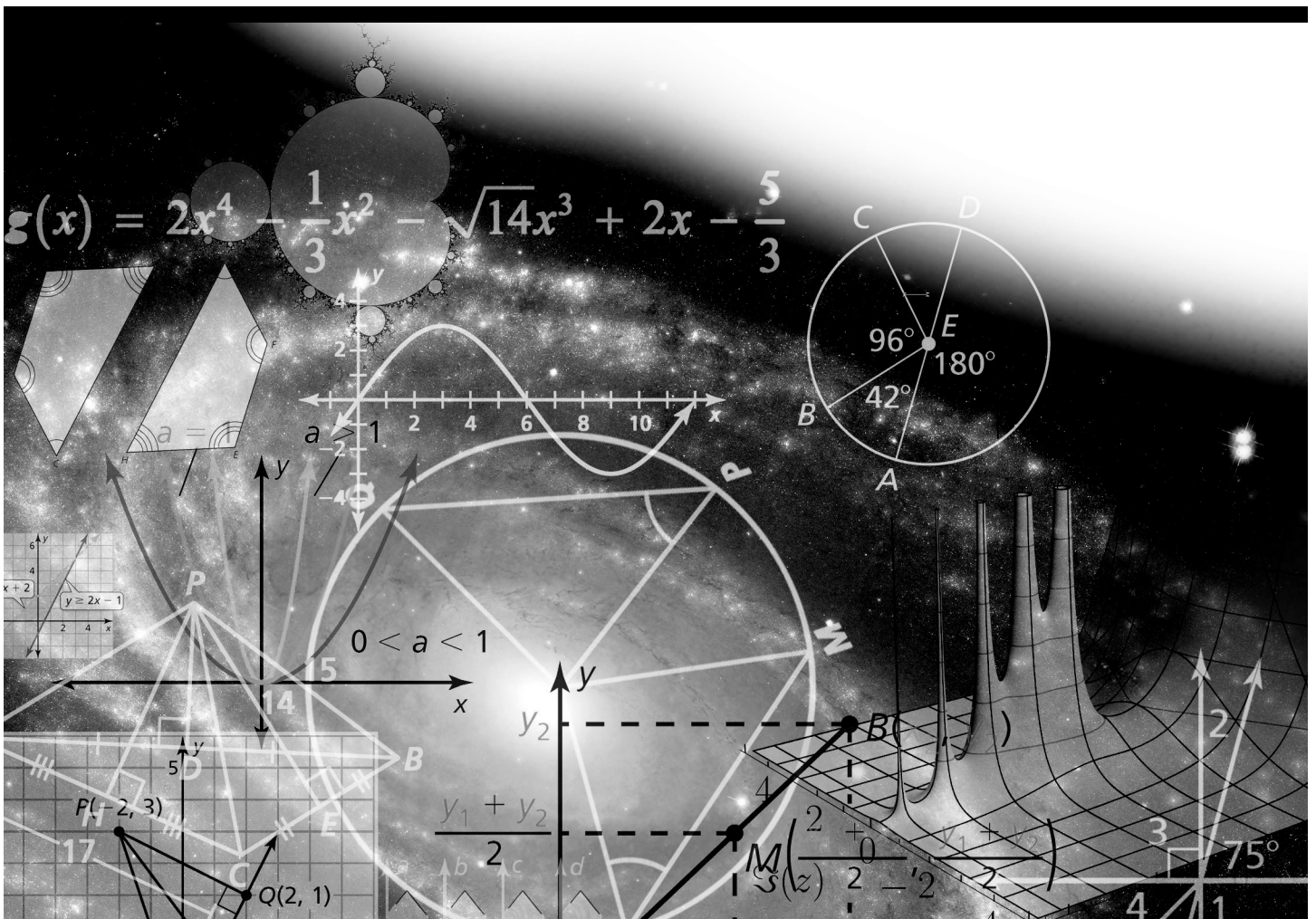


CHAPTER 1

Linear Functions

1.1 Parent Functions and Transformations.....	3
1.2 Modeling with Linear Functions	9
1.3 Solving Linear Systems	17



Chapter 1 Maintaining Mathematical Proficiency

Evaluate.

1. $7 \cdot 3^2 + 11$

2. $10 - 3(3 + 1)^3$

3. $64 \div 4^2 + \frac{1}{2}$

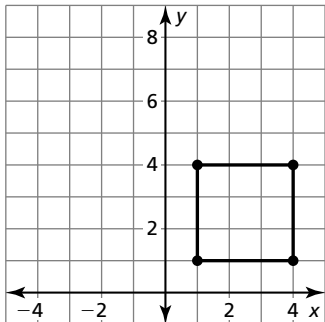
4. $-99 \div 3^2 \cdot 5$

5. $\frac{1}{7}(7^2 + 28)$

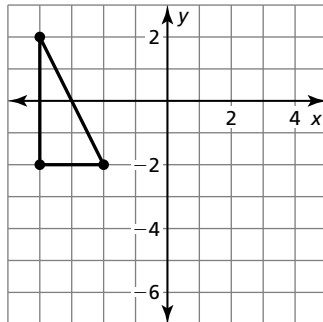
6. $-\frac{1}{8}(8 + 24) - 2^2$

Graph the transformation of the figure.

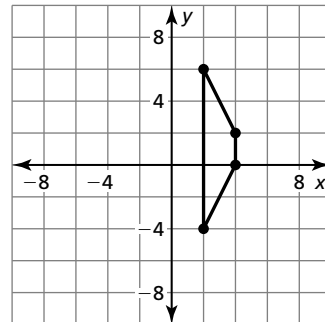
7. Translate the rectangle 3 units left and 4 units up.



8. Reflect the right triangle in the y -axis. Then translate 3 units down.



9. Translate the trapezoid 2 units up. Then reflect in the x -axis.



10. The point $(1, 1)$ is on $f(x)$. After a series of 3 transformations, $(1, 1)$ has been moved to $(2, -7)$. Write a function $g(x)$ that represents the transformations on $f(x)$.

1.1

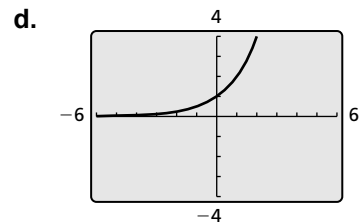
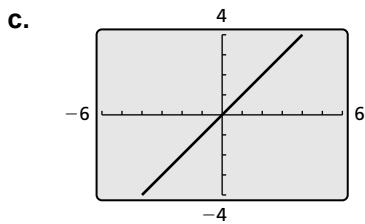
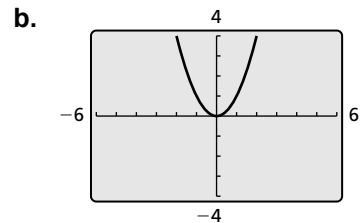
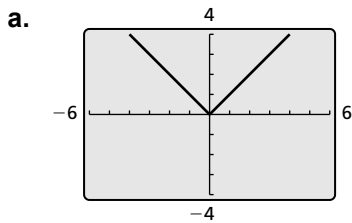
Parent Functions and Transformations

For use with Exploration 1.1

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

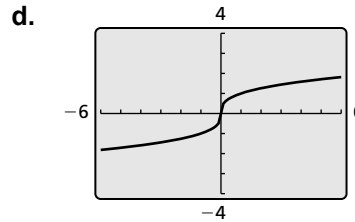
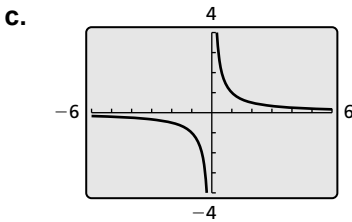
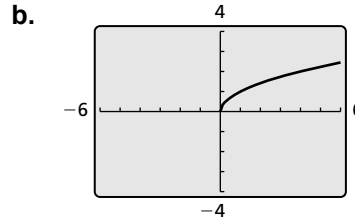
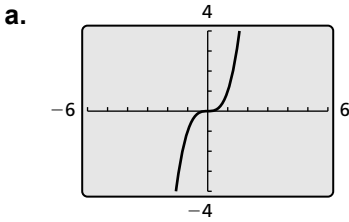
1 EXPLORATION: Identifying Basic Parent Functions

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



1.1 Parent Functions and Transformations (continued)**2 EXPLORATION: Identifying Basic Parent Functions**

Work with a partner. Graphs of four basic parent functions that you will study later in this course are shown below. Classify each function as *square root*, *cube root*, *cubic*, or *reciprocal*. Justify your reasoning.

**Communicate Your Answer**

- What are the characteristics of some of the basic parent functions?
- Write an equation for each function whose graph is shown in Exploration 1. Then use a graphing calculator to verify that your equations are correct.

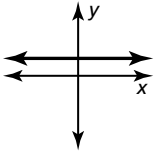
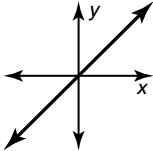
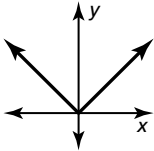
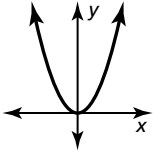
1.1

Practice

For use after Lesson 1.1

Core Concepts

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	$y \geq 0$	$y \geq 0$

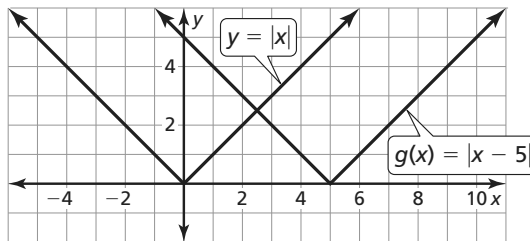
Notes:

Worked-Out Examples

Example #1

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

$$g(x) = |x - 5|$$

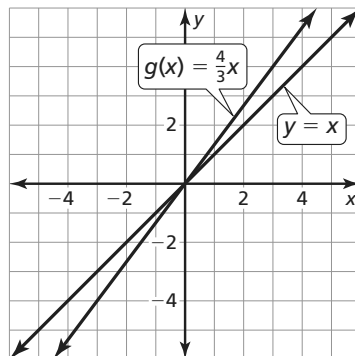


So, the graph of $g(x) = |x - 5|$ is a horizontal translation 5 units right of the parent absolute value function.

Example #2

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

$$g(x) = \frac{4}{3}x$$

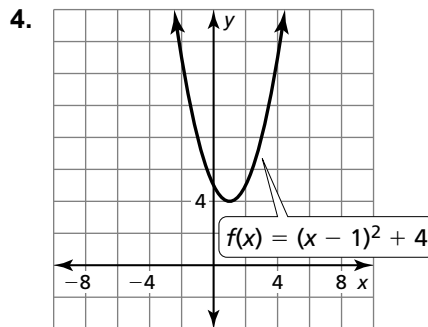
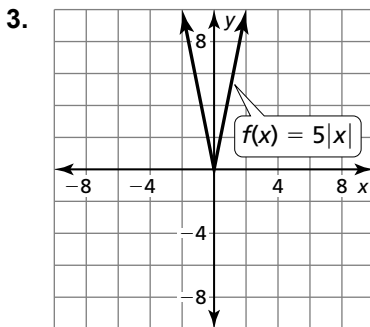
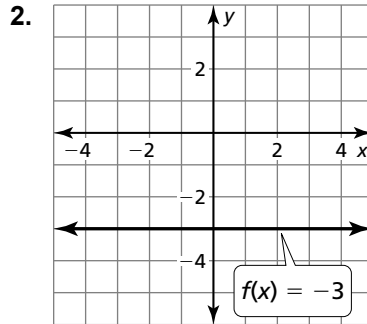
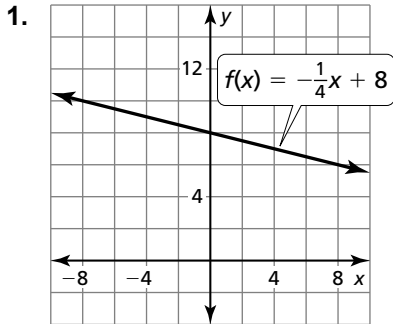


So, the graph of $g(x) = \frac{4}{3}x$ is a vertical stretch of the parent linear function.

1.1 Practice (continued)

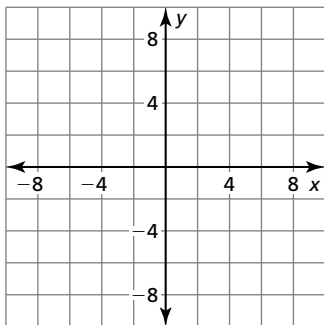
Practice A

In Exercises 1–4, identify the function family to which f belongs. Compare the graph of f to the graph of its parent function.

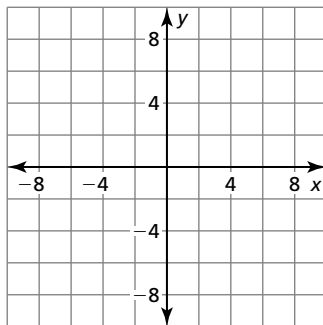


In Exercises 5–10, graph the function and its parent function. Then describe the transformation.

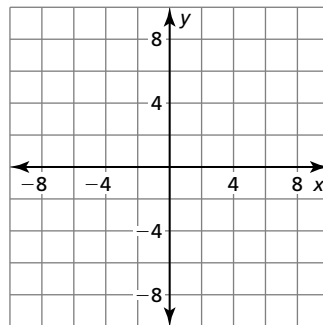
5. $f(x) = x - 7$



6. $f(x) = -9$

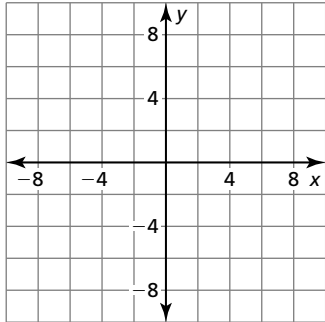


7. $f(x) = |x| + 1$

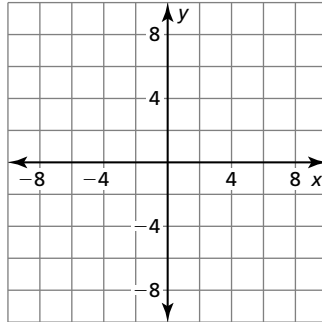


1.1 Practice (continued)

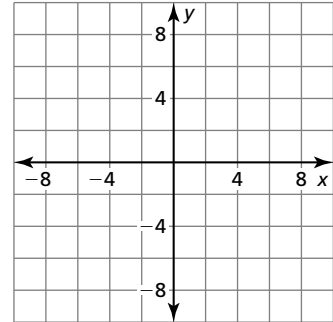
8. $h(x) = -x^2$



9. $f(x) = \frac{1}{8}x^2$



10. $g(x) = 6|x|$



11. Identify the function family of $f(x) = \frac{1}{3}|-x| + 4$ and describe the domain and range.

Use a graphing calculator to verify your answer.

12. The table shows the distance a biker rides in his first team relay competition.

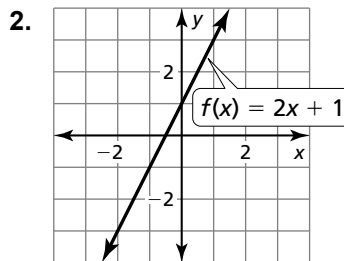
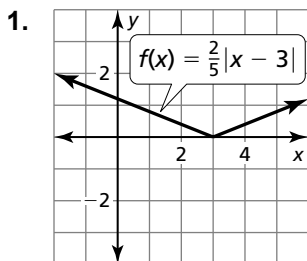
Time (hours), x	1	2	3	4
Distance (miles), y	12	24	36	48

a. What type of function can you use to model the data? Explain.

b. If the biker's teammate rides at the same pace but leaves 1 hour later, what type of transformation does this represent?

Practice B

In Exercises 1 and 2, identify the function family to which f belongs. Compare the graph of f with the graph of its parent function.



In Exercises 3–8, graph the function and its parent function. Then describe the transformation.

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

4. $f(x) = -x$

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

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

7. $h(x) = |x| - 2$

8. $f(x) = -3$

In Exercises 9–11, graph the function and its parent function. Then describe the transformation.

9. $f(x) = \frac{3}{5}x$

10. $h(x) = \frac{3}{2}|x|$

11. $h(x) = \frac{4}{3}x^2$

In Exercises 12–14, use a graphing calculator to graph the function and its parent function. Then describe the transformations.

12. $g(x) = \frac{1}{10}x^2 + 5$

13. $h(x) = (x - 5)^2 + \frac{4}{9}$

14. $f(x) = -|x + 2| - \frac{1}{3}$

In Exercises 15–18, identify the function family and describe the domain and range. Use a graphing calculator to verify your answer.

15. $h(x) = |x + 5| + 3$

16. $g(x) = -2x - 10$

17. $g(x) = 7x^2 - 3$

18. You are throwing a football with your friends. The height (in feet) of the ball above the ground t seconds after it is released from your hand is modeled by the function $f(t) = -16t^2 + 45t + 6$.

- Without graphing, identify the type of function modeled by the equation.
- What is the value of t when the ball is released from your hand? Explain.
- How many feet above the ground is the ball when it is released from your hand? Explain.