54630	47445	4/4/2024	Rocky & B	ullwinkle			List all models available at each dealership.	C
Ford	F150	Lightning	Electric	20)23 Tr	uck	Frostbite Falls	92440	83740	4/14/2024	Rocky & B	ullwinkle			A due a superficient and all and sub-stational differences	
Chevrolet	Suburban	Premier	Gas	20	024 SL	JV	Hutchinson	79910	74310	4/27/2024	Lindsey W	halen			Ask a question, or tell me what you'd like to	do
Chevrolet	Blazer	RS	Gas	20	024 SL	JV	Hutchinson	55555	50470	5/3/2024	Lindsey W	halen			WITH A LENS I	
Ford	Mustang	Mach-E	Electric	20	023 Ca	ar	Hutchinson	43430	43430	4/13/2024	Lindsey W	halen				~
-														•	Ψ	\triangleright

The result returned was:

🌍 Сор	ilot		\times						
	there?								
l analyzed	d data in A1:K31, ship'	and here's what I found:							
Disti 6	nct Count of	Dealership							
Another p	rompt asked	, "Which Salesperson h	as the mos	t sales?"	The result retur	ned was:			
🌍 Copi	lot			🌍 Сор	ilot		>		
Top 'Sal	esperson' by	'Sales Price'							
Salesper	SalespersonSum of Sales PriceRocky & Bullwinkle477169			The salesperson with the most sa					
Rocky &				& Bullw	/Inkle with a total	l sales price of			
Grand To	otal	477169		477109.					

While a user could write formulas with functions to extrapolate similar answers, the Copilot prompting functionality generated answers in a fraction of the time!

In addition to answering prompts, Copilot can identify insights, generate formulas, highlight, sort & filter, as well as advanced functionality such as helping to write Python code, and provide text insights to streamline and enhance data interpretation. With AI-powered features, Excel users can now analyze large datasets, identify trends, and make informed decisions more efficiently.

Solver

The Solver tool is an add-in program available in Excel that allows users to perform additional what-if analysis, by altering different variables in a spreadsheet in order find an optimal (maximum or minimum) value for a formula in one cell — called the objective cell — subject to constraints, or limits, on the values of other formula cells on a worksheet. For example, what is the minimum number of sales you'd need to make to cover the cost of an expensive piece of business equipment?
Solver has three parts to it—a target value, variables that it can change to reach that value, and constraints that Solver has to work in. Solver adjusts the values in the variable cells to satisfy the limits on constraint cells and produce the result you want for the objective cell.



To install Solver, go to File > Options and in the Excel Options window choose the Solver Add-in. If

Solver option should appear in an Analysis group under the Data tab.

Let's use Solver to determine a common staffing scheduling dilemma. You manage a small business and need to determine the optimal hours per week to schedule each employee given a set of constraints. Open the following worksheet (try using the Insert Data From Picture feature) and study the formulas in column D & F.

	А	В	С	D	Е	F			
1		Let Th	em Eat	Cake, Inc					
2	Decorating Staff Work Schedule Hand-Decorated Valentines Cakes								
		Hours per	Cakes	Number of	Hourly				
3	Employee	Week	per Hr	Cakes	Wage	Labor Cost			
4	Esslinger, Annmarie	32	4.00	128	\$ 14.00	\$ 448.00			
5	Holland, Christine	20	5.00	100	12.50	\$ 250.00			
6	Gunderson, Mike	40	4.00	160	12.00	\$ 480.00			
7	Petermeier, Jane	35	3.50	122.5	15.55	\$ 544.25			
8	Swanson, Brian	20	4.50	90	12.65	\$ 253.00			
9	Total								

Consider the following constraints:

- Ensure that no employee works more than 40 hours per week.
- Fractional cakes are not acceptable.
- 1. Select the range B9:F9 and click the AutoSum button.
- 2. Select cell D9 and use the Solver feature to determine how many hours each employee needs to work to produce at least 750 cakes in a week. (Current output is barely 600 cakes)
- 3. In the Solver window that opens, add the objective, variables and constraints as shown below.
- 4. Choose Solve. The Solver Results window should eventually display...

Se <u>t</u> Objective:		\$D\$9		1
To: <u>M</u> ax	() Mi <u>n</u>	O <u>V</u> alue Of:	750	
By Changing Variable	e Cells:			
\$B\$4:\$B\$8				1
S <u>u</u> bject to the Constr	aints:			
\$B\$4:\$B\$8 <= 40 \$B\$4:\$B\$8 = integer				Add
				<u>C</u> hange
				<u>D</u> elete
				<u>R</u> eset All
			•	Load/Save
<mark>∠</mark> Ma <u>k</u> e Unconstrai	ined Variables Non-Ne	gative		
S <u>e</u> lect a Solving Method:	GRG Nonlinear		× [Options
Solving Method				
Select the GRG Nor for linear Solver Pro	nlinear engine for Solv oblems, and select the	er Problems that are sm Evolutionary engine for	ooth nonlinear. Select the Solver problems that are	LP Simplex engine non-smooth.

@ 080

Solver found an integer solution within tolera	ance. All
Constraints are satisfied.	Reports
<u>Keep Solver Solution</u> <u>Restore Original Values</u>	Answer
Return to Solver Parameters Dialog	□O <u>u</u> tline Reports
<u>O</u> K <u>C</u> ancel	<u>S</u> ave Scenario

5.

6. Choose the Keep Solver Solution option and click OK. Your updated spreadsheet should now display the solution to your scheduling dilemma.

	А	В	С	D	E		F		
1	Let Them Eat Cake, Inc.								
2	Decorating Staff Work Schedule Hand-Decorated Valentines Cakes								
		Hours per	Cakes	Number of	Hourly				
3	Employee	Week	per Hr	Cakes	Wage	La	bor Cost		
4	Esslinger, Annmarie	40	4.00	160	\$ 14.00	\$	560.00		
5	Holland, Christine	31	5.00	155	12.50	\$	387.50		
6	Gunderson, Mike	40	4.00	160	12.00	\$	480.00		
7	Petermeier, Jane	40	3.50	140	15.55	\$	622.00		
8	Swanson, Brian	30	4.50	135	12.65	\$	379.50		
9	Total	181	21.00	750	66.70	\$	2,429.00		

Power³ – Oh, so much power!!!

Power BI, Power Query, and Power Pivot are powerful business intelligence tools developed by Microsoft that allow users to connect, transform, and analyze data from various sources to create compelling visualizations, reports, and dashboards. While they all help manage data, there are key differences between these solutions.

Power BI, Microsoft's business intelligence tool, enables users to transform raw data into operable insights. Power BI focuses on data visualization and reporting, while Excel is better for detailed analysis and financial

modeling. Power BI and Excel both have Power Query for gathering/combining and transformation of data, however power BI lets users connect to more data sources (such as Google sheets). Both Power Query and Power Pivot are part of the Power BI cloud-based business analytics service. Power BI strengths over regular Excel are in its visualizations. Visualizations is the name assigned to the charts, slicers, tables and matrixes that users can insert into their reports in Power BI. Power BI has a greater choice of visualizations than Excel, and lots of options for how they interact with the other visualizations on a page, or even across the entire report.

Power Query

Power Query is a data extraction, loading and transformation tool used for business intelligence.

With Power Query (known as Get & Transform in Excel), users can or connect to external data, and then *shape* that data. For example, a can remove a column, change a data type, or merge tables, in ways that their needs. Then, the user can load their query into Excel to create and reports. Periodically, the user can refresh the data to make it up to

Get & Transform Data date. In Excel, select the Data tab on the ribbon to see the Get & Transform Data and Queries & Connections groups.

After importing and refreshing data from a wide variety of data sources, users can then shape the data in a step-by-step transformation that gradually creates a unique, tabular shape to fit the user's data analysis needs. For users who perform repetitive data transformation tasks or struggle to organize and analyze their data, Power Query might be a great solution.







except where otherwise noted

import user meet

charts

Power Pivot

Power Pivot is used to model data and perform more complex calculations than Excel can handle. Power Pivot is great when working with huge data sets. Once Power Query has imported and cleaned the various data sources, Power Pivot is used to establish relationships between the

tables/queries. Using DAX (Data Analysis





Expressions), the formula language of Power Pivot, users can create more powerful calculations and more sophisticated data models than they can in Excel alone.

Power Query can prepare simple but large datasets for analysis. Power Pivot, on the other hand, is for more complex models and more powerful calculations than Excel worksheet functions or PivotTables alone. Conversely, while Power Pivot contains features for importing and shaping data, it is recommended to leave this job to Power Query. Use both to shape your data in Excel so you can explore and visualize it in PivotTables, PivotCharts, and Power BI.

3-D References

An Excel cell reference that refers to the same cell or range on multiple sheets is called a 3-D reference. A 3-D reference, sometimes referred to as 3-D formula, is a useful and convenient way to reference several worksheets that follow the same pattern and contain the same type of data—such as when a user consolidates budget data from different departments in their organization.

3-D references work brilliantly when a user desires to consolidate data into a summary sheet. For example, monthly sales data can be entered on



separate sheets, then consolidated via 3-D formulas on a summary sheet that reference each monthly sheet.

Creating a 3D reference is straightforward once you understand the structure of your workbook. Here's a simple guide to setting up a 3D reference:

- 1. **Identify the Range**: Determine which cell or range of cells you want to reference. Make sure this cell or range is consistently used across all worksheets for accurate results.
- 2. **Initiate the Formula**: Click on the cell where you want to display the result of your calculation. Begin typing the formula that will incorporate the 3D reference, such as =SUM(or =AVERAGE(.
- 3. **Select the Worksheet Range**: While still in the formula bar, click on the first worksheet tab that you want to include in the reference. Then hold down the Shift key and click on the last worksheet tab to include. This action selects all worksheets between and including the first and last tabs clicked.
- 4. **Complete the Reference**: After selecting the worksheets, select the cell or range of cells in the formula bar that you wish to calculate across the selected sheets. For example, if calculating the sum of values in cell B3 across sheets "Jan" to "Dec", the completed formula would look like =SUM(Jan:Dec!B3).
- 5. **Enter and Apply**: Press Enter to complete the formula. Excel will now calculate the sum, average, or other aggregate measures of the cell or range across the selected worksheets.

In the workbooks below, a small business has monthly expenses in separate worksheets (Jan, Feb, Mar) that the manager would like to aggregate into a summary sheet, named Q1. Each sheet has the identical structure, but many of the cells that represent variable expenses, differ from month-to-month, while other fixed expenses stay consistent from month-to-month. The Q1 sheet below is ready for some 3-D references to consolidate data from sheets Jan, Feb, and Mar.

A B C D E F										
1	1 MJL Property Management Services									
2	January Expenses									
3		Unit A	Unit B	Unit C	Unit D	Unit E				
4	Electricity	\$646.00	\$180.88	\$206.72	\$109.82	\$148.58				
5	Gas	\$510.00	\$142.80	\$163.20	\$86.70	\$117.30				
6	Water	\$211.00	\$59.08	\$67.52	\$35.87	\$48.53				
7	Garbage	\$56.00	\$15.68	\$17.92	\$9.52	\$12.88				
8	Advertising	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00				
9	Internet	\$98.00	\$27.44	\$31.36	\$16.66	\$22.54				
10	Security	\$55.00	\$15.40	\$17.60	\$9.35	\$12.65				
11	Maintenance	\$300.00	\$100.00	\$100.00	\$60.00	\$100.00				
12	Cleaning Services	\$400.00	\$112.00	\$128.00	\$68.00	\$92.00				
13	TOTALS	\$2,326.00	\$703.28	\$782.32	\$445.92	\$604.48				
14										
15										
16										
17										
18										
19										
20										
21										
-	Jan Feb Mar Q1 (+)									

	А	В	С	D	E	F		
1	MJL Property Management Services							
2	March Expenses							
3		Unit A	Unit B	Unit C	Unit D	Unit E		
4	Electricity							
5	Gas							
6	Water							
7	Garbage							
8	Advertising							
9	Internet							
10	Security							
11	Maintenance							
12	Cleaning Services							
13	TOTALS	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00		
14								
15								
16								
17								
18								
19								
20								
21								
-	Jan Fe	b Mar	Q1 (+)				

In cell B4 of the Q1 sheet the following formula will be inserted: =SUM(Jan:Mar!B4)

After using AutoFill to copy the formulas to the rest of columns B:F and rows 4:12, the Q1 worksheet now appears on the right. Any changes to the data in the Jan, Feb or Mar sheets will be reflected in the Q1 sheet.

3-D references are a powerful feature in Excel that allow for dynamic data management and analysis across multiple worksheets. By learning how to create and manage these references, users can significantly streamline their workflow, ensuring that their calculations are both efficient and accurate.

F13	2 -	$\times \checkmark$	fx =	=SUM(Jan:Mar!F12)			
	А	В	С	D	E	F	
1	MJL	Property	y Manag	ement S	ervices		
2	March Expenses						
3		Unit A	Unit B	Unit C	Unit D	Unit E	
4	Electricity	\$2,029.20	\$556.67	\$636.52	\$333.46	\$482.28	
5	Gas	\$1,575.40	\$435.28	\$495.55	\$267.12	\$391.39	
6	Water	\$665.30	\$178.07	\$202.85	\$109.47	\$173.42	
7	Garbage	\$168.00	\$47.04	\$53.76	\$28.56	\$38.64	
8	Advertising	\$150.00	\$150.00	\$150.00	\$150.00	\$150.00	
9	Internet	\$294.00	\$82.32	\$94.08	\$49.98	\$67.62	
10	Security	\$165.00	\$46.20	\$52.80	\$28.05	\$37.95	
11	Maintenance	\$900.00	\$300.00	\$300.00	\$180.00	\$300.00	
12	Cleaning Services	\$1,200.00	\$336.00	\$384.00	\$204.00	\$276.00	
13	TOTALS	\$7,146.90	\$2,131.58	\$2,369.56	\$1,350.64	\$1,917.30	
14							
15							
16							
17							
18							
19							
20							
21							
-	🕨 🛛 Jan 🛛 Fe	eb Mar	Q1 (1	•)			