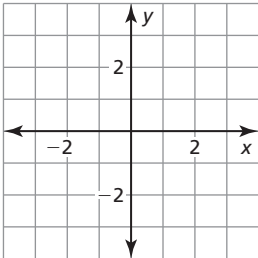


**Chapter
3**

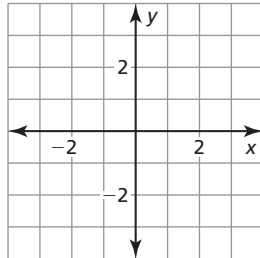
Maintaining Mathematical Proficiency

Plot the point in a coordinate plane. Describe the location of the point.

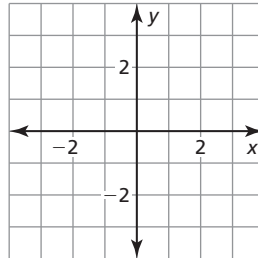
1. $A(-3, 1)$



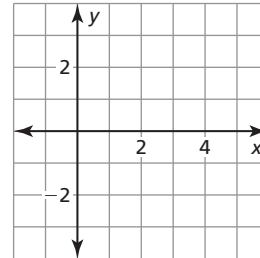
2. $B(2, 2)$



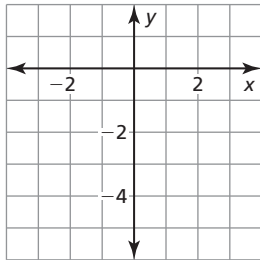
3. $C(1, 0)$



4. $D(5, 2)$



5. Plot the point that is on the y -axis and 5 units down from the origin.



Evaluate the expression for the given value of x .

6. $2x + 1; x = 3$

7. $16 - 4x; x = -4$

8. $12x + 7; x = -2$

9. $-9 - 3x; x = 5$

10. The length of a side of a square is represented by $(24 - 3x)$ feet. What is the length of the side of the square when $x = 6$?

3.1

Functions

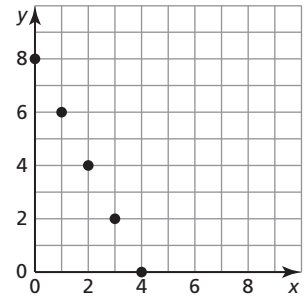
For use with Exploration 3.1

Essential Question What is a function?

1 EXPLORATION: Describing a Function

Work with a partner. Functions can be described in many ways.

- by an equation
- by an input-output table
- using words
- by a graph
- as a set of ordered pairs



a. Explain why the graph shown represents a function.

b. Describe the function in two other ways.

2 EXPLORATION: Identifying Functions

Work with a partner. Determine whether each relation represents a function. Explain your reasoning.

a.

Input, x	0	1	2	3	4
Output, y	8	8	8	8	8

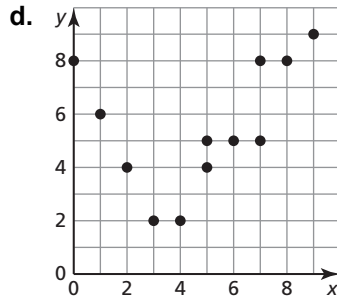
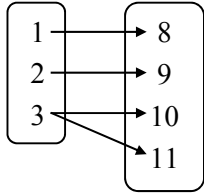
b.

Input, x	8	8	8	8	8
Output, y	0	1	2	3	4

3.1 Functions (continued)

2 EXPLORATION: Identifying Functions (continued)

c. Input, x Output, y



e. $(-2, 5), (-1, 8), (0, 6), (1, 6), (2, 7)$ f. $(-2, 0), (-1, 0), (-1, 1), (0, 1), (1, 2), (2, 2)$

g. Each radio frequency x in a listening area has exactly one radio station y .

h. The same television station x can be found on more than one channel y .

i. $x = 2$

j. $y = 2x + 3$

Communicate Your Answer

3. What is a function? Give examples of relations, other than those in Explorations 1 and 2, that (a) are functions and (b) are not functions.

3.1

Notetaking with Vocabulary

For use after Lesson 3.1

In your own words, write the meaning of each vocabulary term.

relation

function

domain

range

independent variable

dependent variable

Notes:

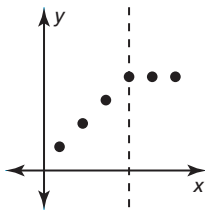
3.1 Notetaking with Vocabulary (continued)

Core Concepts

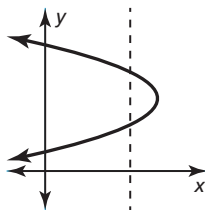
Vertical Line Test

Words A graph represents a function when no vertical line passes through more than one point on the graph.

Examples Function



Not a function



Notes:

The Domain and Range of a Function

The **domain** of a function is the set of all possible input values.

The **range** of a function is the set of all possible output values.



Notes:

3.1 Notetaking with Vocabulary (continued)

Extra Practice

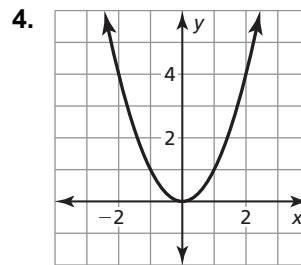
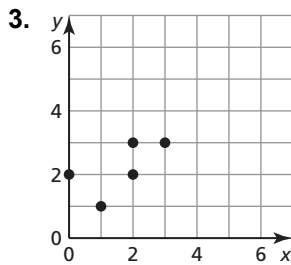
In Exercises 1 and 2, determine whether the relation is a function. Explain.

1.

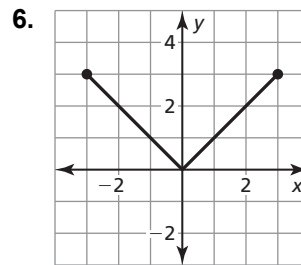
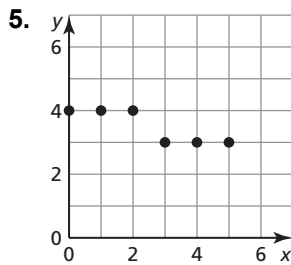
Input, x	-2	0	1	-2
Output, y	4	5	4	5

2. $(0, 3), (1, 1), (2, 1), (3, 0)$

In Exercises 3 and 4, determine whether the graph represents a function. Explain.



In Exercises 5 and 6, find the domain and range of the function represented by the graph.



7. The function $y = 12x$ represents the number y of pages of text a computer printer can print in x minutes.
- Identify the independent and dependent variables.
 - The domain is 1, 2, 3, and 4. What is the range?

3.2

Linear Functions

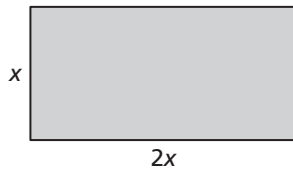
For use with Exploration 3.2

Essential Question How can you determine whether a function is linear or nonlinear?

1 EXPLORATION: Finding Patterns for Similar Figures

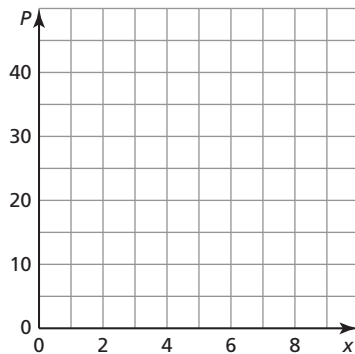
Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Complete each table for the sequence of similar figures. (In parts (a) and (b), use the rectangle shown.) Graph the data in each table. Decide whether each pattern is linear or nonlinear. Justify your conclusion.



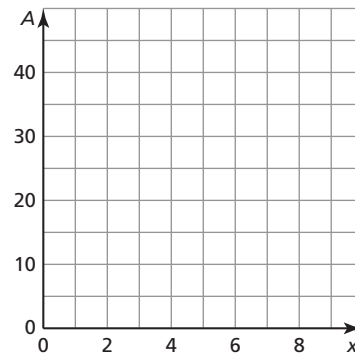
a. perimeters of similar rectangles

x	1	2	3	4	5
P					



b. areas of similar rectangles

x	1	2	3	4	5
A					

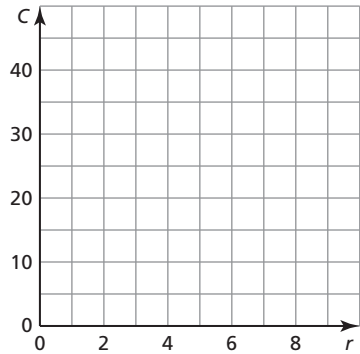


3.2 Linear Functions (continued)

1 EXPLORATION: Finding Patterns for Similar Figures (continued)

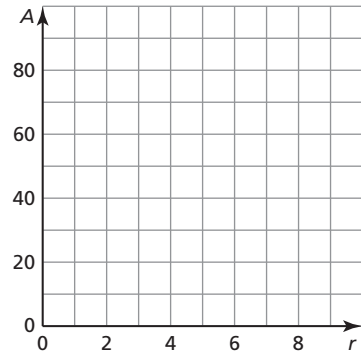
c. circumferences of circles of radius r

r	1	2	3	4	5
C					



d. areas of circles of radius r

r	1	2	3	4	5
A					



Communicate Your Answer

- How do you know that the patterns you found in Exploration 1 represent functions?

- How can you determine whether a function is linear or nonlinear?

- Describe two real-life patterns: one that is linear and one that is nonlinear. Use patterns that are different from those described in Exploration 1.

3.2

Notetaking with Vocabulary

For use after Lesson 3.2

In your own words, write the meaning of each vocabulary term.

linear equation in two variables

linear function

nonlinear function

solution of a linear equation in two variables

discrete domain

continuous domain

Notes:

3.2 Notetaking with Vocabulary (continued)

Core Concepts

Representations of Functions

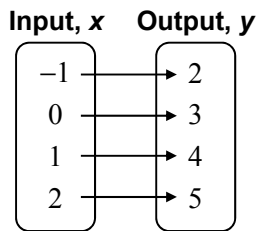
Words An output is 3 more than the input.

Equation $y = x + 3$

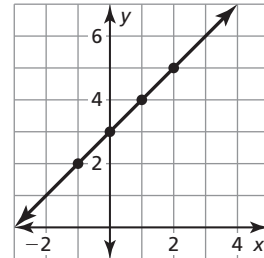
Input-Output Table

Input, x	Output, y
-1	2
0	3
1	4
2	5

Mapping Diagram



Graph



Notes:

Discrete and Continuous Domains

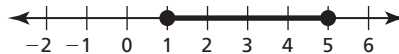
A **discrete domain** is a set of input values that consists of only certain numbers in an interval.

Example: Integers from 1 to 5



A **continuous domain** is a set of input values that consists of all numbers in an interval.

Example: All numbers from 1 to 5

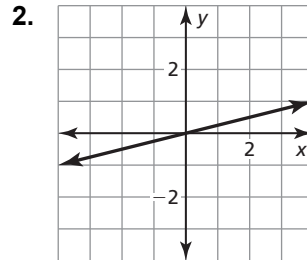
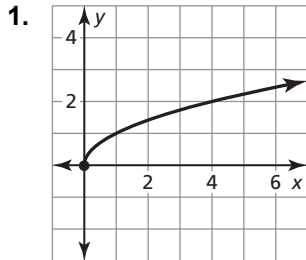


Notes:

3.2 Notetaking with Vocabulary (continued)

Extra Practice

In Exercises 1 and 2, determine whether the graph represents a *linear* or *nonlinear* function. Explain.



In Exercises 3 and 4, determine whether the table represents a *linear* or *nonlinear* function. Explain.

3.

x	1	2	3	4
y	-1	2	5	8

4.

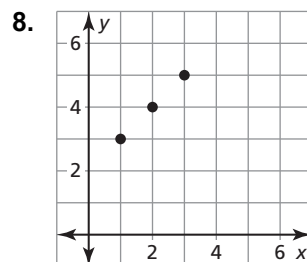
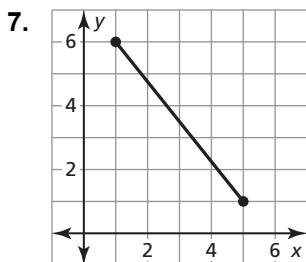
x	-1	0	1	2
y	0	-1	0	3

In Exercises 5 and 6, determine whether the equation represents a *linear* or *nonlinear* function. Explain.

5. $y = 3 - 2x$

6. $y = -\frac{3}{4}x^3$

In Exercises 7 and 8, find the domain of the function represented by the graph. Determine whether the domain is *discrete* or *continuous*. Explain.



3.3

Function Notation

For use with Exploration 3.3

Essential Question How can you use function notation to represent a function?

1 EXPLORATION: Matching Functions with Their Graphs

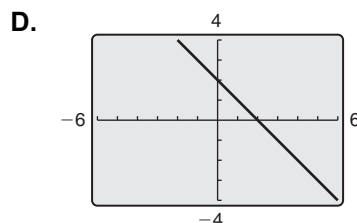
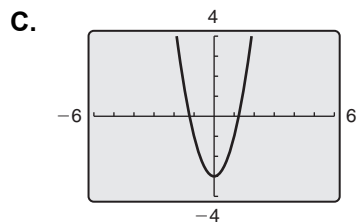
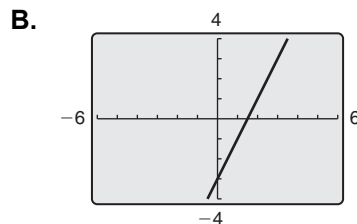
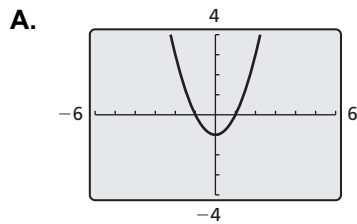
Work with a partner. Match each function with its graph.

a. $f(x) = 2x - 3$

b. $g(x) = -x + 2$

c. $h(x) = x^2 - 1$

d. $j(x) = 2x^2 - 3$



3.3 Function Notation (continued)**2** **EXPLORATION:** Evaluating a Function

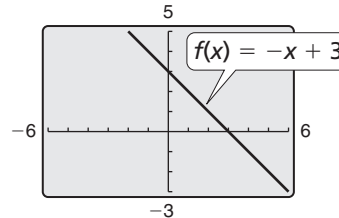
Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Consider the function

$$f(x) = -x + 3.$$

Locate the points $(x, f(x))$ on the graph.

Explain how you found each point.



a. $(-1, f(-1))$

b. $(0, f(0))$

c. $(1, f(1))$

d. $(2, f(2))$

Communicate Your Answer

3. How can you use function notation to represent a function? How are standard notation and function notation similar? How are they different?

Standard Notation

$$y = 2x + 5$$

Function Notation

$$f(x) = 2x + 5$$

3.3

Notetaking with Vocabulary

For use after Lesson 3.3

In your own words, write the meaning of each vocabulary term.

function notation

Notes:

3.3 Notetaking with Vocabulary (continued)**Extra Practice**

In Exercises 1–6, evaluate the function when $x = -4$, 0 , and 2 .

1. $f(x) = -x + 4$

2. $g(x) = 5x$

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

4. $s(x) = 12 - 0.25x$

5. $t(x) = 6 + 3x - 2$

6. $u(x) = -2 - 2x + 7$

7. Let $n(t)$ be the number of DVDs you have in your collection after t trips to the video store. Explain the meaning of each statement.

a. $n(0) = 8$

b. $n(3) = 14$

c. $n(5) > n(3)$

d. $n(7) - n(2) = 10$

In Exercises 8–11, find the value of x so that the function has the given value.

8. $b(x) = -3x + 1$; $b(x) = -20$

9. $r(x) = 4x - 3$; $r(x) = 33$

10. $m(x) = -\frac{3}{5}x - 4$; $m(x) = 2$

11. $w(x) = \frac{5}{6}x - 3$; $w(x) = -18$

3.3 Notetaking with Vocabulary (continued)

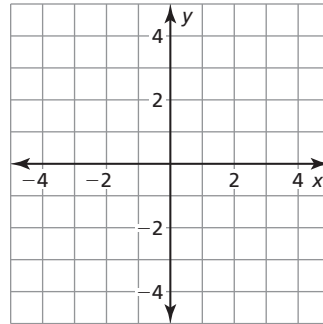
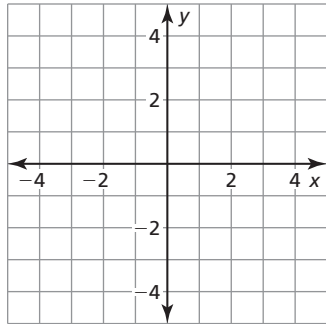
In Exercises 12 and 13, graph the linear function.

12. $s(x) = \frac{1}{2}x - 2$

13. $t(x) = 1 - 2x$

x	-4	-2	0	2	4
s(x)					

x	-2	-1	0	1	2
t(x)					



14. The function $B(m) = 50m + 150$ represents the balance (in dollars) in your savings account after m months. The table shows the balance in your friend's savings account. Who has the better savings plan? Explain.

Month	Balance
2	\$330
4	\$410
6	\$490

3.4

Graphing Linear Equations in Standard Form

For use with Exploration 3.4

Essential Question How can you describe the graph of the equation $Ax + By = C$?

1 EXPLORATION: Using a Table to Plot Points

Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

Work with a partner. You sold a total of \$16 worth of tickets to a fundraiser. You lost track of how many of each type of ticket you sold. Adult tickets are \$4 each. Child tickets are \$2 each.

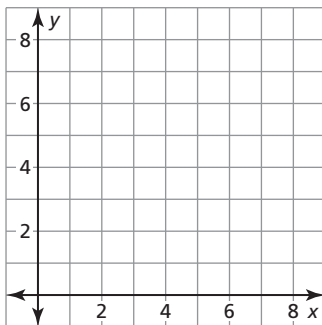
$$\frac{\boxed{}}{\text{adult}} \cdot \text{Number of adult tickets} + \frac{\boxed{}}{\text{child}} \cdot \text{Number of child tickets} = \boxed{}$$

a. Let x represent the number of adult tickets. Let y represent the number of child tickets. Use the verbal model to write an equation that relates x and y .

b. Complete the table to show the different combinations of tickets you might have sold.

x					
y					

c. Plot the points from the table. Describe the pattern formed by the points.



d. If you remember how many adult tickets you sold, can you determine how many child tickets you sold? Explain your reasoning.

3.4 Graphing Linear Equations in Standard Form (continued)**2 EXPLORATION:** Rewriting and Graphing an Equation

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. You sold a total of \$48 worth of cheese. You forgot how many pounds of each type of cheese you sold. Swiss cheese costs \$8 per pound. Cheddar cheese costs \$6 per pound.

$$\frac{\boxed{}}{\text{pound}} \cdot \text{Pounds of Swiss} + \frac{\boxed{}}{\text{pound}} \cdot \text{Pounds of cheddar} = \boxed{}$$

- Let x represent the number of pounds of Swiss cheese. Let y represent the number of pounds of cheddar cheese. Use the verbal model to write an equation that relates x and y .
- Solve the equation for y . Then use a graphing calculator to graph the equation. Given the real-life context of the problem, find the domain and range of the function.
- The **x -intercept** of a graph is the x -coordinate of a point where the graph crosses the x -axis. The **y -intercept** of a graph is the y -coordinate of a point where the graph crosses the y -axis. Use the graph to determine the x - and y -intercepts.
- How could you use the equation you found in part (a) to determine the x - and y -intercepts? Explain your reasoning.
- Explain the meaning of the intercepts in the context of the problem.

Communicate Your Answer

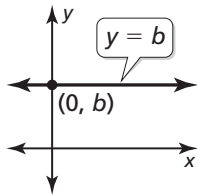
- How can you describe the graph of the equation $Ax + By = C$?
- Write a real-life problem that is similar to those shown in Explorations 1 and 2.

3.4**Notetaking with Vocabulary**

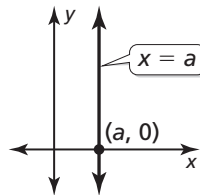
For use after Lesson 3.4

In your own words, write the meaning of each vocabulary term.

standard form

 x -intercept y -intercept**Core Concepts****Horizontal and Vertical Lines**

The graph of $y = b$ is a horizontal line.
The line passes through the point $(0, b)$.

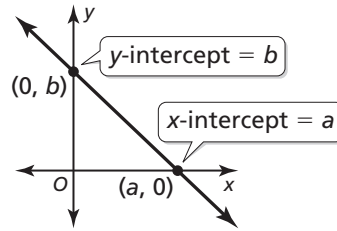


The graph of $x = a$ is a vertical line.
The line passes through the point $(a, 0)$.

Notes:

3.4 Notetaking with Vocabulary (continued)**Using Intercepts to Graph Equations**

The **x -intercept** of a graph is the x -coordinate of a point where the graph crosses the x -axis. It occurs when $y = 0$.



The **y -intercept** of a graph is the y -coordinate of a point where the graph crosses the y -axis. It occurs when $x = 0$.

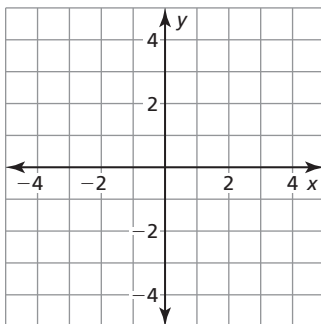
To graph the linear equation $Ax + By = C$, find the intercepts and draw the line that passes through the two intercepts.

- To find the x -intercept, let $y = 0$ and solve for x .
- To find the y -intercept, let $x = 0$ and solve for y .

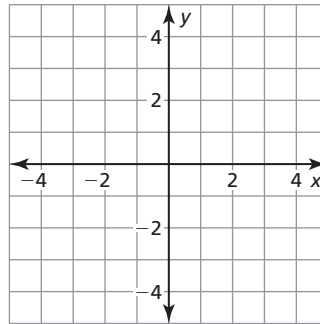
Notes:**Extra Practice**

In Exercises 1 and 2, graph the linear equation.

1. $y = -3$



2. $x = 2$



3.4 Notetaking with Vocabulary (continued)

In Exercises 3–5, find the x - and y -intercepts of the graph of the linear equation.

3. $3x + 4y = 12$

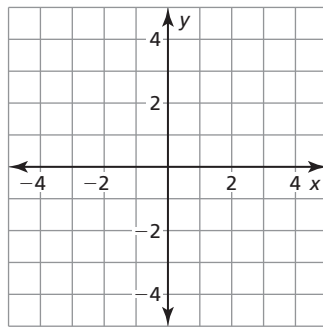
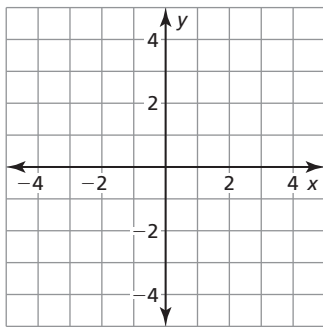
4. $-x - 4y = 16$

5. $5x - 2y = -30$

In Exercises 6 and 7, use intercepts to graph the linear equation. Label the points corresponding to the intercepts.

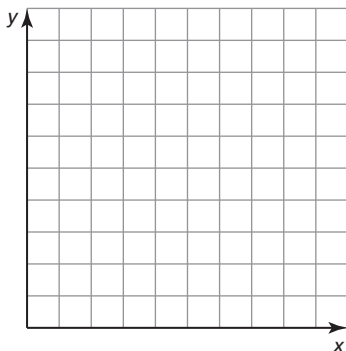
6. $-8x + 12y = 24$

7. $2x + y = 4$



8. The school band is selling sweatshirts and baseball caps to raise \$9000 to attend a band competition. Sweatshirts cost \$25 each and baseball caps cost \$10 each. The equation $25x + 10y = 9000$ models this situation, where x is the number of sweatshirts sold and y is the number of baseball caps sold.

- a. Find and interpret the intercepts.
- b. If 258 sweatshirts are sold, how many baseball caps are sold?
- c. Graph the equation. Find two more possible solutions in the context of the problem.



3.5

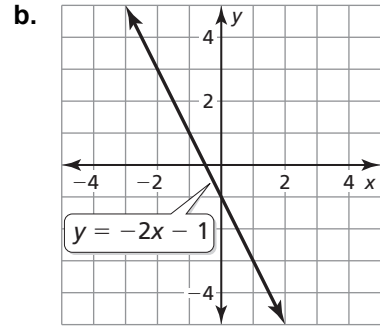
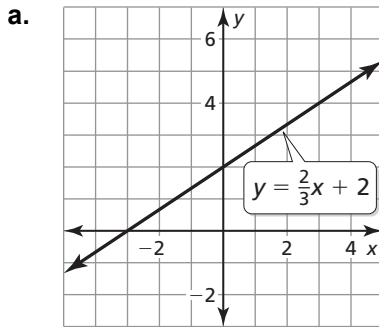
Graphing Linear Equations in Slope-Intercept Form

For use with Exploration 3.5

Essential Question How can you describe the graph of the equation $y = mx + b$?

1 EXPLORATION: Finding Slopes and y-Intercepts

Work with a partner. Find the slope and y-intercept of each line.

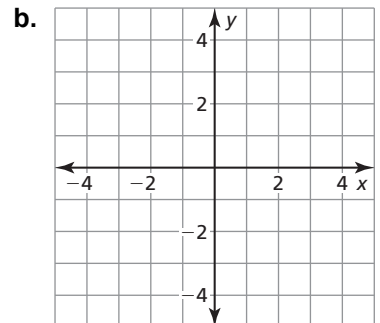
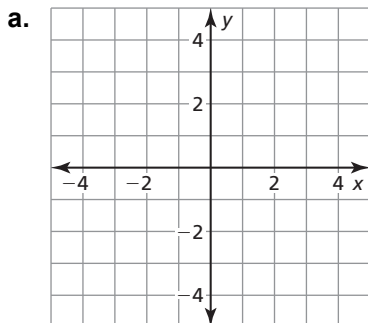


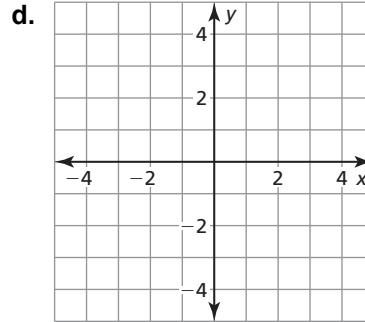
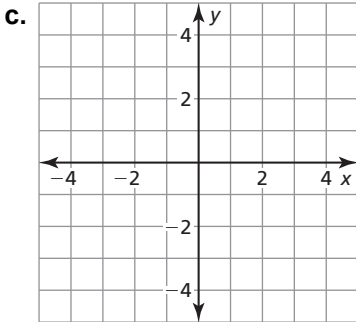
2 EXPLORATION: Writing a Conjecture

Go to BigIdeasMath.com for an interactive tool to investigate this exploration.

Work with a partner. Graph each equation. Then complete the table. Use the completed table to write a conjecture about the relationship between the graph of $y = mx + b$ and the values of m and b .

Equation	Description of graph	Slope of graph	y-Intercept
a. $y = -\frac{2}{3}x + 3$	Line	$-\frac{2}{3}$	3
b. $y = 2x - 2$			
c. $y = -x + 1$			
d. $y = x - 4$			



3.5 Graphing Linear Equation in Slope-Intercept Form (continued)**2 EXPLORATION:** Writing a Conjecture (continued)**Communicate Your Answer**

3. How can you describe the graph of the equation $y = mx + b$?
- How does the value of m affect the graph of the equation?
 - How does the value of b affect the graph of the equation?
 - Check your answers to parts (a) and (b) by choosing one equation from Exploration 2 and (1) varying only m and (2) varying only b .

3.5**Notetaking with Vocabulary**

For use after Lesson 3.5

In your own words, write the meaning of each vocabulary term.

slope

rise

run

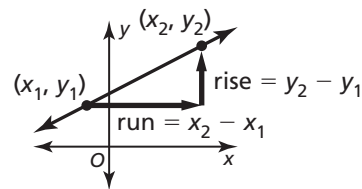
slope-intercept form

constant function

Core Concepts**Slope**

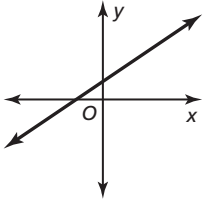
The **slope** m of a nonvertical line passing through two points (x_1, y_1) and (x_2, y_2) is the ratio of the **rise** (change in y) to the **run** (change in x).

$$\text{slope} = m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

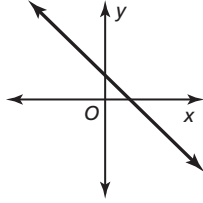


When the line rises from left to right, the slope is positive. When the line falls from left to right, the slope is negative.

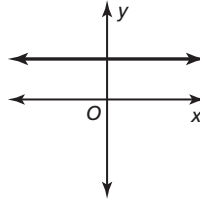
Notes:

3.5 Notetaking with Vocabulary (continued)**Slope***Positive slope*

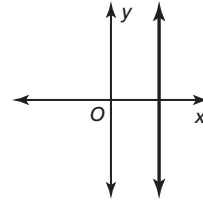
The line rises
from left to right.

Negative slope

The line falls
from left to right.

Slope of 0

The line is horizontal.

Undefined slope

The line is vertical.

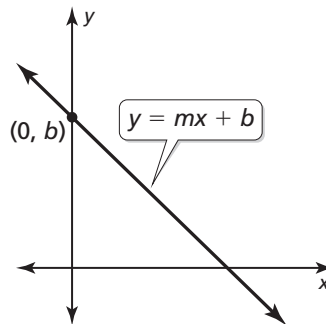
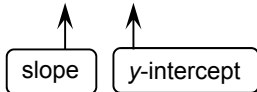
Notes:**Slope-Intercept Form**

Words A linear equation written in the form
 $y = mx + b$ is in **slope-intercept form**.

The slope of the line is m , and the
 y -intercept of the line is b .

Algebra

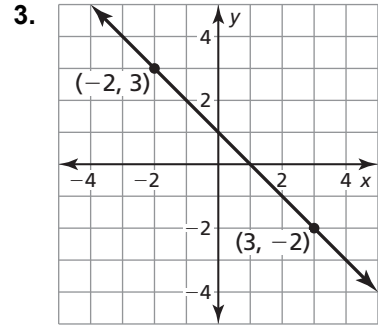
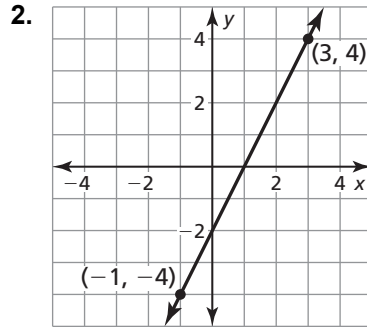
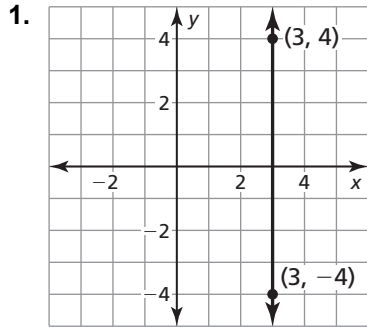
$$y = mx + b$$

**Notes:**

3.5 Notetaking with Vocabulary (continued)

Extra Practice

In Exercise 1–3, describe the slope of the line. Then find the slope.



In Exercise 4 and 5, the points represented by the table lie on a line. Find the slope of the line.

4.

x	1	2	3	4
y	-2	-2	-2	-2

5.

x	-3	-1	1	3
y	11	3	-5	-13

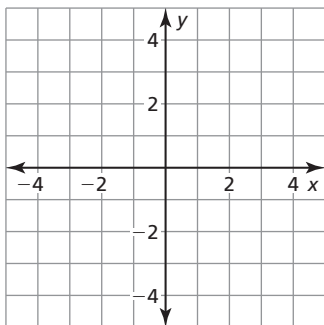
In Exercise 6–8, find the slope and the y -intercept of the graph of the linear equation.

6. $6x + 4y = 24$

7. $y = -\frac{3}{4}x + 2$

8. $y = 5x$

9. A linear function f models a relationship in which the dependent variable decreases 6 units for every 3 units the independent variable decreases. The value of the function at 0 is 4. Graph the function. Identify the slope, y -intercept, and x -intercept of the graph.



3.6

Transformations of Graphs of Linear Functions

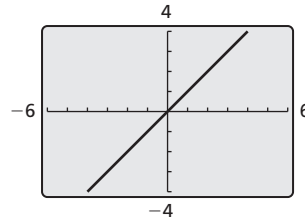
For use with Exploration 3.6

Essential Question How does the graph of the linear function $f(x) = x$ compare to the graphs of $g(x) = f(x) + c$ and $h(x) = f(cx)$?

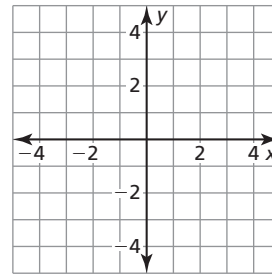
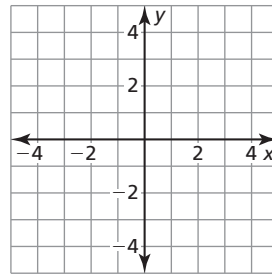
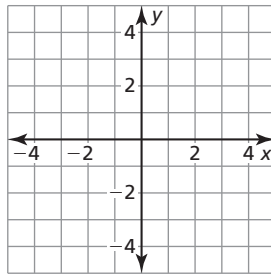
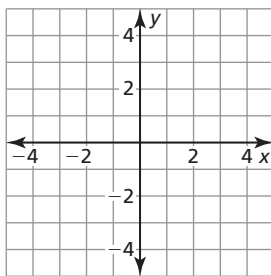
1 EXPLORATION: Comparing Graphs of Functions

Work with a partner. The graph of $f(x) = x$ is shown.

Sketch the graph of each function, along with f , on the same set of coordinate axes. Use a graphing calculator to check your results. What can you conclude?



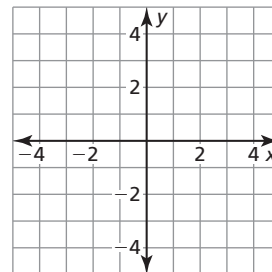
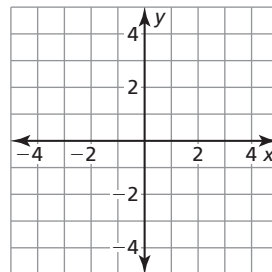
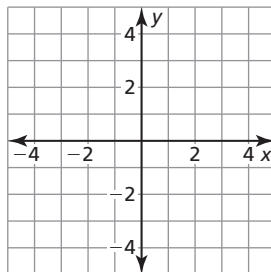
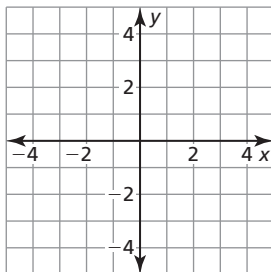
- a. $g(x) = x + 4$ b. $g(x) = x + 2$ c. $g(x) = x - 2$ d. $g(x) = x - 4$



2 EXPLORATION: Comparing Graphs of Functions

Work with a partner. Sketch the graph of each function, along with $f(x) = x$, on the same set of coordinate axes. Use a graphing calculator to check your results. What can you conclude?

- a. $h(x) = \frac{1}{2}x$ b. $h(x) = 2x$ c. $h(x) = -\frac{1}{2}x$ d. $h(x) = -2x$



3.6 Transformations of Graphs of Linear Functions (continued)

3 EXPLORATION: Matching Functions with Their Graphs

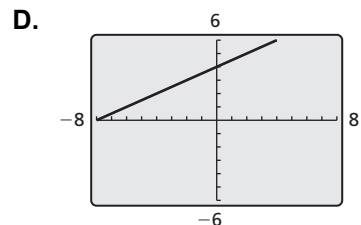
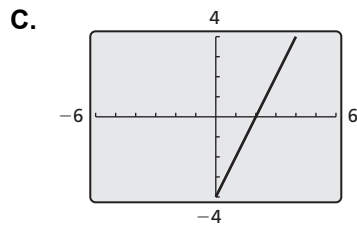
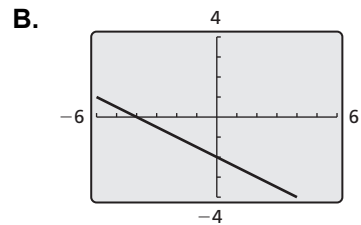
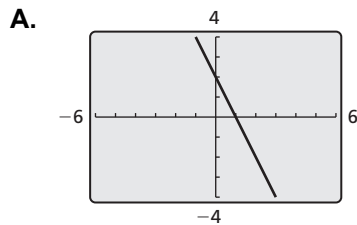
Work with a partner. Match each function with its graph. Use a graphing calculator to check your results. Then use the results of Explorations 1 and 2 to compare the graph of k to the graph of $f(x) = x$.

a. $k(x) = 2x - 4$

b. $k(x) = -2x + 2$

c. $k(x) = \frac{1}{2}x + 4$

d. $k(x) = -\frac{1}{2}x - 2$



Communicate Your Answer

4. How does the graph of the linear function $f(x) = x$ compare to the graphs of $g(x) = f(x) + c$ and $h(x) = f(cx)$?

3.6

Notetaking with Vocabulary

For use after Lesson 3.6

In your own words, write the meaning of each vocabulary term.

family of functions

parent function

transformation

translation

reflection

horizontal shrink

horizontal stretch

vertical stretch

vertical shrink

Notes:

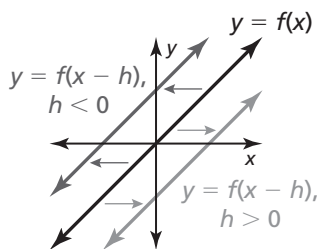
3.6 Notetaking with Vocabulary (continued)

Core Concepts

A **translation** is a transformation that shifts a graph horizontally or vertically but does not change the size, shape, or orientation of the graph.

Horizontal Translations

The graph of $y = f(x - h)$ is a horizontal translation of the graph of $y = f(x)$, where $h \neq 0$.

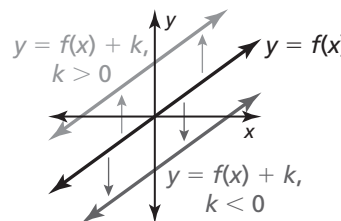


Subtracting h from the *inputs* before evaluating the function shifts the graph left when $h < 0$ and right when $h > 0$.

Notes:

Vertical Translations

The graph of $y = f(x) + k$ is a vertical translation of the graph of $y = f(x)$, where $k \neq 0$.

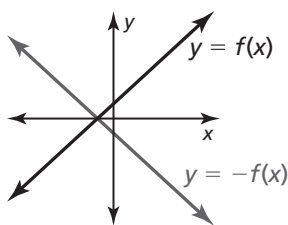


Adding k to the *outputs* shifts the graph down when $k < 0$ and up when $k > 0$.

A **reflection** is a transformation that flips a graph over a line called the *line of reflection*.

Reflections in the x-axis

The graph of $y = -f(x)$ is a reflection in the x -axis of the graph of $y = f(x)$.

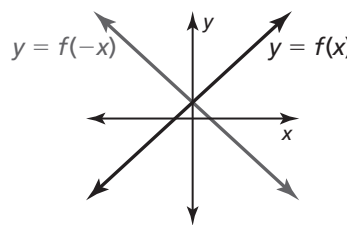


Multiplying the outputs by -1 changes their signs.

Notes:

Reflections in the y-axis

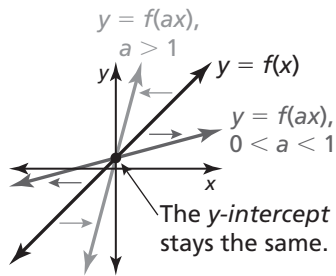
The graph of $y = f(-x)$ is a reflection in the y -axis of the graph of $y = f(x)$.



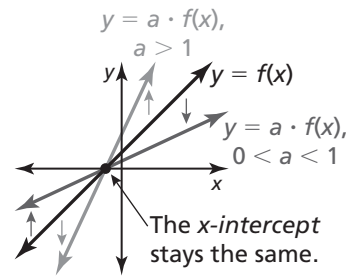
Multiplying the inputs by -1 changes their signs.

3.6 Notetaking with Vocabulary (continued)**Horizontal Stretches and Shrinks**

The graph of $y = f(ax)$ is a horizontal stretch or shrink by a factor of $\frac{1}{a}$ of the graph of $y = f(x)$, where $a > 0$ and $a \neq 1$.

**Vertical Stretches and Shrinks**

The graph of $y = a \cdot f(x)$ is a vertical stretch or shrink by a factor of a of the graph of $y = f(x)$, where $a > 0$ and $a \neq 1$.

**Notes:****Transformations of Graphs**

The graph of $y = a \cdot f(x - h) + k$ or the graph of $y = f(ax - h) + k$ can be obtained from the graph of $y = f(x)$ by performing these steps.

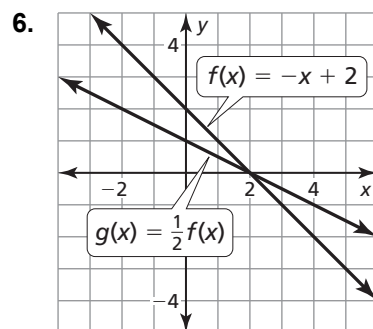
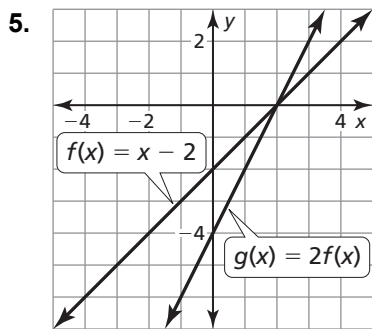
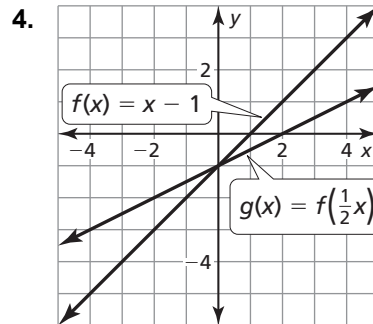
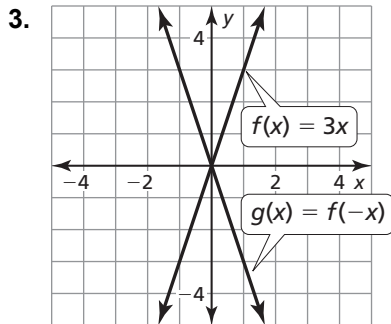
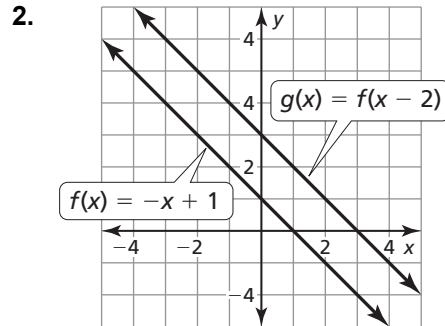
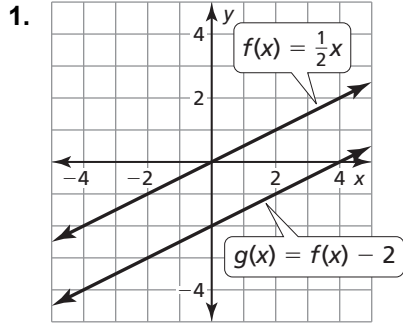
- Step 1** Translate the graph of $y = f(x)$ horizontally h units.
- Step 2** Use a to stretch or shrink the resulting graph from Step 1.
- Step 3** Reflect the resulting graph from Step 2 when $a < 0$.
- Step 4** Translate the resulting graph from Step 3 vertically k units.

Notes:

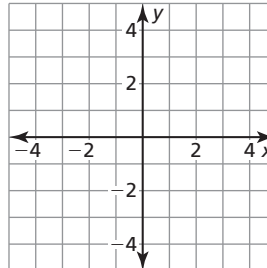
3.6 Notetaking with Vocabulary (continued)

Extra Practice

In Exercises 1–6, use the graphs of f and g to describe the transformation from the graph of f to the graph of g .



7. Graph $f(x) = x$ and $g(x) = 3x - 2$. Describe the transformations from the graph of f to the graph of g .



3.7

Graphing Absolute Value Functions

For use with Exploration 3.7

Essential Question How do the values of a , h , and k affect the graph of the absolute value function $g(x) = a|x - h| + k$?

1 EXPLORATION: Identifying Graphs of Absolute Value Functions

Work with a partner. Match each absolute value function with its graph. Then use a graphing calculator to verify your answers.

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

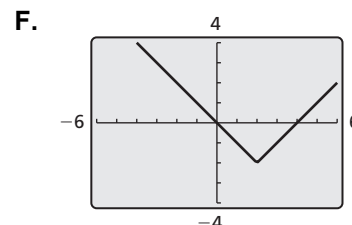
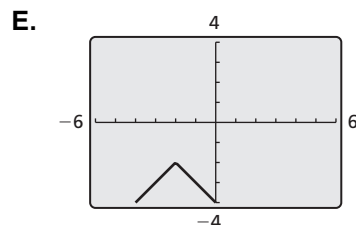
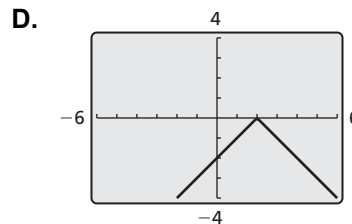
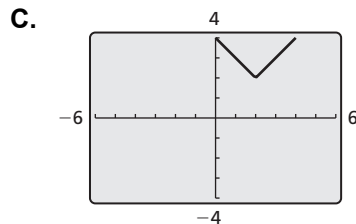
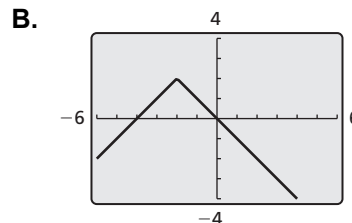
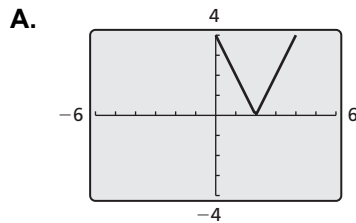
b. $g(x) = |x - 2| + 2$

c. $g(x) = -|x + 2| - 2$

d. $g(x) = |x - 2| - 2$

e. $g(x) = 2|x - 2|$

f. $g(x) = -|x + 2| + 2$

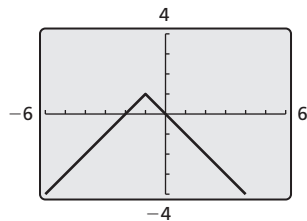


3.7 Graphing Absolute Value Functions (continued)**Communicate Your Answer**

2. How do the values of a , h , and k affect the graph of the absolute value function

$$g(x) = a|x - h| + k?$$

3. Write the equation of the absolute value function whose graph is shown. Use a graphing calculator to verify your equation.



3.7

Notetaking with Vocabulary

For use after Lesson 3.7

In your own words, write the meaning of each vocabulary term.

absolute value function

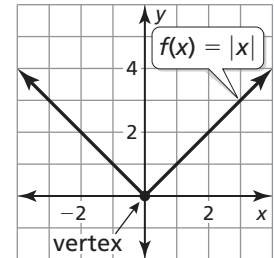
vertex

vertex form

Notes:

3.7 Notetaking with Vocabulary (continued)**Core Concepts****Absolute Value Function**

An **absolute value function** is a function that contains an absolute value expression. The parent absolute value function is $f(x) = |x|$. The graph of $f(x) = |x|$ is V-shaped and symmetric about the y -axis. The **vertex** is the point where the graph changes direction. The vertex of the graph of $f(x) = |x|$ is $(0, 0)$.



The domain of $f(x) = |x|$ is all real numbers.

The range is $y \geq 0$.

Notes:**Vertex Form of an Absolute Value Function**

An absolute value function written in the form $g(x) = a|x - h| + k$, where $a \neq 0$, is in **vertex form**. The vertex of the graph of g is (h, k) .

Any absolute value function can be written in vertex form, and its graph is symmetric about the line $x = h$.

Notes:

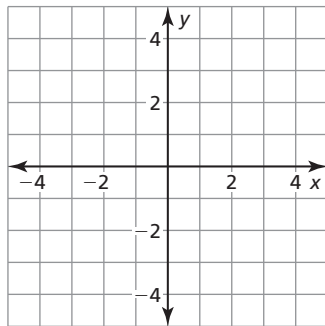
3.7 Notetaking with Vocabulary (continued)

Extra Practice

In Exercises 1–4, graph the function. Compare the graph to the graph of $f(x) = |x|$. Describe the domain and range.

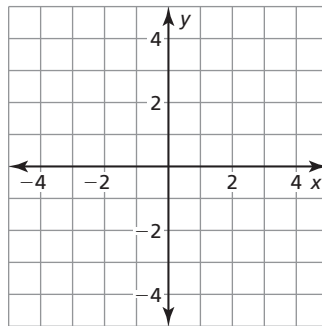
1. $t(x) = \frac{1}{2}|x|$

x	-4	-2	0	2	4
t(x)					



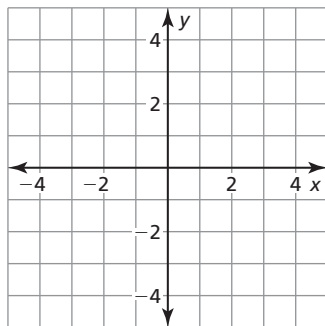
2. $u(x) = -|x|$

x	-2	-1	0	1	2
u(x)					



3. $p(x) = |x| - 3$

x	-2	-1	0	1	2
p(x)					



4. $r(x) = |x + 2|$

x	-4	-3	-2	-1	0
r(x)					

