Objectives

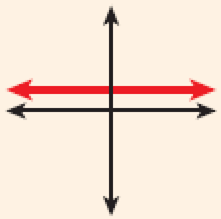
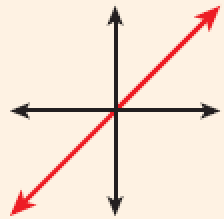
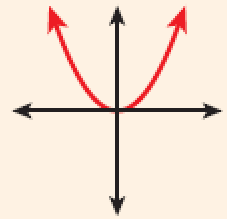
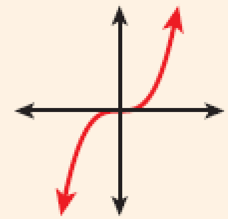
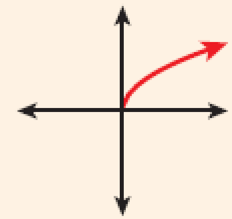
Identify parent functions from graphs and equations.

Vocabulary

parent function

Similar to the way that numbers are classified into sets based on common characteristics, functions can be classified into *families of functions*. The **parent function** is the simplest function with the defining characteristics of the family. Functions in the same family are transformations of their parent function.

Parent Functions

Family	Constant	Linear	Quadratic	Cubic	Square root
Rule	$f(x) = c$	$f(x) = x$	$f(x) = x^2$	$f(x) = x^3$	$f(x) = \sqrt{x}$
Graph					
Domain	$\mathbb{R}$	$\mathbb{R}$	$\mathbb{R}$	$\mathbb{R}$	$x \geq 0$
Range	$y = c$	$\mathbb{R}$	$y \geq 0$	$\mathbb{R}$	$y \geq 0$
Intersects y-axis	$(0, c)$	$(0, 0)$	$(0, 0)$	$(0, 0)$	$(0, 0)$

Example 1A: Identifying Transformations of Parent Functions

Identify the parent function for *g* from its function rule. Then graph *g* on your calculator and describe what transformation of the parent function it represents.

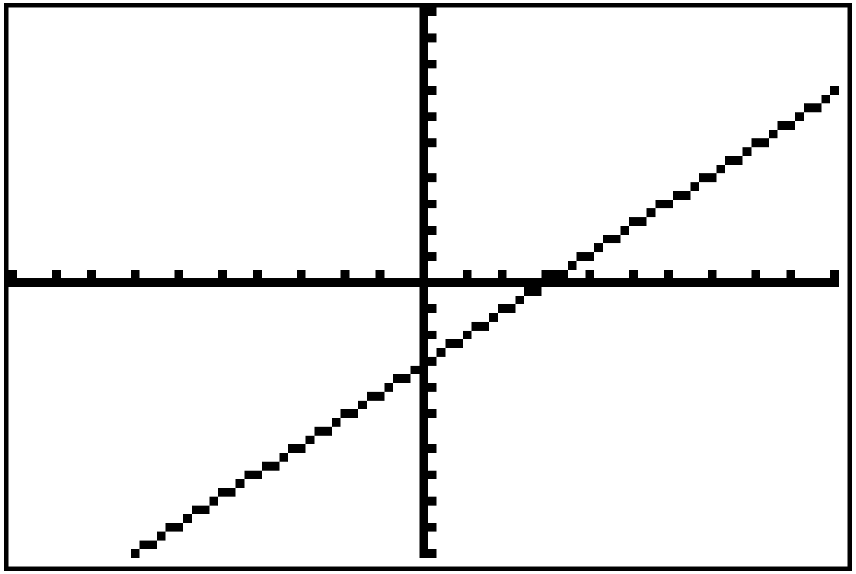
$g(x) = x - 3$

$g(x) = x - 3$ is linear

x has a power of 1.

The linear parent function $f(x) = x$ intersects the *y*-axis at the point (0, 0).

Graph $\mathbf{Y_1 = x - 3}$ on the graphing calculator. The function $g(x) = x - 3$ intersects the *y*-axis at the point (0, –3).



So $g(x) = x - 3$ represents a vertical translation of the linear parent function 3 units down.

Example 1B: Identifying Transformations of Parent Functions

Identify the parent function for *g* from its function rule. Then graph on your calculator and describe what transformation of the parent function it represents.

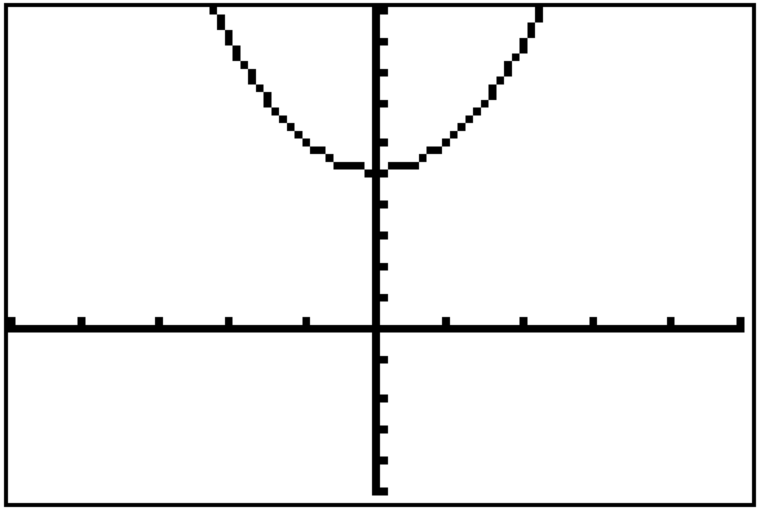
$g(x) = x^2 + 5$

$g(x) = x^2 + 5$ is quadratic. *x has a power of 2.*

The quadratic parent function $f(x) = x$ intersects the *y*-axis at the point (0, 0).

Graph $\mathbf{Y_1 = x^2 + 5}$ on a graphing calculator. The function $g(x) = x^2 + 5$ intersects the y-axis at the point (0, 5).

So $g(x) = x^2 + 5$ represents a vertical translation of the quadratic parent function 5 units up.



Check It Out! Example 1a

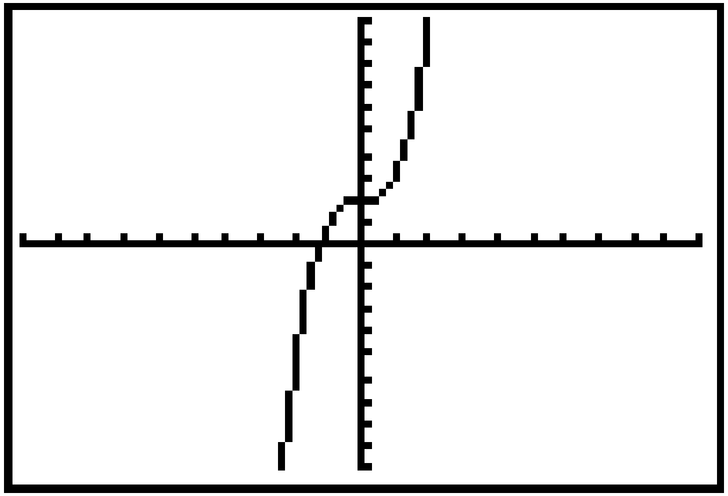
Identify the parent function for *g* from its function rule. Then graph on your calculator and describe what transformation of the parent function it represents.

$$g(x) = x^3 + 2$$

$g(x) = x^3 + 2$ is cubic. *x has a power of 3.*

The cubic parent function $f(x) = x^3$ intersects the y-axis at the point (0, 0).

Graph $\mathbf{Y_1 = x^3 + 2}$ on a graphing calculator. The function $g(x) = x^3 + 2$ intersects the *y*-axis at the point (0, 2).



So $g(x) = x^3 + 2$ represents a vertical translation of the quadratic parent function 2 units up.

Check It Out! Example 1b

Identify the parent function for *g* from its function rule. Then graph on your calculator and describe what transformation of the parent function it represents.

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

$g(x) = (-x)^2$ is quadratic. *x has a power of 2.*

The quadratic parent function $f(x) = x^2$ intersects the *y*-axis at the point (0, 0).

Graph **$Y_1 = (-x)^2$** on a graphing calculator. The function $g(x) = (-x)^2$ intersects the *y*-axis at the point (0, 0).

So $g(x) = (-x)^2$ represents a reflection across the *y*-axis of the quadratic parent function.