Section 1.3 *Translations of Parent Functions*

Objective: Given the parent functions students will be able to identify and graph rigid and non rigid transformations (focus on step function).

Study problems
Page 106 # 14, 5-40 (*5), 55, 59, 65, 71

Summary of Function Terminology

Function: A **function** is a relationship between two variables such that to each value of the independent variable there corresponds exactly one value of the dependent variable.

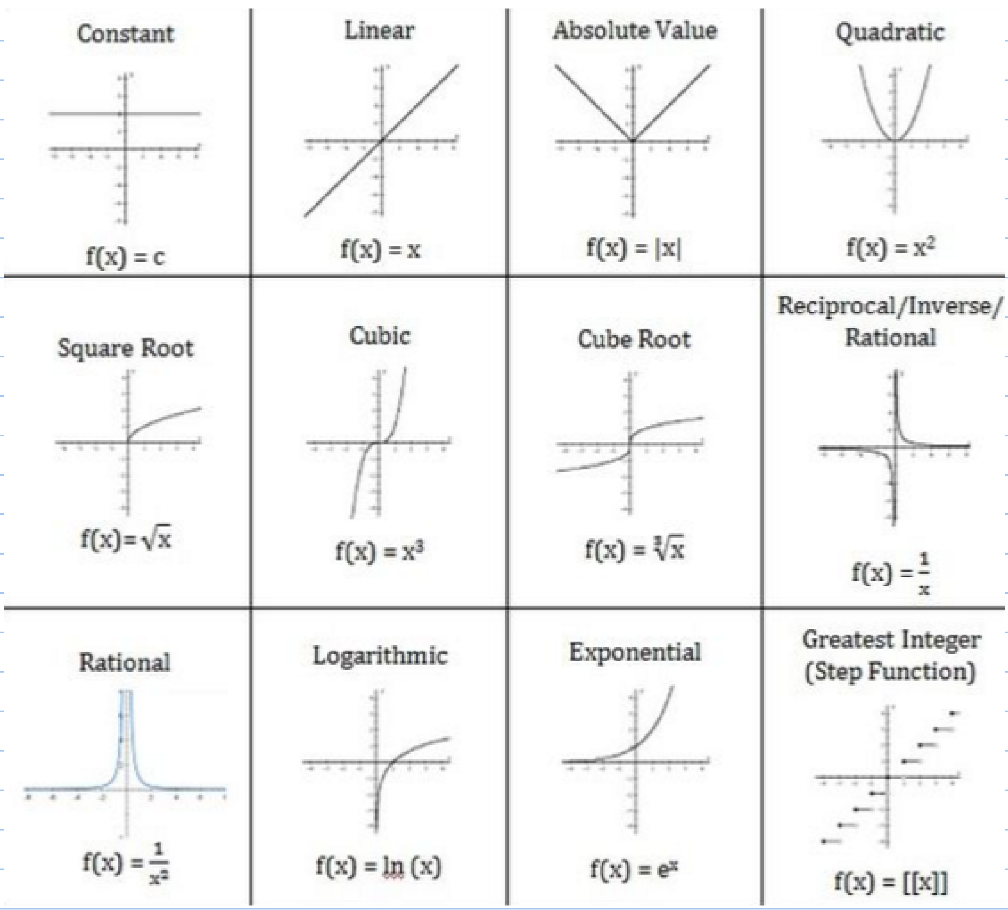
Function Notation: $y = f(x)$

- f is the *name* of the function.
- y is the **dependent variable,** or output value.
- x is the **independent variable,** or input value.
- $f(x)$ is the *value of the function at* x.

Domain: The **domain** of a function is the set of all values (inputs) of the independent variable for which the function is defined.

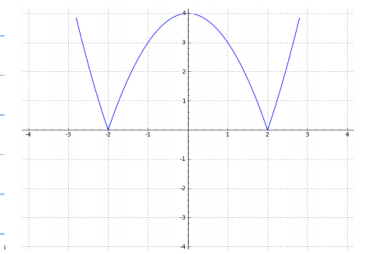
Range: The **range** of a function is the set of all values (outputs) assumed by the dependent variable (that is, the set of all function values).

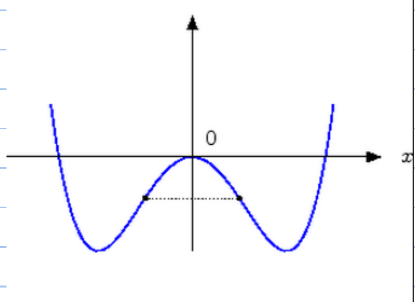
What are the parent functions you remember?



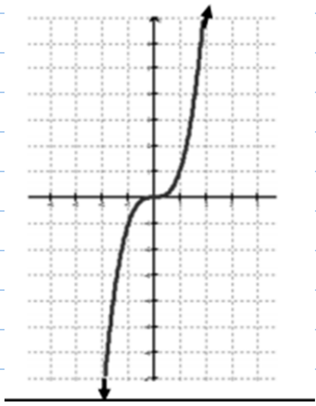
Vocabulary:

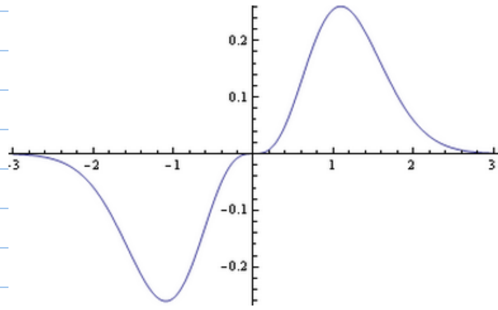
Even Functions: $f(x)$ is an even function if it reflects across the y axis. Therefore $f(-x)=f(x)$





Odd Functions: $f(x)$ is an odd function if it reflects across the x axis and y axis. Therefore $f(-x)=-f(x)$





$$y=a\,f(x-h)+k$$

Rigid Transformations (Shape of graph does not change)

- Horizontal Shifts
- Vertical shifts
- Reflections

Nonrigid Transformations (Same shape but Dilated)

- Y value increases if a> 1
- Y value decreases if 0 < a < 1

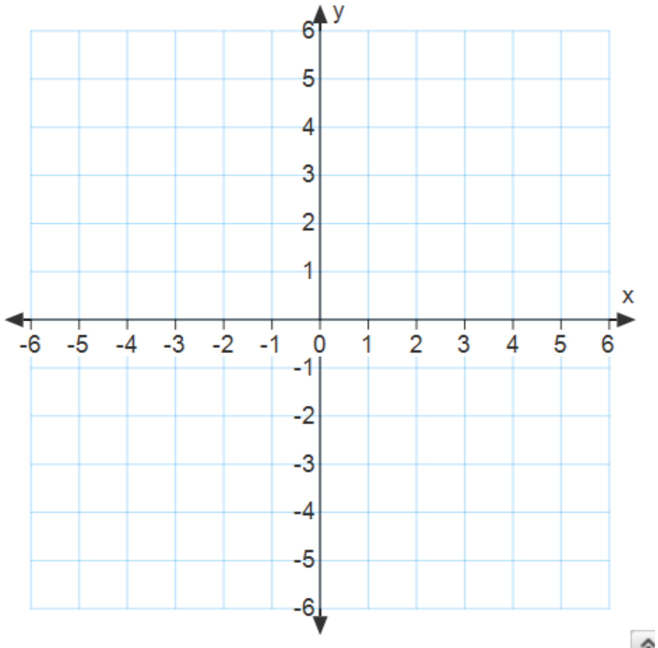
Sketch the graph

$f(x) = x$

Describe how the graphs are relate to the graph of *f (parent function)*.

$f(x) = 2x + 1$

$f(x) = -\frac{2}{5}x + 1$



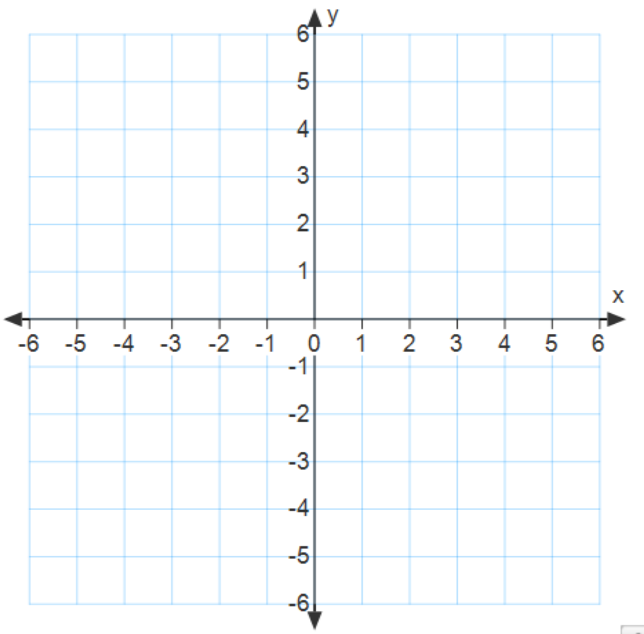
Sketch the graph

$f(x) = \sqrt{x}$

Describe how the graphs are relate to the graph of *f (parent function)*.

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

$f(x) = \sqrt{x} + 4$



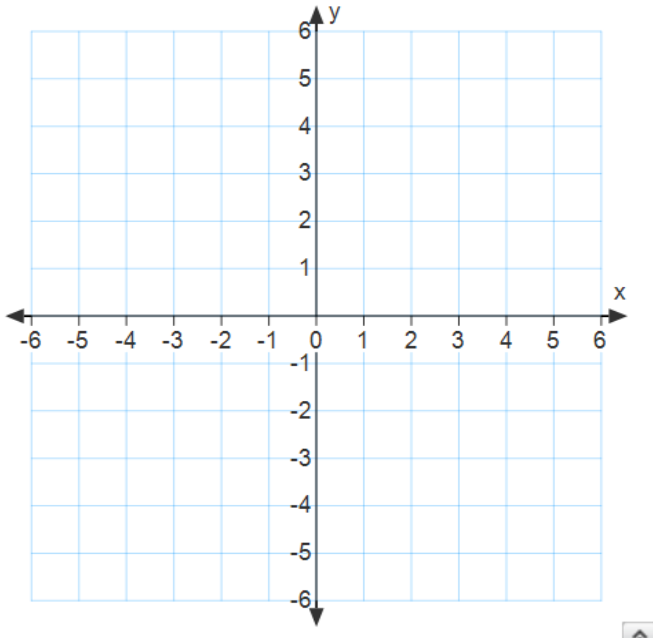
Sketch the graph

$f(x) = |x|$

Describe how the graphs are relate to the graph of *f (parent function)*.

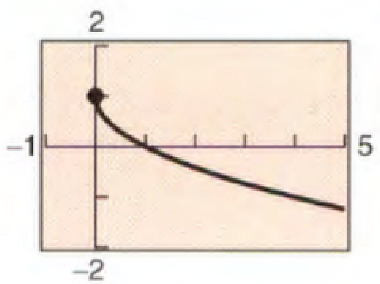
$f(x) = |x| + 2$

$f(x) = |x - 3|$

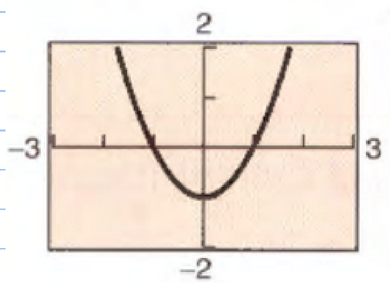


Identify the parent function. Write a function for the graph below using function notation.

1.

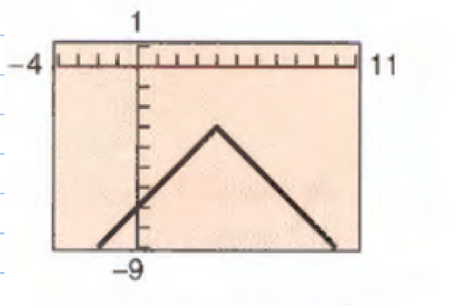


2.

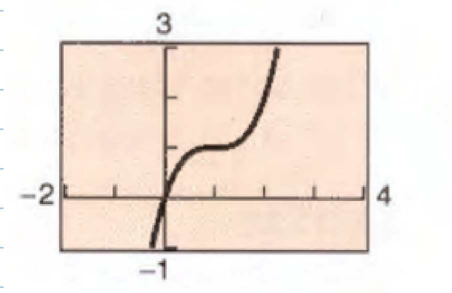


Identify the parent function. Write a function for the graph below using function notation.

1.



2.



Example

Use the graph of $f(x) = x^2$ to describe the graph of the function.

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

- a. Shift $f(x)$ to the right 2 units and then reflect in the x-axis.
- b. Shift $f(x)$ to the left 2 units and then reflect in the x-axis.
- c. Shift $f(x)$ to the right 2 units and then reflect in the y-axis.
- d. None of the above.

Example

Compare the graph of the function

$g(x) = -\sqrt{x} - 2$

with the graph of

$f(x) = \sqrt{x} + 2$.

- a. The graph of g is a reflection of the graph of f in the y-axis.
- b. The graph of g is reflection of the graph of f in the y-axis and shifted left 2 units.
- c. The graph of g is a reflection of the graph of f in the x-axis and shifted left 2 units.
- d. None of the above.

Example

Use the graph of $f(x) = x^2$ to describe the graph of the function.

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

- a. Reflect $f(x)$ in the y-axis and then shift downward 3 units.
- b. Reflect $f(x)$ in the x-axis and then shift downward 3 units.
- c. Reflect $f(x)$ in the x-axis and then shift upward 3 units.
- d. None of the above.

Example

Relative to the graph of $f(x) = x^3$, how is the graph of $h(x)$ shifted?
$h(x) = (x - 1)^3 + 8$

- a. 1 unit right, 8 units upward
- b. 8 units left, 1 unit downward
- c. 8 units right, 1 unit upward
- d. None of the above.

Describe how you would graph y=f(-x-6)-3 by using the graph of y=f(x)

- a. Move the graph of $f(x)$ 6 units to the left, reflect through the y-axis and then move 3 units down.
- b. Move the graph of $f(x)$ 6 units to the right, reflect through the y-axis and then move 3 units down.
- c. Move the graph of $f(x)$ 6 units to the left, reflect through the y-axis and then move 3 units up.
- d. Move the graph of $f(x)$ 6 units to the right, reflect through the x-axis and then move 3 units up.

13. Use the graph of f to sketch each graph.

(a) $y = f(x) + 2$

(b) $y = -f(x)$

(c) $y = f(x - 2)$

(d) $y = f(x + 3)$

(e) $y = 2f(x)$

(f) $y = f(-x)$