

Lesson 4.1 • Interpreting Graphs

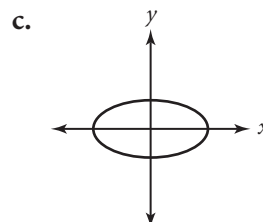
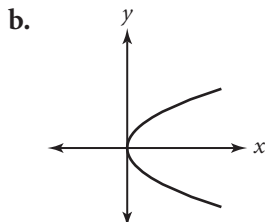
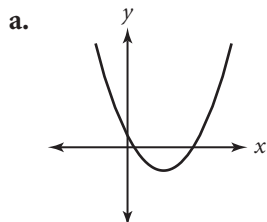
Name _____ Period _____ Date _____

1. Describe the pattern of the graph of each of the following situations as the graphs are read from left to right as *increasing*, *decreasing*, *increasing and then decreasing*, or *decreasing and then increasing*.
 - a. The height of a child at birth and on each birthday from age 1 to age 6
 - b. The balance that is due on a home mortgage from the date the house was purchased until it was sold 8 years later
 - c. The height of a ball that is thrown upward from the top of a building from the time it is thrown until it hits the ground
 - d. The monthly electric bill for August of one year to July of the next year for a family living in Atlanta, Georgia, in a home with central air conditioning. (Assume that July and August are the hottest months and that the family uses natural gas for heating.)
 - e. The value of a car from the time it was purchased as a new car to the time it was traded in 5 years later
2. For each of the situations described in Exercise 1, describe the real-world meaning of the vertical intercept of the graph.
3. Sketch a graph to match each description.
 - a. Decreasing steadily throughout, first slowly and then at a faster rate
 - b. Increasing rapidly at a constant rate, then suddenly becoming constant, then decreasing rapidly at a constant rate
4. Sketch what you think is a reasonable graph for each relationship described. In each situation, identify the variables and label your axes appropriately.
 - a. The money you earned in a week compared to the number of hours you worked in the week
 - b. The temperature of a hot drink sitting on your desk
 - c. Your speed as you cycle up a hill and down the other side
 - d. The amount of postage charged for different weights of letters
 - e. The intensity of light available for reading compared to your distance from the reading lamp
 - f. The height of a hot dog wrapper after it is released by your little brother from the top row of a football stadium

Lesson 4.2 • Function Notation

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1. Determine whether or not each graph represents a function. Explain how you know.



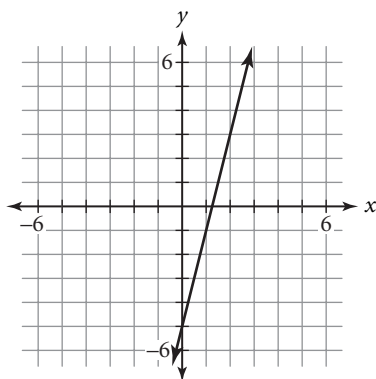
2. Find each of the indicated function values.

a. If $f(x) = -\sqrt{4x + 1}$, find $f(-\frac{1}{4})$, $f(0)$, $f(0.75)$, $f(2)$, and $f(12)$.

b. If $f(x) = -x^2 + 3x + 5$, find $f(-3)$, $f(0)$, $f(2)$, $f(5)$, and $f(8)$.

c. If $f(x) = \frac{2}{x-4}$, find $f(-4)$, $f(0)$, $f(5)$, $f(8)$, and $f(24)$.

3. Use the graph below to find each of the following.



a. $f(3) + f(-3)$

b. $f(10) \cdot f(-2)$

c. $f(f(10))$

d. x when $f(x) = 19$

e. x when $f(x) = -3$

f. x when $f(x) = 15$

g. x when $f(x + 2) = -9$

h. x when $f(x - 3) = 35$

i. x when $f(x + 4) = -21$

4. Define variables and write a function that describes each situation.

a. You drive on an interstate highway with your cruise control set at 65 miles per hour and do not need to stop or alter your speed.

b. You rent a small moving van to move your belongings to your new apartment. The rental company charges \$45 a day plus \$0.22 a mile to rent the van.

Lesson 4.3 • Lines in Motion

Name _____ Period _____ Date _____

1. Describe how each graph translates the graph of $y = f(x)$.

a. $y = f(x) + 5$

b. $y = f(x) - 3$

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

d. $y = f(x + 6)$

e. $y = f(x + 4) - 2$

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

2. Find each of the following.

a. $f(x + 1)$ if $f(x) = 3x$

b. $f(x - 2)$ if $f(x) = -4x$

c. $3 + f(x + 4)$ if $f(x) = 2x$

d. $-4 + f(x + 3)$ if $f(x) = -x$

e. $f(x - 5)$ if $f(x) = 2x + 1$

f. $3 + f(x + 6)$ if $f(x) = 8 - x$

3. Write an equation for each line.

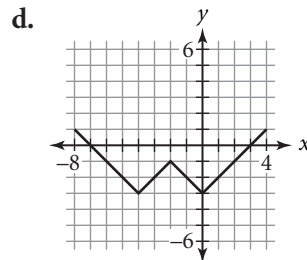
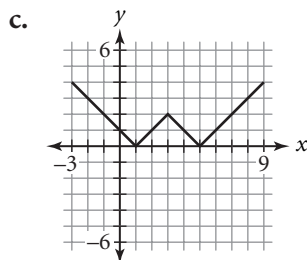
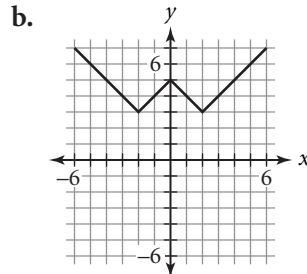
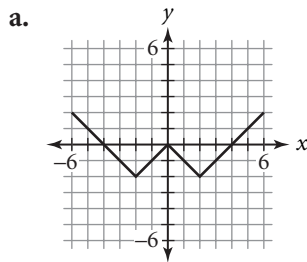
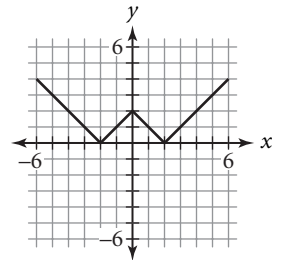
a. The line $y = 2.5x$ translated up 4 units

b. The line $y = -1.2x$ translated right 3 units

c. The line $y = -x$ translated up 5 units and left 2 units

d. The line $y = \frac{1}{2}x$ translated down 1 unit and right 4 units

4. The graph of $y = f(x)$ is shown at right. Write an equation for each related graph showing how the function has been translated.



Lesson 4.4 • Translations and the Quadratic Family

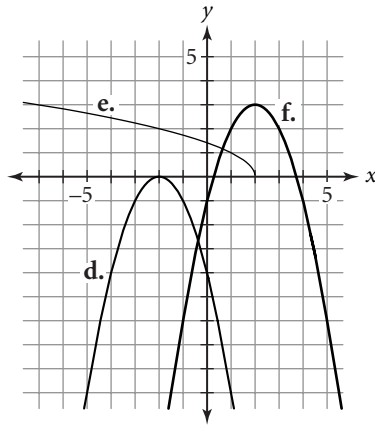
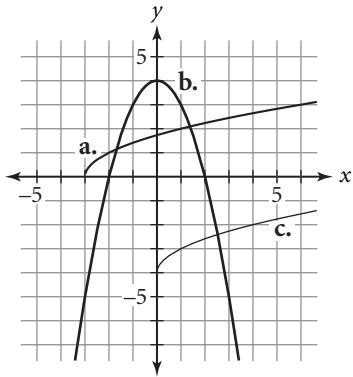
Name _____ Period _____ Date _____

- Describe the translations of the graph of $y = x^2$ needed to produce the graph of each equation.
 - $y = x^2 - 6$
 - $y = (x + 5)^2$
 - $y = x^2 + 2.5$
 - $y = (x - 10)^2$
 - $y = (x - 3)^2 - 9$
 - $y = (x + 7.5)^2 + 2.5$
- Find the vertex of each parabola.
 - $y = x^2$
 - $y = x^2 + 3$
 - $y = x^2 - 4$
 - $y = (x - 2)^2$
 - $y = (x + 3)^2$
 - $y = (x + 1)^2 + 5$
 - $y = (x - 4)^2 - 10$
 - $y = 4 + (x - 7)^2$
 - $y = -8 + (x + 5)^2$
- Each parabola described is the graph of $y = x^2$. Write an equation for each parabola and sketch its graph.
 - The parabola is translated left 3 units.
 - The parabola is translated up 1 unit.
 - The parabola is translated right 5 units.
 - The parabola is translated down 4 units.
 - The parabola is translated left 4 units and up 2 units.
 - The parabola is translated right 2 units and down 3 units.
- Describe what happens to the graph of $y = x^2$ in the following situations.
 - y is replaced with $(y + 1)$.
 - x is replaced with $(x - 5)$.
 - x is replaced with $(x + 3)$.
 - y is replaced with $(y - 6)$.
- Solve.
 - $x^2 = 49$
 - $x^2 + 6 = 31$
 - $x^2 - 12 = 52$
 - $(x + 4)^2 = 81$
 - $(x - 3)^2 = 100$
 - $(x + 7)^2 = 144$
 - $x^2 = 17$
 - $x^2 - 11 = 19$
 - $(x + 2)^2 = 13$
 - $(x + 4)^2 - 5 = 31$
 - $14 + (x + 12)^2 = 35$
 - $-20 + (x - 5)^2 = 3$

Lesson 4.5 • Reflections and the Square Root Family

Name _____ Period _____ Date _____

- Describe what happens to the graph of $y = \sqrt{x}$ in each of the following situations.
 - x is replaced with $(x + 6)$.
 - y is replaced with $(y - 5)$.
 - y is replaced with $(y + 1)$.
 - x is replaced with $(x - 8)$.
- Each graph below is a transformation of the graph of either the parent function $y = x^2$ or the parent function $y = \sqrt{x}$. Write an equation for each graph.



- Given the graph of $y = f(x)$, draw a graph of each of these related functions.

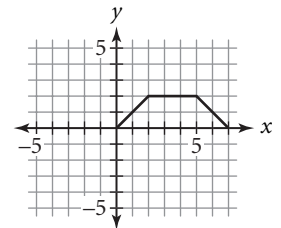
a. $y = -f(x)$ b. $y = f(-x)$ c. $y = -f(-x)$

- Solve each equation for y to get two separate functions that could be entered into a graphing calculator. In each case, label the equations as Y_1 and Y_2 . Then combine both functions to create a single relation that involves x and y .

a. $(y + 2)^2 = x$ b. $y^2 = x + 2$ c. $(y + 1)^2 = x - 6$

- Use the function $h = -4.9t^2 + d$ to answer each question. (Round your answers to the nearest tenth of a second.)

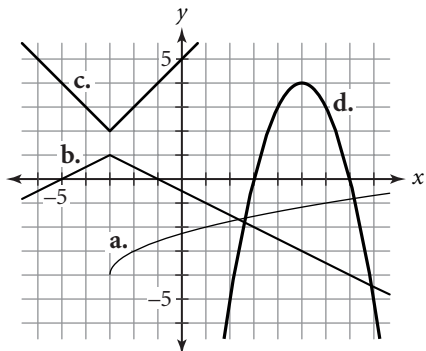
- If a ball is dropped from a height of 500 meters, how long will it take the ball to reach a height of 200 meters?
- If a ball is dropped from a height of 175 meters, how long will it take the ball to reach a height of 50 meters?
- If a ball is dropped from a height of 90 meters, how long will it take the ball to hit the ground?



Lesson 4.6 • Stretches and Shrinks and the Absolute-Value Family

Name _____ Period _____ Date _____

1. Each graph is a transformation of one of the parent functions you've studied. Write an equation for each graph.



2. Describe the transformations of the graph of $y = |x|$ needed to produce the graph of each equation.

a. $y = |x - 3|$

b. $y = -|x|$

c. $y = |-x|$

d. $y = \left|\frac{x}{4}\right|$

e. $y = 3|x|$

f. $y = |3x|$

g. $y = -|x| + 5$

h. $y = |x + 2| - 1$

i. $y = 1.5\left|\frac{x}{2}\right|$

j. $\frac{y}{0.5} = -|x|$

k. $y = -3|x + 4| + 6$

l. $\frac{y}{2} = |x - 1| - 2$

3. Find the vertex of the graph of each equation in Exercise 2 and sketch the graph.

4. Solve.

a. $|x| = 9$

b. $|x + 2| = 5$

c. $|x - 5| - 7 = 0$

d. $|x + 2| + 5 = 4$

e. $3|x - 5| - 2 = 10$

f. $\left|\frac{x}{2}\right| + 5 = 12$

5. Solve each equation for y .

a. $\frac{y}{2} = \left|\frac{x}{4}\right|$

b. $y - 2 = -4(x + 1)^2$

c. $\frac{y}{-3} = \sqrt{x} + 1.5$

d. $\frac{y - 3}{2} = (x + 1)^2$

e. $\frac{y + 1}{-3} = \sqrt{x + 2}$

f. $\frac{y - 5}{3} = \left|\frac{x + 2}{4}\right|$

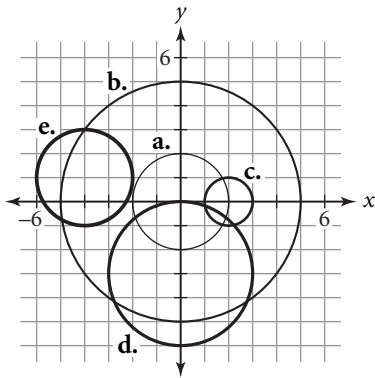
Lesson 4.7 • Transformations and the Circle Family

Name _____ Period _____ Date _____

1. Solve each equation for y to get two separate equations that could be entered into a graphing calculator. In each case, label the two equations as Y_1 and Y_2 .

a. $x^2 + y^2 = 4$ b. $4x^2 + y^2 = 9$ c. $3x - 2y^2 = 1$

2. Write an equation for each circle.



3. If $f(x) = \sqrt{1 - x^2}$, write an equation for each of the following related functions.

a. $-f(x)$ b. $f(-x)$ c. $2f(x)$ d. $f(2x)$

4. Without graphing, find the x - and y -intercepts of the graph of each equation.

a. $x^2 + y^2 = 1$ b. $y = \sqrt{1 - x^2}$ c. $y = -\sqrt{1 - x^2}$
 d. $y = 3\sqrt{1 - x^2}$ e. $y = -2\sqrt{1 - x^2}$ f. $y = \sqrt{1 - (2x)^2}$
 g. $y = -2\sqrt{1 - (4x)^2}$ h. $y = -\sqrt{1 - \left(\frac{x}{3}\right)^2}$ i. $y = 2\sqrt{1 - \left(\frac{x}{4}\right)^2}$

5. Write an equation for each transformation of the unit circle, and identify its graph as a circle or an ellipse. Then sketch the graph.

a. Replace x with $(x - 2)$. b. Replace y with $(y + 4)$.
 c. Replace y with $\frac{y}{3}$. d. Replace x with $\frac{x}{4}$.
 e. Replace x with $\frac{x}{2}$ and y with $\frac{y}{2}$. f. Replace x with $\frac{x}{4}$ and y with $\frac{y}{3}$.

Lesson 4.8 • Compositions of Functions

Name _____ Period _____ Date _____

1. The functions f and g are defined by sets of input and output values.

$$f = \{(5, 0), (-1, 1), (-3, 4), (1, 2), (3, 4), (-2, 6)\}$$

$$g = \{(4, -1), (0, -2), (1, -1), (2, -2), (6, 0)\}$$

- a. Find $f(-3)$, $f(1)$, and $f(5)$. b. Find $g(0)$, $g(2)$, and $g(4)$. c. What is the domain of f ?
 d. What is the range of g ? e. Find $f(g(4))$. f. Find $g(f(-3))$.
 g. Find $f(g(f(5)))$. h. Find $g(f(g(0)))$.

2. Use these three functions to find each value: $f(x) = -3x + 5$,
 $g(x) = (x - 2)^2$, $h(x) = x^2 + 4$.

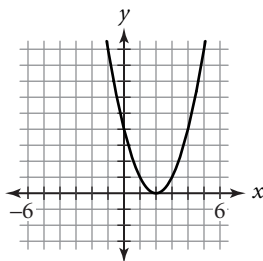
- a. $f(x + 2)$ b. $g(2x) + 1$ c. $h(x - 1) + 3$ d. $f(g(6))$
 e. $h(f(7))$ f. $g(h(-5))$ g. $f(g(h(-2)))$ h. $g(h(f(4)))$
 i. $h(g(f(0)))$ j. $f(h(a))$ k. $h(f(a))$ l. $g(h(a))$

3. For each graph below:

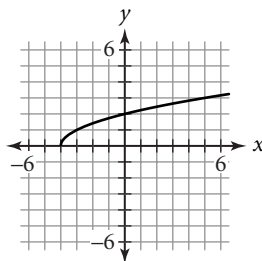
i. Write an equation for the graph.

ii. Write two functions, f and g , such that the figure is the graph of $f(g(x))$.

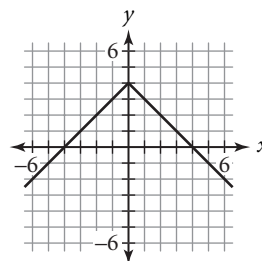
a.



b.



c.



4. Marla, Shamim, and Julie went out for dinner together. The sales tax on the meal was 6%, and they agreed to leave a 15% tip. Marla thought they should calculate the tip by finding 15% of the total bill, including the sales tax. Shamim thought they should calculate the tip by finding 15% of the bill before the tax was added. Julie thought it wouldn't make any difference. Let x represent the cost of the meal in dollars before tax and tip are added.

- a. Find a function f that gives the cost of the meal, including sales tax but not the tip.
 b. Find a function g that gives the amount of the tip calculated the way Shamim suggested.
 c. Use composition to find a function that gives the amount of the tip calculated the way Marla suggested.
 d. If the cost of the meal before tax was \$50, find the amount they will leave as a tip, calculated Marla's way and Shamim's way.