Math 0915 Foundations of College Algebra

Corequisite of Math 1115 College Algebra

The OER of this course consists of in-class worksheets. The template uses Graphic Organizer.

Use of Graphic Organizer

Purpose: Facilitates active learning by allowing students to fill in and build their own learning maps.

Format: Omits key words and partial definitions to keep students engaged and prevent working ahead.

Educational Benefits

Concept Integration: Reorders traditional textbook concepts for easier review and concept connections.

Example: When using OER in the chapter of functions, all factoring skills will be separated into three parts. Each part is reviewed alongside different concepts introduced in the chapter of functions in College Algebra. Finally, all factoring skills are applied in problems at the end of the chapter.

Feedback and Convenience

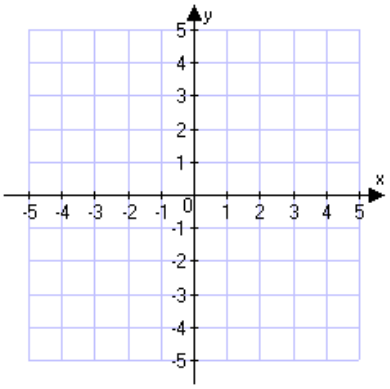
Faculty Feedback: Positive responses from Math 0915 instructors.

Ease of Use: Eases course preparation, especially for instructors assigned just before the semester.

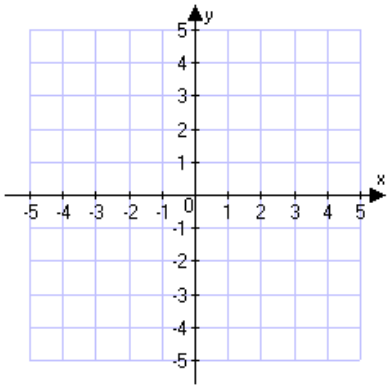
Math 0915 **Section 2.4 & 2.5 A library of Parent Functions & Transformations of Functions**

1. The Parent function of a **LINEAR** function has two special types.

a constant function $f(x)=c$



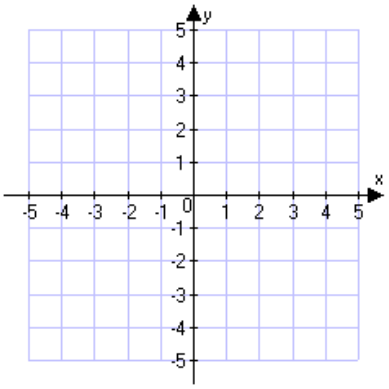
the identity function $f(x)=x$



- ✓ **The graph of a constant function is a _____.**
- ✓ **The graph of the identity function is a _____ with _____ and _____.**
- ✓ **The graph of a linear function $f(x)=ax+b$ is a _____ with _____ and _____.**

Ex 1. Sketch the graphs of the following functions.

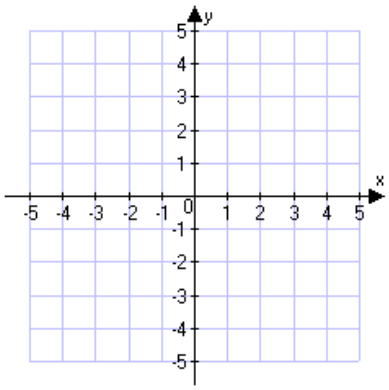
(1) $g(x)=x+2$



Let $f(x)=x$

- ➢ $g(x)=f(x)+$____
- ➢ $g(x)$ **shifts** $f(x)=x$ _____ units **up / down**.

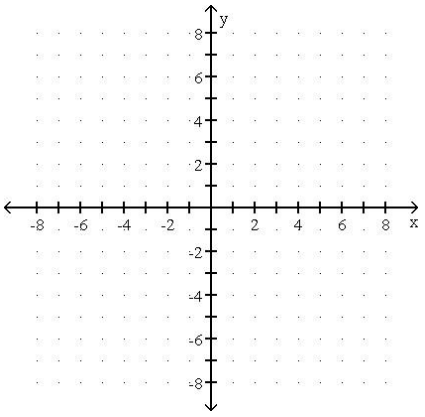
(2) $h(x)=x-3$



Let $f(x)=x$

- ➢ $h(x)=f(x)-$____
- ➢ $h(x)$ **shifts** $f(x)=x$ _____ units **up / down**.

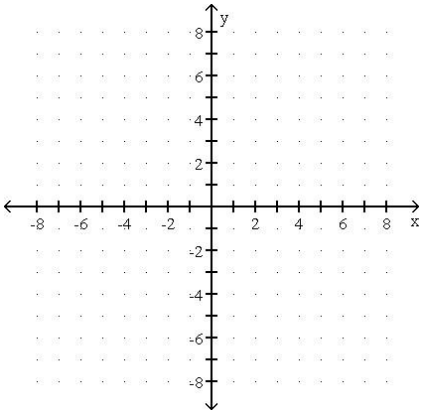
2. The parent function of a **QUADRATIC** function is $f(x)=x^2$.



- ✓ **Domain _____.**
- ✓ **_____ shaped.**
- ✓ **Symmetric with respect to _____.**
- ✓ **An odd / even function, and f(-x)=_____.**

Ex 2. Sketch the graphs of the following functions.

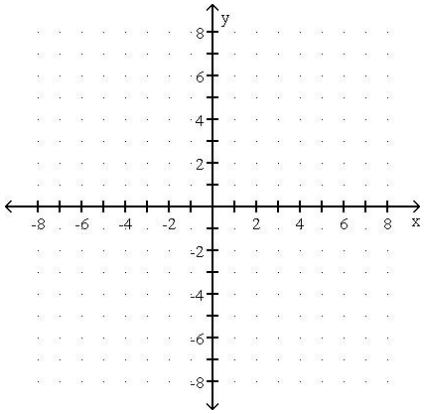
(1) $s(x)=(x+2)^2$



The parent function is $f(x)=$_____.

- Choose one: $s(x)=f(x)+2$ / $s(x)=f(x+2)$
- The graph of $s(x)$ **shifts** the graph of $f(x)$ _____ units to the **left /right**.

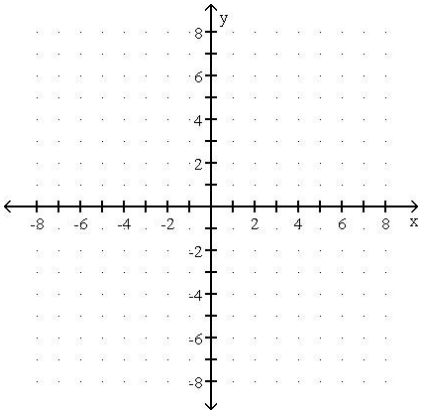
(2) $w(x)=(x-1)^2$



The parent function is $f(x)=$_____.

- Choose one: $w(x)=f(x)-1$ / $w(x)=f(x-1)$
- The graph of $w(x)$ **shifts** the graph of $f(x)=x^2$ ___ units to the **left /right**.

3. The parent function of a **CUBIC** function is $f(x)=x^3$.

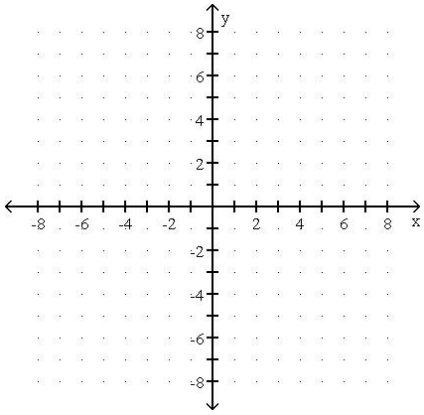


- ✓ **Domain _____.**
- ✓ **Symmetric with respect to _____.**
- ✓ **An odd / even function, and f(-x)=_____.**

Ex 3. Sketch the graphs of the following functions.

(1) $J(x)=(x+1)^3+2$

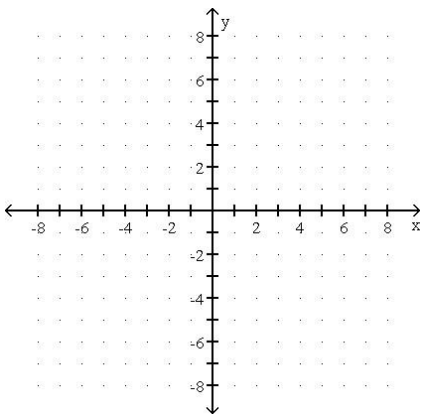
- The parent function is $f(x)=$_____ and $J(x)=f($ $)+$
- The graph of $J(x)$ **shifts** the graph of $f(x)$ ____ units to the **left /right** and _____ units **up / down**.



Points	Transformation #1	Transformation #2

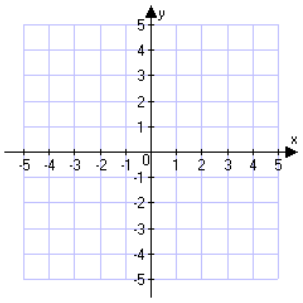
(2) $K(x)=(x-1)^3-2$

- The parent function is $f(x)=$_____, and $K(x)=f$
- The graph of $K(x)$ **shifts** the graph of $f(x)$ ____ units to the **left /right** and _____ units **up / down**.



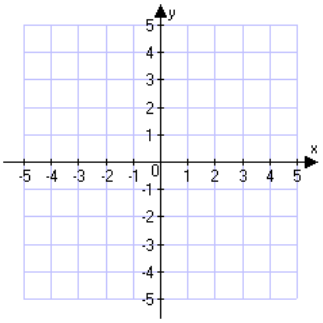
Points	Transformation #1	Transformation #2

4. The parent function of an **ABSOLUTE VALUE** function is $f(x)=|x|$.



- ✓ **Domain _____.**
- ✓ **_____ shaped.**
- ✓ **Symmetric with respect to _____.**

Ex 4. Sketch the graph of $p(x)=-|x|$.



- The graph of $p(x)$ **reflects** the graph of $f(x)=|x|$ in the ***x* - axis / *y* - axis**.
- Let $f(x)=|x|$, then $p(x)=$

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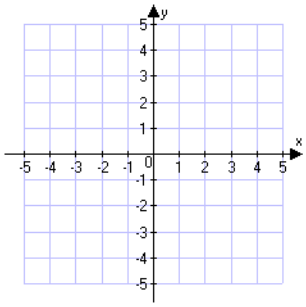
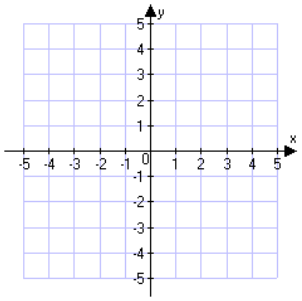
5. The parent function of a **SQUARE ROOT** function is $f(x)=\sqrt{x}$.



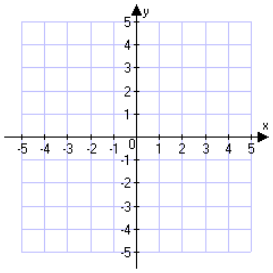
- ✓ **Domain _____.**

Ex 5. Sketch the graphs of the following functions.

$q(x)=2\sqrt{x}$



$r(x)=\frac{1}{2}\sqrt{x}$



- The graph of $q(x)$ is a vertical **stretch / shrink** of the graph of $f(x)=\sqrt{x}$ by a factor of ____.
- The graph of $r(x)$ is a vertical **stretch / shrink** of the graph of $f(x)=\sqrt{x}$ by a factor of ____.

SHIFT

$y = f(x-h)$ → **horizontal shift:** $\begin{cases} \text{if } h>0, \text{ then shift } f(x) \text{ to the } \_\_\_\_\_ \text{ by } h \text{ units.} \\ \text{if } h<0, \text{ then shift } f(x) \text{ to the } \_\_\_\_\_ \text{ by } |h| \text{ units.} \end{cases}$

$y = f(x)+k$ → **vertical shift:** $\begin{cases} \text{if } k>0, \text{ then shift } f(x) \_\_\_\_\_ \text{ by } k \text{ units.} \\ \text{if } k<0, \text{ then shift } f(x) \_\_\_\_\_ \text{ by } |k| \text{ units.} \end{cases}$

REFLECTION

$y = -f(x)$ → reflects $f(x)$ across the __ - axis.

Vertical STRETCH / SHRINK $a>1$

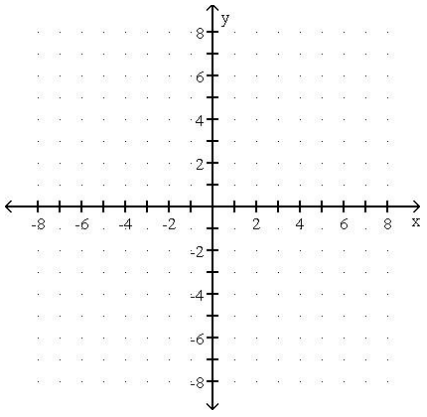
$y = a\,f(x)$ → _____ $f(x)$ vertically by a.

$y = \frac{1}{a} f(x)$ → _____ $f(x)$ vertically by $\frac{1}{a}$.

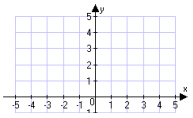
Ex 6. Sketch the graphs of the following functions.

(1) $u(x) = -\sqrt{x+1}$

- The parent function is $f(x) =$_____, and $u(x) =$ f
- The sequence of transformations from $f(x)$ to $u(x)$ _____.

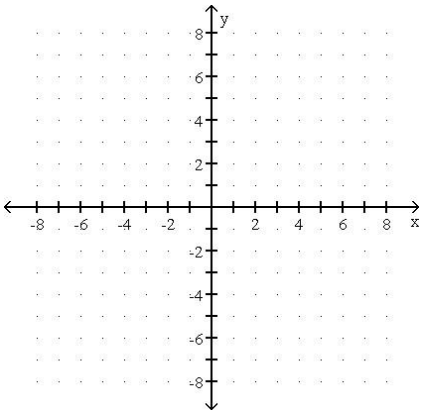


Points	Transformation #1	Transformation #2



(2) $a(x) = -3\sqrt{x-2}$

- The parent function is $f(x) =$_____, and $a(x) =$ f
- The sequence of transformations from $f(x)$ to $a(x)$ _____.



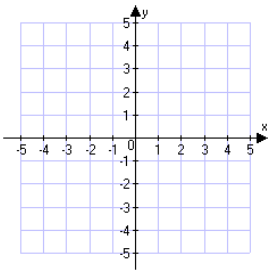
Points	Transformation #1	Transformation #2

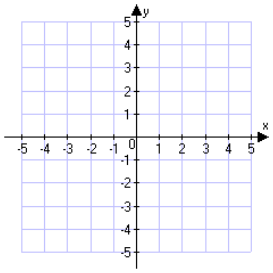
Ex 7. Sketch the graph of $g(x)$ by identifying the parent function $f(x)$ and writing $g(x)$ in terms of $f(x)$. Also describe the transformations.

(1) $g(x) = 2\sqrt{x+1}$

$f(x) =$ $g(x) =$

Transformation(s):



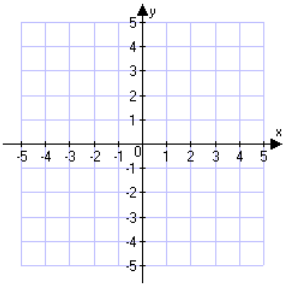


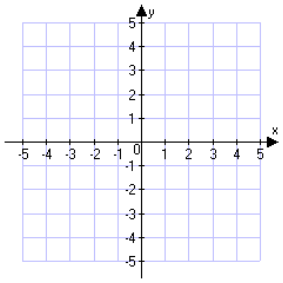
Points	Transformation #1	Transformation #2

(2) $g(x) = (x-1)^2 - 3$

$f(x) =$ $g(x) =$

Transformation(s):



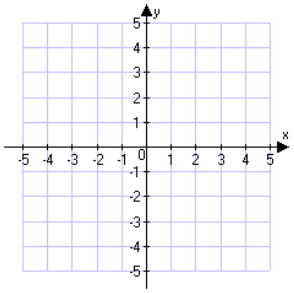


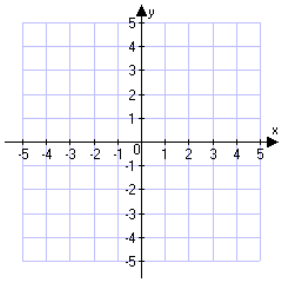
Points	Transformation #1	Transformation #2

(3) $g(x) = -\frac{1}{3}|x|$

$f(x) =$ $g(x) =$

Transformation(s):





Points	Transformation #1	Transformation #2

Math 0915 Foundations of College Algebra

Corequisite of Math 1115 College Algebra

The OER of this course consists of in-class worksheets. The template uses <u>Graphic Organizer.</u>

- **The purpose is to enhance the learners' thinking by directing them to FILL IN and BUILD their own learning map based on the provided information of math concepts and skills.**
- **This OER is like a lesson outline. Except the key words, partial definitions, facts, and properties are deliberately not included.**
  - ✓ **This format saves students some of the copying tasks, but they must stay engaged because they cannot work ahead in the lesson until those missing pieces are provided.**
  - ✓ **This format incorporates some hands–on while still leaving time for thinking, not just writing.**

- **By reorganizing order of concepts and skills presented in a traditional algebra textbook, the students will have an easier time to review concepts and skills learned before and connect them to the new ones.**

  - ✓ **For example. When all factoring polynomial skills are reviewed in one chunk of time, many students will feel overwhelmed and will not fully grasp all the skills. In this OER, all factoring skills are separated into three parts. Each part is reviewed alongside different concepts introduced in the chapter of functions in College Algebra. Finally, all factoring skills are applied in problems at the end of the chapter.**

- **This OER enhances the students' learning compared to my traditional lecture format when students do all the notetaking.**

- **This OER has received positive feedback from other math faculties who teach Math 0915.**

- **This OER makes teaching this course convenient for instructors, especially for those who are assigned to teach right before the semester begins.**

Page #1

Section numbers here match the ones in the textbook of College Algebra.

These two sections are taught in one lecture. Usually, they are in two separate sections in textbooks. But in this OER, they are intertwined.

Students must actively listen, as there are missing parts for them to fill in. They cannot simply sit there and listen to the lecture.

Page #2

The properties of a graph are usually given in several different paragraphs in a traditional algebra textbook. But here, key points are listed right next to the graph.

I have found that many students have hard time writing a given function in terms of its parent function when it is just introduced. This OER has different answers for the students to pick from. This enables the students to explore potential answers as they begin learning the concepts.

Page #3

This OER contains tables that will help lead students into organizing and writing their work. These table are not provided in a traditional textbook.

Page #4

More parent functions and transformations are introduced on this page. Totally there are five parents functions and three transformations discussed in this lesson.

Page #5

All transformations are summarized together. More examples are given.

Page #6

Less guidance is provided on this page. These problems are for extra practice – can be the review problems of next class or the review problems of test review.