GLENCOE MATHEMATICS

Algebra 2

Chapter 2
Resource Masters

Glencoe McGraw-Hill

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Columbus, Ohio
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Consumable Workbooks

Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks.

Study Guide and Intervention Workbook	0-07-828029-X
Skills Practice Workbook	0-07-828023-0
Practice Workbook	0-07-828024-9

ANSWERS FOR WORKBOOKS The answers for Chapter 2 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

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Algebra 2
Chapter 2 Resource Masters

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Contents

Teacher's Guide to Using the Chapter 2 Resource Masters

The ***Fast File*** Chapter Resource system allows you to conveniently file the resources you use most often. The *Chapter 2 Resource Masters* includes the core materials needed for Chapter 2. These materials include worksheets, extensions, and assessment options. The answers for these pages appear at the back of this booklet.

All of the materials found in this booklet are included for viewing and printing in the *Algebra 2 TeacherWorks* CD-ROM.

Vocabulary Builder Pages vii–viii include a student study tool that presents up to twenty of the key vocabulary terms from the chapter. Students are to record definitions and/or examples for each term. You may suggest that students highlight or star the terms with which they are not familiar.

WHEN TO USE Give these pages to students before beginning Lesson 2-1. Encourage them to add these pages to their Algebra 2 Study Notebook. Remind them to add definitions and examples as they complete each lesson.

Study Guide and Intervention

Each lesson in *Algebra 2* addresses two objectives. There is one Study Guide and Intervention master for each objective.

WHEN TO USE Use these masters as reteaching activities for students who need additional reinforcement. These pages can also be used in conjunction with the Student Edition as an instructional tool for students who have been absent.

Skills Practice There is one master for each lesson. These provide computational practice at a basic level.

WHEN TO USE These masters can be used with students who have weaker mathematics backgrounds or need additional reinforcement.

Practice There is one master for each lesson. These problems more closely follow the structure of the Practice and Apply section of the Student Edition exercises. These exercises are of average difficulty.

WHEN TO USE These provide additional practice options or may be used as homework for second day teaching of the lesson.

Reading to Learn Mathematics

One master is included for each lesson. The first section of each master asks questions about the opening paragraph of the lesson in the Student Edition. Additional questions ask students to interpret the context of and relationships among terms in the lesson. Finally, students are asked to summarize what they have learned using various representation techniques.

WHEN TO USE This master can be used as a study tool when presenting the lesson or as an informal reading assessment after presenting the lesson. It is also a helpful tool for ELL (English Language Learner) students.

Enrichment There is one extension master for each lesson. These activities may extend the concepts in the lesson, offer an historical or multicultural look at the concepts, or widen students' perspectives on the mathematics they are learning. These are not written exclusively for honors students, but are accessible for use with all levels of students.

WHEN TO USE These may be used as extra credit, short-term projects, or as activities for days when class periods are shortened.

Assessment Options

The assessment masters in the *Chapter 2 Resource Masters* offer a wide range of assessment tools for intermediate and final assessment. The following lists describe each assessment master and its intended use.

Chapter Assessment

CHAPTER TESTS

- *Form 1* contains multiple-choice questions and is intended for use with basic level students.
- *Forms 2A and 2B* contain multiple-choice questions aimed at the average level student. These tests are similar in format to offer comparable testing situations.
- *Forms 2C and 2D* are composed of free-response questions aimed at the average level student. These tests are similar in format to offer comparable testing situations. Grids with axes are provided for questions assessing graphing skills.
- *Form 3* is an advanced level test with free-response questions. Grids without axes are provided for questions assessing graphing skills.

  All of the above tests include a free-response Bonus question.
- The **Open-Ended Assessment** includes performance assessment tasks that are suitable for all students. A scoring rubric is included for evaluation guidelines. Sample answers are provided for assessment.
- A **Vocabulary Test**, suitable for all students, includes a list of the vocabulary words in the chapter and ten questions assessing students' knowledge of those terms. This can also be used in conjunction with one of the chapter tests or as a review worksheet.

Intermediate Assessment

- Four free-response **quizzes** are included to offer assessment at appropriate intervals in the chapter.
- A **Mid-Chapter Test** provides an option to assess the first half of the chapter. It is composed of both multiple-choice and free-response questions.

Continuing Assessment

- The **Cumulative Review** provides students an opportunity to reinforce and retain skills as they proceed through their study of Algebra 2. It can also be used as a test. This master includes free-response questions.
- The **Standardized Test Practice** offers continuing review of algebra concepts in various formats, which may appear on the standardized tests that they may encounter. This practice includes multiple-choice, grid-in, and quantitative-comparison questions. Bubble-in and grid-in answer sections are provided on the master.

Answers

- Page A1 is an answer sheet for the Standardized Test Practice questions that appear in the Student Edition on pages 106–107. This improves students' familiarity with the answer formats they may encounter in test taking.
- The answers for the lesson-by-lesson masters are provided as reduced pages with answers appearing in red.
- Full-size answer keys are provided for the assessment masters in this booklet.

2 Reading to Learn Mathematics

Vocabulary Builder

This is an alphabetical list of the key vocabulary terms you will learn in Chapter 2. As you study the chapter, complete each term's definition or description. Remember to add the page number where you found the term. Add these pages to your Algebra Study Notebook to review vocabulary at the end of the chapter.

Vocabulary Term	Found on Page	Definition/Description/Example
absolute value function		
boundary		
constant function		
family of graphs		
function		
greatest integer function		
identity function		
linear equation		
line of fit		
one-to-one function		

(continued on the next page)

2 Reading to Learn Mathematics

Vocabulary Builder *(continued)*

Vocabulary Term	Found on Page	Definition/Description/Example
parent graph		
piecewise function PEES·WYZ		
point-slope form		
prediction equation pree·DIHK·shuhn		
relation		
scatter plot		
slope		
slope-intercept form IHN·tuhr·SEHPT		
standard form		
step function		

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2-1 Study Guide and Intervention

Relations and Functions

Graph Relations A **relation** can be represented as a set of ordered pairs or as an equation; the relation is then the set of all ordered pairs (x, y) that make the equation true. The **domain** of a relation is the set of all first coordinates of the ordered pairs, and the **range** is the set of all second coordinates.

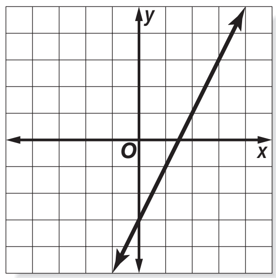
A **function** is a relation in which each element of the domain is paired with exactly one element of the range. You can tell if a relation is a function by graphing, then using the **vertical line test**. If a vertical line intersects the graph at more than one point, the relation is not a function.

Example **Graph the equation $y = 2x - 3$ and find the domain and range. Does the equation represent a function?**

Make a table of values to find ordered pairs that satisfy the equation. Then graph the ordered pairs.

The domain and range are both all real numbers. The graph passes the vertical line test, so it is function.

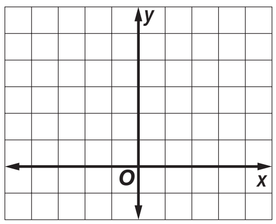
x	y
−1	−5
0	−3
1	−1
2	1
3	3



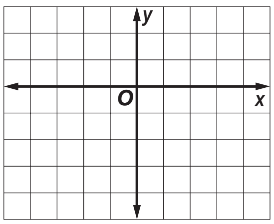
Exercises

Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

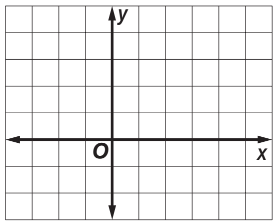
1. {(1, 3), (−3, 5), (−2, 5), (2, 3)}



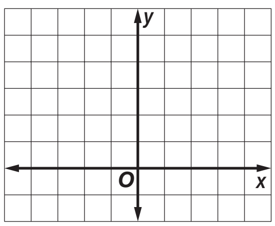
2. {(3, −4), (1, 0), (2, −2), (3, 2)}



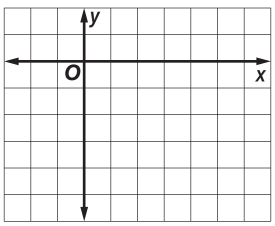
3. {(0, 4), (−3, −2), (3, 2), (5, 1)}



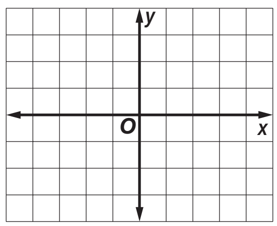
4. $y = x^2 - 1$



5. $y = x - 4$



6. $y = 3x + 2$



2-1 Study Guide and Intervention *(continued)*

Relations and Functions

Equations of Functions and Relations Equations that represent functions are often written in **functional notation**. For example, $y = 10 - 8x$ can be written as $f(x) = 10 - 8x$. This notation emphasizes the fact that the values of y, the **dependent variable**, depend on the values of x, the **independent variable**.

To evaluate a function, or find a functional value, means to substitute a given value in the domain into the equation to find the corresponding element in the range.

Example **Given the function $f(x) = x^2 + 2x$, find each value.**

a. $f(3)$

$f(x) = x^2 + 2x$ Original function

$f(3) = 3^2 + 2(3)$ Substitute.

$= 15$ Simplify.

b. $f(5a)$

$f(x) = x^2 + 2x$ Original function

$f(5a) = (5a)^2 + 2(5a)$ Substitute.

$= 25a^2 + 10a$ Simplify.

Exercises

Find each value if $f(x) = -2x + 4$.

1. $f(12)$

2. $f(6)$

3. $f(2b)$

Find each value if $g(x) = x^3 - x$.

4. $g(5)$

5. $g(-2)$

6. $g(7c)$

Find each value if $f(x) = 2x + \frac{2}{x}$ and $g(x) = 0.4x^2 - 1.2$.

7. $f(0.5)$

8. $f(-8)$

9. $g(3)$

10. $g(-2.5)$

11. $f(4a)$

12. $g\left(\frac{b}{2}\right)$

13. $f\left(\frac{1}{3}\right)$

14. $g(10)$

15. $f(200)$

Let $f(x) = 2x^2 - 1$.

16. Find the values of $f(2)$ and $f(5)$.

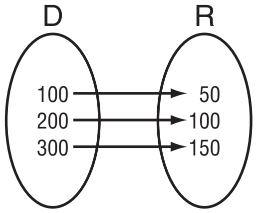
17. Compare the values of $f(2) \cdot f(5)$ and $f(2 \cdot 5)$.

2-1 Skills Practice

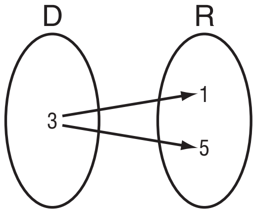
Relations and Functions

Determine whether each relation is a function. Write *yes* or *no*.

1.



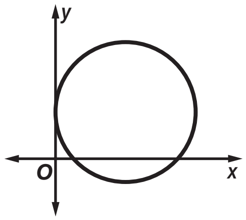
2.



3.

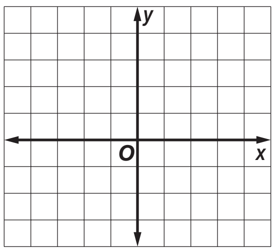
x	y
1	2
2	4
3	6

4.

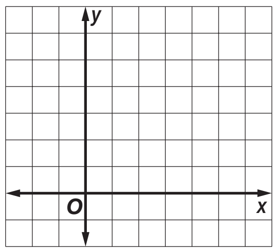


Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

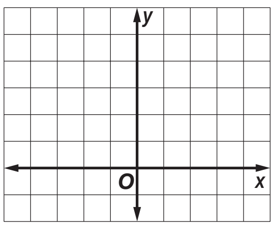
5. $\{(2, -3), (2, 4), (2, -1)\}$



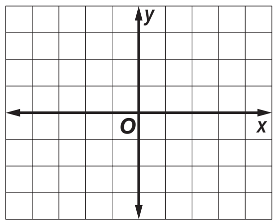
6. $\{(2, 6), (6, 2)\}$



7. $\{(-3, 4), (-2, 4), (-1, -1), (3, -1)\}$



8. $x = -2$



Find each value if $f(x) = 2x - 1$ and $g(x) = 2 - x^2$.

9. $f(0)$

10. $f(12)$

11. $g(4)$

12. $f(-2)$

13. $g(-1)$

14. $f(d)$

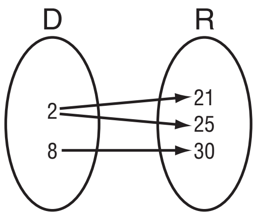
NAME ______________________________ DATE ____________ PERIOD _____

2-1 Practice

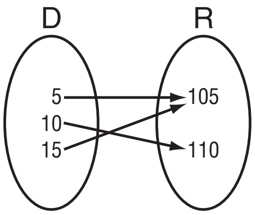
Relations and Functions

Determine whether each relation is a function. Write *yes* or *no*.

1.



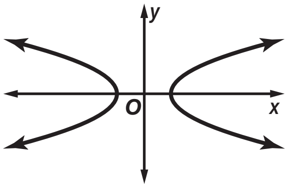
2.



3.

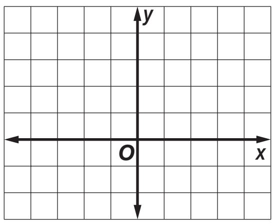
x	*y*
−3	0
−1	−1
0	0
2	−2
3	4

4.

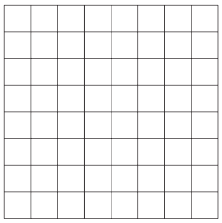


Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

5. $\{(-4, -1), (4, 0), (0, 3), (2, 0)\}$



6. $y = 2x - 1$



Find each value if $f(x) = \dfrac{5}{x + 2}$ and $g(x) = -2x + 3$.

7. $f(3)$

8. $f(-4)$

9. $g\left(\frac{1}{2}\right)$

10. $f(-2)$

11. $g(-6)$

12. $f(m - 2)$

13. MUSIC The ordered pairs (1, 16), (2, 16), (3, 32), (4, 32), and (5, 48) represent the cost of buying various numbers of CDs through a music club. Identify the domain and range of the relation. Is the relation a function?

14. COMPUTING If a computer can do one calculation in 0.0000000015 second, then the function $T(n) = 0.0000000015n$ gives the time required for the computer to do n calculations. How long would it take the computer to do 5 billion calculations?

NAME ______________________________ DATE ____________ PERIOD _____

2-1 Reading to Learn Mathematics

Relations and Functions

Pre-Activity **How do relations and functions apply to biology?**

Read the introduction to Lesson 2-1 at the top of page 56 in your textbook.

- Refer to the table. What does the ordered pair (8, 20) tell you?
- Suppose that this table is extended to include more animals. Is it possible to have an ordered pair for the data in which the first number is larger than the second?

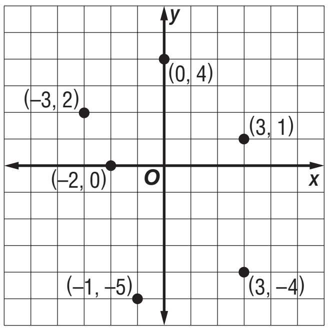
Lesson 2-1

Reading the Lesson

1. a. Explain the difference between a relation and a function.

b. Explain the difference between domain and range.

2. a. Write the domain and range of the relation shown in the graph.



b. Is this relation a function? Explain.

Helping You Remember

3. Look up the words *dependent* and *independent* in a dictionary. How can the meaning of these words help you distinguish between independent and dependent variables in a function?

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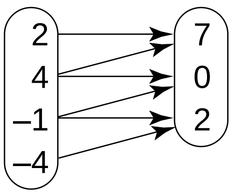
2-1 Enrichment

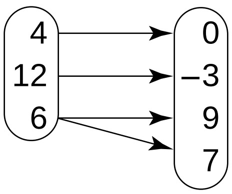
Mappings

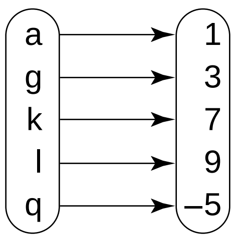
There are three special ways in which one set can be mapped to another. A set can be mapped *into* another set, *onto* another set, or can have a *one-to-one correspondence* with another set.

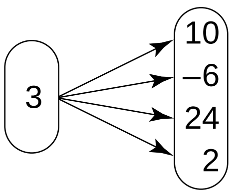
Into mapping	A mapping from set *A* to set *B* where every element of *A* is mapped to one or more elements of set *B*, but never to an element not in *B*.
Onto mapping	A mapping from set *A* to set *B* where each element of set *B* has at least one element of set *A* mapped to it.
One-to-one correspondence	A mapping from set *A* onto set *B* where each element of set *A* is mapped to exactly one element of set *B* and different elements of *A* are never mapped to the same element of *B*.

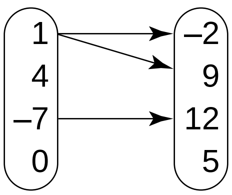
State whether each set is mapped into the second set, onto the second set, or has a one-to-one correspondence with the second set.

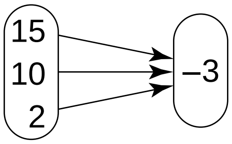
1.


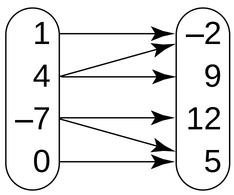
2.


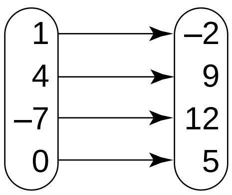
3.


4.


5.


6.


7.


8.


9. Can a set be mapped *onto* a set with fewer elements than it has?

10. Can a set be mapped *into* a set that has more elements than it has?

11. If a mapping from set *A* into set *B* is a one-to-one correspondence, what can you conclude about the number of elements in *A* and *B*?

NAME ______________________________ DATE ____________ PERIOD _____

2-2 Study Guide and Intervention

Linear Equations

Identify Linear Equations and Functions A **linear equation** has no operations other than addition, subtraction, and multiplication of a variable by a constant. The variables may not be multiplied together or appear in a denominator. A linear equation does not contain variables with exponents other than 1. The graph of a linear equation is a line.

A **linear function** is a function whose ordered pairs satisfy a linear equation. Any linear function can be written in the form $f(x) = mx + b$, where m and b are real numbers.

If an equation is linear, you need only two points that satisfy the equation in order to graph the equation. One way is to find the x-intercept and the y-intercept and connect these two points with a line.

Example 1 **Is $f(x) = 0.2 - \frac{x}{5}$ a linear function? Explain.**

Yes; it is a linear function because it can be written in the form
$f(x) = -\frac{1}{5}x + 0.2$.

Example 2 **Is $2x + xy - 3y = 0$ a linear function? Explain.**

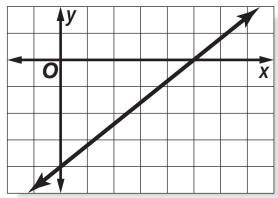
No; it is not a linear function because the variables x and y are multiplied together in the middle term.

Example 3 **Find the x-intercept and the y-intercept of the graph of $4x - 5y = 20$. Then graph the equation.**

The x-intercept is the value of x when $y = 0$.

$4x - 5y = 20$	Original equation
$4x - 5(0) = 20$	Substitute 0 for y.
$x = 5$	Simplify.

So the x-intercept is 5. Similarly, the y-intercept is -4.



Exercises

State whether each equation or function is linear. Write *yes* or *no*. If no, explain.

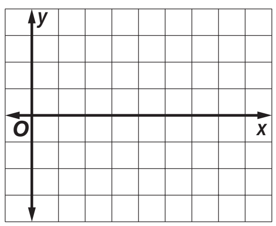
1. $6y - x = 7$

2. $9x = \frac{18}{y}$

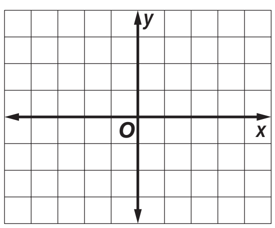
3. $f(x) = 2 - \frac{x}{11}$

Find the x-intercept and the y-intercept of the graph of each equation. Then graph the equation.

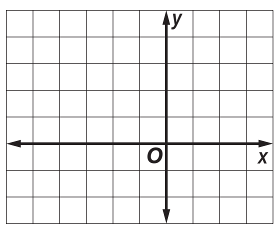
4. $2x + 7y = 14$



5. $5y - x = 10$



6. $2.5x - 5y + 7.5 = 0$



2-2 Study Guide and Intervention *(continued)*

Linear Equations

Standard Form The **standard form** of a linear equation is $Ax + By = C$, where A, B, and C are integers whose greatest common factor is 1.

Example **Write each equation in standard form. Identify *A*, *B*, and *C*.**

a. $\mathbf{y = 8x - 5}$

$y = 8x - 5$	Original equation
$-8x + y = -5$	Subtract $8x$ from each side.
$8x - y = 5$	Multiply each side by -1.

So $A = 8$, $B = -1$, and $C = 5$.

b. $\mathbf{14x = -7y + 21}$

$14x = -7y + 21$	Original equation
$14x + 7y = 21$	Add $7y$ to each side.
$2x + y = 3$	Divide each side by 7.

So $A = 2$, $B = 1$, and $C = 3$.

Exercises

Write each equation in standard form. Identify *A*, *B*, and *C*.

1. $2x = 4y - 1$

2. $5y = 2x + 3$

3. $3x = -5y + 2$

4. $18y = 24x - 9$

5. $\frac{3}{4}y = \frac{2}{3}x + 5$

6. $6y - 8x + 10 = 0$

7. $0.4x + 3y = 10$

8. $x = 4y - 7$

9. $2y = 3x + 6$

10. $\frac{2}{5}x + \frac{1}{3}y - 2 = 0$

11. $4y + 4x + 12 = 0$

12. $3x = -18$

13. $x = \frac{y}{9} + 7$

14. $3y = 9x - 18$

15. $2x = 20 - 8y$

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

17. $\left(\frac{5x}{2}\right) = \frac{3}{4}y + 8$

18. $0.25y = 2x - 0.75$

19. $2y - \frac{x}{6} - 4 = 0$

20. $1.6x - 2.4y = 4$

21. $0.2x = 100 - 0.4y$

2-2 Skills Practice

Linear Equations

State whether each equation or function is linear. Write *yes* or *no*. If no, explain your reasoning.

1. $y = 3x$

2. $y = -2 + 5x$

3. $2x + y = 10$

4. $f(x) = 4x^2$

5. $-\frac{3}{x} + y = 15$

6. $\frac{1}{3}x = y + 8$

7. $g(x) = 8$

8. $h(x) = \sqrt{x} + 3$

Write each equation in standard form. Identify *A*, *B*, and *C*.

9. $y = x$

10. $y = 5x + 1$

11. $2x = 4 - 7y$

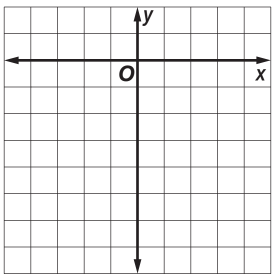
12. $3x = -2y - 2$

13. $5y - 9 = 0$

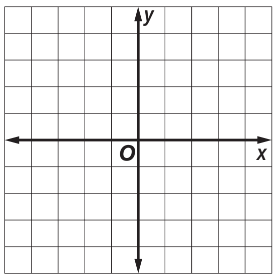
14. $-6y + 14 = 8x$

Find the *x*-intercept and the *y*-intercept of the graph of each equation. Then graph the equation.

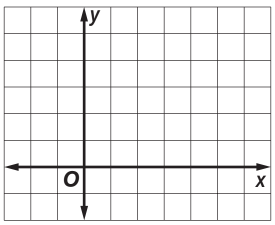
15. $y = 3x - 6$



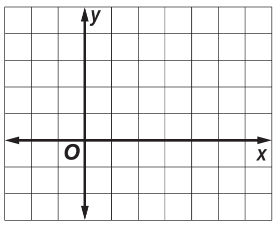
16. $y = -2x$



17. $x + y = 5$



18. $2x + 5y = 10$



NAME ____ DATE ____________ PERIOD _____

2-2 Practice

Linear Equations

State whether each equation or function is linear. Write *yes* or *no*. If no, explain your reasoning.

1. $h(x) = 23$

2. $y = \frac{2}{3}x$

3. $y = \frac{5}{x}$

4. $9 - 5xy = 2$

Write each equation in standard form. Identify *A*, *B*, and *C*.

5. $y = 7x - 5$

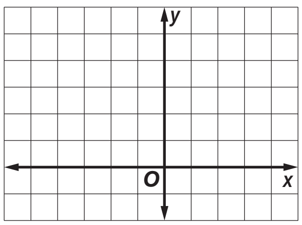
6. $y = \frac{3}{8}x + 5$

7. $3y - 5 = 0$

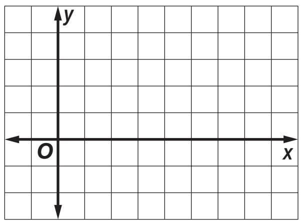
8. $x = -\frac{2}{7}y + \frac{3}{4}$

Find the *x*-intercept and the *y*-intercept of the graph of each equation. Then graph the equation.

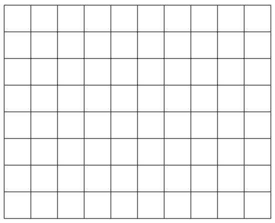
9. $y = 2x + 4$



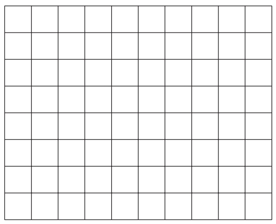
10. $2x + 7y = 14$



11. $y = -2x - 4$



12. $6x + 2y = 6$



13. MEASURE The equation $y = 2.54x$ gives the length in centimeters corresponding to a length x in inches. What is the length in centimeters of a 1-foot ruler?

LONG DISTANCE For Exercises 14 and 15, use the following information.

For Meg's long-distance calling plan, the monthly cost C in dollars is given by the linear function $C(t) = 6 + 0.05t$, where t is the number of minutes talked.

14. What is the total cost of talking 8 hours? of talking 20 hours?

15. What is the effective cost per minute (the total cost divided by the number of minutes talked) of talking 8 hours? of talking 20 hours?

2-2 Reading to Learn Mathematics

Linear Equations

Pre-Activity **How do linear equations relate to time spent studying?**

Read the introduction to Lesson 2-2 at the top of page 63 in your textbook.

- If Lolita spends $2\frac{1}{2}$ hours studying math, how many hours will she have to study chemistry?
- Suppose that Lolita decides to stay up one hour later so that she now has 5 hours to study and do homework. Write a linear equation that describes this situation.

Reading the Lesson

1. Write *yes* or *no* to tell whether each linear equation is in standard form. If it is not, explain why it is not.

a. $-x + 2y = 5$

b. $9x - 12y = -5$

c. $5x - 7y = 3$

d. $2x - \frac{4}{7}y = 1$

e. $0x + 0y = 0$

f. $2x + 4y = 8$

2. How can you use the standard form of a linear equation to tell whether the graph is a horizontal line or a vertical line?

Helping You Remember

3. One way to remember something is to explain it to another person. Suppose that you are studying this lesson with a friend who thinks that she should let $x = 0$ to find the x-intercept and let $y = 0$ to find the y-intercept. How would you explain to her how to remember the correct way to find intercepts of a line?

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2-2 Enrichment

Greatest Common Factor

Suppose we are given a linear equation $ax + by = c$ where a, b, and c are nonzero integers, and we want to know if there exist *integers* x and y that satisfy the equation. We could try guessing a few times, but this process would be time consuming for an equation such as $588x + 432y = 72$. By using the Euclidean Algorithm, we can determine not only if such integers x and y exist, but also find them. The following example shows how this algorithm works.

Example **Find integers x and y that satisfy $588x + 432y = 72$.**

Divide the greater of the two coefficients by the lesser to get a quotient and remainder. Then, repeat the process by dividing the divisor by the remainder until you get a remainder of 0. The process can be written as follows.

$588 = 432(1) + 156$ (1)

$432 = 156(2) + 120$ (2)

$156 = 120(1) + 36$ (3)

$120 = 36(3) + 12$ (4)

$36 = 12(3)$

The last nonzero remainder is the GCF of the two coefficients. If the constant term 72 is divisible by the GCF, then integers x and y do exist that satisfy the equation. To find x and y, work backward in the following manner.

$72 = 6 \cdot 12$

$= 6 \cdot [120 - 36(3)]$ Substitute for 12 using (4)

$= 6(120) - 18(36)$

$= 6(120) - 18[156 - 120(1)]$ Substitute for 36 using (3)

$= -18(156) + 24(120)$

$= -18(156) + 24[432 - 156(2)]$ Substitute for 120 using (2)

$= 24(432) - 66(156)$

$= 24(432) - 66[588 - 432(1)]$ Substitute for 156 using (1)

$= 588(-66) + 432(90)$

Thus, $x = -66$ and $y = 90$.

Find integers x and y, if they exist, that satisfy each equation.

1. $27x + 65y = 3$

2. $45x + 144y = 36$

3. $90x + 117y = 10$

4. $123x + 36y = 15$

5. $1032x + 1001y = 1$

6. $3125x + 3087y = 1$

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2-3 Study Guide and Intervention

Slope

Slope

Slope *m* of a Line	For points (x_1, y_1) and (x_2, y_2), where $x_1 \neq x_2$, $m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$

Example 1 **Determine the slope of the line that passes through (2, −1) and (−4, 5).**

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

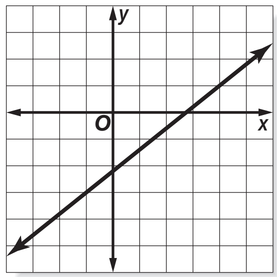
$= \frac{5 - (-1)}{-4 - 2}$ $(x_1, y_1) = (2, -1), (x_2, y_2) = (-4, 5)$

$= \frac{6}{-6} = -1$ Simplify.

The slope of the line is −1.

Example 2 **Graph the line passing through (−1, −3) with a slope of $\frac{4}{5}$.**

Graph the ordered pair (−1, −3). Then, according to the slope, go up 4 units and right 5 units. Plot the new point (4,1). Connect the points and draw the line.



Exercises

Find the slope of the line that passes through each pair of points.

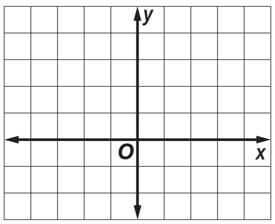
1. (4, 7) and (6, 13) **2.** (6, 4) and (3, 4) **3.** (5, 1) and (7, −3)

4. (5, −3) and (−4, 3) **5.** (5, 10) and (−1,−2) **6.** (−1, −4) and (−13, 2)

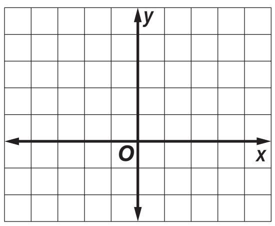
7. (7, −2) and (3, 3) **8.** (−5, 9) and (5, 5) **9.** (4, −2) and (−4, −8)

Graph the line passing through the given point with the given slope.

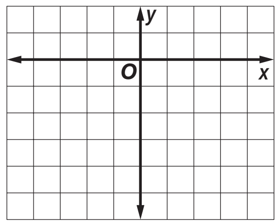
10. slope $= -\frac{1}{3}$
passes through (0, 2)



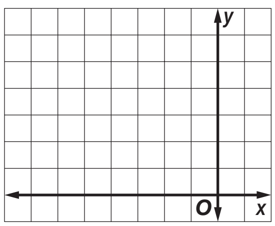
11. slope = 2
passes through (1, 4)



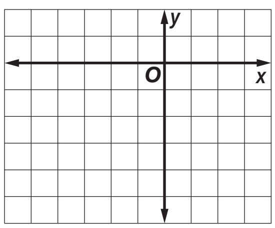
12. slope = 0
passes through (−2, −5)



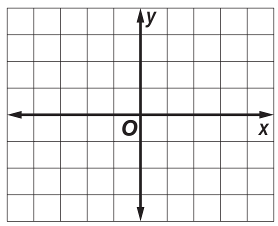
13. slope = 1
passes through (−4, 6)



14. slope $= -\frac{3}{4}$
passes through (−3, 0)



15. slope $= \frac{1}{5}$
passes through (0, 0)

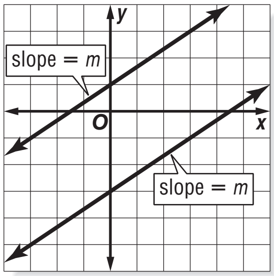


2-3 Study Guide and Intervention *(continued)*

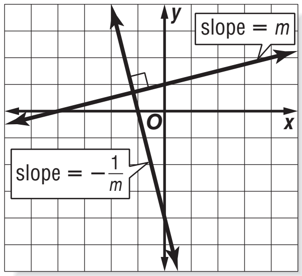
Slope

Parallel and Perpendicular Lines

In a plane, nonvertical lines with the same slope are **parallel**. All vertical lines are parallel.



In a plane, two oblique lines are **perpendicular** if and only if the product of their slopes is −1. Any vertical line is perpendicular to any horizontal line.



Example **Are the line passing through (2, 6) and (−2, 2) and the line passing through (3, 0) and (0, 4) parallel, perpendicular, or neither?**

Find the slopes of the two lines.

The slope of the first line is $\frac{6-2}{2-(-2)} = 1$.

The slope of the second line is $\frac{4-0}{0-3} = -\frac{4}{3}$.

The slopes are not equal and the product of the slopes is not −1, so the lines are neither parallel nor perpendicular.

Exercises

Are the lines parallel, perpendicular, or neither?

1. the line passing through (4, 3) and (1, −3) and the line passing through (1, 2) and (−1, 3)

2. the line passing through (2, 8) and (−2, 2) and the line passing through (0, 9) and (6, 0)

3. the line passing through (3, 9) and (−2, −1) and the graph of $y = 2x$

4. the line with x-intercept −2 and y-intercept 5 and the line with x-intercept 2 and y-intercept −5

5. the line with x-intercept 1 and y-intercept 3 and the line with x-intercept 3 and y-intercept 1

6. the line passing through (−2, −3) and (2, 5) and the graph of $x + 2y = 10$

7. the line passing through (−4, −8) and (6, −4) and the graph of $2x - 5y = 5$

2-3 Skills Practice

Slope

Find the slope of the line that passes through each pair of points.

1. (1, 5), (−1, −3)

2. (0, 2), (3, 0)

3. (1, 9), (0, 6)

4. (8, −5), (4, −2)

5. (−3, 5), (−3, −1)

6. (−2, −2), (10, −2)

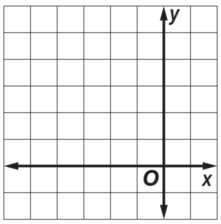
7. (4, 5), (2, 7)

8. (−2, −4), (3, 2)

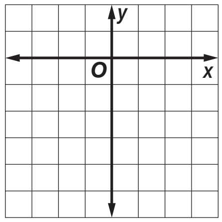
9. (5, 2), (−3, 2)

Graph the line passing through the given point with the given slope.

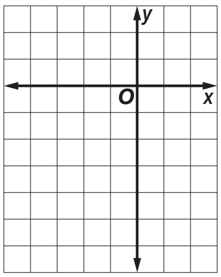
10. (0, 4), $m = 1$



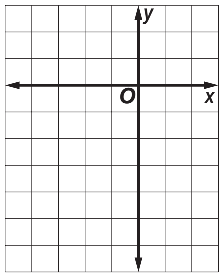
11. (2, −4), $m = -1$



12. (−3, −5), $m = 2$

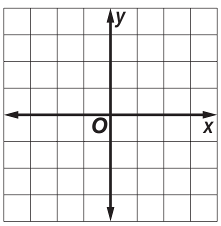


13. (−2, −1), $m = -2$

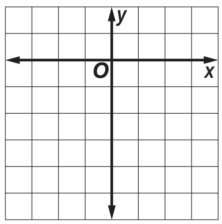


Graph the line that satisfies each set of conditions.

14. passes through (0, 1), perpendicular to a line whose slope is $\frac{1}{3}$



15. passes through (0, −5), parallel to the graph of $y = 1$



16. HIKING Naomi left from an elevation of 7400 feet at 7:00 A.M. and hiked to an elevation of 9800 feet by 11:00 A.M. What was her rate of change in altitude?

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2-3 Practice

Slope

Find the slope of the line that passes through each pair of points.

1. (3, −8), (−5, 2)

2. (−10, −3), (7, 2)

3. (−7, −6), (3, −6)

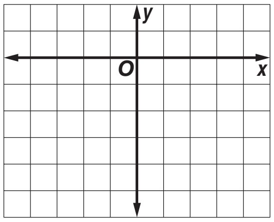
4. (8, 2), (8, −1)

5. (4, 3), (7, −2)

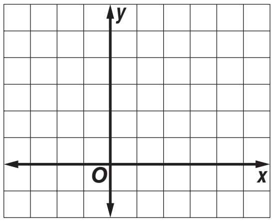
6. (−6, −3), (−8, 4)

Graph the line passing through the given point with the given slope.

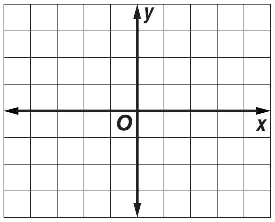
7. (0, −3), $m = 3$



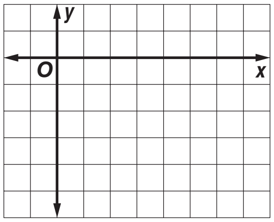
8. (2, 1), $m = -\frac{3}{4}$



9. (0, 2), $m = 0$

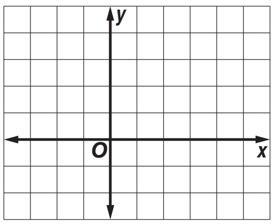


10. (2, −3), $m = \frac{4}{5}$

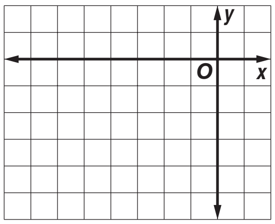


Graph the line that satisfies each set of conditions.

11. passes through (3, 0), perpendicular to a line whose slope is $\frac{3}{2}$



12. passes through (−3, −1), parallel to a line whose slope is −1



DEPRECIATION For Exercises 13–15, use the following information.

A machine that originally cost \$15,600 has a value of \$7500 at the end of 3 years. The same machine has a value of \$2800 at the end of 8 years.

13. Find the average rate of change in value (depreciation) of the machine between its purchase and the end of 3 years.

14. Find the average rate of change in value of the machine between the end of 3 years and the end of 8 years.

15. Interpret the sign of your answers.

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2-3 Reading to Learn Mathematics

Slope

Pre-Activity **How does slope apply to the steepness of roads?**

Read the introduction to Lesson 2-3 at the top of page 68 in your textbook.

- What is the grade of a road that rises 40 feet over a horizontal distance of 1000 feet?
- What is the grade of a road that rises 525 meters over a horizontal distance of 10 kilometers? (1 kilometer = 1000 meters)

Reading the Lesson

1. Describe each type of slope and include a sketch.

Type of Slope	Description of Graph	Sketch
Positive		
Zero		
Negative		
Undefined		

2. a. How are the slopes of two nonvertical parallel lines related?

b. How are the slopes of two oblique perpendicular lines related?

Helping You Remember

3. Look up the terms *grade*, *pitch*, *slant*, and *slope*. How can everyday meanings of these words help you remember the definition of slope?

Lesson 2-3

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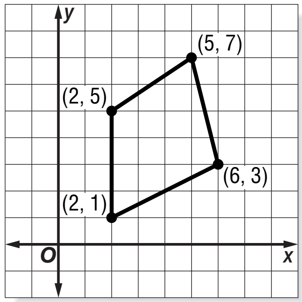
2-3 Enrichment

Aerial Surveyors and Area

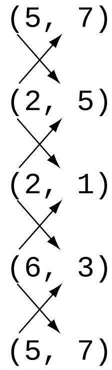
Many land regions have irregular shapes. Aerial surveyors supply aerial mappers with lists of coordinates and elevations for the areas that need to be photographed from the air. These maps provide information about the horizontal and vertical features of the land.



Step 1 List the ordered pairs for the vertices in counterclockwise order, repeating the first ordered pair at the bottom of the list.

Step 2 Find D, the sum of the downward diagonal products (from left to right).

$D = (5 \cdot 5) + (2 \cdot 1) + (2 \cdot 3) + (6 \cdot 7)$
$= 25 + 2 + 6 + 42$ or 75



Step 3 Find U, the sum of the upward diagonal products (from left to right).

$U = (2 \cdot 7) + (2 \cdot 5) + (6 \cdot 1) + (5 \cdot 3)$
$= 14 + 10 + 6 + 15$ or 45

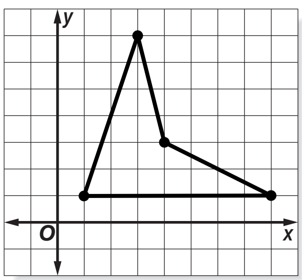
Step 4 Use the formula $A = \frac{1}{2}(D - U)$ to find the area.

$A = \frac{1}{2}(75 - 45)$
$= \frac{1}{2}(30)$ or 15

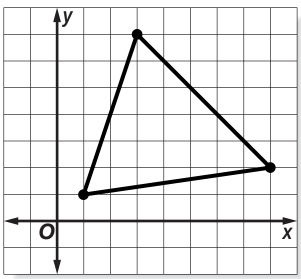
The area is 15 square units. Count the number of square units enclosed by the polygon. Does this result seem reasonable?

Use the coordinate method to find the area of each region in square units.

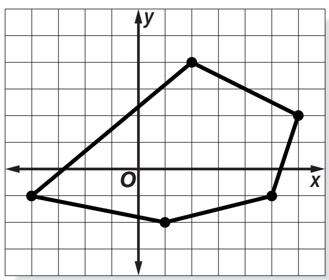
1.



2.



3.



2-4 Study Guide and Intervention

Writing Linear Equations

Forms of Equations

Slope-Intercept Form of a Linear Equation	$y = mx + b$, where m is the slope and b is the y-intercept
Point-Slope Form of a Linear Equation	$y - y_1 = m(x - x_1)$, where (x_1, y_1) are the coordinates of a point on the line and m is the slope of the line

Example 1 **Write an equation in slope-intercept form for the line that has slope −2 and passes through the point (3, 7).**

Substitute for m, x, and y in the slope-intercept form.

$y = mx + b$	Slope-intercept form
$7 = (-2)(3) + b$	$(x, y) = (3, 7)$, $m = -2$
$7 = -6 + b$	Simplify.
$13 = b$	Add 6 to both sides.

The y-intercept is 13. The equation in slope-intercept form is $y = -2x + 13$.

Example 2 **Write an equation in slope-intercept form for the line that has slope $\frac{1}{3}$ and x-intercept 5.**

$y = mx + b$	Slope-intercept form
$0 = \left(\frac{1}{3}\right)(5) + b$	$(x, y) = (5, 0)$, $m = \frac{1}{3}$
$0 = \frac{5}{3} + b$	Simplify.
$-\frac{5}{3} = b$	Subtract $\frac{5}{3}$ from both sides.

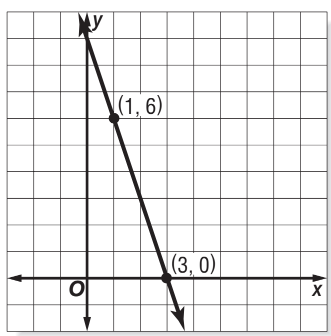
The y-intercept is $-\frac{5}{3}$. The slope-intercept form is $y = \frac{1}{3}x - \frac{5}{3}$.

Exercises

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

1. slope −2, passes through (−4, 6)
2. slope $\frac{3}{2}$, y-intercept 4
3. slope 1, passes through (2, 5)
4. slope $-\frac{13}{5}$, passes through (5, −7)

Write an equation in slope-intercept form for each graph.

5.


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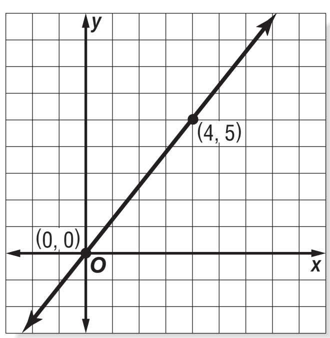

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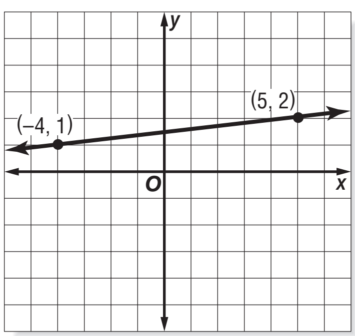


Lesson 2-4

2-4 Study Guide and Intervention *(continued)*

Writing Linear Equations

Parallel and Perpendicular Lines Use the slope-intercept or point-slope form to find equations of lines that are parallel or perpendicular to a given line. Remember that parallel lines have equal slope. The slopes of two perpendicular lines are negative reciprocals, that is, their product is -1.

Example 1 **Write an equation of the line that passes through (8, 2) and is perpendicular to the line whose equation is $y = -\frac{1}{2}x + 3$.**

The slope of the given line is $-\frac{1}{2}$. Since the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line is 2.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$	Point-slope form
$y - 2 = 2(x - 8)$	$(x_1, y_1) = (8, 2)$, $m = 2$
$y - 2 = 2x - 16$	Distributive Prop.
$y = 2x - 14$	Add 2 to each side.

An equation of the line is $y = 2x - 14$.

Example 2 **Write an equation of the line that passes through (−1, 5) and is parallel to the graph of $y = 3x + 1$.**

The slope of the given line is 3. Since the slopes of parallel lines are equal, the slope of the parallel line is also 3.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$	Point-slope form
$y - 5 = 3(x - (-1))$	$(x_1, y_1) = (-1, 5)$, $m = 3$
$y - 5 = 3x + 3$	Distributive Prop.
$y = 3x + 8$	Add 5 to each side.

An equation of the line is $y = 3x + 8$.

Exercises

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

1. passes through $(-4, 2)$, parallel to the line whose equation is $y = \frac{1}{2}x + 5$

2. passes through (3, 1), perpendicular to the graph of $y = -3x + 2$

3. passes through $(1, -1)$, parallel to the line that passes through (4, 1) and $(2, -3)$

4. passes through (4, 7), perpendicular to the line that passes through (3, 6) and (3, 15)

5. passes through $(8, -6)$, perpendicular to the graph of $2x - y = 4$

6. passes through $(2, -2)$, perpendicular to the graph of $x + 5y = 6$

7. passes through (6, 1), parallel to the line with x-intercept -3 and y-intercept 5

8. passes through $(-2, 1)$, perpendicular to the line $y = 4x - 11$

2-4 Skills Practice

Writing Linear Equations

State the slope and *y*-intercept of the graph of each equation.

1. $y = 7x - 5$

2. $y = -\frac{3}{5}x + 3$

3. $y = \frac{2}{3}x$

4. $3x + 4y = 4$

5. $7y = 4x - 7$

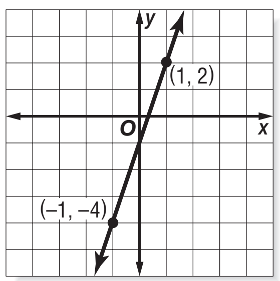
6. $3x - 2y + 6 = 0$

7. $2x - y = 5$

8. $2y = 6 - 5x$

Write an equation in slope-intercept form for each graph.

9.



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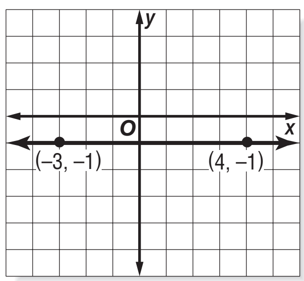

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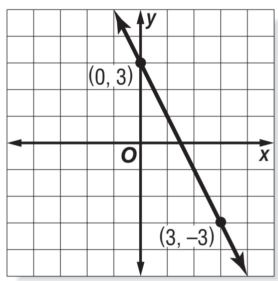

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

12. slope 3, passes through $(1, -3)$

13. slope -1, passes through $(0, 0)$

14. slope -2, passes through $(0, -5)$

15. slope 3, passes through $(2, 0)$

16. passes through $(-1, -2)$ and $(-3, 1)$

17. passes through $(-2, -4)$ and $(1, 8)$

18. *x*-intercept 2, *y*-intercept -6

19. *x*-intercept $\frac{5}{2}$, *y*-intercept 5

20. passes through $(3, -1)$, perpendicular to the graph of $y = -\frac{1}{3}x - 4$.

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2-4 Practice

Writing Linear Equations

State the slope and y-intercept of the graph of each equation.

1. $y = 8x + 12$

2. $y = 0.25x - 1$

3. $y = -\frac{3}{5}x$

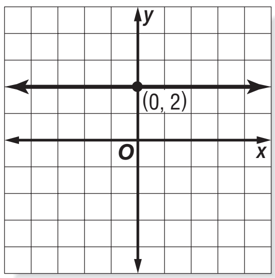
4. $3y = 7$

5. $3x = -15 + 5y$

6. $2x - 3y = 10$

Write an equation in slope-intercept form for each graph.

7.



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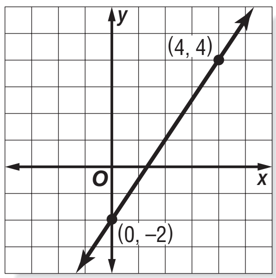

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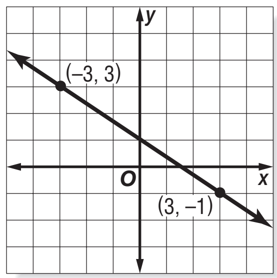


Write an equation in slope-intercept form for the line that satisfies each set of conditions.

10. slope -5, passes through $(-3, -8)$

11. slope $\frac{4}{5}$, passes through $(10, -3)$

12. slope 0, passes through $(0, -10)$

13. slope $-\frac{2}{3}$, passes through $(6, -8)$

14. passes through $(3, 11)$ and $(-6, 5)$

15. passes through $(7, -2)$ and $(3, -1)$

16. x-intercept 3, y-intercept 2

17. x-intercept -5, y-intercept 7

18. passes through $(-8, -7)$, perpendicular to the graph of $y = 4x - 3$

19. RESERVOIRS The surface of Grand Lake is at an elevation of 648 feet. During the current drought, the water level is dropping at a rate of 3 inches per day. If this trend continues, write an equation that gives the elevation in feet of the surface of Grand Lake after x days.

20. BUSINESS Tony Marconi's company manufactures CD-ROM drives. The company will make \$150,000 profit if it manufactures 100,000 drives, and \$1,750,000 profit if it manufactures 500,000 drives. The relationship between the number of drives manufactured and the profit is linear. Write an equation that gives the profit P when n drives are manufactured.

NAME ____ DATE ____________ PERIOD _____

2-4 Reading to Learn Mathematics

Writing Linear Equations

Pre-Activity **How do linear equations apply to business?**

Read the introduction to Lesson 2-4 at the top of page 75 in your textbook.

- If the total cost of producing a product is given by the equation $y = 5400 + 1.37x$, what is the fixed cost? What is the variable cost (for each item produced)?
- Write a linear equation that describes the following situation: A company that manufactures computers has a fixed cost of \$228,750 and a variable cost of \$852 to produce each computer.

Reading the Lesson

1. a. Write the slope-intercept form of the equation of a line. Then explain the meaning of each of the variables in the equation.

b. Write the point-slope form of the equation of a line. Then explain the meaning of each of the variables in the equation.

2. Suppose that your algebra teacher asks you to write the point-slope form of the equation of the line through the points $(-6, 7)$ and $(-3, -2)$. You write $y + 2 = -3(x + 3)$ and your classmate writes $y - 7 = -3(x + 6)$. Which of you is correct? Explain.

3. You are asked to write an equation of two lines that pass through $(3, -5)$, one of them parallel to and one of them perpendicular to the line whose equation is $y = -3x + 4$. The first step in finding these equations is to find their slopes. What is the slope of the parallel line? What is the slope of the perpendicular line?

Helping You Remember

4. Many students have trouble remembering the point-slope form for a linear equation. How can you use the definition of slope to remember this form?

NAME ______________________________ DATE __________ PERIOD _____

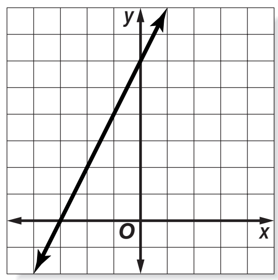
2-4 Enrichment

Two-Intercept Form of a Linear Equation

You are already familiar with the slope-intercept form of a linear equation, $y = mx + b$. Linear equations can also be written in the form $\frac{x}{a} + \frac{y}{b} = 1$ with x-intercept a and y-intercept b. This is called two-intercept form.

Example 1 **Draw the graph of $\frac{x}{-3} + \frac{y}{6} = 1$.**

The graph crosses the x-axis at -3 and the y-axis at 6. Graph $(-3, 0)$ and $(0, 6)$, then draw a straight line through them.



Example 2 **Write $3x + 4y = 12$ in two-intercept form.**

$\frac{3x}{12} + \frac{4y}{12} = \frac{12}{12}$ Divide by 12 to obtain 1 on the right side.

$\frac{x}{4} + \frac{y}{3} = 1$ Simplify.

The x-intercept is 4; the y-intercept is 3.

Use the given intercepts a and b, to write an equation in two-intercept form. Then draw the graph.

1. $a = -2, b = -4$

2. $a = 1, b = 8$

3. $a = 3, b = 5$

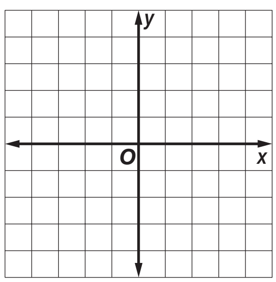
4. $a = 6, b = 9$

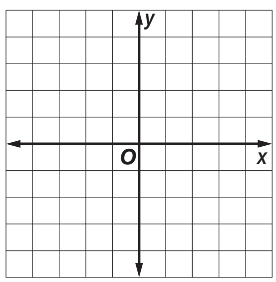
Write each equation in two-intercept form. Then draw the graph.

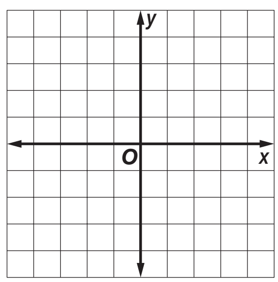
5. $3x - 2y = -6$

6. $\frac{1}{2}x + \frac{1}{4}y = 1$

7. $5x + 2y = -10$







NAME ____ DATE ____________ PERIOD _____

2-5 Study Guide and Intervention

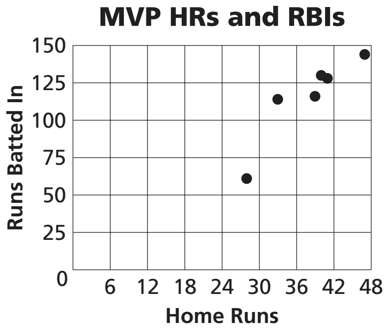
Modeling Real-World Data: Using Scatter Plots

Scatter Plots When a set of data points is graphed as ordered pairs in a coordinate plane, the graph is called a **scatter plot**. A scatter plot can be used to determine if there is a relationship among the data.

Example **BASEBALL The table below shows the number of home runs and runs batted in for various baseball players who won the Most Valuable Player Award during the 1990s. Make a scatter plot of the data.**

Home Runs	Runs Batted In
33	114
39	116
40	130
28	61
41	128
47	144

Source: *New York Times Almanac*



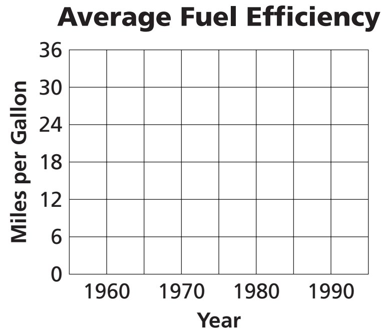
Exercises

Make a scatter plot for the data in each table below.

1. **FUEL EFFICIENCY** The table below shows the average fuel efficiency in miles per gallon of new cars manufactured during the years listed.

Year	Fuel Efficiency (mpg)
1960	15.5
1970	14.1
1980	22.6
1990	26.9

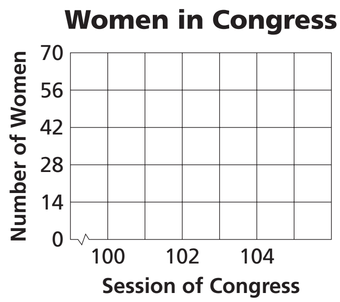
Source: *New York Times Almanac*



2. **CONGRESS** The table below shows the number of women serving in the United States Congress during the years 1987–1999.

Congressional Session	Number of Women
100	25
101	31
102	33
103	55
104	58
105	62

Source: *Wall Street Journal Almanac*



Lesson 2-5

2-5 Study Guide and Intervention *(continued)*

Modeling Real-World Data: Using Scatter Plots

Prediction Equations A **line of fit** is a line that closely approximates a set of data graphed in a scatter plot. The equation of a line of fit is called a **prediction equation** because it can be used to predict values not given in the data set.

To find a prediction equation for a set of data, select two points that seem to represent the data well. Then to write the prediction equation, use what you know about writing a linear equation when given two points on the line.

Example **STORAGE COSTS According to a certain prediction equation, the cost of 200 square feet of storage space is $60. The cost of 325 square feet of storage space is $160.**

a. Find the slope of the prediction equation. What does it represent?

Since the cost depends upon the square footage, let x represent the amount of storage space in square feet and y represent the cost in dollars. The slope can be found using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. So, $m = \frac{160 - 60}{325 - 200} = \frac{100}{125} = 0.8$

The slope of the prediction equation is 0.8. This means that the price of storage increases 80¢ for each one-square-foot increase in storage space.

b. Find a prediction equation.

Using the slope and one of the points on the line, you can use the point-slope form to find a prediction equation.

$y - y_1 = m(x - x_1)$ Point-slope form
$y - 60 = 0.8(x - 200)$ $(x_1, y_1) = (200, 60)$, $m = 0.8$
$y - 60 = 0.8x - 160$ Distributive Property
$y = 0.8x - 100$ Add 60 to both sides.

A prediction equation is $y = 0.8x - 100$.

Exercises

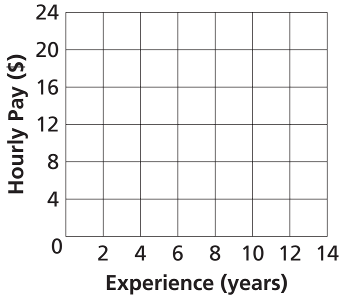
SALARIES The table below shows the years of experience for eight technicians at Lewis Techomatic and the hourly rate of pay each technician earns. Use the data for Exercises 1 and 2.

Experience (years)	9	4	3	1	10	6	12	8
Hourly Rate of Pay	$17	$10	$10	$7	$19	$12	$20	$15

1. Draw a scatter plot to show how years of experience are related to hourly rate of pay. Draw a line of fit.

2. Write a prediction equation to show how years of experience (x) are related to hourly rate of pay (y).

Technician Salaries



2-5 Skills Practice

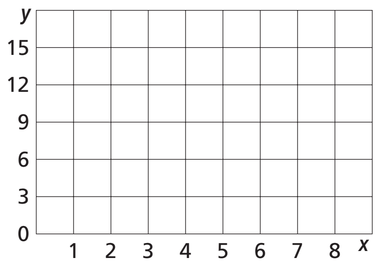
Modeling Real-World Data: Using Scatter Plots

For Exercises 1–3, complete parts a–c for each set of data.

a. Draw a scatter plot.
b. Use two ordered pairs to write a prediction equation.
c. Use your prediction equation to predict the missing value.

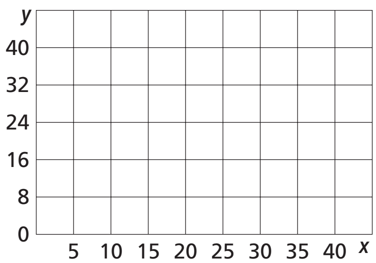
1.

x	y
1	1
3	5
4	7
6	11
7	12
8	15
10	?



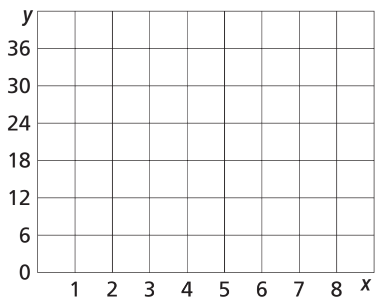
2.

x	y
5	9
10	17
20	22
25	30
35	38
40	44
50	?



3.

x	y
1	16
2	16
3	?
4	22
5	30
7	34
8	36



NAME ______________________________ DATE ____________ PERIOD _____

2-5 Practice

Modeling Real-World Data: Using Scatter Plots

For Exercises 1–3, complete parts a–c for each set of data.

a. Draw a scatter plot.

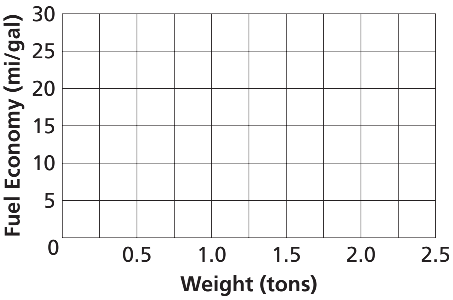
b. Use two ordered pairs to write a prediction equation.

c. Use your prediction equation to predict the missing value.

1. FUEL ECONOMY The table gives the approximate weights in tons and estimates for overall fuel economy in miles per gallon for several cars.

Weight (tons)	1.3	1.4	1.5	1.8	2	2.1	2.4
Miles per Gallon	29	24	23	21	?	17	15

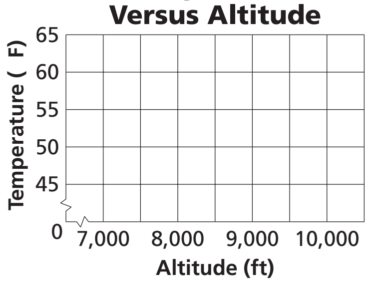
Fuel Economy Versus Weight



2. ALTITUDE In most cases, temperature decreases with increasing altitude. As Anchara drives into the mountains, her car thermometer registers the temperatures (°F) shown in the table at the given altitudes (feet).

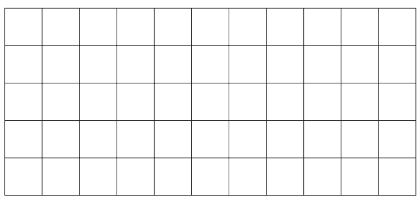
Altitude (ft)	7500	8200	8600	9200	9700	10,400	12,000
Temperature (°F)	61	58	56	53	50	46	?

Temperature Versus Altitude



3. HEALTH Alton has a treadmill that uses the time on the treadmill and the speed of walking or running to estimate the number of Calories he burns during a workout. The table gives workout times and Calories burned for several workouts.

Time (min)	18	24	30	40	42	48	52	60
Calories Burned	260	280	320	380	400	440	475	?



2-5 Reading to Learn Mathematics

Modeling Real-World Data: Using Scatter Plots

Pre-Activity **How can a linear equation model the number of Calories you burn exercising?**

Read the introduction to Lesson 2-5 at the top of page 81 in your textbook.

- If a woman runs 5.5 miles per hour, about how many Calories will she burn in an hour?
- If a man runs 7.5 miles per hour, about how many Calories will he burn in half an hour?

Reading the Lesson

1. Suppose that a set of data can be modeled by a linear equation. Explain the difference between a scatter plot of the data and a graph of the linear equation that models that data.

2. Suppose that tuition at a state college was $3500 per year in 1995 and has been increasing at a rate of $225 per year.

a. Write a prediction equation that expresses this information.

b. Explain the meaning of each variable in your prediction equation.

3. Use this model to predict the tuition at this college in 2007.

Helping You Remember

4. Look up the word *scatter* in a dictionary. How can its definition help you to remember the meaning of the difference between a scatter plot and the graph of a linear equation?

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2-5 Enrichment

Median-Fit Lines

A **median-fit line** is a particular type of line of fit. Follow the steps below to find the equation of the median-fit line for the data.

Approximate Percentage of Violent Crimes Committed by Juveniles That Victims Reported to Law Enforcement									
Year	1980	1982	1984	1986	1988	1990	1992	1994	1996
Offenders	36	35	33	32	31	30	29	29	30

Source: U.S. Bureau of Justice Statistics

1. Divide the data into three approximately equal groups. There should always be the same number of points in the first and third groups. In this case, there will be three data points in each group.

2. Find x_1, x_2, and x_3, the medians of the x values in groups 1, 2, and 3, respectively. Find y_1, y_2, and y_3, the medians of the y values in groups 1, 2, and 3, respectively.

3. Find an equation of the line through (x_1, y_1) and (x_3, y_3).

4. Find Y, the y-coordinate of the point on the line in Exercise 2 with an x-coordinate of x_2.

5. The median-fit line is parallel to the line in Exercise 2, but is one-third closer to (x_2, y_2). This means it passes through $\left(x_2, \frac{2}{3}Y + \frac{1}{3}y_2\right)$. Find this ordered pair.

6. Write an equation of the median-fit line.

7. Use the median-fit line to predict the percentage of juvenile violent crime offenders in 2010 and 2020.

2-6 Study Guide and Intervention

Special Functions

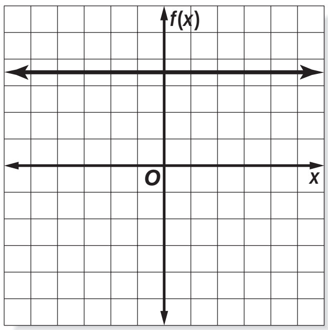
Step Functions, Constant Functions, and the Identity Function The chart below lists some special functions you should be familiar with.

Function	Written as	Graph
Constant	$f(x) = c$	horizontal line
Identity	$f(x) = x$	line through the origin with slope 1
Greatest Integer Function	$f(x) = [\![x]\!]$	one-unit horizontal segments, with right endpoints missing, arranged like steps

The greatest integer function is an example of a **step function**, a function with a graph that consists of horizontal segments.

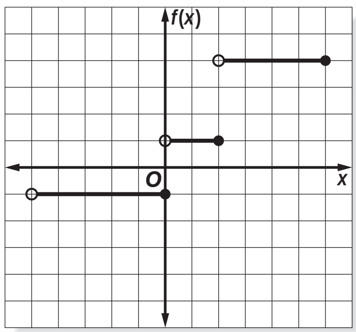
Example **Identify each function as a constant function, the identity function, or a step function.**

a.



a constant function

b.

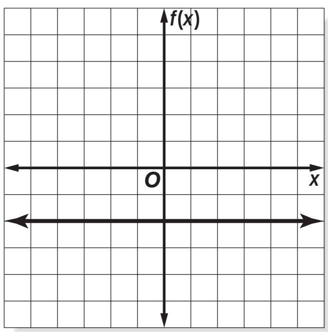


a step function

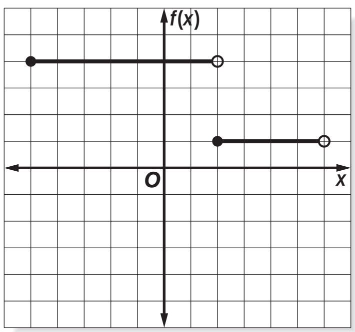
Exercises

Identify each function as a constant function, the identity function, a greatest integer function, or a step function.

1.



2.



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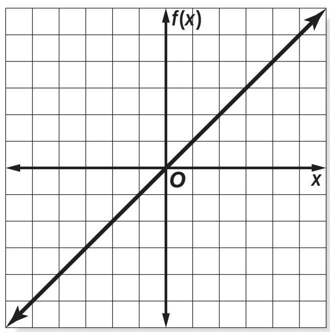

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2-6 Study Guide and Intervention *(continued)*

Special Functions

Absolute Value and Piecewise Functions

Another special function is the **absolute value function**, which is also called a **piecewise function**.

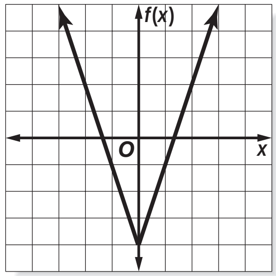
Absolute Value Function	$f(x) = \lvert x \rvert$	two rays that are mirror images of each other and meet at a point, the vertex

To graph a special function, use its definition and your knowledge of the parent graph. Find several ordered pairs, if necessary.

Example 1 **Graph $f(x) = 3|x| - 4$.**

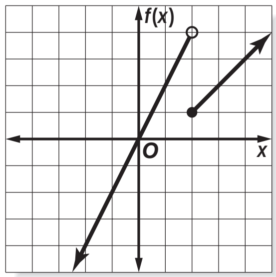
Find several ordered pairs. Graph the points and connect them. You would expect the graph to look similar to its parent function, $f(x) = |x|$.

x	$3\lvert x \rvert - 4$
0	−4
1	−1
2	2
−1	−1
−2	2



Example 2 **Graph $f(x) = \begin{cases} 2x \text{ if } x < 2 \\ x - 1 \text{ if } x \geq 2. \end{cases}$**

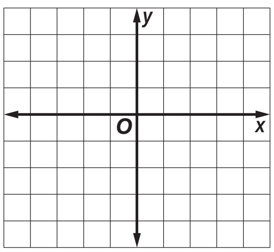
First, graph the linear function $f(x) = 2x$ for $x < 2$. Since 2 does not satisfy this inequality, stop with a circle at (2, 4). Next, graph the linear function $f(x) = x - 1$ for $x \geq 2$. Since 2 does satisfy this inequality, begin with a dot at (2, 1).



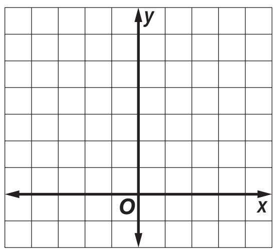
Exercises

Graph each function. Identify the domain and range.

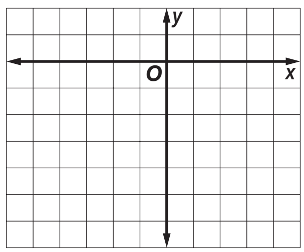
1. $g(x) = \left[\!\left[\frac{x}{3}\right]\!\right]$



2. $h(x) = |2x + 1|$



3. $h(x) = \begin{cases} \frac{x}{3} \text{ if } x \leq 0 \\ 2x - 6 \text{ if } 0 < x < 2 \\ 1 \text{ if } x \geq 2 \end{cases}$

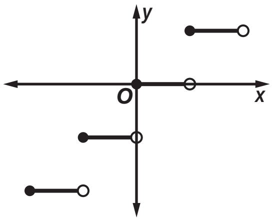


2-6 Skills Practice

Special Functions

Identify each function as S for step, C for constant, A for absolute value, or P for piecewise.

1.



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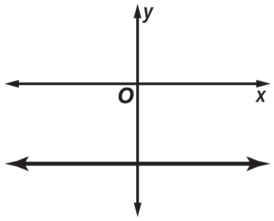

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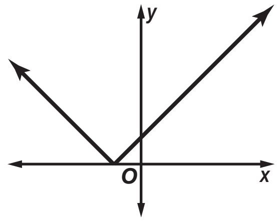
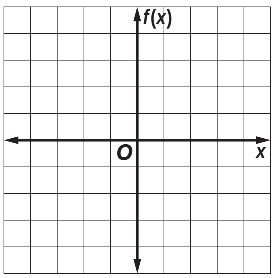
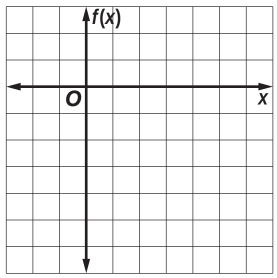


Graph each function. Identify the domain and range.

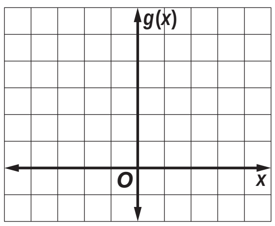
4. $f(x) = [\![x + 1]\!]$



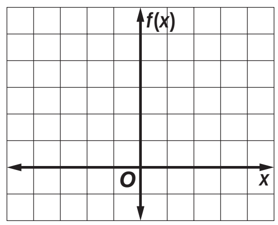
5. $f(x) = [\![x - 3]\!]$



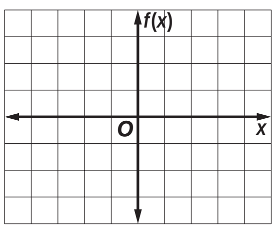
6. $g(x) = 2|x|$



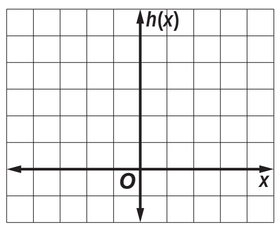
7. $f(x) = |x| + 1$



8. $f(x) = \begin{cases} x \text{ if } x < 0 \\ 2 \text{ if } x \geq 0 \end{cases}$



9. $h(x) = \begin{cases} 3 \text{ if } x < -1 \\ x + 1 \text{ if } x > 1 \end{cases}$



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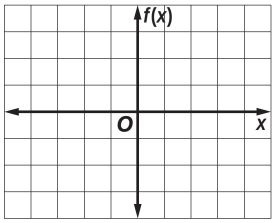
2-6 Practice

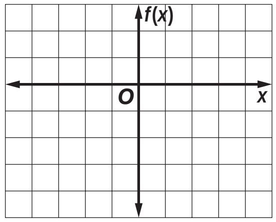
Special Functions

Graph each function. Identify the domain and range.

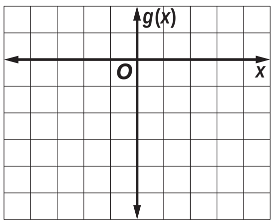
1. $f(x) = [\![0.5x]\!]$



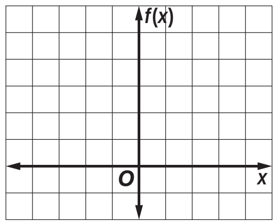
2. $f(x) = [\![x]\!] - 2$



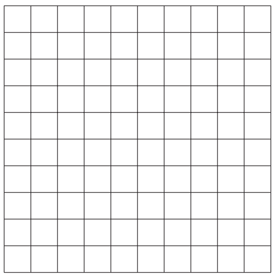
3. $g(x) = -2|x|$



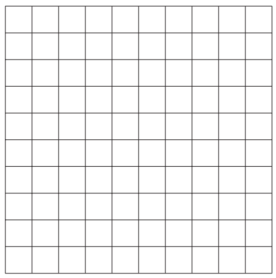
4. $f(x) = |x + 1|$



5. $f(x) = \begin{cases} x + 2 \text{ if } x \leq -2 \\ 3x \text{ if } x > -2 \end{cases}$

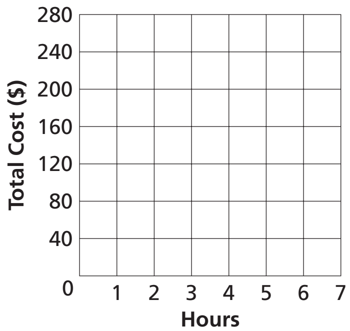


6. $h(x) = \begin{cases} 4 - x \text{ if } x > 0 \\ -2x - 2 \text{ if } x < 0 \end{cases}$

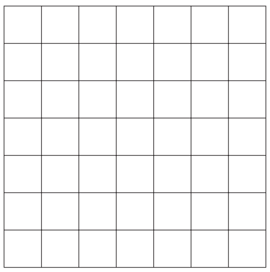


7. BUSINESS *A Stitch in Time* charges $40 per hour or any fraction thereof for labor. Draw a graph of the step function that represents this situation.

Labor Costs



8. BUSINESS A wholesaler charges a store $3.00 per pound for less than 20 pounds of candy and $2.50 per pound for 20 or more pounds. Draw a graph of the function that represents this situation.



2-6 Reading to Learn Mathematics

Special Functions

Pre-Activity **How do step functions apply to postage rates?**

Read the introduction to Lesson 2-6 at the top of page 89 in your textbook.

- What is the cost of mailing a letter that weighs 0.5 ounce?
- Give three different weights of letters that would each cost 55 cents to mail.

Reading the Lesson

1. Find the value of each expression.

a. $|-3| =$ ________ $[\![-3]\!] =$ ________

b. $|6.2| =$ ________ $[\![6.2]\!] =$ ________

c. $|-4.01| =$ ________ $[\![-4.01]\!] =$ ________

2. Tell how the name of each kind of function can help you remember what the graph looks like.

a. constant function

b. absolute value function

c. step function

d. identity function

Helping You Remember

3. Many students find the greatest integer function confusing. Explain how you can use a number line to find the value of this function for any real number.

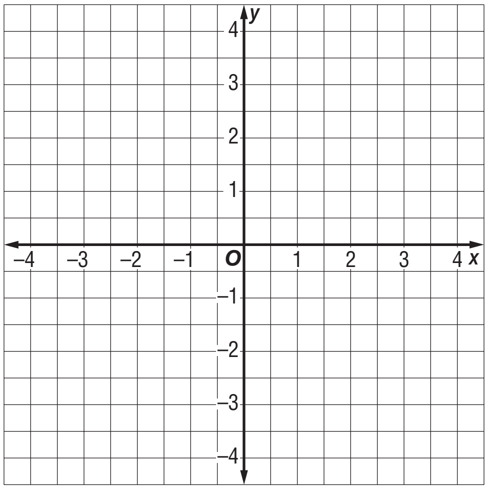
2-6 Enrichment

Greatest Integer Functions

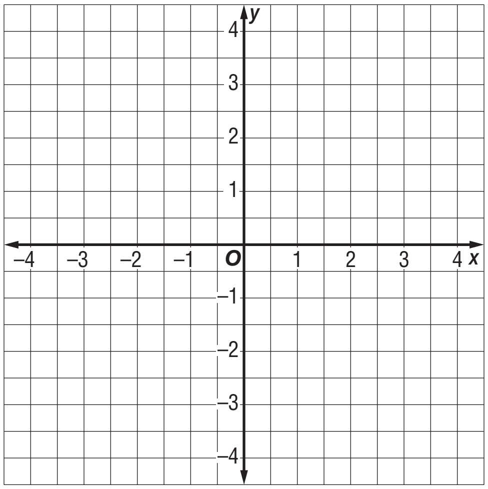
Use the greatest integer function $[\![x]\!]$ to explore some unusual graphs. It will be helpful to make a chart of values for each functions and to use a colored pen or pencil.

Graph each function.

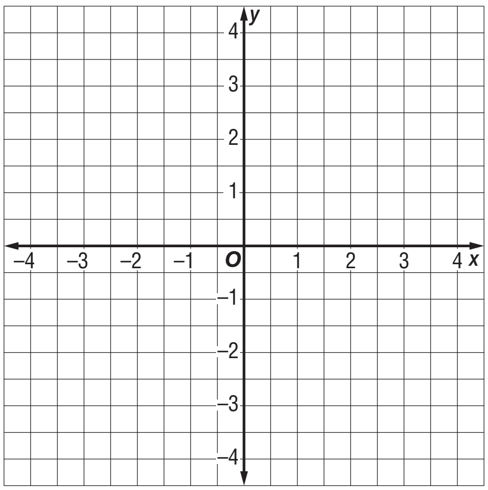
1. $y = 2x - [\![x]\!]$



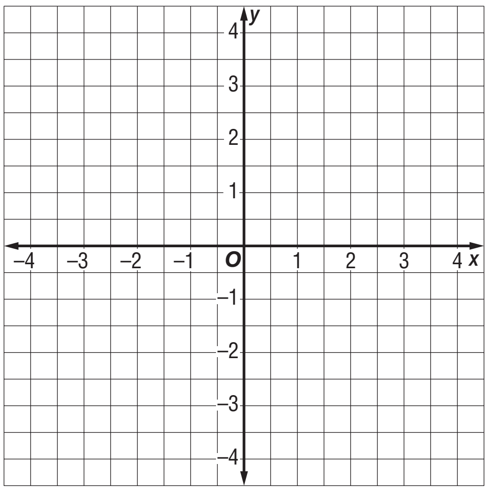
2. $y = \dfrac{[\![x]\!]}{[\![x]\!]}$



3. $y = \dfrac{[\![0.5x + 1]\!]}{[\![0.5x + 1]\!]}$



4. $y = \dfrac{x}{[\![x]\!]}$



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2-7 Study Guide and Intervention

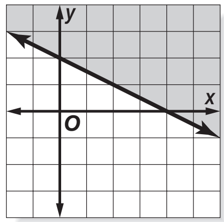
Graphing Inequalities

Graph Linear Inequalities. A **linear inequality**, like $y \geq 2x - 1$, resembles a linear equation, but with an inequality sign instead of an equals sign. The graph of the related linear equation separates the coordinate plane into two half-planes. The line is the boundary of each half-plane.

To graph a linear inequality, follow these steps.

1. Graph the boundary, that is, the related linear equation. If the inequality symbol is $\leq$ or $\geq$, the boundary is solid. If the inequality symbol is $<$ or $>$, the boundary is dashed.
2. Choose a point not on the boundary and test it in the inequality. (0, 0) is a good point to choose if the boundary does not pass through the origin.
3. If a true inequality results, shade the half-plane containing your test point. If a false inequality results, shade the other half-plane.

Example **Graph $x + 2y \geq 4$.**



The boundary is the graph of $x + 2y = 4$.

Use the slope-intercept form, $y = -\frac{1}{2}x + 2$, to graph the boundary line.

The boundary line should be solid.

Now test the point (0, 0).

$0 + 2(0) \stackrel{?}{\geq} 4$ $(x, y) = (0, 0)$

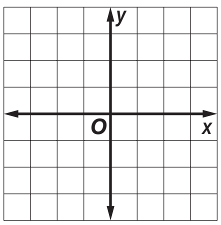
$0 \geq 4$ false

Shade the region that does *not* contain (0, 0).

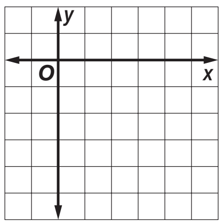
Exercises

Graph each inequality.

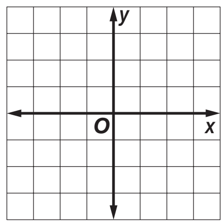
1. $y < 3x + 1$



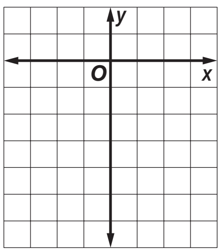
2. $y \geq x - 5$



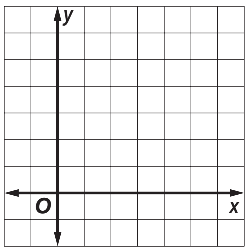
3. $4x + y \leq -1$



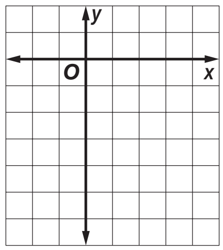
4. $y < \frac{x}{2} - 4$



5. $x + y > 6$



6. $0.5x - 0.25y < 1.5$



NAME ______________________ DATE ____________ PERIOD _____

2-7 Study Guide and Intervention *(continued)*

Graphing Inequalities

Graph Absolute Value Inequalities Graphing absolute value inequalities is similar to graphing linear inequalities. The graph of the related absolute value equation is the boundary. This boundary is graphed as a solid line if the inequality is $\leq$ or $\geq$, and dashed if the inequality is $<$ or $>$. Choose a test point not on the boundary to determine which region to shade.

Example **Graph $y \leq 3|x - 1|$.**

First graph the equation $y = 3|x - 1|$.

Since the inequality is $\leq$, the graph of the boundary is solid.

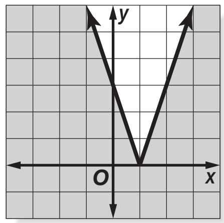
Test (0, 0).

$0 \stackrel{?}{\leq} 3|0 - 1|$ $\quad (x, y) = (0, 0)$

$0 \stackrel{?}{\leq} 3|-1|$ $\quad |-1| = 1$

$0 \leq 3$ $\quad$ true

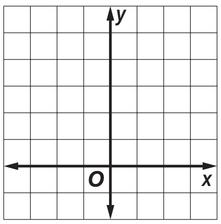
Shade the region that contains (0, 0).



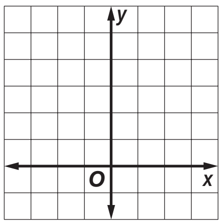
Exercises

Graph each inequality.

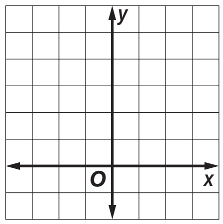
1. $y \geq |x| + 1$



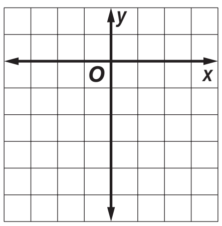
2. $y \leq |2x - 1|$



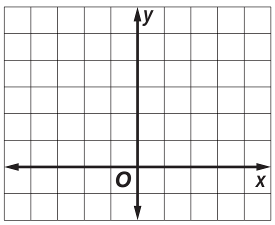
3. $y - 2|x| > 3$



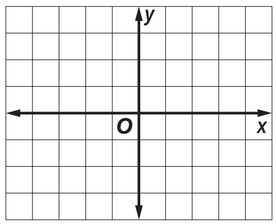
4. $y < -|x| - 3$



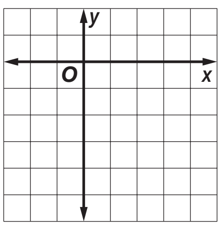
5. $|x| + y \geq 4$



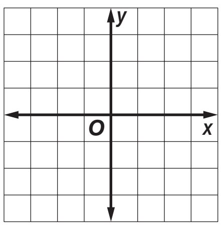
6. $|x + 1| + 2y < 0$



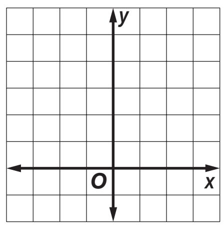
7. $|2 - x| + y > -1$



8. $y < 3|x| - 3$



9. $y \leq |1 - x| + 4$

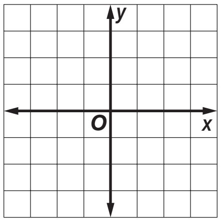


2-7 Skills Practice

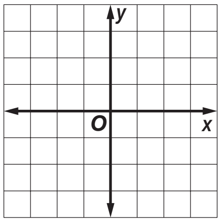
Graphing Inequalities

Graph each inequality.

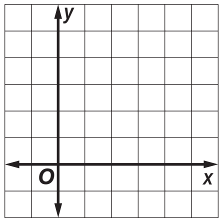
1. $y > 1$



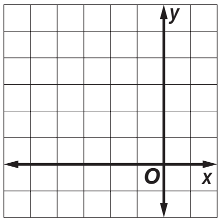
2. $y \leq x + 2$



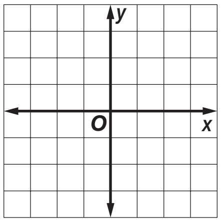
3. $x + y \leq 4$



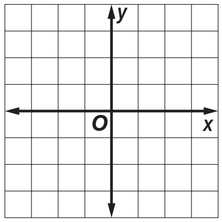
4. $x + 3 < y$



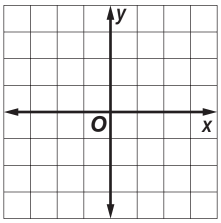
5. $2 - y < x$



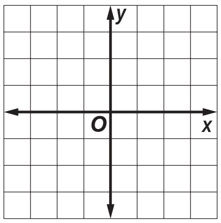
6. $y \geq -x$



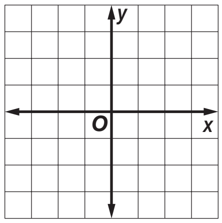
7. $x - y > -2$



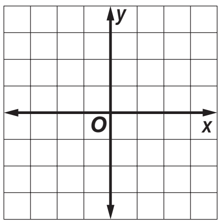
8. $9x + 3y - 6 \leq 0$



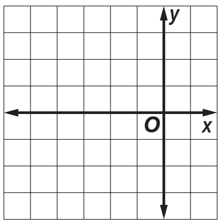
9. $y + 1 \geq 2x$



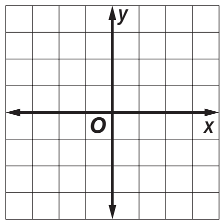
10. $y - 7 \leq -9$



11. $x > -5$



12. $y > |x|$

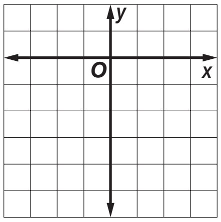


2-7 Practice

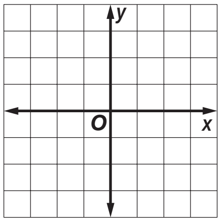
Graphing Inequalities

Graph each inequality.

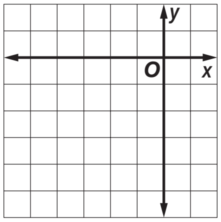
1. $y \leq -3$



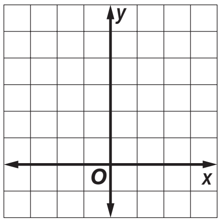
2. $x > 2$



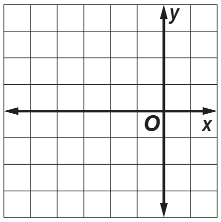
3. $x + y \leq -4$



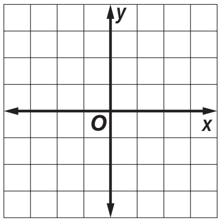
4. $y < -3x + 5$



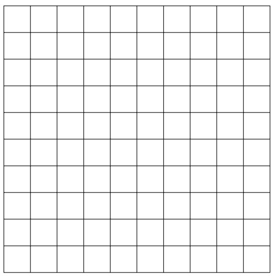
5. $y < \frac{1}{2}x + 3$



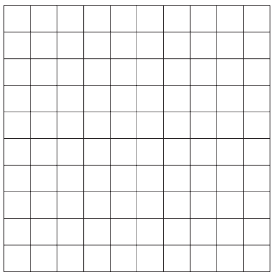
6. $y - 1 \geq -x$



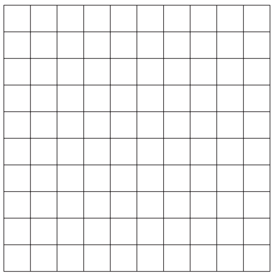
7. $x - 3y \leq 6$



8. $y > |x| - 1$



9. $y > -3|x + 1| - 2$



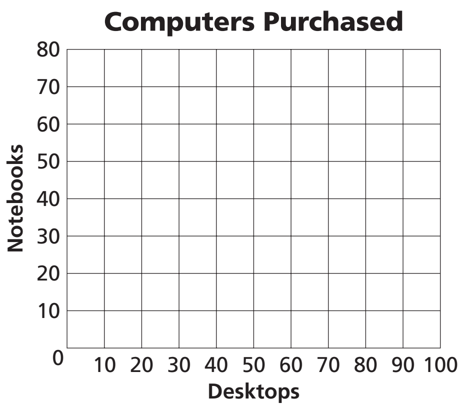
COMPUTERS For Exercises 10–12, use the following information.

A school system is buying new computers. They will buy desktop computers costing $1000 per unit, and notebook computers costing $1200 per unit. The total cost of the computers cannot exceed $80,000.

10. Write an inequality that describes this situation.

11. Graph the inequality.

12. If the school wants to buy 50 of the desktop computers and 25 of the notebook computers, will they have enough money?



2-7 Reading to Learn Mathematics

Graphing Inequalities

Pre-Activity **How do inequalities apply to fantasy football?**

Read the introduction to Lesson 2-7 at the top of page 96 in your textbook.

- Which of the combinations of yards and touchdowns listed would Dana consider a good game?

- Suppose that in one of the games Dana plays, Moss gets 157 receiving yards. What is the smallest number of touchdowns he must get in order for Dana to consider this a good game?

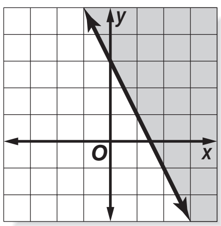
Reading the Lesson

1. When graphing a linear inequality in two variables, how do you know whether to make the boundary a solid line or a dashed line?

2. How do you know which side of the boundary to shade?

3. Match each inequality with its graph.

a. $y > 2x - 3$ **b.** $y < -2x + 3$ **c.** $y \geq 2x - 3$ **d.** $y \geq -2x + 3$

i.


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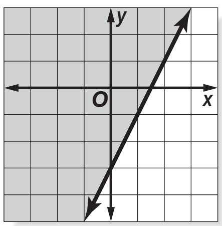
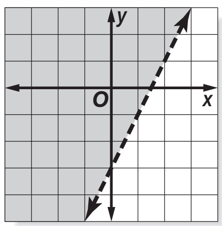


iii.


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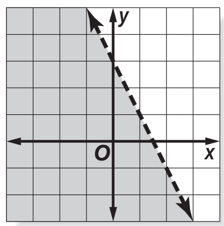


Helping You Remember

4. Describe some ways in which graphing an inequality in one variable on a number line is similar to graphing an inequality in two variables in a coordinate plane. How can what you know about graphing inequalities on a number line help you to graph inequalities in a coordinate plane?

NAME ____ DATE ____________ PERIOD _____

2-7 Enrichment

Algebraic Proof

The following paragraph states a result you might be asked to prove in a mathematics course. Parts of the paragraph are numbered.

01 Let n be a positive integer.

02 Also, let $n_1 = s(n_1)$ be the sum of the squares of the digits in n.

03 Then $n_2 = s(n_1)$ is the sum of the squares of the digits of n_1, and $n_3 = s(n_2)$ is the sum of the squares of the digits of n_2.

04 In general, $n_k = s(n_{k-1})$ is the sum of the squares of the digits of n_{k-1}.

05 Consider the sequence: $n, n_1, n_2, n_3, \cdots, n_k, \cdots$.

06 In this sequence either all the terms from some k on have the value 1,

07 or some term, say n_j, has the value 4, so that the eight terms 4, 16, 37, 58, 89, 145, 42, and 20 keep repeating from that point on.

Use the paragraph to answer these questions.

1. Use the sentence in line 01. List the first five values of n.

2. Use 9246 for n and give an example to show the meaning of line 02.

3. In line 02, which symbol shows a function? Explain the function in a sentence.

4. For $n = 9246$, find n_2 and n_3 as described in sentence 03.

5. How do the first four sentences relate to sentence 05?

6. Use $n = 31$ and find the first four terms of the sequence.

7. Which sentence of the paragraph is illustrated by $n = 31$?

8. Use $n = 61$ and find the first ten terms.

9. Which sentence is illustrated by $n = 61$?

NAME ______________________ DATE ____________ PERIOD ______

2 Chapter 2 Test, Form 1

SCORE ______

Write the letter for the correct answer in the blank at the right of each question.

1. Find the domain of the relation {(0, 0), (1, 1), (2, 0)}. Then determine whether the relation is a function.

A. {0, 1, 0}; function **B.** {0, 1, 0}; not a function
C. {0, 1, 2}; function **D.** {0, 1, 2}; not a function **1.** ______

2. The table shows the annualized percent return of a mutual fund for several years. Find the range of the relation. Then determine whether the relation is a function.

Year	1	3	5	10
Percent Return	20.9	22.8	20.0	20.5

A. {20.9, 22.8, 20.0, 20.5}; not a function **B.** {1, 3, 5, 10}; not a function
C. {20.9, 22.8, 20.0, 20.5}; function **D.** {1, 3, 5, 10}; function **2.** ______

3. Find $f(-1)$ if $f(x) = -3x - 5$.
A. -9 **B.** -8 **C.** -2 **D.** 2 **3.** ______

4. Find $f(0)$ if $f(t) = t^2 - 2t - 2$.
A. 2 **B.** -4 **C.** 0 **D.** -2 **4.** ______

5. Which equation is linear?
A. $xy = 60$ **B.** $3x - 2y = 5$
C. $y = x^2 - 3x + 1$ **D.** $y^2 + 1 = x$ **5.** ______

6. Which function is a linear function?
A. $f(x) = x^3 + x$ **B.** $g(s) = 1 - 4s$
C. $h(t) = 2t + \frac{1}{t}$ **D.** $f(r) = \sqrt{r}$ **6.** ______

7. Write $y - 4x = 7$ in standard form.
A. $4x - y = -7$ **B.** $4x + y = 7$ **C.** $y = 4x + 7$ **D.** $4x = y - 7$ **7.** ______

8. Find the x-intercept of the graph of $-5x + 10y = 20$.
A. -2 **B.** 2 **C.** 4 **D.** -4 **8.** ______

9. Find the slope of the line that passes through (0, 2) and (8, 8).
A. 8 **B.** $\frac{4}{3}$ **C.** $\frac{3}{4}$ **D.** $\frac{5}{4}$ **9.** ______

10. If a line rises to the right, its slope is __?__.
A. zero **B.** positive **C.** negative **D.** undefined **10.** ______

11. What is the slope of a line that is perpendicular to the graph of $y = 2x + 5$?
A. $-\frac{1}{2}$ **B.** $\frac{1}{2}$ **C.** 2 **D.** -2 **11.** ______

12. Graph the line through (2, 3) that is parallel to the line with equation $y = -1$. Which point below also lies on that line?
A. (2, 9) **B.** $(-5, 3)$ **C.** (0, 1) **D.** (1, 4) **12.** ______

Assessment

2 Chapter 2 Test, Form 1 *(continued)*

13. Write an equation in slope-intercept form for the line that has a slope of $-\frac{4}{5}$ and passes through (0, 7).

A. $y = 7x$ **B.** $y = 7x - \frac{4}{5}$ **C.** $y = \frac{4}{5}x + 7$ **D.** $y = -\frac{4}{5}x + 7$ **13.** ______

14. Write an equation for the line that passes through (0, 1) and is perpendicular to the line whose equation is $y = 2x$.

A. $y = -2x + 1$ **B.** $y = 2x + 1$ **C.** $y = \frac{1}{2}x + 1$ **D.** $y = -\frac{1}{2}x + 1$ **14.** ______

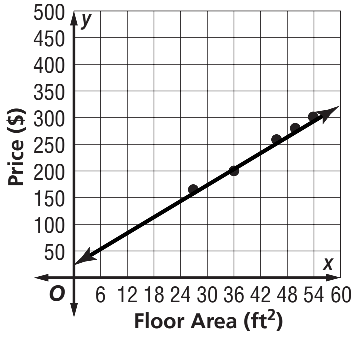
15. Use a scatter plot to determine which data point is an outlier.

x	0	1	2	5	8
y	2	3	10	12	18

A. (0, 2) **B.** (1, 3) **C.** (2, 10) **D.** (8, 18) **15.** ______

16. The scatter plot shows the area of the floor and the price for certain tents. Which equation could be a prediction equation for this set of data?

A. $y = x + 50$ **B.** $y = 10x + 25$
C. $y = 5x - 50$ **D.** $y = 5x + 22$ **16.** ______



17. A banquet hall has tables that can seat 8 people. The number of tables needed depends on the number of guests. What type of special function models this situation?

A. linear function **B.** step function
C. absolute value function **D.** constant function **17.** ______

18. Identify the range of $y = |x|$.

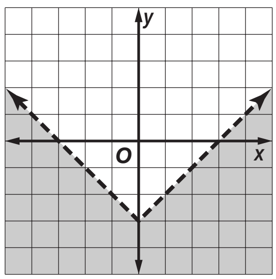
A. all real numbers **B.** $\{x \mid x \geq 0\}$
C. $\{y \mid y \geq 0\}$ **D.** $\{y \mid y \leq 0\}$ **18.** ______

19. The graph of the linear inequality $y \geq 2x - 1$ is the region __?__ the graph of the line $y = 2x - 1$.

A. on or above **B.** on or below **C.** above **D.** below **19.** ______

20. Which inequality is graphed at the right?

A. $y \geq |x| - 3$ **B.** $y \leq |x| - 3$
C. $y > |x| - 3$ **D.** $y < |x| - 3$ **20.** ______



Bonus Find the value of k so that the slope of the line through (4, 2) and $(k, 3)$ is $\frac{1}{6}$. **B:** ______________

NAME ______________________ DATE __________ PERIOD ______

2 Chapter 2 Test, Form 2A

SCORE ______

Write the letter for the correct answer in the blank at the right of each question.

1. Find the range of the relation $\{(-2, 3), (-1, 3), (-1, 5)\}$. Then determine whether the relation is a function.

A. $\{-2, -1\}$; function **B.** $\{-2, -1\}$; not a function
C. $\{3, 5\}$; function **D.** $\{3, 5\}$; not a function **1.** ______

2. Find $f(-1)$ if $f(x) = \frac{x^2 - 4}{x + 2}$.

A. -5 **B.** -3 **C.** 1 **D.** 3 **2.** ______

3. Find $f(a)$ if $f(t) = t^2 - 2t - 2$.

A. $(t + a)^2 - 2t + a - 2$ **B.** $(t + a)^2 - 2(t + a) - 2$
C. $a^2 - 2t - 2$ **D.** $a^2 - 2a - 2$ **3.** ______

4. Which equation is linear?

A. $y > x - 2$ **B.** $y = x^2$ **C.** $y = 3$ **D.** $y^2 = \frac{1}{2}x + 1$ **4.** ______

5. Write $3y = -1 - 5x$ in standard form.

A. $5x + 3y = -1$ **B.** $-5x - 3y = -1$
C. $y = -\frac{5}{3}x - 1$ **D.** $3x + 5y - 1 = 0$ **5.** ______

6. Find the x-intercept and the y-intercept of the graph of $3x - 2y = 12$.

A. $(4, -6)$ **B.** $4; -6$ **C.** $(2, -3)$ **D.** $-6; 4$ **6.** ______

7. Find the slope of the line that passes through $(2, 6)$ and $(-7, 8)$.

A. $-\frac{5}{2}$ **B.** $-\frac{2}{5}$ **C.** $-\frac{2}{9}$ **D.** $-\frac{9}{2}$ **7.** ______

8. What is the slope of the line $y = -2$?

A. -2 **B.** 0 **C.** $\frac{1}{2}$ **D.** undefined **8.** ______

9. What is the slope of a line that is parallel to the graph of $2x + 3y = 5$?

A. $\frac{3}{2}$ **B.** $-\frac{2}{3}$ **C.** $\frac{2}{3}$ **D.** $-\frac{3}{2}$ **9.** ______

10. The graph of the line through $(2, 3)$ that is perpendicular to the line with equation $y = -1$ also goes through which point?

A. $(0, 1)$ **B.** $(1, 4)$ **C.** $(2, -4)$ **D.** $(-2, 3)$ **10.** ______

11. Write an equation in slope-intercept form for the line that has a slope of -4 and passes through $(1, 2)$.

A. $y = -2x + 4$ **B.** $y = -4x + 6$ **C.** $y = -4x + 2$ **D.** $y = -4x + 9$ **11.** ______

12. Write an equation in slope-intercept form for the line that passes through $(1, -2)$ and $(3, 7)$.

A. $y = \frac{9}{2}x - \frac{13}{2}$ **B.** $y = \frac{9}{2}x - \frac{57}{2}$ **C.** $y = \frac{2}{9}x + \frac{13}{9}$ **D.** $y = \frac{2}{9}x - \frac{19}{3}$ **12.** ______

NAME ____________________ DATE __________ PERIOD ______

2 Chapter 2 Test, Form 2A *(continued)*

13. Write an equation for the line that passes through (0, 5) and is parallel to the line whose equation is $4x - y = 3$.

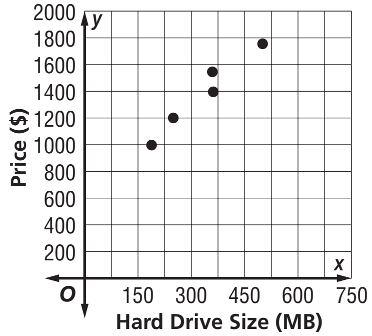
A. $y = -\frac{1}{4}x + 5$ **B.** $y = 4x - 3$ **C.** $y = \frac{1}{4}x + 5$ **D.** $y = 4x + 5$ **13.** ______

14. The table shows the relationship between height and growing times for 8 plants of the same species. Use a scatter plot to determine which data point is an outlier.

Height (inches)	15	17	18	19	20	22	23	25
Growing Time (weeks)	6	14	16	17	18	21	23	24

A. (15, 6) **B.** (17, 14) **C.** (20, 18) **D.** (25, 24) **14.** ______

15. Which equation could be a prediction equation for the data points shown in the scatter plot at the right?



A. $y = \frac{7}{4}x + 400$ **B.** $y = \frac{11}{5}x + 650$

C. $y = 5x + 600$ **D.** $y = \frac{3}{2}x + 800$ **15.** ______

16. Evaluate $f\left(\frac{3}{4}\right)$ if $f(x) = [\![1 - 2x]\!]$.

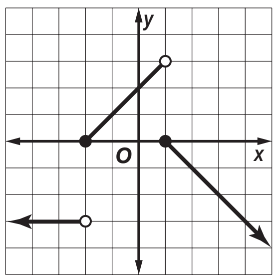
A. 0 **B.** -2 **C.** -1 **D.** 1 **16.** ______

17. Identify the range of $y = |x| - 4$.

A. $\{x \mid x \geq 4\}$ **B.** $\{y \mid y \geq -4\}$

C. $\{y \mid y \geq 0\}$ **D.** all real numbers **17.** ______

18. Which is *not* part of the definition of the piecewise function shown?



A. -3 if $x < -2$

B. $x + 2$ if $-2 \leq x < 1$

C. $x - 3$ if $x < -2$

D. $-x + 1$ if $x \geq 1$ **18.** ______

19. The graph of the linear inequality $y \leq -\frac{2}{3}x + 2$ is the region ___?___ the graph of $y = -\frac{2}{3}x + 2$.

A. above **B.** below **C.** on or above **D.** on or below **19.** ______

20. Which point satisfies the inequality $y \leq |-x + 3|$?

A. (3, 6) **B.** $(-2, 4)$ **C.** (5, 7) **D.** (1, 4) **20.** ______

Bonus Find the value of k so that the slope of the line through $(2, -k)$ and $(-1, 4)$ is -3. **B:** ____________

NAME ______________________ DATE ____________ PERIOD ______

2 Chapter 2 Test, Form 2B

SCORE ______

Write the letter for the correct answer in the blank at the right of each question.

1. Find the range of the relation {(−1, 4), (2, 5), (3, 5)}. Then determine whether the relation is a function.

A. {−1, 2, 3}; function **B.** {−1, 2, 3}; not a function
C. {4, 5}; function **D.** {4, 5}; not a function **1.** ______

2. Find $f(-1)$ if $f(x) = \frac{x^2 - 6x}{x + 2}$.

A. -5 **B.** $-\frac{5}{3}$ **C.** $\frac{7}{3}$ **D.** 7 **2.** ______

3. Find $f(a)$ if $f(t) = 2t^2 - t - 2$.

A. $2(t + a)^2 - 2t + a - 2$ **B.** $2(t + a)^2 - 2(t + a) - 2$
C. $2a^2 - a - 2$ **D.** $4a^2 - 2a - 2$ **3.** ______

4. Which equation is linear?

A. $x = -2$ **B.** $y = 3x^2 + 1$ **C.** $y < 5x - 2$ **D.** $y^2 = \frac{1}{2}x + 3$ **4.** ______

5. Write $-3y = -1 + 5x$ in standard form.

A. $-5x - 3y = 1$ **B.** $5x + 3y = 1$ **C.** $y = -\frac{5}{3}x - 1$ **D.** $3x + 5y - 1 = 0$ **5.** ______

Assessment

6. Find the x-intercept and the y-intercept of the graph of $4x - 2y = 8$.

A. (2, −4) **B.** −4; 2 **C.** (4, −2) **D.** 2; −4 **6.** ______

7. Find the slope of a line that passes through (2, 4) and (−7, 8).

A. $-\frac{4}{9}$ **B.** $-\frac{4}{5}$ **C.** $\frac{5}{4}$ **D.** $-\frac{9}{4}$ **7.** ______

8. What is the slope of the line $x = -2$?

A. -2 **B.** 0 **C.** $\frac{1}{2}$ **D.** undefined **8.** ______

9. What is the slope of a line that is parallel to the graph of $2x - 3y = 6$?

A. $\frac{3}{2}$ **B.** $-\frac{2}{3}$ **C.** $\frac{2}{3}$ **D.** $-\frac{3}{2}$ **9.** ______

10. The graph of the line through (2, 3) that is perpendicular to the line with equation $x = -1$ also goes through which point?

A. (0, −1) **B.** (−2, 3) **C.** (2, −4) **D.** (1, 4) **10.** ______

11. Write an equation in slope-intercept form for the line that has a slope of 3 and passes through (−1, 2).

A. $y = 3x - 1$ **B.** $y = 3x - 5$ **C.** $y = 5x + 3$ **D.** $y = 3x + 5$ **11.** ______

12. Write an equation in slope-intercept form for the line that passes through (−1, −2) and (3, −7).

A. $y = \frac{5}{4}x - \frac{3}{4}$ **B.** $y = -\frac{4}{5}x - \frac{6}{5}$ **C.** $y = \frac{4}{5}x - \frac{6}{5}$ **D.** $y = -\frac{5}{4}x - \frac{13}{4}$ **12.** ______

2 Chapter 2 Test, Form 2B *(continued)*

13. Write an equation for the line that passes through (0, −2) and is parallel to the line whose equation is $3x + 5y = 3$.

A. $y = -\frac{3}{5}x - 2$ **B.** $y = 3x - 2$ **C.** $y = \frac{3}{5}x + 2$ **D.** $y = -3x + 2$ **13.** ______

14. The table shows the relationship between the number of hours practiced and the number of free throws made by 6 players. Use a scatter plot to determine which data point is an outlier.

Hours Practiced	1	3	4	6	7	12
Free Throws Made	0	4	6	9	16	18

A. (1, 0) **B.** (3, 4) **C.** (7, 16) **D.** (12, 18) **14.** ______

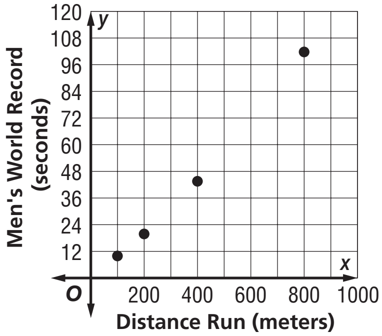
15. Which equation could be a prediction equation for the data points shown in the scatter plot at the right?

A. $y = 10x - 6$

B. $y = -\frac{1}{10}x + 6$

C. $y = x + 6$

D. $y = \frac{1}{10}x - 6$ **15.** ______



Source: *The World Almanac*

16. Evaluate $f\left(-\frac{3}{4}\right)$ if $f(x) = [\![2x - 1]\!]$.

A. 1 **B.** −3 **C.** −1 **D.** −2 **16.** ______

17. Identify the domain of $y = 3|x + 2|$.

A. all real numbers **B.** $\{x \mid x \geq 2\}$

C. $\{y \mid y \geq 0\}$ **D.** $\{y \mid y \geq 2\}$ **17.** ______

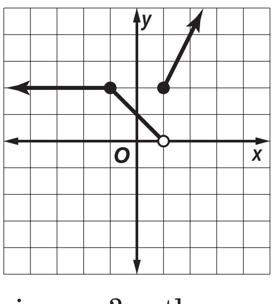
18. Which is not part of the definition of the piecewise function shown?

A. 2 if $x \leq -1$

B. $x + 1$ if $-1 < x < 1$

C. $-x + 1$ if $-1 \leq x < 1$

D. $2x$ if $x \geq 1$ **18.** ______



19. The graph of the linear inequality $y \geq 3x - 1$ is the region __?__ the graph of $y = 3x - 1$.

A. above **B.** below **C.** on or above **D.** on or below **19.** ______

20. Which point satisfies the inequality $y < -|x + 2|$?

A. (−1, −1) **B.** (1, 0) **C.** (−4, −3) **D.** (3, 2) **20.** ______

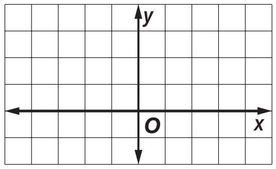
Bonus Find the value of k so that the slope of the line through (2, $-k$) and (−1, 4) is 4. **B:** ____________

NAME ____________________ DATE ____________ PERIOD ________

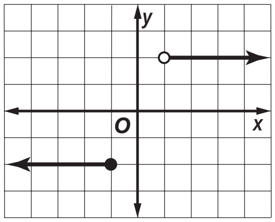
2 Chapter 2 Test, Form 2C

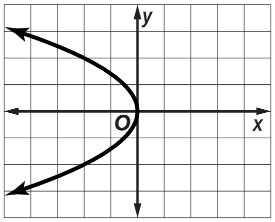
SCORE ________

1. Graph the relation {(−3, 3), (−3, 2), (−3, 1), (−3, 0)} and find the domain and range. Then determine whether the relation is a function.

1. 

Determine whether each relation is a function.

2. 

3. 

2. ____________

3. ____________

Find each value if $f(x) = 10x + 3x^2$ and $g(x) = 5x^2 - 8x$.

4. $f(-3)$

5. $g(a)$

4. ____________

5. ____________

For Questions 6 and 7, state whether each equation or function is linear. If no, explain your reasoning.

6. $f(x) = \frac{1}{x + 3}$

7. $y - 3x = 10$

6. ____________

7. ____________

8. Write the equation $\frac{5}{2}x - 9 = 8y$ in standard form. Identify A, B, and C.

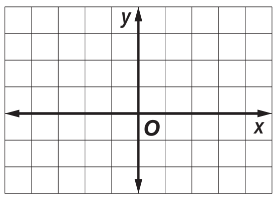
8. ____________

9. Find the x-intercept and the y-intercept of the graph of $3y = 2x - 6$.

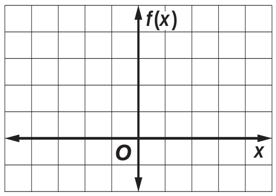
9. ____________

For Questions 10–13, graph each equation or inequality.

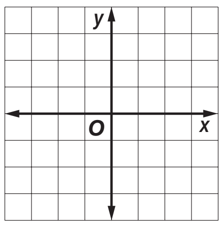
10. $y - 3x = 2$

10. 

11. $f(x) = \begin{cases} 1 - x \text{ if } x < 2 \\ 3 \text{ if } x \geq 2 \end{cases}$

11. 

12. $x \geq 2 - \frac{1}{2}y$

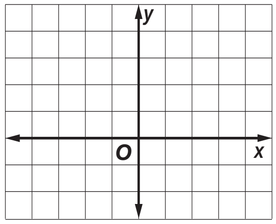
12. 

Assessment

2 Chapter 2 Test, Form 2C *(continued)*

13. $y > |-2x + 2|$

13.

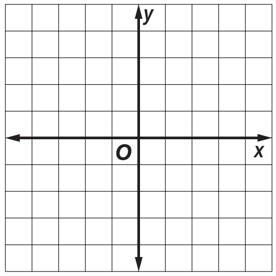


14. Find the slope of the line that passes through $(-7, 9)$ and $(-6, -5)$.

14. ____________

15. Graph the line passing through (2, 4) that is perpendicular to the graph of $y = -3$.

15.



16. Write an equation in slope-intercept form for the line that has a slope of 2 and passes through $(1, -5)$.

16. ____________

17. Write an equation for the line that passes through $(-2, 3)$ and is parallel to the line whose equation is $3x + 2y = 6$.

17. ____________

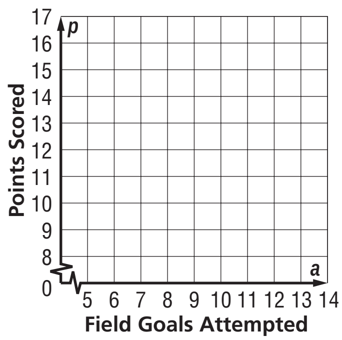
For Questions 18 and 19, use the set of data in the table.

The table below shows the relationship between the number of field goals attempted and the number of points scored by one basketball player over a 6-game period.

Field Goals Attempted (*a*)	8	6	10	9	7	10
Points Scored (*p*)	12	9	14	14	11	15

18. Draw a scatter plot for the data.

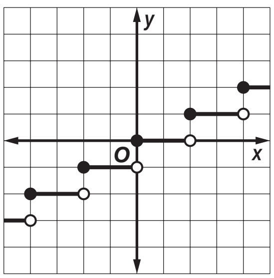
18.



19. Use two ordered pairs to write a prediction equation. Then use your prediction equation to predict the number of points scored when 20 field goals are attempted.

19. ____________

20. Determine whether the graph represents a *step function*, a *constant function*, the *identity function*, an *absolute value function*, or a *piecewise function*. Then identify the domain and range.



20. ____________

Bonus Find the value of k so that the slope of the line through $(2, -k)$ and $(-1, 4)$ is 1.

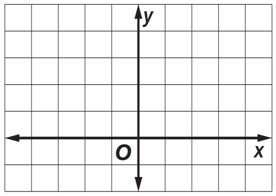
B: ____________

NAME ________________ DATE ________ PERIOD ____

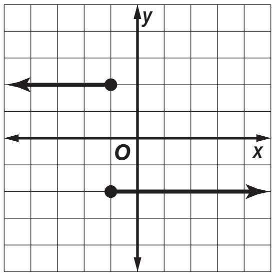
2 Chapter 2 Test, Form 2D

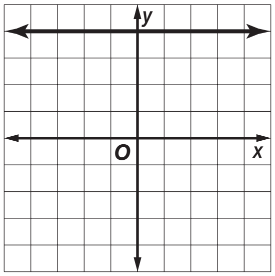
SCORE ______

1. Graph the relation {(0, 0), (2, 4), (−4, 0), (4, 0)} and find the domain and range. Then determine whether the relation is a function.

1.


Determine whether each relation is a function.

2.


3.


2. ________________

3. ________________

Find each value if $f(x) = -3x + 2x^2$ and $g(x) = -4x^2 + 2x - 3$.

4. $f(-2)$

5. $g(a)$

4. ________________

5. ________________

For Questions 6 and 7, state whether each equation or function is linear. If no, explain your reasoning.

6. $f(x) = 100x - 37$

7. $xy - 60 = 0$

6. ________________

7. ________________

8. Write $\frac{2x - 1}{7} = 8y$ in standard form. Identify A, B, and C.

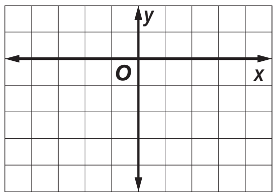
8. ________________

9. Find the x-intercept and the y-intercept of the graph of $4y - 12 = 3x$.

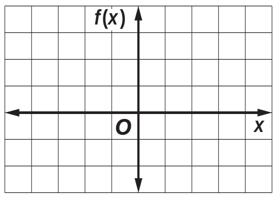
9. ________________

For Questions 10–13, graph each equation or inequality.

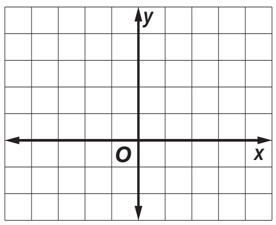
10. $3y = 2x - 9$

10.


11. $f(x) = \begin{cases} -2 \text{ if } x \leq -2 \\ x + 3 \text{ if } x > -2 \end{cases}$

11.


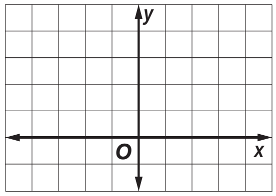
12. $x > 2y - 4$

12.


Assessment

2 Chapter 2 Test, Form 2D *(continued)*

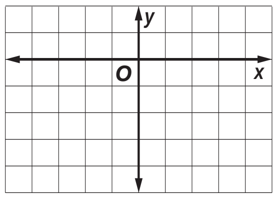
13. $y \leq |x + 1|$

13. 

14. Find the slope of the line that passes through (2, 18) and (4, −2).

14. ____________________

15. Graph the line passing through (3, −2) that is perpendicular to the graph of $x = -3$.

15. 

16. Write an equation in slope-intercept form for the line that has a slope of −1 that passes through (−4, 3).

16. ____________________

17. Write an equation for the line that passes through (2, −5) and is parallel to the line whose equation is $5x + 2y = 6$.

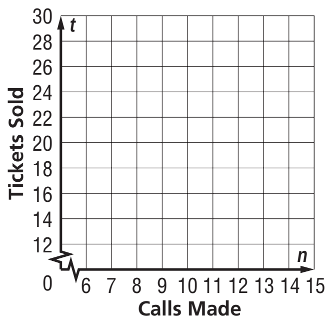
17. ____________________

For Questions 18 and 19, use the set of data in the table.

The table below shows the relationship between the number of phone calls made and the number of tickets sold during a fundraising campaign by 6 callers.

Calls Made (*n*)	8	9	7	8	6	12
Tickets Sold (*t*)	16	17	15	15	12	25

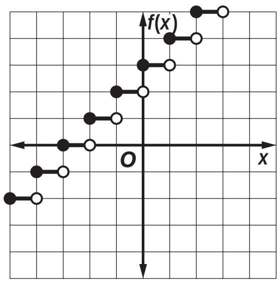
18. Draw a scatter plot for the data.

18. 

19. Use two ordered pairs to write a prediction equation. Then use your prediction equation to predict the number of tickets sold when 16 calls are made.

19. ____________________

20. Determine whether the graph represents a *step function*, a *constant function*, the *identity function*, an *absolute value function*, or a *piecewise function*. Then identify the domain and range.



20. ____________________

Bonus Find the value of k so that the slope of the line through $(2, -k)$ and $(4, -1)$ is -2.

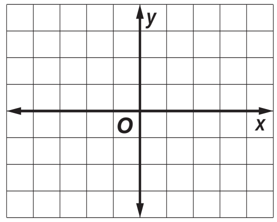
B: ____________________

NAME ______________________ DATE ____________ PERIOD ________

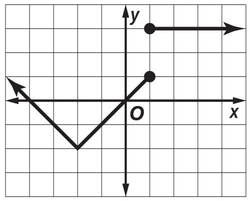
2 Chapter 2 Test, Form 3

SCORE ________

1. Graph the relation $x = 1 - y^2$ and find the domain and range. Then determine whether the relation is a function.

1. 

2. Determine whether the relation shown at the right is a function.



2. ____________

3. Find $f(-2)$ if $f(x) = \dfrac{2x^3 + 4x}{|1 - x^2|}$.

3. ____________

4. If $f(2b - 1) = 6b + 2$, find $f(x)$.

4. ____________

5. State whether each equation or function is linear.

A. $f(x) = \dfrac{3x - 14}{5}$ **B.** $3x - xy = y$

5. ____________

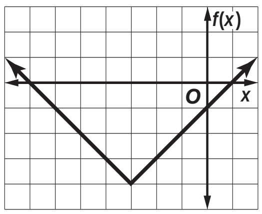
6. Write $\dfrac{2.5x - 0.3}{3} = \dfrac{1}{6}y$ in standard form. Identify A, B, and C.

6. ____________

7. Find the x-intercept and the y-intercept of the graph of $2(y + 0.5) = 3.5x + 2y$.

7. ____________

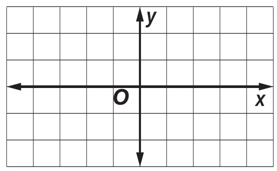
8. Determine whether the graph at the right represents a step function, a constant function, an absolute value function, or a piecewise function.



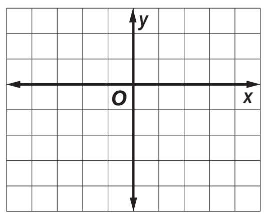
8. ____________

For Questions 9 and 10, graph each equation.

9. $2y + 1 = 0.8x$

9. 

10. $y = \left[\!\left[\frac{1}{2}x - 1\right]\!\right]$

10. 

11. Determine the value of t so that the line through $(1.6, t)$ and $(2, 5)$ has slope $-\frac{3}{2}$.

12. The median weekly earnings for American workers in 1990 was \$412 and in 1999 it was \$549. Calculate the average rate of change between 1990 and 1999.

11. ____________

12. ____________

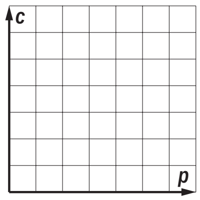
Assessment

2 Chapter 2 Test, Form 3 *(continued)*

13. Write an equation for the line that passes through $(5, -4)$ and is perpendicular to the graph of $5x - 2y = -6$. **13.** ____________

14. Write an equation in slope-intercept form of the line through $\left(-\frac{1}{4}, \frac{5}{3}\right)$ and $\left(\frac{1}{2}, -\frac{4}{3}\right)$. **14.** ____________

15. Sweets Bakery charges $12 for each pie and $15 for each cake. Yesterday, the bakery took in no more than $360 for sales of pies and cakes. Write an inequality to represent the situation, where p is the number of pies sold and c is the number of cakes sold. Then graph the inequality. **15.** ____________

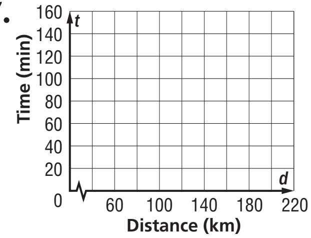


16. Write an equation in standard form for the line that is perpendicular to the graph of $\frac{1}{5}x + \frac{2}{5}y = 0.05$ and has the same y-intercept as the graph of $-0.8x + 1.2y = -0.6$. **16.** ____________

For Questions 17 and 18, use the set of data in the table. The table below shows the relationship between distance traveled and elapsed time.

Distance *d* (km)	40	75	110	150	160	200
Time *t* (min)	30	60	80	110	150	150

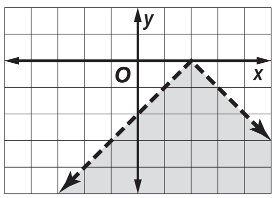
17.



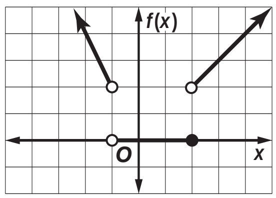
17. Draw a scatter plot for the data. Then identify any outliers.

18. Use two ordered pairs to write a prediction equation. Then use your prediction equation to predict the time for a distance of 160 kilometers. Compare your prediction to the one given in the table. **18.** ____________

19. Write an absolute value inequality for the graph at the right. **19.** ____________



20. Write the function shown in the graph at the right. **20.** ____________



Bonus Find the value of k so that the graph of $kx + 3y = 4$ is parallel to the line through $(2, -k)$ and $(4, -1)$. **B:** ____________

NAME ______________________ DATE ____________ PERIOD ______

2 Chapter 2 Open-Ended Assessment

SCORE ______

Demonstrate your knowledge by giving a clear, concise solution to each problem. Be sure to include all relevant drawings and justify your answers. You may show your solutions in more than one way or investigate beyond the requirements of the problem.

1. Explain two ways to determine whether a relation is a function. Use specific examples. Then write a relation that is *not* a function.

2. Give an example of a real-world situation for which there would be a negative rate of change.

3. The point-slope form of the equation of a line is $y - 2 = \frac{1}{2}(x + 6)$.

Write the equation in slope-intercept form, then write the equation in standard form. Which of the three forms of the equation is most useful? Explain your choice.

4. Suppose you are looking at a scatter plot and the graph of a line of fit for the data points. The horizontal axis is labeled 1990, 1991, …, 2000. The vertical axis is labeled 0, 10, …, 100. You use a prediction equation to predict values for the years 1994 and 2005. Which prediction do you think would be more accurate? Why ?

5. Compare the graph of the parent function $f(x) = |x|$ with the graphs of the functions $g(x) = |x + 2|$ and $h(x) = |x - 3|$. How are the graphs similar? How are they different? How would the graph of $y = |x + 500|$ compare with the graph of the parent function?

6. When graphing the linear inequality $y \leq -2 + 5$, Alessia first graphed the line $y = -2x + 5$. She then selected the test point $(-1, 7)$ in order to complete her graph. Why did Alessia need a test point? What information did the point $(-1, 7)$ give Alessia about her graph?

7. Is the graph of the relation $y > |x + 3|$ a function? Explain.

Assessment

NAME ______________________ DATE __________ PERIOD _____

2 Chapter 2 Vocabulary Test/Review

SCORE _____

absolute value function	linear equation	rate of change
boundary	linear function	relation
Cartesian coordinate plane	line of fit	scatter plot
constant function	mapping	slope
dependent variable	one-to-one function	slope-intercept form
domain	ordered pair	standard form
family of graphs	parent graph	step function
function	piecewise function	vertical line test
functional notation	point-slope form	*x*-intercept
greatest integer function	prediction equation	*y*-intercept
identity function	quadrant	
independent variable	range	

Write the letter of the term that best describes each example.

_____ **1.** $f(x) = 6$

_____ **2.** $3x + 5y = 2$

_____ **3.** $f(x) = |4x + 3|$

_____ **4.** $y = -5x + 10$

_____ **5.** $(-12, 8)$

_____ **6.** $f(x) = [\![x]\!] + 1$

_____ **7.** $y - 5 = -2(x + 3)$

_____ **8.** $f(x) = \begin{cases} x + 3 \text{ if } x < 0 \\ 2 - x \text{ if } x \geq 0 \end{cases}$

_____ **9.** $\frac{8 - 5}{3 - (-1)} = \frac{3}{4}$

_____ **10.** {3, 4, 5} for the function {(0, 4), (2, 5), (3, 3)}

a. ordered pair
b. point-slope form
c. step function
d. range
e. constant function
f. piecewise function
g. slope-intercept form
h. absolute value function
i. standard form
j. slope

In your own words—
Define each term.

11. vertical line test

12. linear function

NAME ______________________ DATE ____________ PERIOD ________

2 Chapter 2 Quiz

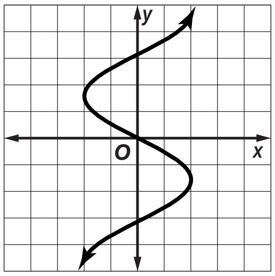
SCORE ________

(Lessons 2–1 and 2–2)

1. Find the domain and range of $x + y = 1$. Then determine whether it is a function. **1.** ______________

Determine whether the relation shown in the graph is a function.

2.



3. Find $f(4)$ if $f(x) = \dfrac{x^2 + 9}{x + 1}$.

2. ______________

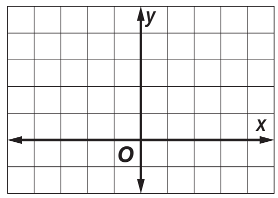
3. ______________

4. ______________

5. ______________

4. Write $x + 2 = \frac{1}{5}y$ in standard form. Identify A, B, and C.

5. Find the x-intercept and the y-intercept of the graph of $3x + 4y = 12$. Then graph the equation.



Assessment

NAME ______________________ DATE ____________ PERIOD ________

2 Chapter 2 Quiz

SCORE ________

(Lessons 2–3 and 2–4)

For Questions 1 and 2, find the slope of the line that passes through each pair of points.

1. ______________

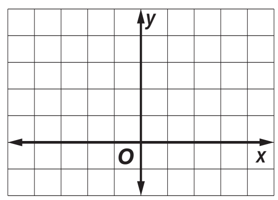
1. (2, 4), (4, 7)

2. $\left(\frac{1}{2}, -4\right), \left(\frac{1}{2}, 5\right)$

2. ______________

3. Graph the line passing through (2, 4) that is parallel to the graph of $x - 3y = 6$.

3.



4. Standardized Test Practice Which is an equation of the line that has a slope of $-\frac{2}{3}$ and passes through $(-1, 3)$?

A. $y = \frac{3}{2}x + \frac{7}{3}$ **B.** $y = -\frac{2}{3}x + \frac{7}{3}$

C. $y = -\frac{2}{3}x + 1$ **D.** $y = -\frac{2}{3}x + \frac{11}{3}$

4. ______________

5. Write an equation for the line that passes through (3, 5) and is perpendicular to the line whose equation is $y = \frac{1}{2}(x + 2)$.

5. ______________

NAME ____________ DATE ________ PERIOD ______

2 Chapter 2 Quiz

SCORE ______

(Lessons 2–5 and 2–6)

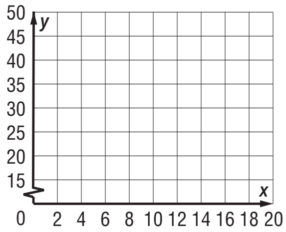
For Questions 1 and 2, use the set of data in the table.

x	2	5	10	15	20	30
y	1	25	21	32	41	?

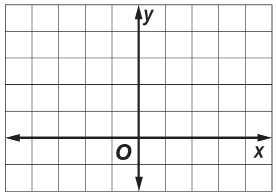
1. Draw a scatter plot for the data. Then state which of the data points is an outlier.

2. Use two ordered pairs to write a prediction equation. Then use your prediction equation to predict the missing value.

3. $f(x) = |x - 2|$. Identify the domain and range.

1.


2. ____________

3.


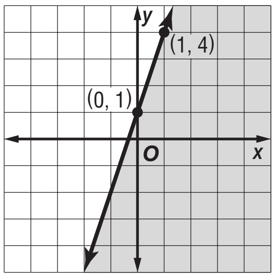
NAME ____________ DATE ________ PERIOD ______

2 Chapter 2 Quiz

SCORE ______

(Lesson 2–7)

1. Write an inequality for the graph shown.



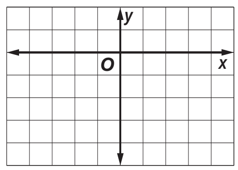
Graph each inequality.

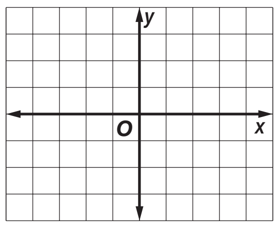
2. $y \geq -2$

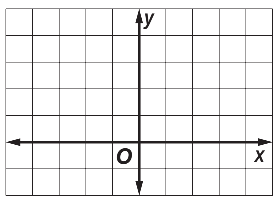
3. $6 - 2y < 3x$

4. $y > |-2x|$

1. ____________

2.


3.


4.


NAME ______________________ DATE ____________ PERIOD ______

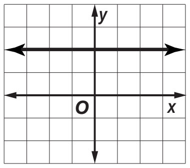
Chapter 2 Mid-Chapter Test

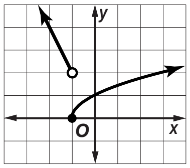
SCORE ______

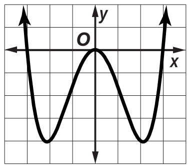
(Lessons 2–1 through 2–4)

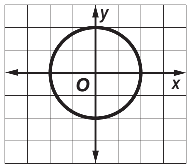
Part I ***Write the letter for the correct answer in the blank at the right of each question.***

1. Which of the following relations is *not* a function?

A. 

B. 

C. 

D. 

1. ______

2. Which equation or function is linear?

A. $y = \frac{3}{x + 1}$ **B.** $f(x) = \frac{2}{3}(1 - x)^2$ **C.** $2y = \frac{2x - 1}{4}$ **D.** $3xy = 4$ **2.** ______

3. Write an equation in standard form for the line that is parallel to the graph of $-8x = 5 - 4y$ and has y-intercept -0.5.

A. $x - 0.5y = 0.25$ **B.** $10x - 5y = 2.5$ **C.** $4x - 2y = 1$ **D.** $2x - y = 1$ **3.** ______

4. Find the slope of the line that passes through $\left(-4.5, \frac{7}{2}\right)$ and (3, 3.5).

A. $-\frac{1}{6}$ **B.** -6 **C.** undefined **D.** 0 **4.** ______

5. The graphs of which pair of lines are perpendicular?

A. $2x - 3y = 12, y = -\frac{2}{3}x + 5$ **B.** $3x + 2y = 6, 2x - 3y = 7$

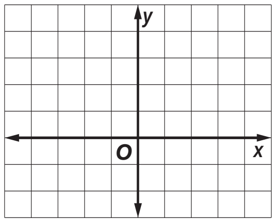
C. $y = 4x + 13, y = \frac{1}{4}x - 13$ **D.** $x + y = 1, 2y = -2x + 2$ **5.** ______

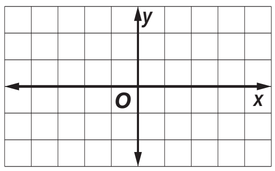
Part II

Graph each relation and find the domain and range. Then determine whether the relation is a function.

6. $\{(2, 4), (4, -2), (1, 3), (0, 3)\}$

7. $y = 2x - 3$

6. 

7. 

For Questions 8 and 9, find each value if $f(x) = -3x^3 + 2x^2$.

8. $f(-1)$ **9.** $f\left(\frac{1}{2}\right)$

8. ______________

9. ______________

10. Write an equation in slope-intercept form for the line that has a slope of $-\frac{1}{3}$ and passes through $(-6, 1)$.

10. ______________

Assessment

NAME ______________________ DATE __________ PERIOD ______

2 Chapter 2 Cumulative Review

(Chapters 1 and 2)

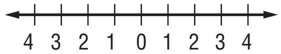
1. Evaluate $\frac{7a - 2c}{a^2 + b}$ if $a = 3$, $b = 2$, and $c = 5$. (Lesson 1-1) **1.** __________

2. Name the sets of numbers to which -42.1 belongs. (Lesson 1-2) **2.** __________

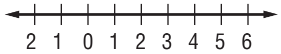
3. Solve $3|7 - a| = 12$. Check each solution. (Lesson 1-4) **3.** __________

For Questions 4 and 5, solve each inequality. Graph the solution set.

4. $2(3x - 1) \leq 5x - 3$ (Lesson 1-5) **4.** __________



5. $-6 \leq 2(y - 1) < 10$ (Lesson 1-6) **5.** __________



6. Find the domain and range of the relation. Then determine whether the relation is a function.
$\{(4, -7), (3, -7), (2, 0), (4, 0)\}$ (Lesson 2-1) **6.** __________

7. Find $f(-7)$ if $f(x) = 2x^2 - 3x$. (Lesson 2-1) **7.** __________

8. Find the x-intercept and the y-intercept of the graph of $3x - 4y = 8$. (Lesson 2-2) **8.** __________

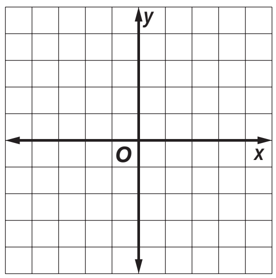
9. Find the slope of the line whose graph is perpendicular to the graph of $2x - 5y = 7$. (Lesson 2-3) **9.** __________

10. Write an equation in slope-intercept form for the line that has a slope of -4 and passes through $(3, -5)$. (Lesson 2-4) **10.** __________

11. The prediction equation $y = 5.92x + 119.21$ models the median selling price, in thousands of dollars, of new homes in a certain area since 1995. Predict the median selling price in 2015. (Lesson 2-5) **11.** __________

12. Identify the domain and range of the piecewise function
$h(x) = \begin{cases} x + 5 \text{ if } x \leq -2 \\ -4x \text{ if } x > -2 \end{cases}$. (Lesson 2-6) **12.** __________

13. Graph $y > -\frac{4}{5}x + 1$. (Lesson 2-7) **13.**



NAME ______________________ DATE ____________ PERIOD ______

2 Standardized Test Practice

(Chapters 1 and 2)

Part 1: Multiple Choice

Instructions: Fill in the appropriate oval for the best answer.

1. If the perimeter of a rectangle is 96 inches and the length is 4 inches longer than the width, what is the area?

A. 22 in^2 **B.** 26 in^2 **C.** 230 in^2 **D.** 572 in^2

1. (A) (B) (C) (D)

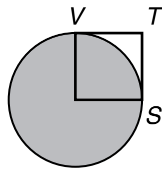
2. For what values of a will $3a - 1$ be equal to $3a + 10$?

E. all negative values **F.** 0

G. all positive values **H.** no values

2. (E) (F) (G) (H)

3. In the figure at the right, if *RSTV* is a square with perimeter 24, what is the area of the circle with center *R*?



A. 6π **B.** 36π

C. 12π **D.** 144π

3. (A) (B) (C) (D)

4. In a group of 20 students, 12 belonged to the band, 7 belonged to the choir, and 5 belonged to both the band and the choir. How many students did not belong to either the band or the choir?

E. 1 **F.** 2 **G.** 6 **H.** 14

4. (E) (F) (G) (H)

5. A point on the graph of $2x - 2y = 12$ is __?__.

A. $(-3, -3)$ **B.** $(-3, 3)$ **C.** $(3, 3)$ **D.** $(3, -3)$

5. (A) (B) (C) (D)

6. If $x - y = 6$ and $3x - 10 = 2y$, what is the value of y?

E. -8 **F.** -4 **G.** 4 **H.** 8

6. (E) (F) (G) (H)

7. Which is equal to $x^3 - 8$?

A. $(x - 2)(x^2 + 4x + 4)$ **B.** $(x - 2)(x^2 + 2x + 4)$

C. $(x + 2)(x^2 - 4x + 4)$ **D.** $(x + 2)(x^2 - 2x + 4)$

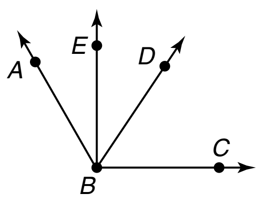
7. (A) (B) (C) (D)

8. In the sequence 1, 3, 12, 60, 360, ___, ___, ___, the eighth term is __?__.

E. 2520 **F.** 2880 **G.** 20,160 **H.** 181,440

8. (E) (F) (G) (H)

9. If $m\angle ABD = 65°$, $m\angle EBC = 70°$, and $m\angle ABC = 115°$, find $m\angle EBD$.



A. 5° **B.** 20°

C. 45° **D.** 50°

9. (A) (B) (C) (D)

10. 8 less than a is 6 more than c. Thus, c expressed in terms of a is __?__.

E. $\frac{a - 8}{6}$ **F.** $a - 2$ **G.** $a - 14$ **H.** $2 - a$

10. (E) (F) (G) (H)

NAME ______________________ DATE ____________ PERIOD ______

2 Standardized Test Practice *(continued)*

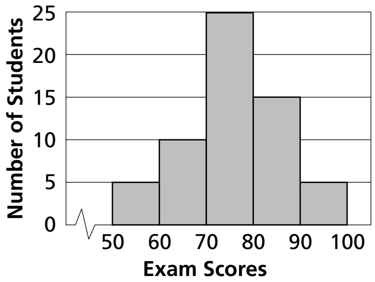
Part 2: Grid In

Instructions: Enter your answer by writing each digit of the answer in a column box and then shading in the appropriate oval that corresponds to that entry.

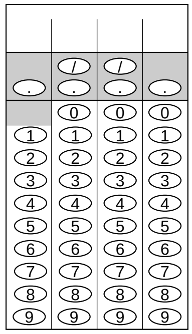
11. A shoe salesperson sold 20 pairs of shoes for \$640. A brown pair of shoes sells for \$30 and a black pair for \$35. How many brown pairs were sold?

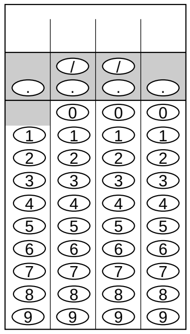
12. How many integers between 299 and 501 are divisible by 2 or 5?

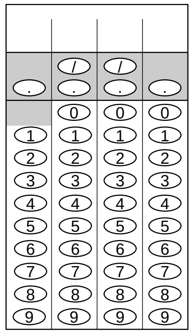
13. The histogram shows the distribution of mid-term exam scores for Ms. Hawkins' three algebra classes. What percent of her students scored at least 70?

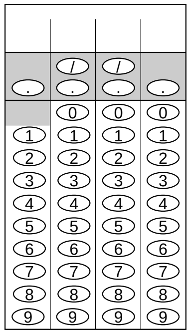


14. If $3^{x-2} = 81$, what is the value of 2^{2x-7}?

11.


12.


13.


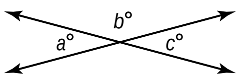
14.


Part 3: Quantitative Comparison

Instructions: Compare the quantities in columns A and B. Shade in
- (A) if the quantity in column A is greater;
- (B) if the quantity in column B is greater;
- (C) if the quantities are equal; or
- (D) if the relationship cannot be determined from the information given.

	Column A		Column B	
15.	$3(6)(0) - 14$		$8(4 - 3) - 6$	**15.** (A) (B) (C) (D)
16.		$8 > 7 + y$		
	$2y + 2$		$4y - 10$	**16.** (A) (B) (C) (D)
17.	$-4(c + c)$		$(c)(c)(c)(c)$	**17.** (A) (B) (C) (D)

18.



, $a + b + c = 4a$

Column A	Column B	
c	b	**18.** (A) (B) (C) (D)

NAME ________________ DATE ________ PERIOD ______

2 Standardized Test Practice

Student Record Sheet *(Use with pages 106–107 of the Student Edition.)*

Part 1 *Multiple Choice*

Select the best answer from the choices given and fill in the corresponding oval.

1 (A) (B) (C) (D)
2 (A) (B) (C) (D)
3 (A) (B) (C) (D)
4 (A) (B) (C) (D)
5 (A) (B) (C) (D)
6 (A) (B) (C) (D)
7 (A) (B) (C) (D)
8 (A) (B) (C) (D)
9 (A) (B) (C) (D)

Part 2 *Short Response/Grid In*

Solve the problem and write your answer in the blank.

For Questions 11–17, also enter your answer by writing each number or symbol in a box. Then fill in the corresponding oval for that number or symbol.

10 ________

11 ________

12 ________

13 ________

14 ________

15 ________

16 ________

17 ________

Part 3 *Quantitative Comparison*

Select the best answer from the choices given and fill in the corresponding oval.

18 (A) (B) (C) (D)
19 (A) (B) (C) (D)
20 (A) (B) (C) (D)
21 (A) (B) (C) (D)
22 (A) (B) (C) (D)

Answers

NAME ______________________ DATE ____________ PERIOD _____

2-1 Study Guide and Intervention

Relations and Functions

Graph Relations A **relation** can be represented as a set of ordered pairs or as an equation; the relation is then the set of all ordered pairs (x, y) that make the equation true. The **domain** of a relation is the set of all first coordinates of the ordered pairs, and the **range** is the set of all second coordinates.

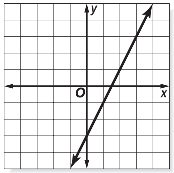
A **function** is a relation in which each element of the domain is paired with exactly one element of the range. You can tell if a relation is a function by graphing, then using the **vertical line test**. If a vertical line intersects the graph at more than one point, the relation is not a function.

Example **Graph the equation $y = 2x - 3$ and find the domain and range. Does the equation represent a function?**

Make a table of values to find ordered pairs that satisfy the equation. Then graph the ordered pairs.

The domain and range are both all real numbers. The graph passes the vertical line test, so it is function.

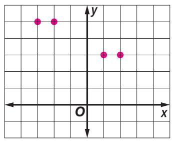
x	y
−1	−5
0	−3
1	−1
2	1
3	3



Exercises

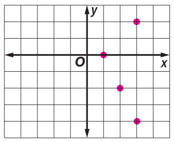
Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

1. {(1, 3), (−3, 5), (−2, 5), (2, 3)}



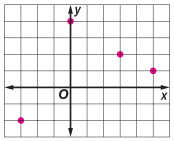
D = {−3, −2, 1, 2}, R = {3, 5}; yes

2. {(3, −4), (1, 0), (2, −2), (3, 2)}



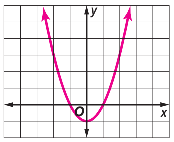
D = {1, 2, 3}, R = {−4, −2, 0, 2}; no

3. {(0, 4), (−3, −2), (3, 2), (5, 1)}



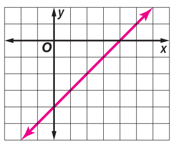
D = {−3, 0, 3, 5}, R = {−2, 1, 2, 4}; yes

4. $y = x^2 - 1$



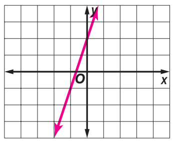
D = all reals, R = {y | y ≥ −1}; yes

5. $y = x - 4$



D = all reals, R = all reals; yes

6. $y = 3x + 2$



D = all reals, R = all reals; yes

NAME ______________________ DATE ____________ PERIOD _____

2-1 Study Guide and Intervention *(continued)*

Relations and Functions

Equations of Functions and Relations Equations that represent functions are often written in **functional notation**. For example, $y = 10 - 8x$ can be written as $f(x) = 10 - 8x$. This notation emphasizes the fact that the values of y, the **dependent variable**, depend on the values of x, the **independent variable**.

To evaluate a function, or find a functional value, means to substitute a given value in the domain into the equation to find the corresponding element in the range.

Example **Given the function $f(x) = x^2 + 2x$, find each value.**

a. $f(3)$

$f(x) = x^2 + 2x$ Original function

$f(3) = 3^2 + 2(3)$ Substitute.

$= 15$ Simplify.

b. $f(5a)$

$f(x) = x^2 + 2x$ Original function

$f(5a) = (5a)^2 + 2(5a)$ Substitute.

$= 25a^2 + 10a$ Simplify.

Exercises

Find each value if $f(x) = -2x + 4$.

1. $f(12)$ **−20** **2.** $f(6)$ **−8** **3.** $f(2b)$ $\mathbf{-4b + 4}$

Find each value if $g(x) = x^3 - x$.

4. $g(5)$ **120** **5.** $g(-2)$ **−6** **6.** $g(7c)$ $\mathbf{343c^3 - 7c}$

Find each value if $f(x) = 2x + \frac{2}{x}$ and $g(x) = 0.4x^2 - 1.2$.

7. $f(0.5)$ **5** **8.** $f(-8)$ $\mathbf{-16\frac{1}{4}}$ **9.** $g(3)$ **2.4**

10. $g(-2.5)$ **1.3** **11.** $f(4a)$ $\mathbf{8a + \frac{1}{2a}}$ **12.** $g\left(\frac{b}{2}\right)$ $\mathbf{\frac{b^2}{10} - 1.2}$

13. $f\left(\frac{1}{3}\right)$ $\mathbf{6\frac{2}{3}}$ **14.** $g(10)$ **38.8** **15.** $f(200)$ **400.01**

Let $f(x) = 2x^2 - 1$.

16. Find the values of $f(2)$ and $f(5)$. $\mathbf{f(2) = 7, f(5) = 49}$

17. Compare the values of $f(2) \cdot f(5)$ and $f(2 \cdot 5)$. $\mathbf{f(2) \cdot f(5) = 343, f(2 \cdot 5) = 199}$

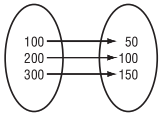
NAME ______________________ DATE __________ PERIOD _____

2-1 Skills Practice

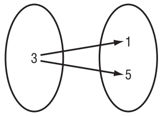
Relations and Functions

Determine whether each relation is a function. Write *yes* or *no*.

1. yes



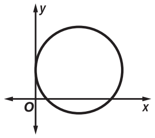
2. no



3. yes

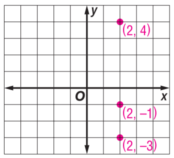
x	y
1	2
2	4
3	6

4. no



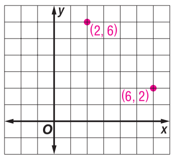
Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

5. $\{(2, -3), (2, 4), (2, -1)\}$



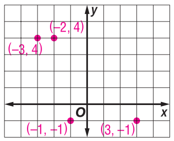
D = {2}, R = {−3, −1, 4}; no

6. $\{(2, 6), (6, 2)\}$



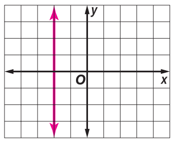
D = {2, 6}, R = {2, 6}; yes

7. $\{(-3, 4), (-2, 4), (-1, -1), (3, -1)\}$



D = {−3, −2, −1, 3}, R = {−1, 4}; yes

8. $x = -2$



D = {−2}, R = all reals; no

Find each value if $f(x) = 2x - 1$ and $g(x) = 2 - x^2$.

9. $f(0)$ **−1** **10.** $f(12)$ **23** **11.** $g(4)$ **−14**

12. $f(-2)$ **−5** **13.** $g(-1)$ **1** **14.** $f(d)$ **2d − 1**

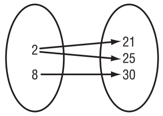
NAME ______________________ DATE __________ PERIOD _____

2-1 Practice (Average)

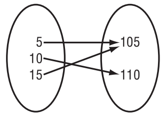
Relations and Functions

Determine whether each relation is a function. Write *yes* or *no*.

1. no



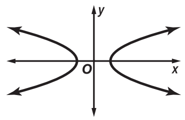
2. yes



3. yes

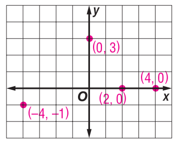
x	y
−3	0
−1	−1
0	0
2	−2
3	4

4. no



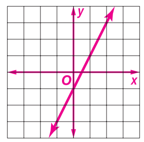
Graph each relation or equation and find the domain and range. Then determine whether the relation or equation is a function.

5. $\{(-4, -1), (4, 0), (0, 3), (2, 0)\}$



D = {−4, 0, 2, 4}, R = {−1, 0, 3}; yes

6. $y = 2x - 1$



D = all reals, R = all reals; yes

Find each value if $f(x) = \frac{5}{x + 2}$ and $g(x) = -2x + 3$.

7. $f(3)$ **1** **8.** $f(-4)$ $-\frac{5}{2}$ **9.** $g\left(\frac{1}{2}\right)$ **2**

10. $f(-2)$ **undefined** **11.** $g(-6)$ **15** **12.** $f(m - 2)$ $\frac{5}{m}$

13. MUSIC The ordered pairs (1, 16), (2, 16), (3, 32), (4, 32), and (5, 48) represent the cost of buying various numbers of CDs through a music club. Identify the domain and range of the relation. Is the relation a function? **D = {1, 2, 3, 4, 5}, R = {16, 32, 48}; yes**

14. COMPUTING If a computer can do one calculation in 0.0000000015 second, then the function $T(n) = 0.0000000015n$ gives the time required for the computer to do n calculations. How long would it take the computer to do 5 billion calculations? **7.5 s**

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2-1 Reading to Learn Mathematics

Relations and Functions

Pre-Activity **How do relations and functions apply to biology?**

Read the introduction to Lesson 2-1 at the top of page 56 in your textbook.

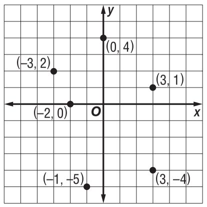
- Refer to the table. What does the ordered pair (8, 20) tell you? **For a deer, the average longevity is 8 years and the maximum longevity is 20 years.**
- Suppose that this table is extended to include more animals. Is it possible to have an ordered pair for the data in which the first number is larger than the second? **Sample answer: No, the maximum longevity must always be greater than the average longevity.**

Reading the Lesson

1. a. Explain the difference between a relation and a function. **Sample answer: A relation is any set of ordered pairs. A function is a special kind of relation in which each element of the domain is paired with exactly one element in the range.**

b. Explain the difference between domain and range. **Sample answer: The domain of a relation is the set of all first coordinates of the ordered pairs. The range is the set of all second coordinates.**

2. a. Write the domain and range of the relation shown in the graph.



D: {−3, −2, −1, 0, 3}; R: {−5, −4, 0, 1, 2, 4}

b. Is this relation a function? Explain. **Sample answer: No, it is not a function because one of the elements of the domain, 3, is paired with two elements of the range.**

Helping You Remember

3. Look up the words *dependent* and *independent* in a dictionary. How can the meaning of these words help you distinguish between independent and dependent variables in a function? **Sample answer: The variable whose values depend on, or are determined by, the values of the other variable is the dependent variable.**

Lesson 2-1

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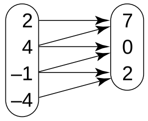
2-1 Enrichment

Mappings

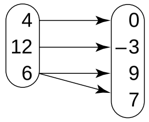
There are three special ways in which one set can be mapped to another. A set can be mapped *into* another set, *onto* another set, or can have a *one-to-one correspondence* with another set.

Into mapping	A mapping from set *A* to set *B* where every element of *A* is mapped to one or more elements of set *B*, but never to an element not in *B*.
Onto mapping	A mapping from set *A* to set *B* where each element of set *B* has at least one element of set *A* mapped to it.
One-to-one correspondence	A mapping from set *A* onto set *B* where each element of set *A* is mapped to exactly one element of set *B* and different elements of *A* are never mapped to the same element of *B*.

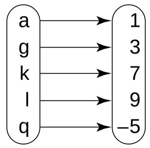
State whether each set is mapped into the second set, onto the second set, or has a one-to-one correspondence with the second set.

1.


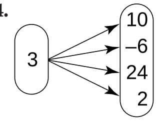
into, onto

2.


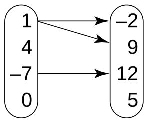
into, onto

3.


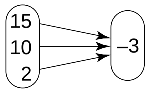
into, onto, one-to-one

4.


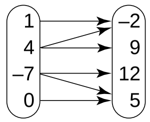
into, onto

5.


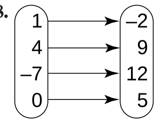
into

6.


into, onto

7.


into, onto

8.


into, onto, one-to-one

9. Can a set be mapped *onto* a set with fewer elements than it has? **yes**

10. Can a set be mapped *into* a set that has more elements than it has? **yes**

11. If a mapping from set *A* into set *B* is a one-to-one correspondence, what can you conclude about the number of elements in *A* and *B*? **The sets have the same number of elements.**

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2-2 Study Guide and Intervention

Linear Equations

Identify Linear Equations and Functions A **linear equation** has no operations other than addition, subtraction, and multiplication of a variable by a constant. The variables may not be multiplied together or appear in a denominator. A linear equation does not contain variables with exponents other than 1. The graph of a linear equation is a line.

A **linear function** is a function whose ordered pairs satisfy a linear equation. Any linear function can be written in the form $f(x) = mx + b$, where m and b are real numbers.

If an equation is linear, you need only two points that satisfy the equation in order to graph the equation. One way is to find the x-intercept and the y-intercept and connect these two points with a line.

Example 1 **Is $f(x) = 0.2 - \frac{x}{5}$ a linear function? Explain.**

Yes; it is a linear function because it can be written in the form
$f(x) = -\frac{1}{5}x + 0.2$.

Example 2 **Is $2x + xy - 3y = 0$ a linear function? Explain.**

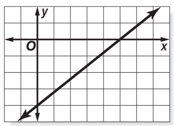
No; it is not a linear function because the variables x and y are multiplied together in the middle term.

Example 3 **Find the x-intercept and the y-intercept of the graph of $4x - 5y = 20$. Then graph the equation.**

The x-intercept is the value of x when $y = 0$.

$4x - 5y = 20$	Original equation
$4x - 5(0) = 20$	Substitute 0 for y.
$x = 5$	Simplify.

So the x-intercept is 5. Similarly, the y-intercept is -4.



Exercises

State whether each equation or function is linear. Write *yes* or *no*. If no, explain.

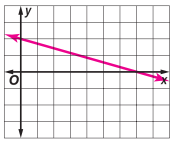
1. $6y - x = 7$ **yes**

2. $9x = \frac{18}{y}$ **No; the variable y appears in the denominator.**

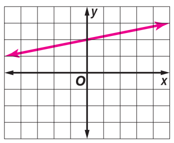
3. $f(x) = 2 - \frac{x}{11}$ **yes**

Find the x-intercept and the y-intercept of the graph of each equation. Then graph the equation.

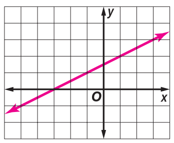
4. $2x + 7y = 14$
x-int: 7; y-int: 2



5. $5y - x = 10$
x-int: -10; y-int: 2



6. $2.5x - 5y + 7.5 = 0$
x-int: -3; y-int: 1.5



Lesson 2-2

NAME ______________________ DATE __________ PERIOD _____

2-2 Study Guide and Intervention *(continued)*

Linear Equations

Standard Form The **standard form** of a linear equation is $Ax + By = C$, where A, B, and C are integers whose greatest common factor is 1.

Example **Write each equation in standard form. Identify A, B, and C.**

a. $y = 8x - 5$

$y = 8x - 5$	Original equation
$-8x + y = -5$	Subtract 8x from each side.
$8x - y = 5$	Multiply each side by −1.

So $A = 8$, $B = -1$, and $C = 5$.

b. $14x = -7y + 21$

$14x = -7y + 21$	Original equation
$14x + 7y = 21$	Add 7y to each side.
$2x + y = 3$	Divide each side by 7.

So $A = 2$, $B = 1$, and $C = 3$.

Exercises

Write each equation in standard form. Identify A, B, and C.

1. $2x = 4y - 1$
$2x - 4y = -1$; $A = 2$, $B = -4$, $C = -1$

2. $5y = 2x + 3$
$2x - 5y = -3$; $A = 2$, $B = -5$, $C = -3$

3. $3x = -5y + 2$
$3x + 5y = 2$; $A = 3$, $B = 5$, $C = 2$

4. $18y = 24x - 9$
$8x - 6y = 3$; $A = 8$, $B = -6$, $C = 3$

5. $\frac{3}{4}y = \frac{2}{3}x + 5$
$8x - 9y = -60$; $A = 8$, $B = -9$, $C = -60$

6. $6y - 8x + 10 = 0$
$4x - 3y = 5$; $A = 4$, $B = -3$, $C = 5$

7. $0.4x + 3y = 10$
$2x + 15y = 50$; $A = 2$, $B = 15$, $C = 50$

8. $x = 4y - 7$
$x - 4y = -7$; $A = 1$, $B = -4$, $C = -7$

9. $2y = 3x + 6$
$3x - 2y = -6$; $A = 3$, $B = -2$, $C = -6$

10. $\frac{2}{5}x + \frac{1}{3}y - 2 = 0$
$6x + 5y = 30$; $A = 6$, $B = 5$, $C = 30$

11. $4y + 4x + 12 = 0$
$x + y = -3$; $A = 1$, $B = 1$, $C = -3$

12. $3x = -18$
$x = -6$; $A = 1$, $B = 0$, $C = -6$

13. $x = \frac{y}{9} + 7$
$9x - y = 63$; $A = 9$, $B = -1$, $C = 63$

14. $3y = 9x - 18$
$3x - y = 6$; $A = 3$, $B = -1$, $C = 6$

15. $2x = 20 - 8y$
$x + 4y = 10$; $A = 1$, $B = 4$, $C = 10$

16. $\frac{y}{4} - 3 = 2x$
$8x - y = -12$; $A = 8$, $B = -1$, $C = -12$

17. $\left(\frac{5x}{2}\right) = \frac{3}{4}y + 8$
$10x - 3y = 32$; $A = 10$, $B = -3$, $C = 32$

18. $0.25y = 2x - 0.75$
$8x - y = 3$; $A = 8$, $B = -1$, $C = 3$

19. $2y - \frac{x}{6} - 4 = 0$
$x - 12y = -24$; $A = 1$, $B = -12$, $C = -24$

20. $1.6x - 2.4y = 4$
$2x - 3y = 5$; $A = 2$, $B = -3$, $C = 5$

21. $0.2x = 100 - 0.4y$
$x + 2y = 500$; $A = 1$, $B = 2$, $C = 500$

Answers

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2-2 Skills Practice

Linear Equations

State whether each equation or function is linear. Write *yes* or *no*. If no, explain your reasoning.

1. $y = 3x$ **yes**

2. $y = -2 + 5x$ **yes**

3. $2x + y = 10$ **yes**

4. $f(x) = 4x^2$ **No; the exponent of *x* is not 1.**

5. $-\frac{3}{x} + y = 15$ **No; *x* is in a denominator.**

6. $\frac{1}{3}x = y + 8$ **yes**

7. $g(x) = 8$ **yes**

8. $h(x) = \sqrt{x} + 3$ **No; *x* is inside a square root.**

Write each equation in standard form. Identify *A*, *B*, and *C*.

9. $y = x$ **$x - y = 0$; 1, −1, 0**

10. $y = 5x + 1$ **$5x - y = -1$; 5, −1, −1**

11. $2x = 4 - 7y$ **$2x + 7y = 4$; 2, 7, 4**

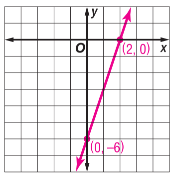
12. $3x = -2y - 2$ **$3x + 2y = -2$; 3, 2, −2**

13. $5y - 9 = 0$ **$5y = 9$; 0, 5, 9**

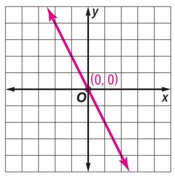
14. $-6y + 14 = 8x$ **$4x + 3y = 7$; 4, 3, 7**

Find the *x*-intercept and the *y*-intercept of the graph of each equation. Then graph the equation.

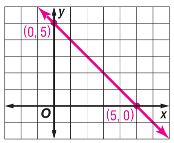
15. $y = 3x - 6$ **2, −6**



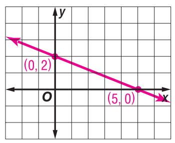
16. $y = -2x$ **0, 0**



17. $x + y = 5$ **5, 5**



18. $2x + 5y = 10$ **5, 2**



Lesson 2-2

NAME ______________________ DATE ____________ PERIOD _____

2-2 Practice (Average)

Linear Equations

State whether each equation or function is linear. Write *yes* or *no*. If no, explain your reasoning.

1. $h(x) = 23$ **yes**

2. $y = \frac{2}{3}x$ **yes**

3. $y = \frac{5}{x}$ **No; *x* is a denominator.**

4. $9 - 5xy = 2$ **No; *x* and *y* are multiplied.**

Write each equation in standard form. Identify *A*, *B*, and *C*.

5. $y = 7x - 5$ **$7x - y = 5$; 7, −1, 5**

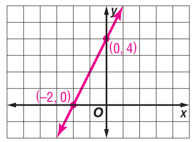
6. $y = \frac{3}{8}x + 5$ **$3x - 8y = -40$; 3, −8, −40**

7. $3y - 5 = 0$ **$3y = 5$; 0, 3, 5**

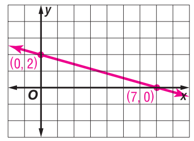
8. $x = -\frac{2}{7}y + \frac{3}{4}$ **$28x + 8y = 21$; 28, 8, 21**

Find the *x*-intercept and the *y*-intercept of the graph of each equation. Then graph the equation.

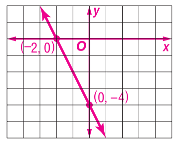
9. $y = 2x + 4$ **−2, 4**



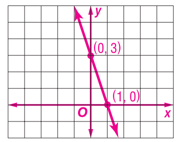
10. $2x + 7y = 14$ **7, 2**



11. $y = -2x - 4$ **−2, −4**



12. $6x + 2y = 6$ **1, 3**



13. MEASURE The equation $y = 2.54x$ gives the length in centimeters corresponding to a length x in inches. What is the length in centimeters of a 1-foot ruler? **30.48 cm**

LONG DISTANCE For Exercises 14 and 15, use the following information.

For Meg's long-distance calling plan, the monthly cost C in dollars is given by the linear function $C(t) = 6 + 0.05t$, where t is the number of minutes talked.

14. What is the total cost of talking 8 hours? of talking 20 hours? **$30; $66**

15. What is the effective cost per minute (the total cost divided by the number of minutes talked) of talking 8 hours? of talking 20 hours? **$0.0625; $0.055**

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2-2 Reading to Learn Mathematics

Linear Equations

Pre-Activity **How do linear equations relate to time spent studying?**

Read the introduction to Lesson 2-2 at the top of page 63 in your textbook.

- If Lolita spends $2\frac{1}{2}$ hours studying math, how many hours will she have to study chemistry? **$1\frac{1}{2}$ hours**
- Suppose that Lolita decides to stay up one hour later so that she now has 5 hours to study and do homework. Write a linear equation that describes this situation. **$x + y = 5$**

Reading the Lesson

1. Write *yes* or *no* to tell whether each linear equation is in standard form. If it is not, explain why it is not.

a. $-x + 2y = 5$ **No; *A* is negative.**

b. $9x - 12y = -5$ **yes**

c. $5x - 7y = 3$ **yes**

d. $2x - \frac{4}{7}y = 1$ **No; *B* is not an integer.**

e. $0x + 0y = 0$ **No; *A* and *B* are both 0.**

f. $2x + 4y = 8$ **No; The greatest common factor of 2, 4, and 8 is 2, not 1.**

2. How can you use the standard form of a linear equation to tell whether the graph is a horizontal line or a vertical line? **If $A = 0$, then the graph is a horizontal line. If $B = 0$, then the graph is a vertical line.**

Helping You Remember

3. One way to remember something is to explain it to another person. Suppose that you are studying this lesson with a friend who thinks that she should let $x = 0$ to find the x-intercept and let $y = 0$ to find the y-intercept. How would you explain to her how to remember the correct way to find intercepts of a line? **Sample answer: The *x*-intercept is the *x*-coordinate of a point on the *x*-axis. Every point on the *x*-axis has *y*-coordinate 0, so let $y = 0$ to find an *x*-intercept. The *y*-intercept is the *y*-coordinate of a point on the *y*-axis. Every point on the *y*-axis has *x*-coordinate 0, so let $x = 0$ to find a *y*-intercept.**

Lesson 2-2

NAME ______________________ DATE __________ PERIOD _____

2-2 Enrichment

Greatest Common Factor

Suppose we are given a linear equation $ax + by = c$ where a, b, and c are nonzero integers, and we want to know if there exist *integers* x and y that satisfy the equation. We could try guessing a few times, but this process would be time consuming for an equation such as $588x + 432y = 72$. By using the Euclidean Algorithm, we can determine not only if such integers x and y exist, but also find them. The following example shows how this algorithm works.

Example **Find integers x and y that satisfy $588x + 432y = 72$.**

Divide the greater of the two coefficients by the lesser to get a quotient and remainder. Then, repeat the process by dividing the divisor by the remainder until you get a remainder of 0. The process can be written as follows.

$588 = 432(1) + 156$ (1)
$432 = 156(2) + 120$ (2)
$156 = 120(1) + 36$ (3)
$120 = 36(3) + 12$ (4)
$36 = 12(3)$

The last nonzero remainder is the GCF of the two coefficients. If the constant term 72 is divisible by the GCF, then integers x and y do exist that satisfy the equation. To find x and y, work backward in the following manner.

$72 = 6 \cdot 12$
$= 6 \cdot [120 - 36(3)]$ Substitute for 12 using (4)
$= 6(120) - 18(36)$
$= 6(120) - 18[156 - 120(1)]$ Substitute for 36 using (3)
$= -18(156) + 24(120)$
$= -18(156) + 24[432 - 156(2)]$ Substitute for 120 using (2)
$= 24(432) - 66(156)$
$= 24(432) - 66[588 - 432(1)]$ Substitute for 156 using (1)
$= 588(-66) + 432(90)$

Thus, $x = -66$ and $y = 90$.

Find integers x and y, if they exist, that satisfy each equation.

1. $27x + 65y = 3$
$x = -36$ and $y = 15$

2. $45x + 144y = 36$
$x = -12$ and $y = 4$

3. $90x + 117y = 10$
no integral solutions exist

4. $123x + 36y = 15$
$x = 25$ and $y = -85$

5. $1032x + 1001y = 1$
$x = -226$ and $y = 233$

6. $3125x + 3087y = 1$
$x = -1381$ and $y = 1398$

Answers

NAME ______________________ DATE __________ PERIOD _____

2-3 Study Guide and Intervention

Slope

Slope

Slope m of a Line	For points (x_1, y_1) and (x_2, y_2), where $x_1 \neq x_2$, $m = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$

Example 1 **Determine the slope of the line that passes through (2, −1) and (−4, 5).**

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

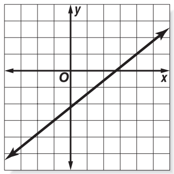
$= \frac{5 - (-1)}{-4 - 2}$ $(x_1, y_1) = (2, -1)$, $(x_2, y_2) = (-4, 5)$

$= \frac{6}{-6} = -1$ Simplify.

The slope of the line is −1.

Example 2 **Graph the line passing through (−1, −3) with a slope of $\frac{4}{5}$.**

Graph the ordered pair (−1, −3). Then, according to the slope, go up 4 units and right 5 units. Plot the new point (4,1). Connect the points and draw the line.



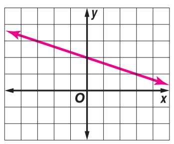
Exercises

Find the slope of the line that passes through each pair of points.

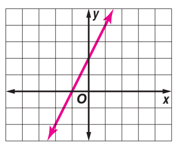
1. (4, 7) and (6, 13) **3**
2. (6, 4) and (3, 4) **0**
3. (5, 1) and (7, −3) **−2**
4. (5, −3) and (−4, 3) $-\frac{2}{3}$
5. (5, 10) and (−1,−2) **2**
6. (−1, −4) and (−13, 2) $-\frac{1}{2}$
7. (7, −2) and (3, 3) $-\frac{5}{4}$
8. (−5, 9) and (5, 5) $-\frac{2}{5}$
9. (4, −2) and (−4, −8) $\frac{3}{4}$

Graph the line passing through the given point with the given slope.

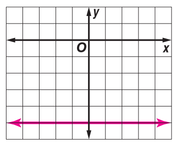
10. slope = $-\frac{1}{3}$
passes through (0, 2)



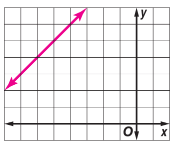
11. slope = 2
passes through (1, 4)



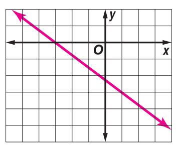
12. slope = 0
passes through (−2, −5)



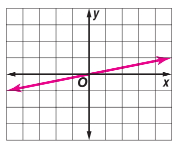
13. slope = 1
passes through (−4, 6)



14. slope = $-\frac{3}{4}$
passes through (−3, 0)



15. slope = $\frac{1}{5}$
passes through (0, 0)



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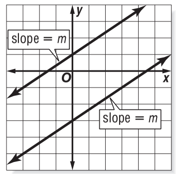
2-3 Study Guide and Intervention *(continued)*

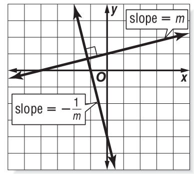
Slope

Parallel and Perpendicular Lines

In a plane, nonvertical lines with the same slope are **parallel**. All vertical lines are parallel.



In a plane, two oblique lines are **perpendicular** if and only if the product of their slopes is −1. Any vertical line is perpendicular to any horizontal line.



Example **Are the line passing through (2, 6) and (−2, 2) and the line passing through (3, 0) and (0, 4) parallel, perpendicular, or neither?**

Find the slopes of the two lines.

The slope of the first line is $\frac{6 - 2}{2 - (-2)} = 1$.

The slope of the second line is $\frac{4 - 0}{0 - 3} = -\frac{4}{3}$.

The slopes are not equal and the product of the slopes is not −1, so the lines are neither parallel nor perpendicular.

Exercises

Are the lines parallel, perpendicular, or neither?

1. the line passing through (4, 3) and (1, −3) and the line passing through (1, 2) and (−1, 3)
perpendicular
2. the line passing through (2, 8) and (−2, 2) and the line passing through (0, 9) and (6, 0)
neither
3. the line passing through (3, 9) and (−2, −1) and the graph of $y = 2x$ **parallel**
4. the line with x-intercept −2 and y-intercept 5 and the line with x-intercept 2 and y-intercept −5 **parallel**
5. the line with x-intercept 1 and y-intercept 3 and the line with x-intercept 3 and y-intercept 1 **neither**
6. the line passing through (−2, −3) and (2, 5) and the graph of $x + 2y = 10$
perpendicular
7. the line passing through (−4, −8) and (6, −4) and the graph of $2x - 5y = 5$ **parallel**

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2-3 Skills Practice

Slope

Find the slope of the line that passes through each pair of points.

1. (1, 5), (−1, −3) **4**

2. (0, 2), (3, 0) $-\frac{2}{3}$

3. (1, 9), (0, 6) **3**

4. (8, −5), (4, −2) $-\frac{3}{4}$

5. (−3, 5), (−3, −1) **undefined**

6. (−2, −2), (10, −2) **0**

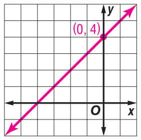
7. (4, 5), (2, 7) **−1**

8. (−2, −4), (3, 2) $\frac{6}{5}$

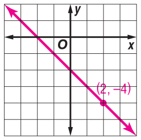
9. (5, 2), (−3, 2) **0**

Graph the line passing through the given point with the given slope.

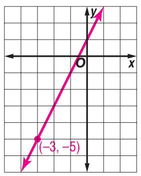
10. (0, 4), $m = 1$



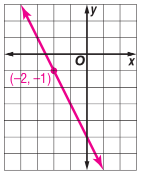
11. (2, −4), $m = -1$



12. (−3, −5), $m = 2$

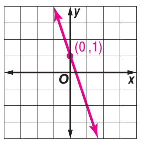


13. (−2, −1), $m = -2$

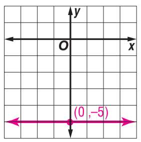


Graph the line that satisfies each set of conditions.

14. passes through (0, 1), perpendicular to a line whose slope is $\frac{1}{3}$



15. passes through (0, −5), parallel to the graph of $y = 1$



16. HIKING Naomi left from an elevation of 7400 feet at 7:00 A.M. and hiked to an elevation of 9800 feet by 11:00 A.M. What was her rate of change in altitude? **600 ft/h**

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2-3 Practice (Average)

Slope

Find the slope of the line that passes through each pair of points.

1. (3, −8), (−5, 2) $-\frac{5}{4}$

2. (−10, −3), (7, 2) $\frac{5}{17}$

3. (−7, −6), (3, −6) **0**

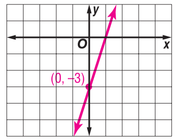
4. (8, 2), (8, −1) **undefined**

5. (4, 3), (7, −2) $-\frac{5}{3}$

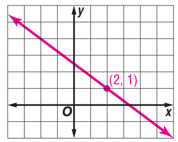
6. (−6, −3), (−8, 4) $-\frac{7}{2}$

Graph the line passing through the given point with the given slope.

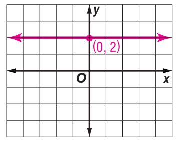
7. (0, −3), $m = 3$



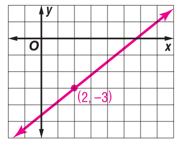
8. (2, 1), $m = -\frac{3}{4}$



9. (0, 2), $m = 0$

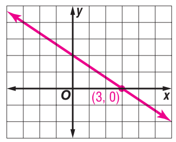


10. (2, −3), $m = \frac{4}{5}$

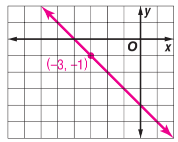


Graph the line that satisfies each set of conditions.

11. passes through (3, 0), perpendicular to a line whose slope is $\frac{3}{2}$



12. passes through (−3, −1), parallel to a line whose slope is −1



DEPRECIATION For Exercises 13–15, use the following information.
A machine that originally cost $15,600 has a value of $7500 at the end of 3 years. The same machine has a value of $2800 at the end of 8 years.

13. Find the average rate of change in value (depreciation) of the machine between its purchase and the end of 3 years. **−$2700 per year**

14. Find the average rate of change in value of the machine between the end of 3 years and the end of 8 years. **−$940 per year**

15. Interpret the sign of your answers. **It is negative because the value is decreasing.**

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2-3 Reading to Learn Mathematics

Slope

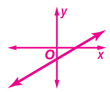
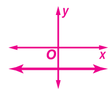
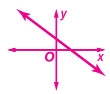
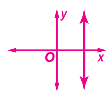
Pre-Activity **How does slope apply to the steepness of roads?**

Read the introduction to Lesson 2-3 at the top of page 68 in your textbook.

- What is the grade of a road that rises 40 feet over a horizontal distance of 1000 feet? **4%**
- What is the grade of a road that rises 525 meters over a horizontal distance of 10 kilometers? (1 kilometer = 1000 meters) **5.25%**

Reading the Lesson

1. Describe each type of slope and include a sketch.

Type of Slope	Description of Graph	Sketch
Positive	**The line rises to the right.**	
Zero	**The line is horizontal.**	
Negative	**The line falls to the right.**	
Undefined	**The line is vertical.**	

2. a. How are the slopes of two nonvertical parallel lines related? **They are equal.**

b. How are the slopes of two oblique perpendicular lines related? **Their product is −1.**

Helping You Remember

3. Look up the terms *grade*, *pitch*, *slant*, and *slope*. How can everyday meanings of these words help you remember the definition of slope? **Sample answer: All these words can be used when you describe how much a thing slants upward or downward. You can describe this numerically by comparing rise to run.**

Lesson 2-3

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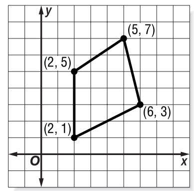
2-3 Enrichment

Aerial Surveyors and Area

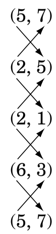
Many land regions have irregular shapes. Aerial surveyors supply aerial mappers with lists of coordinates and elevations for the areas that need to be photographed from the air. These maps provide information about the horizontal and vertical features of the land.



Step 1 List the ordered pairs for the vertices in counterclockwise order, repeating the first ordered pair at the bottom of the list.

Step 2 Find D, the sum of the downward diagonal products (from left to right).

$D = (5 \cdot 5) + (2 \cdot 1) + (2 \cdot 3) + (6 \cdot 7)$
$= 25 + 2 + 6 + 42$ or 75



Step 3 Find U, the sum of the upward diagonal products (from left to right).

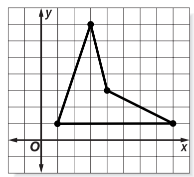
$U = (2 \cdot 7) + (2 \cdot 5) + (6 \cdot 1) + (5 \cdot 3)$
$= 14 + 10 + 6 + 15$ or 45

Step 4 Use the formula $A = \frac{1}{2}(D - U)$ to find the area.

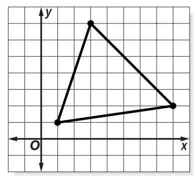
$A = \frac{1}{2}(75 - 45)$
$= \frac{1}{2}(30)$ or 15

The area is 15 square units. Count the number of square units enclosed by the polygon. Does this result seem reasonable?

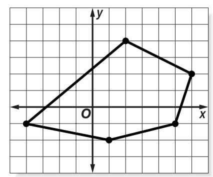
Use the coordinate method to find the area of each region in square units.

1. 

20 units^2

2. 

14 units^2

3. 

34 units^2

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2-4 Study Guide and Intervention

Writing Linear Equations

Forms of Equations

Slope-Intercept Form of a Linear Equation	$y = mx + b$, where m is the slope and b is the y-intercept
Point-Slope Form of a Linear Equation	$y - y_1 = m(x - x_1)$, where (x_1, y_1) are the coordinates of a point on the line and m is the slope of the line

Example 1 **Write an equation in slope-intercept form for the line that has slope −2 and passes through the point (3, 7).**

Substitute for m, x, and y in the slope-intercept form.

$y = mx + b$ Slope-intercept form
$7 = (-2)(3) + b$ $(x, y) = (3, 7)$, $m = -2$
$7 = -6 + b$ Simplify.
$13 = b$ Add 6 to both sides.

The y-intercept is 13. The equation in slope-intercept form is $y = -2x + 13$.

Example 2 **Write an equation in slope-intercept form for the line that has slope $\frac{1}{3}$ and x-intercept 5.**

$y = mx + b$ Slope-intercept form
$0 = \left(\frac{1}{3}\right)(5) + b$ $(x, y) = (5, 0)$, $m = \frac{1}{3}$
$0 = \frac{5}{3} + b$ Simplify.
$-\frac{5}{3} = b$ Subtract $\frac{5}{3}$ from both sides.

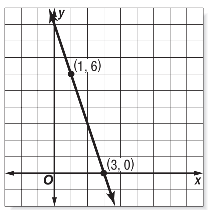
The y-intercept is $-\frac{5}{3}$. The slope-intercept form is $y = \frac{1}{3}x - \frac{5}{3}$.

Exercises

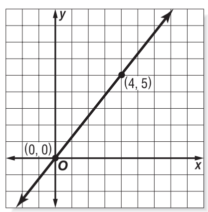
Write an equation in slope-intercept form for the line that satisfies each set of conditions.

1. slope −2, passes through (−4, 6)
   $y = -2x - 2$
2. slope $\frac{3}{2}$, y-intercept 4
   $y = \frac{3}{2}x + 4$
3. slope 1, passes through (2, 5)
   $y = x + 3$
4. slope $-\frac{13}{5}$, passes through (5, −7)
   $y = -\frac{13}{5}x + 6$

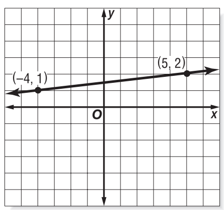
Write an equation in slope-intercept form for each graph.

5. 

$y = -3x + 9$

6. 

$y = \frac{5}{4}x$

7. 

$y = \frac{1}{9}x + 1\frac{4}{9}$

Lesson 2-4

NAME ______________________ DATE ____________ PERIOD _____

2-4 Study Guide and Intervention (continued)

Writing Linear Equations

Parallel and Perpendicular Lines Use the slope-intercept or point-slope form to find equations of lines that are parallel or perpendicular to a given line. Remember that parallel lines have equal slope. The slopes of two perpendicular lines are negative reciprocals, that is, their product is −1.

Example 1 **Write an equation of the line that passes through (8, 2) and is perpendicular to the line whose equation is $y = -\frac{1}{2}x + 3$.**

The slope of the given line is $-\frac{1}{2}$. Since the slopes of perpendicular lines are negative reciprocals, the slope of the perpendicular line is 2.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$ Point-slope form
$y - 2 = 2(x - 8)$ $(x_1, y_1) = (8, 2)$, $m = 2$
$y - 2 = 2x - 16$ Distributive Prop.
$y = 2x - 14$ Add 2 to each side.

An equation of the line is $y = 2x - 14$.

Example 2 **Write an equation of the line that passes through (−1, 5) and is parallel to the graph of $y = 3x + 1$.**

The slope of the given line is 3. Since the slopes of parallel lines are equal, the slope of the parallel line is also 3.

Use the slope and the given point to write the equation.

$y - y_1 = m(x - x_1)$ Point-slope form
$y - 5 = 3(x - (-1))$ $(x_1, y_1) = (-1, 5)$, $m = 3$
$y - 5 = 3x + 3$ Distributive Prop.
$y = 3x + 8$ Add 5 to each side.

An equation of the line is $y = 3x + 8$.

Exercises

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

1. passes through (−4, 2), parallel to the line whose equation is $y = \frac{1}{2}x + 5$ **$y = \frac{1}{2}x + 4$**
2. passes through (3, 1), perpendicular to the graph of $y = -3x + 2$ **$y = \frac{1}{3}x$**
3. passes through (1, −1), parallel to the line that passes through (4, 1) and (2, −3)
   $y = 2x - 3$
4. passes through (4, 7), perpendicular to the line that passes through (3, 6) and (3, 15)
   $y = 7$
5. passes through (8, −6), perpendicular to the graph of $2x - y = 4$ **$y = -\frac{1}{2}x - 2$**
6. passes through (2, −2), perpendicular to the graph of $x + 5y = 6$ **$y = 5x - 12$**
7. passes through (6, 1), parallel to the line with x-intercept −3 and y-intercept 5
   $y = \frac{5}{3}x - 9$
8. passes through (−2, 1), perpendicular to the line $y = 4x - 11$ **$y = -\frac{1}{4}x + \frac{1}{2}$**

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2-4 Skills Practice

Writing Linear Equations

State the slope and *y*-intercept of the graph of each equation.

1. $y = 7x - 5$ **7, −5**

2. $y = -\frac{3}{5}x + 3$ $-\frac{3}{5}$**, 3**

3. $y = \frac{2}{3}x$ $\frac{2}{3}$**, 0**

4. $3x + 4y = 4$ $-\frac{3}{4}$**, 1**

5. $7y = 4x - 7$ $\frac{4}{7}$**, −1**

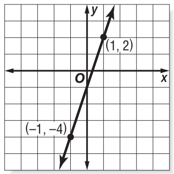
6. $3x - 2y + 6 = 0$ $\frac{3}{2}$**, 3**

7. $2x - y = 5$ **2, −5**

8. $2y = 6 - 5x$ $-\frac{5}{2}$**, 3**

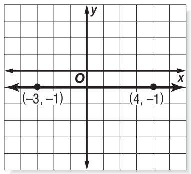
Write an equation in slope-intercept form for each graph.

9.



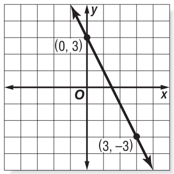
$y = 3x - 1$

10.



$y = -1$

11.



$y = -2x + 3$

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

12. slope 3, passes through (1, −3)
$y = 3x - 6$

13. slope −1, passes through (0, 0)
$y = -x$

14. slope −2, passes through (0, −5)
$y = -2x - 5$

15. slope 3, passes through (2, 0)
$y = 3x - 6$

16. passes through (−1, −2) and (−3, 1)
$y = -\frac{3}{2}x - \frac{7}{2}$

17. passes through (−2, −4) and (1, 8)
$y = 4x + 4$

18. *x*-intercept 2, *y*-intercept −6
$y = 3x - 6$

19. *x*-intercept $\frac{5}{2}$, *y*-intercept 5
$y = -2x + 5$

20. passes through (3, −1), perpendicular to the graph of $y = -\frac{1}{3}x - 4$. **$y = 3x - 10$**

Lesson 2-4

NAME ______________________ DATE ________ PERIOD _____

2-4 Practice (Average)

Writing Linear Equations

State the slope and *y*-intercept of the graph of each equation.

1. $y = 8x + 12$ **8, 12**

2. $y = 0.25x - 1$ **0.25, −1**

3. $y = -\frac{3}{5}x$ $-\frac{3}{5}$**, 0**

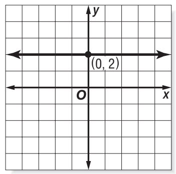
4. $3y = 7$ **0,** $\frac{7}{3}$

5. $3x = -15 + 5y$ $\frac{3}{5}$**, 3**

6. $2x - 3y = 10$ $\frac{2}{3}$**,** $-\frac{10}{3}$

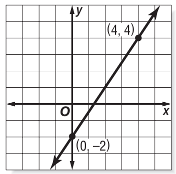
Write an equation in slope-intercept form for each graph.

7.



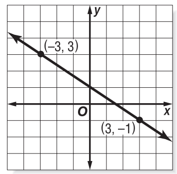
$y = 2$

8.



$y = \frac{3}{2}x - 2$

9.



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

Write an equation in slope-intercept form for the line that satisfies each set of conditions.

10. slope −5, passes through (−3, −8)
$y = -5x - 23$

11. slope $\frac{4}{5}$, passes through (10, −3)
$y = \frac{4}{5}x - 11$

12. slope 0, passes through (0, −10)
$y = -10$

13. slope $-\frac{2}{3}$, passes through (6, −8)
$y = -\frac{2}{3}x - 4$

14. passes through (3, 11) and (−6, 5)
$y = \frac{2}{3}x + 9$

15. passes through (7, −2) and (3, −1)
$y = -\frac{1}{4}x - \frac{1}{4}$

16. *x*-intercept 3, *y*-intercept 2
$y = -\frac{2}{3}x + 2$

17. *x*-intercept −5, *y*-intercept 7
$y = \frac{7}{5}x + 7$

18. passes through (−8, −7), perpendicular to the graph of $y = 4x - 3$ **$y = -\frac{1}{4}x - 9$**

19. RESERVOIRS The surface of Grand Lake is at an elevation of 648 feet. During the current drought, the water level is dropping at a rate of 3 inches per day. If this trend continues, write an equation that gives the elevation in feet of the surface of Grand Lake after *x* days. **$y = -0.25x + 648$**

20. BUSINESS Tony Marconi's company manufactures CD-ROM drives. The company will make \$150,000 profit if it manufactures 100,000 drives, and \$1,750,000 profit if it manufactures 500,000 drives. The relationship between the number of drives manufactured and the profit is linear. Write an equation that gives the profit *P* when *n* drives are manufactured. **$P = 4n - 250,000$**

NAME ______________________ DATE __________ PERIOD _____

2-4 Reading to Learn Mathematics

Writing Linear Equations

Pre-Activity **How do linear equations apply to business?**

Read the introduction to Lesson 2-4 at the top of page 75 in your textbook.

- If the total cost of producing a product is given by the equation $y = 5400 + 1.37x$, what is the fixed cost? What is the variable cost (for each item produced)? **$5400; $1.37**
- Write a linear equation that describes the following situation: A company that manufactures computers has a fixed cost of $228,750 and a variable cost of $852 to produce each computer. **$y = 228{,}750 + 852x$**

Reading the Lesson

1. a. Write the slope-intercept form of the equation of a line. Then explain the meaning of each of the variables in the equation. **$y = mx + b$; m is the slope and b is the y-intercept. The variables x and y are the coordinates of any point on the line.**

b. Write the point-slope form of the equation of a line. Then explain the meaning of each of the variables in the equation. **$y - y_1 = m(x - x_1)$; m is the slope. x and y are the coordinates of any point on the line. x_1 and y_1 are the coordinates of one specific point on the line.**

2. Suppose that your algebra teacher asks you to write the point-slope form of the equation of the line through the points $(-6, 7)$ and $(-3, -2)$. You write $y + 2 = -3(x + 3)$ and your classmate writes $y - 7 = -3(x + 6)$. Which of you is correct? Explain. **You are both correct. Either point may be used as (x_1, y_1) in the point-slope form. You used $(-3, -2)$, and your classmate used $(-6, 7)$.**

3. You are asked to write an equation of two lines that pass through $(3, -5)$, one of them parallel to and one of them perpendicular to the line whose equation is $y = -3x + 4$. The first step in finding these equations is to find their slopes. What is the slope of the parallel line? What is the slope of the perpendicular line? **-3; $\frac{1}{3}$**

Helping You Remember

4. Many students have trouble remembering the point-slope form for a linear equation. How can you use the definition of slope to remember this form? **Sample answer: Write the definition of slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$. Multiply both sides of this equation by $x_2 - x_1$. Drop the subscripts in y_2 and x_2. This gives the point-slope form of the equation of a line.**

Lesson 2-4

NAME ______________________ DATE __________ PERIOD _____

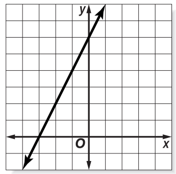
2-4 Enrichment

Two-Intercept Form of a Linear Equation

You are already familiar with the slope-intercept form of a linear equation, $y = mx + b$. Linear equations can also be written in the form $\frac{x}{a} + \frac{y}{b} = 1$ with x-intercept a and y-intercept b. This is called two-intercept form.

Example 1 **Draw the graph of $\frac{x}{-3} + \frac{y}{6} = 1$.**

The graph crosses the x-axis at -3 and the y-axis at 6. Graph $(-3, 0)$ and $(0, 6)$, then draw a straight line through them.



Example 2 **Write $3x + 4y = 12$ in two-intercept form.**

$\frac{3x}{12} + \frac{4y}{12} = \frac{12}{12}$ Divide by 12 to obtain 1 on the right side.

$\frac{x}{4} + \frac{y}{3} = 1$ Simplify.

The x-intercept is 4; the y-intercept is 3.

Use the given intercepts a and b, to write an equation in two-intercept form. Then draw the graph. **See students' graphs.**

1. $a = -2, b = -4$ **$\frac{x}{-2} + \frac{y}{-4} = 1$**

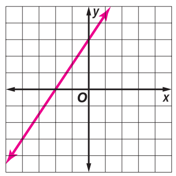
2. $a = 1, b = 8$ **$\frac{x}{1} + \frac{y}{8} = 1$**

3. $a = 3, b = 5$ **$\frac{x}{3} + \frac{y}{5} = 1$**

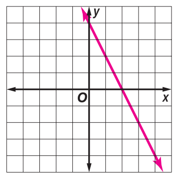
4. $a = 6, b = 9$ **$\frac{x}{6} + \frac{y}{9} = 1$**

Write each equation in two-intercept form. Then draw the graph.

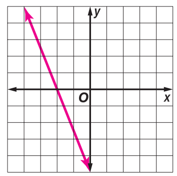
5. $3x - 2y = -6$ **$\frac{x}{-2} + \frac{y}{3} = 1$**



6. $\frac{1}{2}x + \frac{1}{4}y = 1$ **$\frac{x}{2} + \frac{y}{4} = 1$**



7. $5x + 2y = -10$ **$\frac{x}{-2} + \frac{y}{-5} = 1$**



NAME ______________________ DATE ________ PERIOD _____

2-5 Study Guide and Intervention

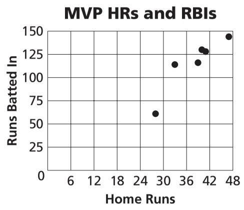
Modeling Real-World Data: Using Scatter Plots

Scatter Plots When a set of data points is graphed as ordered pairs in a coordinate plane, the graph is called a **scatter plot**. A scatter plot can be used to determine if there is a relationship among the data.

Example **BASEBALL The table below shows the number of home runs and runs batted in for various baseball players who won the Most Valuable Player Award during the 1990s. Make a scatter plot of the data.**

Home Runs	Runs Batted In
33	114
39	116
40	130
28	61
41	128
47	144

Source: *New York Times Almanac*



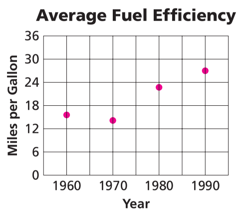
Exercises

Make a scatter plot for the data in each table below.

1. FUEL EFFICIENCY The table below shows the average fuel efficiency in miles per gallon of new cars manufactured during the years listed.

Year	Fuel Efficiency (mpg)
1960	15.5
1970	14.1
1980	22.6
1990	26.9

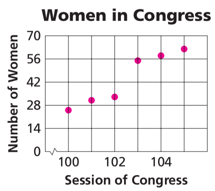
Source: *New York Times Almanac*



2. CONGRESS The table below shows the number of women serving in the United States Congress during the years 1987–1999.

Congressional Session	Number of Women
100	25
101	31
102	33
103	55
104	58
105	62

Source: *Wall Street Journal Almanac*



Lesson 2-5

NAME ______________________ DATE ________ PERIOD _____

2-5 Study Guide and Intervention *(continued)*

Modeling Real-World Data: Using Scatter Plots

Prediction Equations A **line of fit** is a line that closely approximates a set of data graphed in a scatter plot. The equation of a line of fit is called a **prediction equation** because it can be used to predict values not given in the data set.

To find a prediction equation for a set of data, select two points that seem to represent the data well. Then to write the prediction equation, use what you know about writing a linear equation when given two points on the line.

Example **STORAGE COSTS According to a certain prediction equation, the cost of 200 square feet of storage space is $60. The cost of 325 square feet of storage space is $160.**

a. Find the slope of the prediction equation. What does it represent?

Since the cost depends upon the square footage, let x represent the amount of storage space in square feet and y represent the cost in dollars. The slope can be found using the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$. So, $m = \frac{160 - 60}{325 - 200} = \frac{100}{125} = 0.8$

The slope of the prediction equation is 0.8. This means that the price of storage increases 80¢ for each one-square-foot increase in storage space.

b. Find a prediction equation.

Using the slope and one of the points on the line, you can use the point-slope form to find a prediction equation.

$y - y_1 = m(x - x_1)$ Point-slope form
$y - 60 = 0.8(x - 200)$ $(x_1, y_1) = (200, 60)$, $m = 0.8$
$y - 60 = 0.8x - 160$ Distributive Property
$y = 0.8x - 100$ Add 60 to both sides.

A prediction equation is $y = 0.8x - 100$.

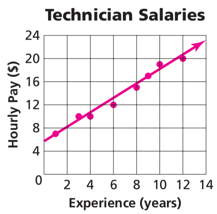
Exercises

SALARIES The table below shows the years of experience for eight technicians at Lewis Techomatic and the hourly rate of pay each technician earns. Use the data for Exercises 1 and 2.

Experience (years)	9	4	3	1	10	6	12	8
Hourly Rate of Pay	$17	$10	$10	$7	$19	$12	$20	$15

1. Draw a scatter plot to show how years of experience are related to hourly rate of pay. Draw a line of fit. **See graph.**

2. Write a prediction equation to show how years of experience (x) are related to hourly rate of pay (y). **Sample answer using (1, 7) and (9, 17): $y = 1.25x + 5.75$**



NAME ______________________ DATE __________ PERIOD _____

2-5 Skills Practice

Modeling Real-World Data: Using Scatter Plots

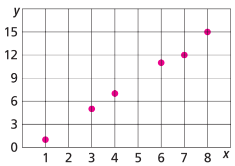
For Exercises 1–3, complete parts a–c for each set of data.

a. Draw a scatter plot.
b. Use two ordered pairs to write a prediction equation.
c. Use your prediction equation to predict the missing value.

1.

x	y
1	1
3	5
4	7
6	11
7	12
8	15
10	?

1a.

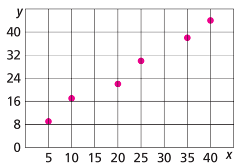


1b. Sample answer using (1, 1) and (8, 15): $y = 2x - 1$
1c. Sample answer: 19

2.

x	y
5	9
10	17
20	22
25	30
35	38
40	44
50	?

2a.

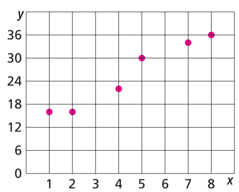


2b. Sample answer using (5, 9) and (40, 44): $y = x + 4$
2c. Sample answer: 54

3.

x	y
1	16
2	16
3	?
4	22
5	30
7	34
8	36

3a.



3b. Sample answer using (2, 16) and (7, 34): $y = 3.6x + 8.8$
3c. Sample answer: 19.6

Lesson 2-5

NAME ______________________ DATE __________ PERIOD _____

2-5 Practice (Average)

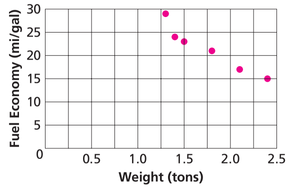
Modeling Real-World Data: Using Scatter Plots

For Exercises 1–3, complete parts a–c for each set of data.
a. Draw a scatter plot.
b. Use two ordered pairs to write a prediction equation.
c. Use your prediction equation to predict the missing value.

1. FUEL ECONOMY The table gives the approximate weights in tons and estimates for overall fuel economy in miles per gallon for several cars.

Weight (tons)	1.3	1.4	1.5	1.8	2	2.1	2.4
Miles per Gallon	29	24	23	21	?	17	15

Fuel Economy Versus Weight



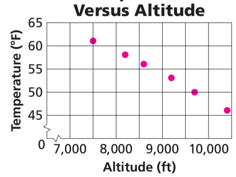
1b. Sample answer using (1.4, 24) and (2.4, 15): $y = -9x + 36.6$

1c. Sample answer: 18.6 mi/gal

2. ALTITUDE In most cases, temperature decreases with increasing altitude. As Anchara drives into the mountains, her car thermometer registers the temperatures (°F) shown in the table at the given altitudes (feet).

Altitude (ft)	7500	8200	8600	9200	9700	10,400	12,000
Temperature (°F)	61	58	56	53	50	46	?

Temperature Versus Altitude

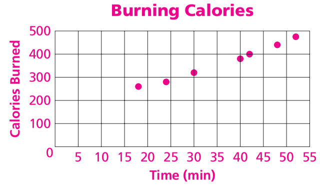


2b. Sample answer using (7500, 61) and (9700, 50): $y = -0.005x + 98.5$
2c. Sample answer: 38.5°F

3. HEALTH Alton has a treadmill that uses the time on the treadmill and the speed of walking or running to estimate the number of Calories he burns during a workout. The table gives workout times and Calories burned for several workouts.

Time (min)	18	24	30	40	42	48	52	60
Calories Burned	260	280	320	380	400	440	475	?

Burning Calories



3b. Sample answer using (24, 280) and (48, 440): $y = 6.67x + 119.92$
3c. Sample answer: about 520 calories

Answers

NAME ______________________ DATE __________ PERIOD _____

2-5 Reading to Learn Mathematics

Modeling Real-World Data: Using Scatter Plots

Pre-Activity **How can a linear equation model the number of Calories you burn exercising?**

Read the introduction to Lesson 2-5 at the top of page 81 in your textbook.

- If a woman runs 5.5 miles per hour, about how many Calories will she burn in an hour? **Sample answer: 572 Calories**
- If a man runs 7.5 miles per hour, about how many Calories will he burn in half an hour? **Sample answer: 397 Calories**

Reading the Lesson

1. Suppose that a set of data can be modeled by a linear equation. Explain the difference between a scatter plot of the data and a graph of the linear equation that models that data.
Sample answer: The scatter plot is a discrete graph. It is made up just of the individual points that represent the data points. The linear equation has a continuous graph that is the line that best fits the data points.

2. Suppose that tuition at a state college was $3500 per year in 1995 and has been increasing at a rate of $225 per year.

a. Write a prediction equation that expresses this information.
$y = 3500 + 225x$

b. Explain the meaning of each variable in your prediction equation.
***x* represents the number of year since 1995 and *y* represents the tuition in that year.**

3. Use this model to predict the tuition at this college in 2007. **$6200**

Helping You Remember

4. Look up the word *scatter* in a dictionary. How can its definition help you to remember the meaning of the difference between a scatter plot and the graph of a linear equation?
Sample answer: To *scatter* means to break up and go in many directions. The points on a scatter plot are broken up. In a scatter plot, the points are scattered or broken up. In the graph of a linear equation, the points are connected to form a continuous line.

NAME ______________________ DATE __________ PERIOD _____

2-5 Enrichment

Median-Fit Lines

A **median-fit line** is a particular type of line of fit. Follow the steps below to find the equation of the median-fit line for the data.

Approximate Percentage of Violent Crimes Committed by Juveniles That Victims Reported to Law Enforcement

Year	1980	1982	1984	1986	1988	1990	1992	1994	1996
Offenders	36	35	33	32	31	30	29	29	30

Source: U.S. Bureau of Justice Statistics

1. Divide the data into three approximately equal groups. There should always be the same number of points in the first and third groups. In this case, there will be three data points in each group.

Group 1		Group 2		Group 3	
Year	Offenders	Year	Offenders	Year	Offenders

2. Find x_1, x_2, and x_3, the medians of the x values in groups 1, 2, and 3, respectively. Find y_1, y_2, and y_3, the medians of the y values in groups 1, 2, and 3, respectively. **1982, 1988, 1994; 35, 31, 29**

3. Find an equation of the line through (x_1, y_1) and (x_3, y_3). $y = -0.5x + 1026$

4. Find Y, the y-coordinate of the point on the line in Exercise 2 with an x-coordinate of x_2. **32**

5. The median-fit line is parallel to the line in Exercise 2, but is one-third closer to (x_2, y_2). This means it passes through $\left(x_2, \frac{2}{3}Y + \frac{1}{3}y_2\right)$. Find this ordered pair. **about (1988, 31.67)**

6. Write an equation of the median-fit line. $y = -0.5x + 1025.67$

7. Use the median-fit line to predict the percentage of juvenile violent crime offenders in 2010 and 2020. **2010: about 21%; 2020: about16%**

NAME ______________________ DATE __________ PERIOD _____

2-6 Study Guide and Intervention

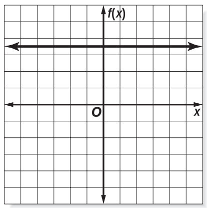
Special Functions

Step Functions, Constant Functions, and the Identity Function The chart below lists some special functions you should be familiar with.

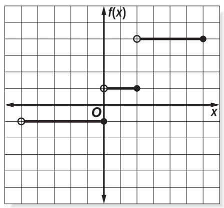
Function	Written as	Graph
Constant	$f(x) = c$	horizontal line
Identity	$f(x) = x$	line through the origin with slope 1
Greatest Integer Function	$f(x) = [\![x]\!]$	one-unit horizontal segments, with right endpoints missing, arranged like steps

The greatest integer function is an example of a **step function**, a function with a graph that consists of horizontal segments.

Example **Identify each function as a constant function, the identity function, or a step function.**

a. 

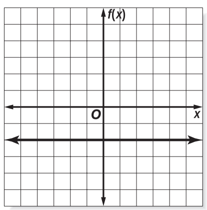
a constant function

b. 

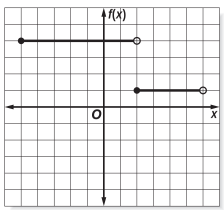
a step function

Exercises

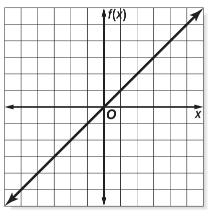
Identify each function as a constant function, the identity function, a greatest integer function, or a step function.

1. 

a constant function

2. 

a step function

3. 

the identity function

Lesson 2-6

NAME ______________________ DATE __________ PERIOD _____

2-6 Study Guide and Intervention *(continued)*

Special Functions

Absolute Value and Piecewise Functions Another special function is the **absolute value function**, which is also called a **piecewise function**.

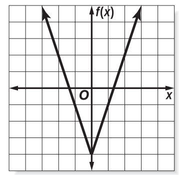
Absolute Value Function	$f(x) = \lvert x \rvert$	two rays that are mirror images of each other and meet at a point, the vertex

To graph a special function, use its definition and your knowledge of the parent graph. Find several ordered pairs, if necessary.

Example 1 **Graph $f(x) = 3|x| - 4$.**

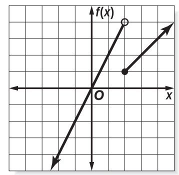
Find several ordered pairs. Graph the points and connect them. You would expect the graph to look similar to its parent function, $f(x) = |x|$.

x	$3\lvert x \rvert - 4$
0	−4
1	−1
2	2
−1	−1
−2	2



Example 2 **Graph $f(x) = \begin{cases} 2x \text{ if } x < 2 \\ x - 1 \text{ if } x \geq 2 \end{cases}$.**

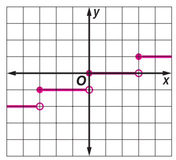
First, graph the linear function $f(x) = 2x$ for $x < 2$. Since 2 does not satisfy this inequality, stop with a circle at (2, 4). Next, graph the linear function $f(x) = x - 1$ for $x \geq 2$. Since 2 does satisfy this inequality, begin with a dot at (2, 1).



Exercises

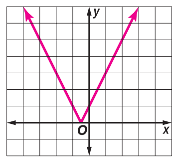
Graph each function. Identify the domain and range.

1. $g(x) = \left[\!\left[\frac{x}{3}\right]\!\right]$



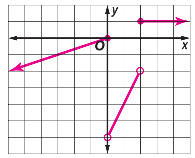
domain: all real numbers; range: all integers

2. $h(x) = |2x + 1|$



domain: all real numbers; range: $\{y \mid y \geq 0\}$

3. $h(x) = \begin{cases} \frac{x}{3} \text{ if } x \leq 0 \\ 2x - 6 \text{ if } 0 < x < 2 \\ 1 \text{ if } x \geq 2 \end{cases}$



domain: all real numbers; range: $\{y \mid y \leq 1\}$

Answers

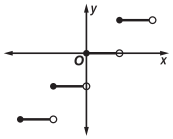
NAME ______________________ DATE ____________ PERIOD _____

2-6 Skills Practice

Special Functions

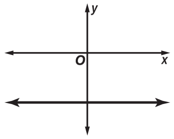
Identify each function as S for step, C for constant, A for absolute value, or P for piecewise.

1.



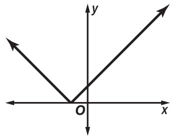
S

2.



C

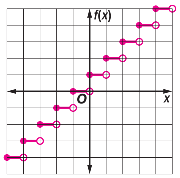
3.



A

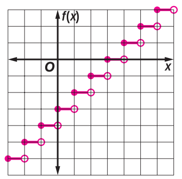
Graph each function. Identify the domain and range.

4. $f(x) = [\![x + 1]\!]$



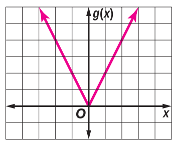
D = all reals, R = all integers

5. $f(x) = [\![x - 3]\!]$



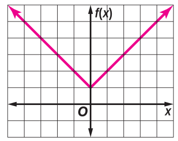
D = all reals, R = all integers

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



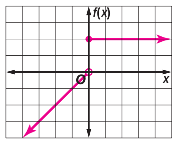
D = all reals,
R = nonnegative reals

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



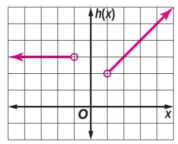
D = all reals, R = {y | y ≥ 1}

8. $f(x) = \begin{cases} x \text{ if } x < 0 \\ 2 \text{ if } x \geq 0 \end{cases}$



D = all reals,
R = {y | y < 0 or y = 2}

9. $h(x) = \begin{cases} 3 \text{ if } x < -1 \\ x + 1 \text{ if } x > 1 \end{cases}$



D = {x | x < −1 or x > 1},
R = {y | y > 2}

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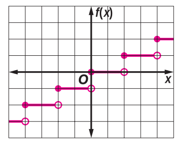
2-6 Practice (Average)

Special Functions

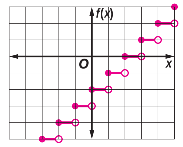
Graph each function. Identify the domain and range.

1. $f(x) = [\![0.5x]\!]$



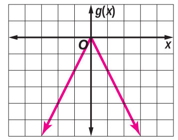
D = all reals, R = all integers

2. $f(x) = [\![x]\!] - 2$



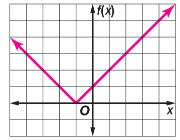
D = all reals, R = all integers

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



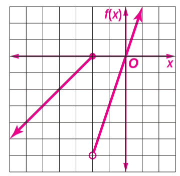
D = all reals,
R = nonpositive reals

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



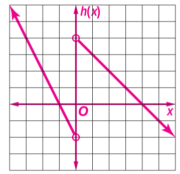
D = all reals,
R = nonnegative reals

5. $f(x) = \begin{cases} x + 2 \text{ if } x \leq -2 \\ 3x \text{ if } x > -2 \end{cases}$



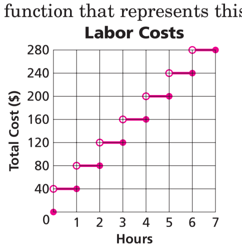
D = all reals, R = all reals

6. $h(x) = \begin{cases} 4 - x \text{ if } x > 0 \\ -2x - 2 \text{ if } x < 0 \end{cases}$

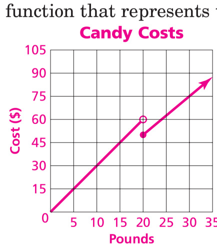


D = all nonzero reals, R = all reals

7. BUSINESS *A Stitch in Time* charges \$40 per hour or any fraction thereof for labor. Draw a graph of the step function that represents this situation.



8. BUSINESS A wholesaler charges a store \$3.00 per pound for less than 20 pounds of candy and \$2.50 per pound for 20 or more pounds. Draw a graph of the function that represents this situation.



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2-6 Reading to Learn Mathematics

Special Functions

Pre-Activity How do step functions apply to postage rates?

Read the introduction to Lesson 2-6 at the top of page 89 in your textbook.

- What is the cost of mailing a letter that weighs 0.5 ounce? **$0.34 or 34 cents**
- Give three different weights of letters that would each cost 55 cents to mail. **Answers will vary. Sample answer: 1.1 ounces, 1.9 ounces, 2.0 ounces**

Reading the Lesson

1. Find the value of each expression.

a. $|-3| =$ **3** $[\![-3]\!] =$ **−3**

b. $|6.2| =$ **6.2** $[\![6.2]\!] =$ **6**

c. $|-4.01| =$ **4.01** $[\![-4.01]\!] =$ **−5**

2. Tell how the name of each kind of function can help you remember what the graph looks like.

a. constant function **Sample answer: Something is constant if it does not change. The *y*-values of a constant function do not change, so the graph is a horizontal line.**

b. absolute value function **Sample answer: The absolute value of a number tells you how far it is from 0 on the number line. It makes no difference whether you go to the left or right so long as you go the same distance each time.**

c. step function **Sample answer: A step function's graph looks like steps that go up or down.**

d. identity function **Sample answer: The *x*- and *y*-values are always identically the same for any point on the graph. So the graph is a line through the origin that has slope 1.**

Helping You Remember

3. Many students find the greatest integer function confusing. Explain how you can use a number line to find the value of this function for any real number. **Answers will vary. Sample answer: Draw a number line that shows the integers. To find the value of the greatest integer function for any real number, place that number on the number line. If it is an integer, the value of the function is the number itself. If not, move to the integer directly to the left of the number you chose. This integer will give the value you need.**

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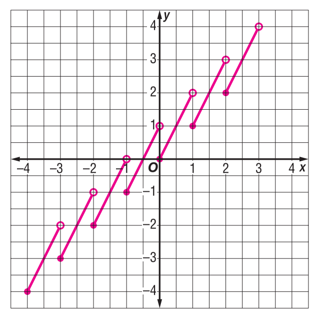
2-6 Enrichment

Greatest Integer Functions

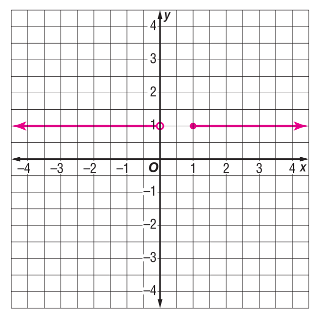
Use the greatest integer function $[\![x]\!]$ to explore some unusual graphs. It will be helpful to make a chart of values for each functions and to use a colored pen or pencil.

Graph each function.

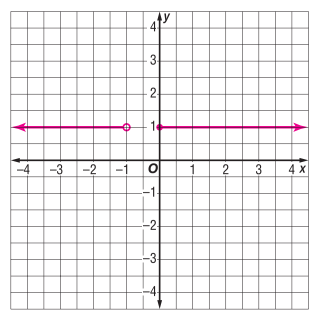
1. $y = 2x - [\![x]\!]$



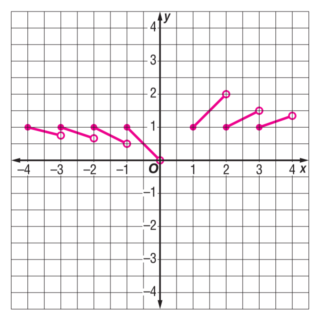
2. $y = \frac{[\![x]\!]}{[\![x]\!]}$



3. $y = \frac{[\![0.5x + 1]\!]}{[\![0.5x + 1]\!]}$



4. $y = \frac{x}{[\![x]\!]}$



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2-7 Study Guide and Intervention

Graphing Inequalities

Graph Linear Inequalities. A **linear inequality**, like $y \geq 2x - 1$, resembles a linear equation, but with an inequality sign instead of an equals sign. The graph of the related linear equation separates the coordinate plane into two half-planes. The line is the boundary of each half-plane.

To graph a linear inequality, follow these steps.

1. Graph the boundary, that is, the related linear equation. If the inequality symbol is $\leq$ or $\geq$, the boundary is solid. If the inequality symbol is $<$ or $>$, the boundary is dashed.
2. Choose a point not on the boundary and test it in the inequality. (0, 0) is a good point to choose if the boundary does not pass through the origin.
3. If a true inequality results, shade the half-plane containing your test point. If a false inequality results, shade the other half-plane.

Example **Graph $x + 2y \geq 4$.**

The boundary is the graph of $x + 2y = 4$.

Use the slope-intercept form, $y = -\frac{1}{2}x + 2$, to graph the boundary line.

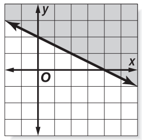
The boundary line should be solid.

Now test the point (0, 0).

$0 + 2(0) \overset{?}{\geq} 4$ $(x, y) = (0, 0)$

$0 \geq 4$ false

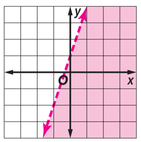
Shade the region that does *not* contain (0, 0).



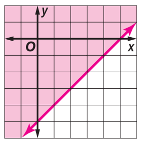
Exercises

Graph each inequality.

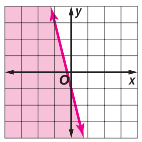
1. $y < 3x + 1$



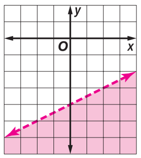
2. $y \geq x - 5$



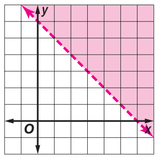
3. $4x + y \leq -1$



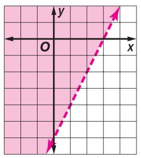
4. $y < \frac{x}{2} - 4$



5. $x + y > 6$



6. $0.5x - 0.25y < 1.5$



Lesson 2-7

NAME ______________________ DATE ________ PERIOD _____

2-7 Study Guide and Intervention *(continued)*

Graphing Inequalities

Graph Absolute Value Inequalities Graphing absolute value inequalities is similar to graphing linear inequalities. The graph of the related absolute value equation is the boundary. This boundary is graphed as a solid line if the inequality is $\leq$ or $\geq$, and dashed if the inequality is $<$ or $>$. Choose a test point not on the boundary to determine which region to shade.

Example **Graph $y \leq 3|x - 1|$.**

First graph the equation $y = 3|x - 1|$.

Since the inequality is $\leq$, the graph of the boundary is solid.

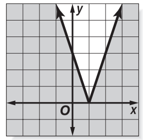
Test (0, 0).

$0 \overset{?}{\leq} 3|0 - 1|$ $(x, y) = (0, 0)$

$0 \overset{?}{\leq} 3|-1|$ $|-1| = 1$

$0 \leq 3$ true

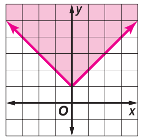
Shade the region that contains (0, 0).



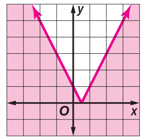
Exercises

Graph each inequality.

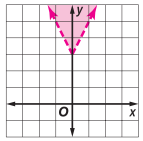
1. $y \geq |x| + 1$



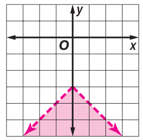
2. $y \leq |2x - 1|$



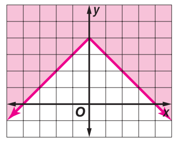
3. $y - 2|x| > 3$



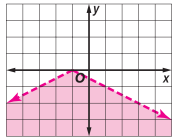
4. $y < -|x| - 3$



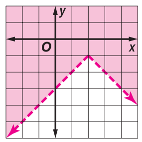
5. $|x| + y \geq 4$



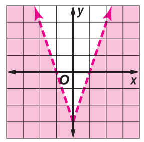
6. $|x + 1| + 2y < 0$



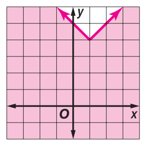
7. $|2 - x| + y > -1$



8. $y < 3|x| - 3$



9. $y \leq |1 - x| + 4$



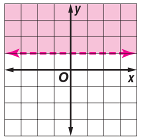
NAME ______________________________ DATE ____________ PERIOD _____

2-7 Skills Practice

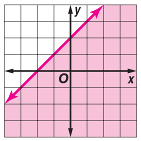
Graphing Inequalities

Graph each inequality.

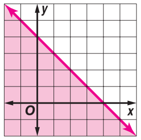
1. $y > 1$



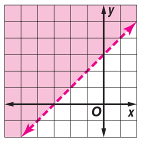
2. $y \leq x + 2$



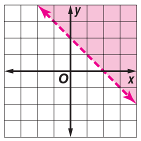
3. $x + y \leq 4$



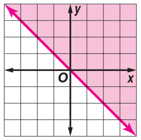
4. $x + 3 < y$



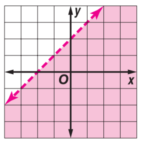
5. $2 - y < x$



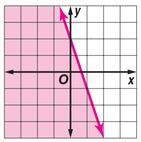
6. $y \geq -x$



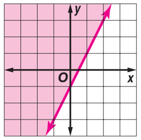
7. $x - y > -2$



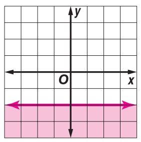
8. $9x + 3y - 6 \leq 0$



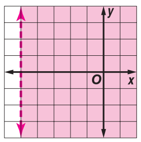
9. $y + 1 \geq 2x$



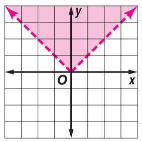
10. $y - 7 \leq -9$



11. $x > -5$



12. $y > |x|$



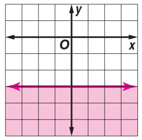
NAME ______________________________ DATE ____________ PERIOD _____

2-7 Practice

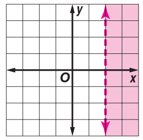
Graphing Inequalities

Graph each inequality.

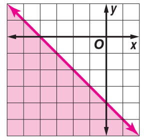
1. $y \leq -3$



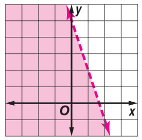
2. $x > 2$



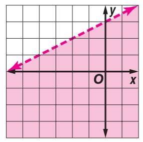
3. $x + y \leq -4$



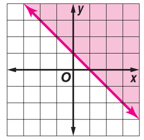
4. $y < -3x + 5$



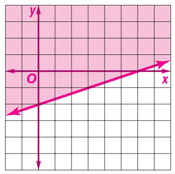
5. $y < \frac{1}{2}x + 3$



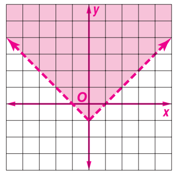
6. $y - 1 \geq -x$



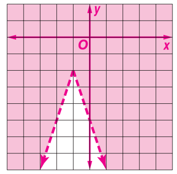
7. $x - 3y \leq 6$



8. $y > |x| - 1$



9. $y > -3|x + 1| - 2$

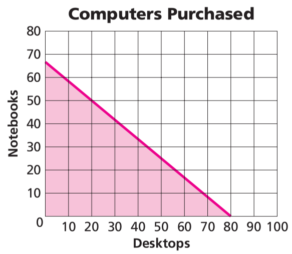


COMPUTERS For Exercises 10–12, use the following information.

A school system is buying new computers. They will buy desktop computers costing $1000 per unit, and notebook computers costing $1200 per unit. The total cost of the computers cannot exceed $80,000.

10. Write an inequality that describes this situation.
$1000d + 1200n \leq 80{,}000$

11. Graph the inequality.



12. If the school wants to buy 50 of the desktop computers and 25 of the notebook computers, will they have enough money? **yes**

NAME ______________________ DATE __________ PERIOD _____

2-7 Reading to Learn Mathematics

Graphing Inequalities

Pre-Activity **How do inequalities apply to fantasy football?**

Read the introduction to Lesson 2-7 at the top of page 96 in your textbook.

- Which of the combinations of yards and touchdowns listed would Dana consider a good game? **The first one: 168 yards and 3 touchdowns**
- Suppose that in one of the games Dana plays, Moss gets 157 receiving yards. What is the smallest number of touchdowns he must get in order for Dana to consider this a good game? **3**

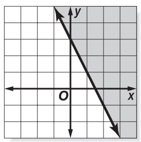
Reading the Lesson

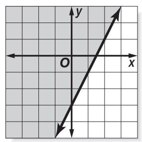
1. When graphing a linear inequality in two variables, how do you know whether to make the boundary a solid line or a dashed line? **If the symbol is ≥ or ≤, the line is solid. If the symbol is > or <, the line is dashed.**

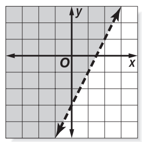
2. How do you know which side of the boundary to shade? **Sample answer: If the test point gives a true inequality, shade the region containing the test point. If the test point gives a false inequality, shade the region *not* containing the test point.**

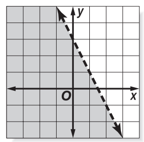
3. Match each inequality with its graph.

a. $y > 2x - 3$ **iii** **b.** $y < -2x + 3$ **iv** **c.** $y \geq 2x - 3$ **ii** **d.** $y \geq -2x + 3$ **i**

i.


ii.


iii.


iv.


Helping You Remember

4. Describe some ways in which graphing an inequality in one variable on a number line is similar to graphing an inequality in two variables in a coordinate plane. How can what you know about graphing inequalities on a number line help you to graph inequalities in a coordinate plane? **Sample answer: A boundary on a coordinate graph is similar to an endpoint on a number line graph. A dashed line is similar to a circle on a number line: both are open and mean *not included*; they represent the symbols > and <. A solid line is similar to a dot on a number line: both are closed and mean *included*; they represent the symbols ≥ and ≤.**

NAME ______________________ DATE __________ PERIOD _____

2-7 Enrichment

Algebraic Proof

The following paragraph states a result you might be asked to prove in a mathematics course. Parts of the paragraph are numbered.

01 Let n be a positive integer.

02 Also, let $n_1 = s(n_1)$ be the sum of the squares of the digits in n.

03 Then $n_2 = s(n_1)$ is the sum of the squares of the digits of n_1, and $n_3 = s(n_2)$ is the sum of the squares of the digits of n_2.

04 In general, $n_k = s(n_{k-1})$ is the sum of the squares of the digits of n_{k-1}.

05 Consider the sequence: $n, n_1, n_2, n_3, \cdots, n_k, \cdots$.

06 In this sequence either all the terms from some k on have the value 1,

07 or some term, say n_j, has the value 4, so that the eight terms 4, 16, 37, 58, 89, 145, 42, and 20 keep repeating from that point on.

Use the paragraph to answer these questions.

1. Use the sentence in line 01. List the first five values of n. **1, 2, 3, 4, 5**

2. Use 9246 for n and give an example to show the meaning of line 02. **$n_1 = s(9246) = 137$, because $137 = 81 + 4 + 16 + 36$**

3. In line 02, which symbol shows a function? Explain the function in a sentence. **$s(n)$; the sum of the squares of the digits of a number is a function of the number**

4. For $n = 9246$, find n_2 and n_3 as described in sentence 03. **$n_2 = 59$, $n_3 = 106$**

5. How do the first four sentences relate to sentence 05? **They explain how to compute the terms of the sequence.**

6. Use $n = 31$ and find the first four terms of the sequence. **31, 10, 1, 1**

7. Which sentence of the paragraph is illustrated by $n = 31$? **sentence 06**

8. Use $n = 61$ and find the first ten terms. **61, 37, 58, 89, 145, 42, 20, 4, 16, 37**

9. Which sentence is illustrated by $n = 61$? **sentence 07**

Chapter 2 Assessment Answer Key

Form 1
Page 99

1. C
2. C
3. C
4. D
5. B
6. B
7. A
8. D
9. C
10. B
11. A
12. B

Page 100

13. D
14. D
15. C
16. D
17. B
18. C
19. A
20. D

B: $k = 10$

Form 2A
Page 101

1. D
2. B
3. D
4. C
5. A
6. B
7. C
8. B
9. B
10. C
11. B
12. A

(continued on the next page)

Answers

Chapter 2 Assessment Answer Key

Form 2A *(continued)*
Page 102

13. D
14. A
15. B
16. C
17. B
18. C
19. D
20. B

B: $k = 5$

Form 2B
Page 103

1. C
2. D
3. C
4. A
5. B
6. D
7. A
8. D
9. C
10. B
11. D
12. D

Page 104

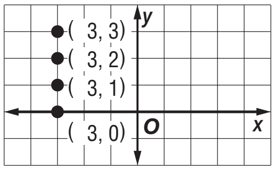
13. A
14. C
15. D
16. B
17. A
18. B
19. C
20. C

B: $k = -16$

Chapter 2 Assessment Answer Key

Form 2C

Page 105

1. 

D = {−3}; R = {0, 1, 2, 3}; no

2. yes

3. no

4. −3

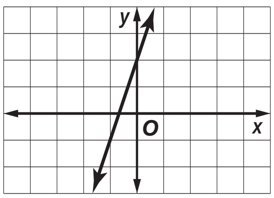
5. $5a^2 - 8a$

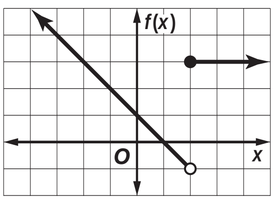
6. No, because a variable appears in the denominator.

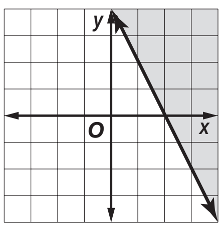
7. yes

8. $5x - 16y = 18$; $A = 5$, $B = -16$, $C = 18$

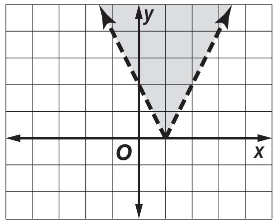
9. x-intercept is 3; y-intercept is −2

10. 

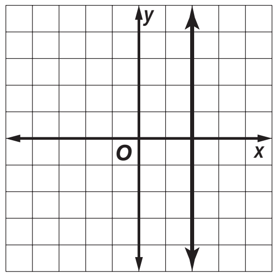
11. 

12. 

Page 106

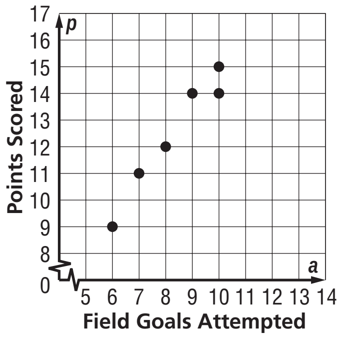
13. 

14. −14

15. 

16. $y = 2x - 7$

17. $y = -\frac{3}{2}x$

18. 

19. Sample answer using (6, 9) and (10, 15): $p = \frac{3}{2}a$; 30

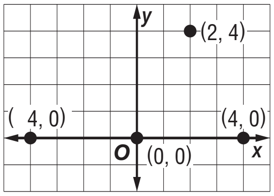
20. step function; D = all reals, R = all integers

B: $k = -7$

Chapter 2 Assessment Answer Key

Form 2D

Page 107

1. 

D = {−4, 0, 2, 4}; R = {0, 4}; yes

2. no

3. yes

4. 14

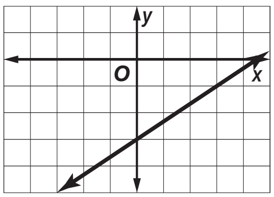
5. $-4a^2 + 2a - 3$

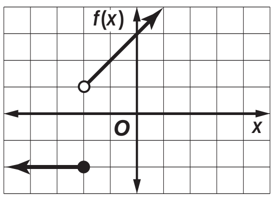
6. yes

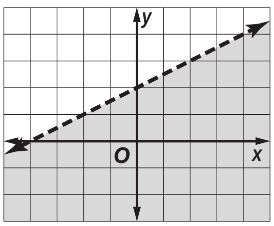
7. No, because the variables are multiplied together.

8. $2x - 56y = 1$; $A = 2$, $B = -56$, $C = 1$

9. x-intercept is -4; y-intercept is 3

10. 

11. 

12. 

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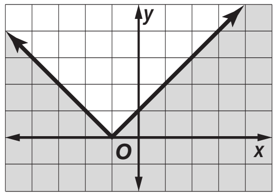
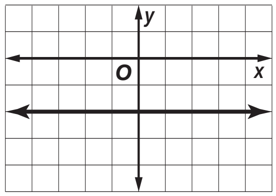
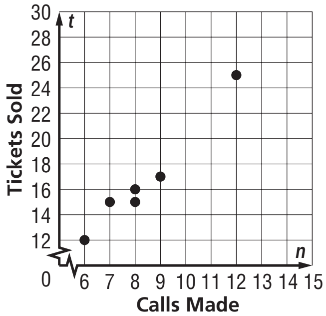
13. 

14. −10

15. 

16. $y = -x - 1$

17. $y = -\frac{5}{2}x$

18. 

19. Sample answer using (6, 12) and (8, 16): $t = 2n$; 32

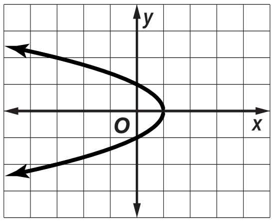
20. step function; D = all reals, R = all integers

B: $k = -3$

Chapter 2 Assessment Answer Key

Form 3

Page 109

1. 

D = {$x \mid x \leq 1$}; R = all reals; no

2. no

3. −8

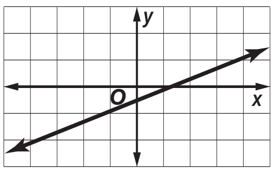
4. $3x + 5$

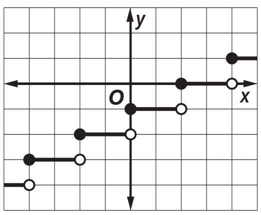
5. A. yes
B. no

6. $25x - 5y = 3$; $A = 25$, $B = -5$, $C = 3$

7. x-intercept is $\frac{2}{7}$; no y-intercept

8. absolute value function

9. 

10. 

11. 5.6

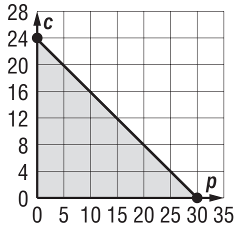
12. $15.22 per year

Page 110

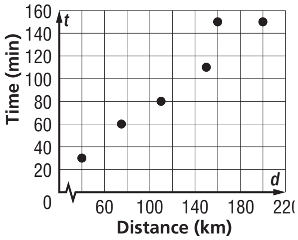
13. $y = -\frac{2}{5}x - 2$

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

15. $12p + 15c \leq 360$



16. $4x - 2y = 1$

17. 

(160,150)

18. Sample answer using (40, 30) and (200, 150): $t = \frac{3}{4}d$; 120 min; much lower

19. $y < -|x - 2|$

20. $f(x) = \begin{cases} -2x \text{ if } x < -1 \\ 0 \text{ if } -1 < x \leq 2 \\ x \text{ if } x > 2 \end{cases}$

B: $k = \frac{3}{5}$

Chapter 2 Assessment Answer Key

Page 111, Open-Ended Assessment
Scoring Rubric

Score	General Description	Specific Criteria
4	**Superior** A correct solution that is supported by well-developed, accurate explanations	• Shows thorough understanding of the concepts of *relations and functions, linear equations and inequalities, scatter plots*, and *prediction equations.* • Uses appropriate strategies to solve problems. • Computations are correct. • Written explanations are exemplary. • Goes beyond requirements of some or all problems.
3	**Satisfactory** A generally correct solution, but may contain minor flaws in reasoning or computation	• Shows an understanding of the concepts of *relations and functions, linear equations and inequalities, scatter plots*, and *prediction equations.* • Uses appropriate strategies to solve problems. • Computations are mostly correct. • Written explanations are effective. • Satisfies all requirements of problems.
2	**Nearly Satisfactory** A partially correct interpretation and/or solution to the problem	• Shows an understanding of most of the concepts of *relations and functions, linear equations and inequalities, scatter plots*, and *prediction equations.* • May not use appropriate strategies to solve problems. • Computations are mostly correct. • Written explanations are satisfactory. • Satisfies the requirements of most of the problems.
1	**Nearly Unsatisfactory** A correct solution with no supporting evidence or explanation	• Final computation is correct. • No written explanations or work is shown to substantiate the final computation. • Satisfies minimal requirements of some of the problems.
0	**Unsatisfactory** An incorrect solution indicating no mathematical understanding of the concept or task, or no solution is given	• Shows little or no understanding of most of the concepts of *relations and functions, linear equations and inequalities, scatter plots*, and *prediction equations.* • Does not use appropriate strategies to solve problems. • Computations are incorrect. • Written explanations are unsatisfactory. • Does not satisfy requirements of problems. • No answer may be given.

Chapter 2 Assessment Answer Key

Page 111, Open-Ended Assessment
Sample Answers

In addition to the scoring rubric found on page A28, the following sample answers may be used as guidance in evaluating open-ended assessment items.

1. Students should describe two situations: If given as a mapping, a set of ordered pairs, or a table, determine whether each member of the domain is paired with exactly one member of the range. If given as a graph, determine whether the graph passes the vertical line test. Functions must satisfy both of these conditions.

2. Sample answer: The speed of a car decreases as you apply the brakes. Thus, the rate of change of the speed with respect to time is negative.

3. slope-intercept form: $y = \frac{1}{2}x + 5$

standard form: $x - 2y = -10$

Sample answer: The slope-intercept form is most useful when graphing since the slope and the y-intercept can be easily determined.

4. Students should indicate that the value for 1994 is likely to be more accurate than the value for 2005 because values in the future may vary considerably from the known data.

5. Students should state that all of the graphs have the same shape, that the graph of $g(x)$ is the graph of the parent function $f(x)$ translated, or shifted, left 2 units, and that the graph of $h(x)$ is the graph of $f(x)$ translated right 3 units. The graph of $y = |x + 500|$ is the graph of $f(x)$ translated left 500 units.

6. Alessia needed a test point to determine which side of the line to shade. Students should indicate that Alessia made a poor choice since the point $(-1, 7)$ lies on the graph of the boundary line and, therefore, does not provide the information she needs to complete the graph.

7. The graph of the relation is an infinite set of points represented graphically as a shaded region. Any vertical line will therefore pass through an infinite number of points in the region. Thus, the relation is not a function.

Answers

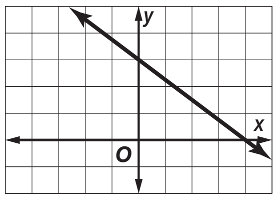
Chapter 2 Assessment Answer Key

Vocabulary Test/Review
Page 112

1. e
2. i
3. h
4. g
5. a
6. c
7. b
8. f
9. j
10. d
11. Sample answer: The vertical line test lets you use the graph of a relation to tell whether the relation is a function. Each vertical line must intersect the graph in at most one point.
12. Sample answer: A linear function is a function that can be written in the form $f(x) = mx + b$, where m and b are real numbers.

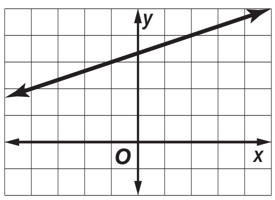
Quiz (Lessons 2–1 and 2–2)
Page 113

1. D = all reals;
   R = all reals; yes
2. no
3. 5
4. $5x - y = -10$; $A = 5$, $B = -1$, $C = -10$
5. x-intercept is 4;
   y-intercept is 3;



Quiz (Lessons 2–3 and 2–4)
Page 113

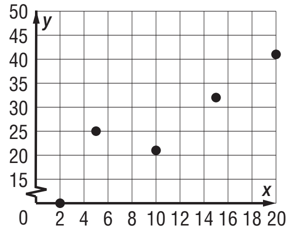
1. $\frac{3}{2}$
2. undefined
3.



4. B
5. $y = -2x + 11$

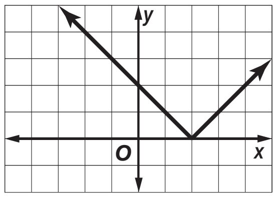
Quiz (Lessons 2–5 and 2–6)
Page 114

1.



(5, 25)

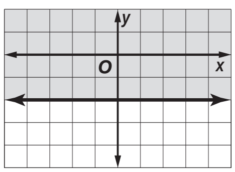
2. Sample answer using (10, 21) and (20, 41): $y = 2x + 1$; 61
3.



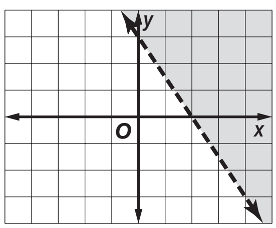
D = all reals;
R = $\{y \mid y \geq 0\}$

Quiz (Lesson 2–7)
Page 114

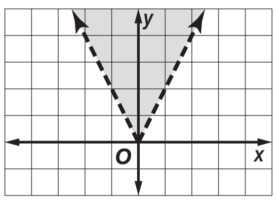
1. $y \leq 3x + 1$
2.



3.



4.



Chapter 2 Assessment Answer Key

Mid-Chapter Test
Page 115

1. D

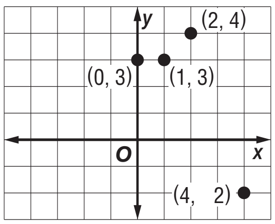
2. C

3. C

4. D

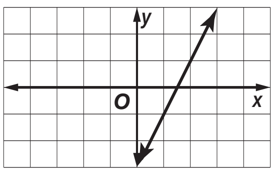
5. B

6.



D = {0, 1, 2, 4};
R = {−2, 3, 4}; yes

7.



D = all reals;
R = all reals; yes

8. 5

9. $\frac{1}{8}$

10. $y = -\frac{1}{3}x - 1$

Cumulative Review
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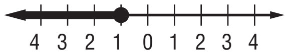
1. 1

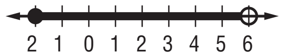
2. Q, R

3. {3, 11}

4. $\{x \mid x \leq -1\}$ or $(-\infty, -1]$



5. $\{y \mid -2 \leq y < 6\}$ or $[-2, 6)$



6. D = {2, 3, 4};
R = {−7, 0}; no

7. 119

8. *x*-intercept is $\frac{8}{3}$;
y-intercept is −2

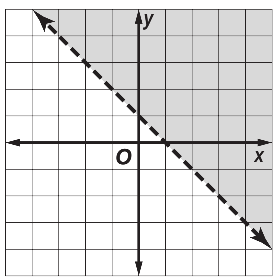
9. $-\frac{5}{2}$

10.

11. about $237,610

12. D = all real numbers;
R = $\{y \mid y < 8\}$

13.



Answers

Chapter 2 Assessment Answer Key

Standardized Test Practice

Page 117

1. (A) (B) (C) **(D)**

2. (E) (F) (G) **(H)**

3. (A) **(B)** (C) (D)

4. (E) (F) **(G)** (H)

5. (A) (B) (C) **(D)**

6. **(E)** (F) (G) (H)

7. (A) **(B)** (C) (D)

8. (E) (F) (G) **(H)**

9. (A) **(B)** (C) (D)

10. (E) (F) **(G)** (H)

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11. 1 2

12. 2 1

13. 7 5

14. 3 2

15. (A) **(B)** (C) (D)

16. **(A)** (B) (C) (D)

17. (A) (B) (C) **(D)**

18. (A) **(B)** (C) (D)