

Plot the ordered pairs from the table in a coordinate plane. Connect them with a line.

1.

x	y
-3	-3
-2	-2
-1	-1
0	0

2.

x	y
-2	-5
0	-3
3	0

3.

x	y
-2	-5
0	0
2	5

4.

x	y
-4	1
-2	3
0	5

Warm Up

Find the slope of the line passing through the set of points.

1. (-4, 4) and (2, 1)

2. (-2, 0) and (0, 2)

3. (5, 2) and (7, 3)

4. (10, 300) and (15, 425)

Cumulative Warm Up

Essential Question

What are the characteristics of some of the basic parent functions?

parent function: the most basic function in a family.

Essential Question

Warm up: Using graph paper - have students plot the points and connect the points to make the graph.

• Have students pair and share the results, what do they notice about the graph? What type of graph was created?

• Students must remember slope formula to calculate

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

• Have students calculate and share solutions with their partner.

What will you learn:

• Identify family functions

• describe transformations of parent functions

• describe combinations of transformations

Work with a partner. Graphs of eight basic parent functions are shown below. Classify each function as *constant*, *linear*, *absolute value*, *quadratic*, *square root*, *cubic*, *reciprocal*, or *exponential*. Justify your reasoning.

Exploration 1a-d

Constant: a linear equation written in the form $y = 0x + b$ or $y = b$.

linear: a function whose graph is a non vertical line

Absolute Value: a function that contains an absolute value expression

quadratic: a non linear function that can be written in standard form $y = ax^2 + bx + c$ $a \neq 0$

Square root: a function that contains a square root with the independent variable in the radicand

cubic: the form of $f(x) = ax^3 + bx^2 + cx + d$

Work with a partner. Graphs of eight basic parent functions are shown below. Classify each function as *constant*, *linear*, *absolute value*, *quadratic*, *square root*, *cubic*, *reciprocal*, or *exponential*. Justify your reasoning.

Exploration 1e-h

reciprocal: general form $f(x) = a/(x+h) + k$ - made of branches - two main parts of the graph

exponential: a non linear function of the form $y = ab^x$ where $a \neq 0$, $b \neq 1$ and $b > 0$

Core Concept

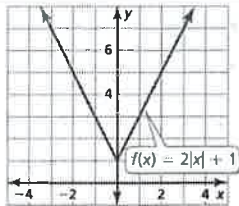
Parent Functions

Family	Constant	Linear	Absolute Value	Quadratic
Rule	$f(x) = 1$	$f(x) = x$	$f(x) = x $	$f(x) = x^2$
Graph				
Domain	All real numbers	All real numbers	All real numbers	All real numbers
Range	$y = 1$	All real numbers	$y \geq 0$	$y \geq 0$

* parent functions students need to know.

Core Concept

Identify the function family to which f belongs. Compare the graph of f to the graph of its parent function.



Example 1

graph of f - absolute value

Shifted up, narrower
than the parent function

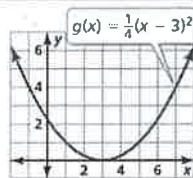
domain: all real numbers

Parent domain - the same

range: $y \geq 1$

parent range: $y \geq 0$

1. Identify the function family to which g belongs. Compare the graph of g to the graph of its parent function.



Monitoring Progress 1

graph of $g(x)$ = quadratic

wider than parent function

translated right 3 units

Graph $g(x) = x - 4$ and its parent function. Then describe the transformation.

$g(x)$ is a vertical translation
4 units down from
the parent function.

Example 2

$$y = mx + b$$

\uparrow \uparrow
 Slope y-Intercept

1.) graph parent function

2.) graph $g(x)$

3.) describe what changed
from Step 1 to Step 2.

use tables

Graph $p(x) = -x^2$ and its parent function. Then describe the transformation.

x	$y = x^2$	$y = -x^2$
-2	4	-4
-1	1	-1
0	0	0
1	1	-1
2	4	-4

Example 3

Graph the function and its parent function. Then describe the transformation.

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

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

4. $n(x) = -|x|$

Monitoring Progress 2-4

Graph each function and its parent function. Then describe the transformation.

a. $g(x) = 2|x|$

b. $h(x) = \frac{1}{2}x^2$

x	$y = x $	$y = 2 x $	x	$y = x^2$	$y = \frac{1}{2}x^2$
-2	2	4	-2	4	2
-1	1	2	-1	1	0.5
0	0	0	0	0	0
1	1	2	1	1	0.5
2	2	4	2	4	2

Example 4

1.) graph the parent function

2.) graph $p(x)$

what happened: $p(x)$ is a reflection in the x-axis of the parent quadratic function.

Student practice

a: absolute value function

: vertical stretch

b: quadratic function

: vertical shrink

Graph the function and its parent function. Then describe the transformation.

5. $g(x) = 3x$

6. $h(x) = \frac{3}{2}x^2$

7. $c(x) = 0.2|x|$

Monitoring Progress 5-7

Use a graphing calculator to graph $g(x) = -|x + 5| - 3$ and its parent function. Then describe the transformations.

Example 5

The table shows the height y of a dirt bike x seconds after jumping off a ramp. What type of function can you use to model the data? Estimate the height after 1.75 seconds.

Time (seconds), x	Height (feet), y
0	8
0.5	20
1	24
1.5	20
2	8

Example 6

height is about 15 feet after 1.75 seconds.

Student practice

* demonstrate how to plug this into a graphing calculator

* can use desmos to show - remind students they need graphing calculators for tests and quizzes.

• begin by plotting points

• use plotted points to determine what type of a parent function you might have

• sketch the graph

• read the graph

* Does it make sense?

Use a graphing calculator to graph the function and its parent function. Then describe the transformations.

8. $h(x) = -\frac{1}{4}x + 5$

9. $d(x) = 3(x - 5)^2 - 1$

10. The table shows the amount of fuel in a chainsaw over time. What type of function can you use to model the data? When will the tank be empty?

Time (minutes), x	0	10	20	30	40
Fuel Remaining (fluid ounces), y	15	12	9	6	3

Monitoring Progress 8-10

Student practice

Describe the transformation of the graph of the function from the graph of the parent function $p(x) = x^2$.

a. $f(x) = (x + 2)^2$

b. $g(x) = 2x^2$

c. $h(x) = x^2 + 2$

Closure

Student practice
