Warm Up:

-Explain what happens to the x-coordinates when you move to the right and left.

R: +
L: -

-Explain what happens to the y-coordinates when you move up and down.

↓ - ↑ +

-What happens to the coordinates when you reflect over x-axis? y-axis?

y-axis x-axis
-x -y

Answers:

12. $f(0) = 7(0) - 4$
$= -4$
$f\left(\frac{3}{2}\right) = 7\left(\frac{3}{2}\right) - 4$
$= \frac{13}{2}$
$f(-1) = 7(-1) - 4$
$= -11$

13. $f(0) = -(0)^2 + 0$
$= 0$
$f\left(\frac{3}{2}\right) = -\left(\frac{3}{2}\right)^2 + \frac{3}{2}$
$= -\frac{3}{4}$
$f(-1) = -(-1)^2 + (-1)$
$= -2$

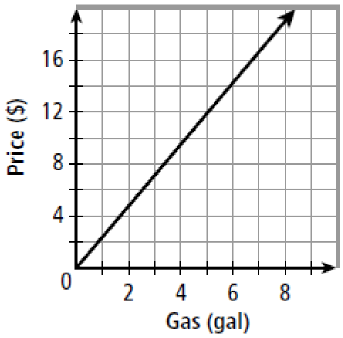
14. $f(0) = -2(0)^2 + 1$
$= 1$
$f\left(\frac{3}{2}\right) = -2\left(\frac{3}{2}\right)^2 + 1$
$= -\frac{7}{2}$
$f(-1) = -2(-1)^2 + 1$
$= -1$

15. $f(0) = 2$
$f\left(\frac{3}{2}\right) = 5$
$f(-1) = 0$

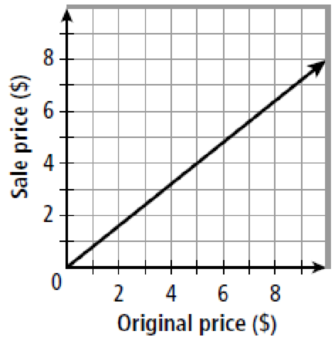
16. $f(0) = 4$
$f\left(\frac{3}{2}\right) = 4$
$f(-1) = -1$

17. $f(0) = 0$
$f\left(\frac{3}{2}\right) = 3$
$f(-1) = \frac{1}{2}$

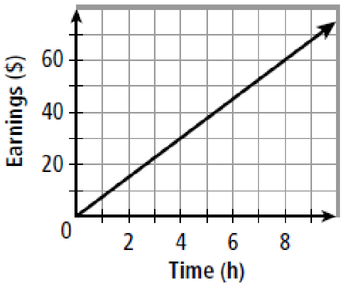
45. $f(x) = 2.37x$



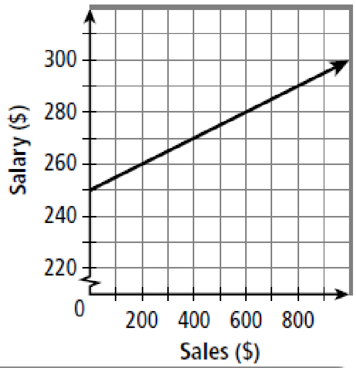
47. $f(x) = 0.8x$



46. $f(x) = 7.5x$

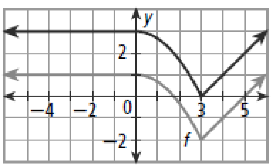


48. $f(x) = 250 + 0.05x$



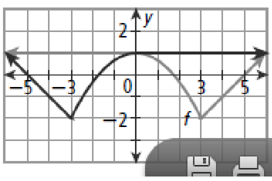
5.

x	y	$y + 2$
-2	1	$1 + 2 = 3$
0	1	$1 + 2 = 3$
1.5	0	$0 + 2 = 2$
3	-2	$-2 + 2 = 0$
5	0	$0 + 2 = 2$



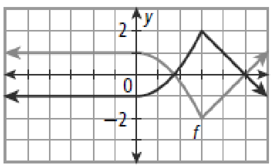
6.

$-x$	x	y
$-1(-2) = 2$	-2	1
$-1(0) = 0$	0	1
$-1(1.5) = -1.5$	1.5	0
$-1(3) = -3$	3	-2
$-1(5) = -5$	5	0



7.

x	y	$-y$
-2	1	$-1(1) = -1$
0	1	$-1(1) = -1$
1.5	0	$-1(0) = 0$
3	-2	$-1(-2) = 2$
5	0	$-1(0) = 0$



44. Possible answer: Order is important in these transformations: horizontal translation and reflection across the y-axis; vertical translation and reflection across the x-axis.
Order is not important in these transformations: horizontal translation and reflection across the x-axis; vertical translation and reflection across the y-axis.

1-8 Exploring Transformations

Imagine grasping two points on the graph of a function that lie on opposite sides of the y-axis. If you pull the points away from the y-axis, you would create a horizontal **stretch** of the graph. If you push the points towards the y-axis, you would create a horizontal **compression**.

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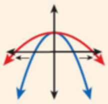
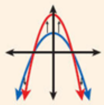
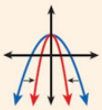
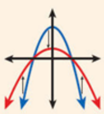
1-8 Exploring Transformations

Stretches and compressions are not congruent to the original graph.

X multiplied by factor 2,3,4

y multiplied by factor

Stretches and Compressions

	Horizontal X	Vertical Y
Stretch	Each point is *pulled away* from the *y*-axis.  The *x*-coordinate changes. $(4, 0) \rightarrow (2(4), 0)$ $(x, y) \rightarrow (bx, y)$ $\lvert b \rvert > 1$	Each point is *pulled away* from the *x*-axis.  The *y*-coordinate changes. $(0, 4) \rightarrow (0, 2(4))$ $(x, y) \rightarrow (x, ay)$ $\lvert a \rvert > 1$
Compression $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$	Each point is *pushed toward* the *y*-axis.  The *x*-coordinate changes. $(4, 0) \rightarrow \left(\frac{1}{2}(4), 0\right)$ $(x, y) \rightarrow (bx, y)$ $0 < \lvert b \rvert < 1$	Each point is *pushed toward* the *x*-axis.  The *y*-coordinate changes. $(0, 4) \rightarrow \left(0, \frac{1}{2}(4)\right)$ $(x, y) \rightarrow (x, ay)$ $0 < \lvert a \rvert < 1$

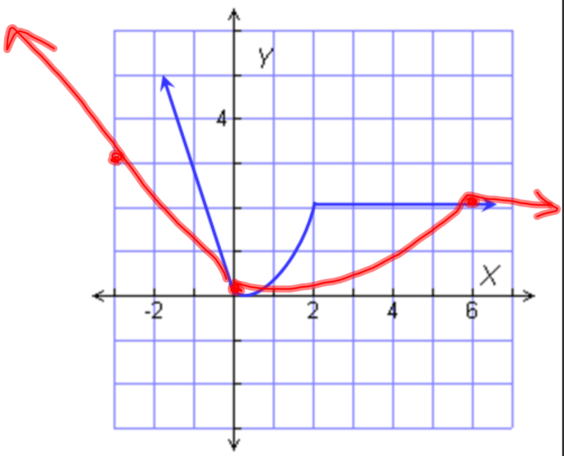
1-8 Exploring Transformations

Example 3: Stretching and Compressing Functions

Use a table to perform a horizontal stretch of the function $y = f(x)$ by a factor of 3. Graph the function and the transformation on the same coordinate plane.

$(2,2) \rightarrow (6,3)$

$(-1,3) \rightarrow (-3,3)$

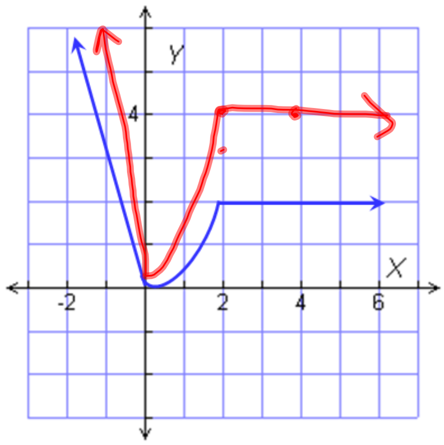


1-8 Exploring Transformations

Check It Out! Example 3

Use a table to perform a vertical stretch of $y = f(x)$ by a factor of 2. Graph the transformed function on the same coordinate plane as the original figure.

(2,2) → (2,4)
(4,2) → (4,4)



1-9 Introduction to Parent Functions

Objectives

Identify parent functions from graphs and equations.

Use parent functions to model real-world data and make estimates for unknown values.

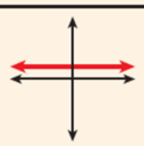
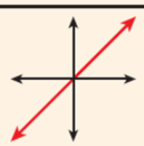
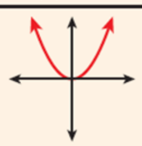
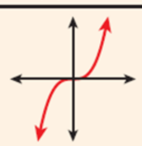
1-9 Introduction to Parent Functions

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.

1-9 Introduction to Parent Functions

$f(x)=3(x+2)^2-7$

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	$(0, c)$	$(0, 0)$	$(0, 0)$	$(0, 0)$	$(0, 0)$

Identifying parent functions is relatively easy. Just look at the variable and ignore everything else. Which parent function matches that variable?

$f(x)=4(x-2)^2+7$

$f(x)=x^2$

1-9 Introduction to Parent Functions

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.

$g(x) = x - 3$

$g(x)=x$ → Down 3

Linear

Add/Subtracting
IN PARANTHESES
w/ x
Horizontal

Add/Subtract
No parantheses
Vertical

Multiplication
Stretch/
Compression

−X
Reflection
Over y-axis

1-9 Introduction to Parent Functions

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.

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

Quadratic

Vertical
Up 5

1-9 Introduction to Parent Functions

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.

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

Cubic

Up 2

1-9 Introduction to Parent Functions

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.

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

Quadratic

Reflection
y-axis

Holt Algebra 2
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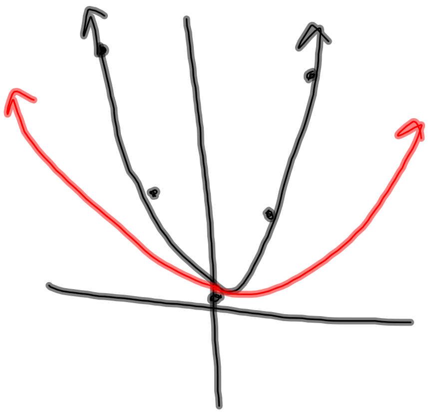
1-9 Introduction to Parent Functions

Example 2: Identifying Parent Functions to Model Data Sets

Graph the data from this set of ordered pairs. Describe the parent function and the transformation that best approximates the data set. {(−2, 12), (−1, 3), (0, 0), (1, 3), (2, 12)}

Quadratic

$y = x^2$



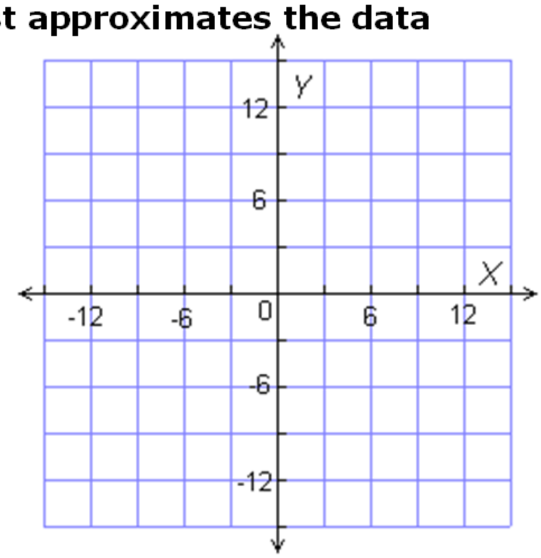
Compression

1-9 Introduction to Parent Functions

Check It Out! Example 2

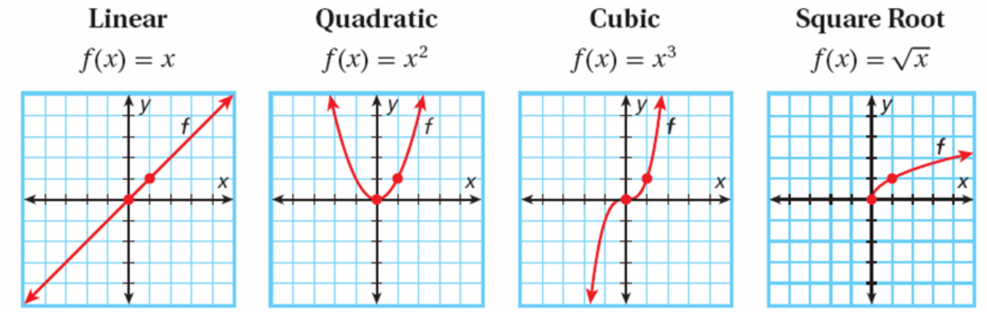
Graph the data from the table. Describe the parent function and the transformation that best approximates the data set.

x	−4	−2	0	2	4
y	−12	−6	0	6	12



1-9 Introduction to Parent Functions

Consider the two data points (0, 0) and (0, 1). If you plot them on a coordinate plane you might very well think that they are part of a linear function. In fact they belong to each of the parent functions below.



Remember that any parent function you use to approximate a set of data should never be considered exact. However, these function approximations are often useful for estimating unknown values.

Homework
p. 63 #8-10, 52, 54
p. 70 #2-7, 47-49

Present: 52, 49