GLENCOE MATHEMATICS

Algebra 1

Chapter 7 Resource Masters

Glencoe McGraw-Hill

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CONSUMABLE WORKBOOKS Many of the worksheets contained in the Chapter Resource Masters booklets are available as consumable workbooks in both English and Spanish.

Study Guide and Intervention Workbook	0-07-827753-1
Study Guide and Intervention Workbook (Spanish)	0-07-827754-X
Skills Practice Workbook	0-07-827747-7
Skills Practice Workbook (Spanish)	0-07-827749-3
Practice Workbook	0-07-827748-5
Practice Workbook (Spanish)	0-07-827750-7
Reading to Learn Mathematics Workbook	0-07-861060-5

ANSWERS FOR WORKBOOKS The answers for Chapter 7 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

StudentWorks™ This CD-ROM includes the entire Student Edition text along with the English workbooks listed above.

TeacherWorks™ All of the materials found in this booklet are included for viewing and printing in the *Glencoe Algebra 1 TeacherWorks* CD-ROM.

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Glencoe Algebra 1
Chapter 7 Resource Masters

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Teacher's Guide to Using the Chapter 7 Resource Masters

The ***Fast File*** Chapter Resource system allows you to conveniently file the resources you use most often. The *Chapter 7 Resource Masters* includes the core materials needed for Chapter 7. 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 1 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 7-1. Encourage them to add these pages to their Algebra Study Notebook. Remind them to add definitions and examples as they complete each lesson.

Study Guide and Intervention

Each lesson in *Algebra 1* 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 7 Resources 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 1. 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 404–405. 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.

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7

Reading to Learn Mathematics

Vocabulary Builder

This is an alphabetical list of the key vocabulary terms you will learn in Chapter 7. 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
consistent kuhn·SIHS·tuhnt		
dependent		
elimination ih·LIH·muh·NAY·shuhn		
independent		
inconsistent		

(continued on the next page)

Reading to Learn Mathematics

Vocabulary Builder *(continued)*

Vocabulary Term	Found on Page	Definition/Description/Example
substitution SUHB·stuh·TOO·shuhn		
system of equations		
system of inequalities		

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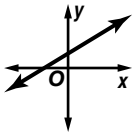
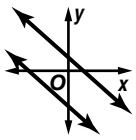
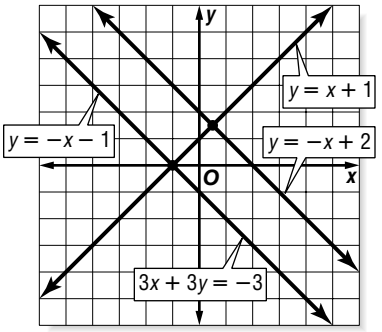
7-1 Study Guide and Intervention

Graphing Systems of Equations

Number of Solutions Two or more linear equations involving the same variables form a **system of equations**. A solution of the system of equations is an ordered pair of numbers that satisfies both equations. The table below summarizes information about systems of linear equations.

Graph of a System	intersecting lines	same line 	parallel lines 
Number of Solutions	exactly one solution	infinitely many solutions	no solution
Terminology	consistent and independent	consistent and dependent	inconsistent

Example **Use the graph at the right to determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions.**



a. $y = -x + 2$
$y = x + 1$

Since the graphs of $y = -x + 2$ and $y = x + 1$ intersect, there is one solution.

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

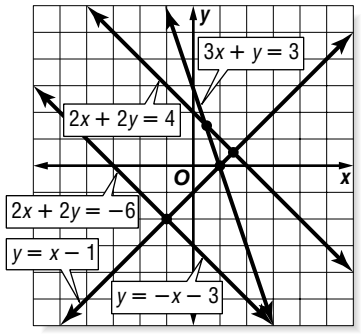
Since the graphs of $y = -x + 2$ and $3x + 3y = -3$ are parallel, there are no solutions.

c. $3x + 3y = -3$
$y = -x - 1$

Since the graphs of $3x + 3y = -3$ and $y = -x - 1$ coincide, there are infinitely many solutions.

Exercises

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $y = -x - 3$
$y = x - 1$

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

3. $y = -x - 3$
$2x + 2y = 4$

4. $2x + 2y = -6$
$3x + y = 3$

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7-1 Study Guide and Intervention *(continued)*

Graphing Systems of Equations

Solve by Graphing One method of solving a system of equations is to graph the equations on the same coordinate plane.

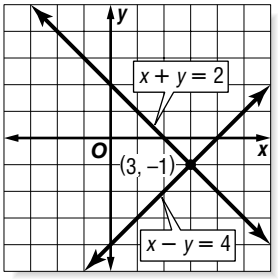
Example **Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.**

a. $x + y = 2$
$x - y = 4$

The graphs intersect. Therefore, there is one solution. The point $(3, -1)$ seems to lie on both lines. Check this estimate by replacing x with 3 and y with -1 in each equation.

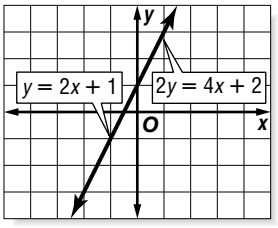
$x + y = 2$
$3 + (-1) = 2$ ✓
$x - y = 4$
$3 - (-1) = 3 + 1$ or 4 ✓

The solution is $(3, -1)$.



b. $y = 2x + 1$
$2y = 4x + 2$

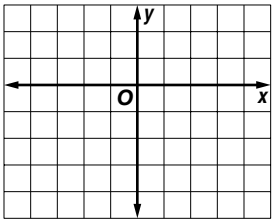
The graphs coincide. Therefore there are infinitely many solutions.



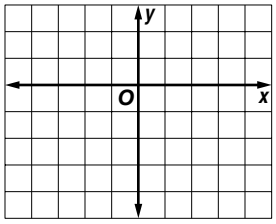
Exercises

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

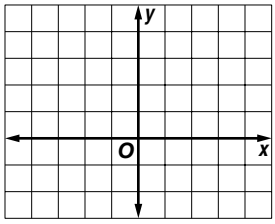
1. $y = -2$
$3x - y = -1$



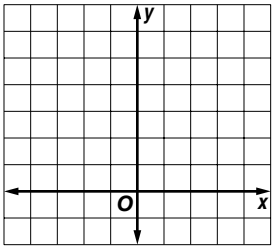
2. $x = 2$
$2x + y = 1$



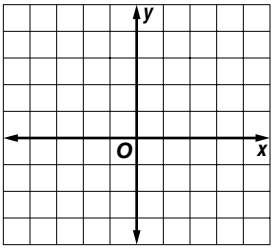
3. $y = \frac{1}{2}x$
$x + y = 3$



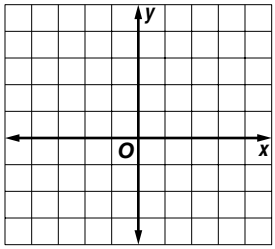
4. $2x + y = 6$
$2x - y = -2$



5. $3x + 2y = 6$
$3x + 2y = -4$



6. $2y = -4x + 4$
$y = -2x + 2$

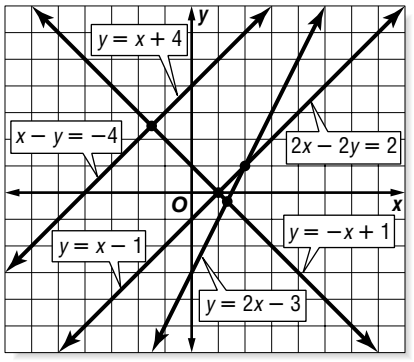


NAME _____ DATE _____ PERIOD _____

7-1 Skills Practice

Graphing Systems of Equations

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $y = x - 1$
$y = -x + 1$

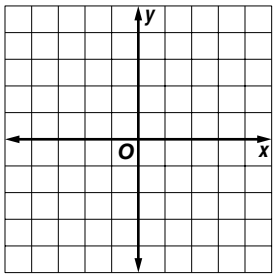
2. $x - y = -4$
$y = x + 4$

3. $y = x + 4$
$2x - 2y = 2$

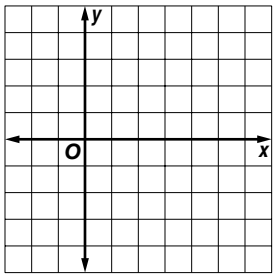
4. $y = 2x - 3$
$2x - 2y = 2$

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

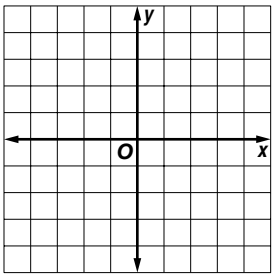
5. $2x - y = 1$
$y = -3$



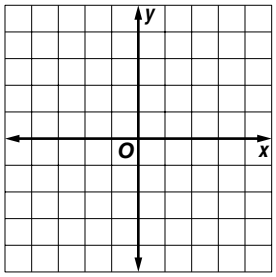
6. $x = 1$
$2x + y = 4$



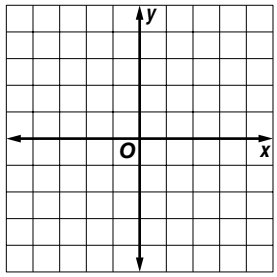
7. $3x + y = -3$
$3x + y = 3$



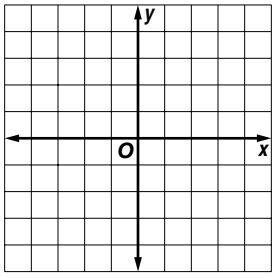
8. $y = x + 2$
$x - y = -2$



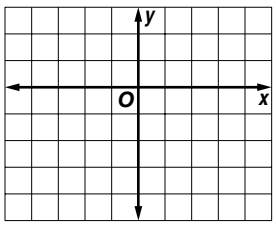
9. $x + 3y = -3$
$x - 3y = -3$



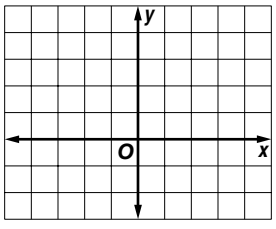
10. $y - x = -1$
$x + y = 3$



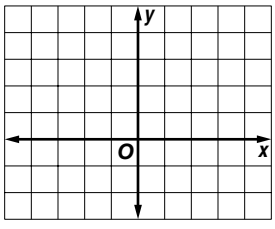
11. $x - y = 3$
$x - 2y = 3$



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



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



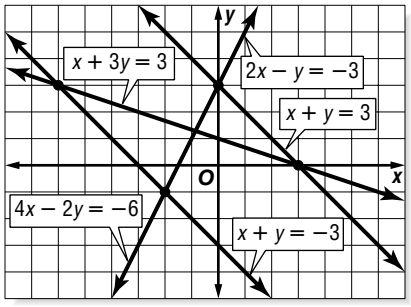
Lesson 7-1

NAME _____ DATE _____ PERIOD _____

7-1 Practice

Graphing Systems of Equations

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $x + y = 3$
$x + y = -3$

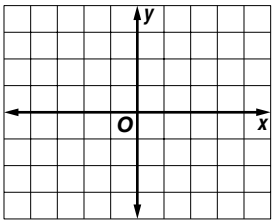
2. $2x - y = -3$
$4x - 2y = -6$

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

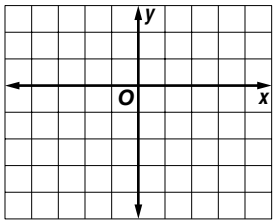
4. $x + 3y = 3$
$2x - y = -3$

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

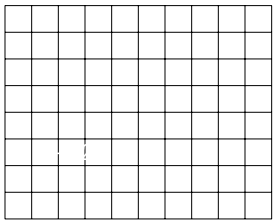
5. $3x - y = -2$
$3x - y = 0$



6. $y = 2x - 3$
$4x = 2y + 6$

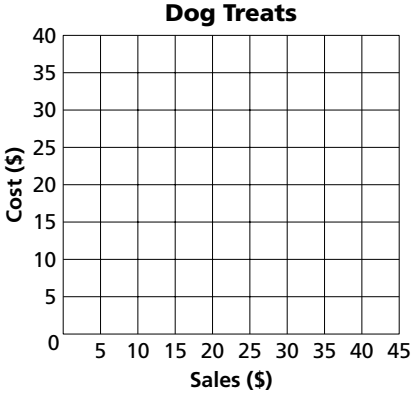


7. $x + 2y = 3$
$3x - y = -5$



BUSINESS For Exercises 8 and 9, use the following information.

Nick plans to start a home-based business producing and selling gourmet dog treats. He figures it will cost \$20 in operating costs per week plus \$0.50 to produce each treat. He plans to sell each treat for \$1.50.

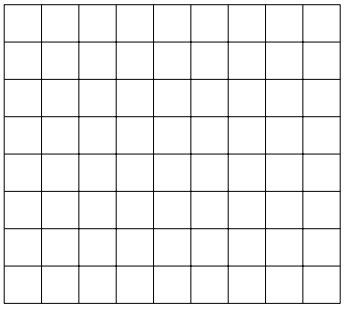


8. Graph the system of equations $y = 0.5x + 20$ and $y = 1.5x$ to represent the situation.

9. How many treats does Nick need to sell per week to break even?

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

A used book store also started selling used CDs and videos. In the first week, the store sold 40 used CDs and videos, at \$4.00 per CD and \$6.00 per video. The sales for both CDs and videos totaled \$180.00



10. Write a system of equations to represent the situation.

11. Graph the system of equations.

12. How many CDs and videos did the store sell in the first week?

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7-1 Reading to Learn Mathematics

Graphing Systems of Equations

Pre-Activity **How can you use graphs to compare the sales of two products?**

Read the introduction to Lesson 7-1 at the top of page 369 in your textbook.

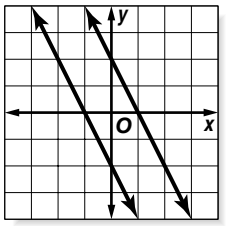
- What is meant by the term linear function?

- What does it mean to say that two lines intersect?

Reading the Lesson

1. Each figure shows the graph of a system of two equations. Write the letter of the figures that illustrate each statement.

A.



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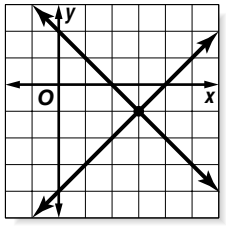

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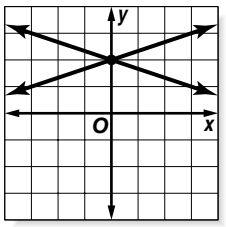

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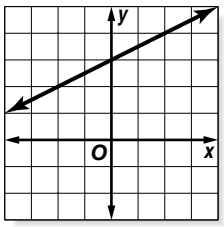

a. A system of two linear equations can have an infinite number of solutions.

b. A system of equations is consistent if there is at least one ordered pair that satisfies both equations.

c. If two graphs are parallel, there are no ordered pairs that satisfy both equations.

d. If a system of equations has exactly one solution, it is independent.

e. If a system of equations has an infinite number of solutions, it is dependent.

Helping You Remember

2. Describe how you can solve a system of equations by graphing.

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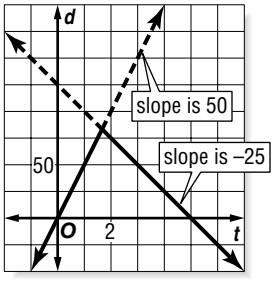
7-1 Enrichment

Graphing a Trip

The distance formula, $d = rt$, is used to solve many types of problems. If you graph an equation such as $d = 50t$, the graph is a model for a car going at 50 mi/h. The time the car travels is t; the distance in miles the car covers is d. The slope of the line is the speed.



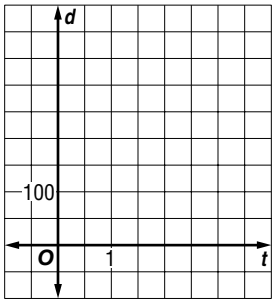
Suppose you drive to a nearby town and return. You average 50 mi/h on the trip out but only 25 mi/h on the trip home. The round trip takes 5 hours. How far away is the town?

The graph at the right represents your trip. Notice that the return trip is shown with a negative slope because you are driving in the opposite direction.

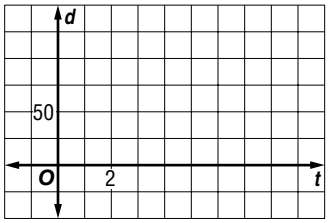
Solve each problem.

1. Estimate the answer to the problem in the above example. About how far away is the town?

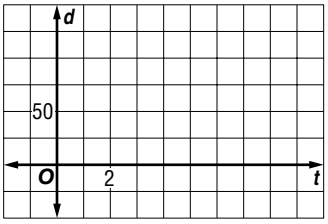
2. Graph this trip and solve the problem. An airplane has enough fuel for 3 hours of safe flying. On the trip out the pilot averages 200 mi/h flying against a headwind. On the trip back, the pilot averages 250 mi/h. How long a trip out can the pilot make?



3. Graph this trip and solve the problem. You drive to a town 100 miles away. On the trip out you average 25 mi/h. On the trip back you average 50 mi/h. How many hours do you spend driving?



4. Graph this trip and solve the problem. You drive at an average speed of 50 mi/h to a discount shopping plaza, spend 2 hours shopping, and then return at an average speed of 25 mi/h. The entire trip takes 8 hours. How far away is the shopping plaza?



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7-2 Study Guide and Intervention

Substitution

Substitution One method of solving systems of equations is **substitution**.

Example 1 **Use substitution to solve the system of equations.**

$y = 2x$
$4x - y = -4$

Substitute $2x$ for y in the second equation.

$4x - y = -4$	Second equation
$4x - 2x = -4$	$y = 2x$
$2x = -4$	Combine like terms.
$\frac{2x}{2} = \frac{-4}{2}$	Divide each side by 2.
$x = -2$	Simplify.

Use $y = 2x$ to find the value of y.

$y = 2x$	First equation
$y = 2(-2)$	$x = -2$
$y = -4$	Simplify.

The solution is $(-2, -4)$.

Example 2 **Solve for one variable, then substitute.**

$x + 3y = 7$
$2x - 4y = -6$

Solve the first equation for x since the coefficient of x is 1.

$x + 3y = 7$	First equation
$x + 3y - 3y = 7 - 3y$	Subtract $3y$ from each side.
$x = 7 - 3y$	Simplify.

Find the value of y by substituting $7 - 3y$ for x in the second equation.

$2x - 4y = -6$	Second equation
$2(7 - 3y) - 4y = -6$	$x = 7 - 3y$
$14 - 6y - 4y = -6$	Distributive Property
$14 - 10y = -6$	Combine like terms.
$14 - 10y - 14 = -6 - 14$	Subtract 14 from each side.
$-10y = -20$	Simplify.
$\frac{-10y}{-10} = \frac{-20}{-10}$	Divide each side by -10.
$y = 2$	Simplify.

Use $y = 2$ to find the value of x.

$x = 7 - 3y$
$x = 7 - 3(2)$
$x = 1$

The solution is $(1, 2)$.

Lesson 7-2

Exercises

Use substitution to solve each system of equations. If the system does *not* have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

1. $y = 4x$
$3x - y = 1$

2. $x = 2y$
$y = x - 2$

3. $x = 2y - 3$
$x = 2y + 4$

4. $x - 2y = -1$
$3y = x + 4$

5. $c - 4d = 1$
$2c - 8d = 2$

6. $x + 2y = 0$
$3x + 4y = 4$

7. $2b = 6a - 14$
$3a - b = 7$

8. $x + y = 16$
$2y = -2x + 2$

9. $y = -x + 3$
$2y + 2x = 4$

10. $x = 2y$
$0.25x + 0.5y = 10$

11. $x - 2y = -5$
$x + 2y = -1$

12. $-0.2x + y = 0.5$
$0.4x + y = 1.1$

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

Substitution

Real-World Problems Substitution can also be used to solve real-world problems involving systems of equations. It may be helpful to use tables, charts, diagrams, or graphs to help you organize data.

Example **CHEMISTRY How much of a 10% saline solution should be mixed with a 20% saline solution to obtain 1000 milliliters of a 12% saline solution?**

Let s = the number of milliliters of 10% saline solution.
Let t = the number of milliliters of 20% saline solution.

Use a table to organize the information.

	10% saline	20% saline	12% saline
Total milliliters	s	t	1000
Milliliters of saline	$0.10s$	$0.20t$	$0.12(1000)$

Write a system of equations.

$s + t = 1000$
$0.10s + 0.20t = 0.12(1000)$

Use substitution to solve this system.

$s + t = 1000$	First equation
$s = 1000 - t$	Solve for s.
$0.10s + 0.20t = 0.12(1000)$	Second equation
$0.10(1000 - t) + 0.20t = 0.12(1000)$	$s = 1000 - t$
$100 - 0.10t + 0.20t = 0.12(1000)$	Distributive Property
$100 + 0.10t = 0.12(1000)$	Combine like terms.
$0.10t = 20$	Simplify.
$\frac{0.10t}{0.10} = \frac{20}{0.10}$	Divide each side by 0.10.
$t = 200$	Simplify.
$s + t = 1000$	First equation
$s + 200 = 1000$	$t = 200$
$s = 800$	Solve for s.

800 milliliters of 10% solution and 200 milliliters of 20% solution should be used.

Exercises

1. **SPORTS** At the end of the 2000-2001 football season, 31 Super Bowl games had been played with the current two football leagues, the American Football Conference (AFC) and the National Football Conference (NFC). The NFC won five more games than the AFC. How many games did each conference win? **Source:** *New York Times Almanac*

2. **CHEMISTRY** A lab needs to make 100 gallons of an 18% acid solution by mixing a 12% acid solution with a 20% solution. How many gallons of each solution are needed?

3. **GEOMETRY** The perimeter of a triangle is 24 inches. The longest side is 4 inches longer than the shortest side, and the shortest side is three-fourths the length of the middle side. Find the length of each side of the triangle.

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7-2 Skills Practice

Substitution

Use substitution to solve each system of equations. If the system does *not* have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

1. $y = 4x$
$x + y = 5$

2. $y = 2x$
$x + 3y = -14$

3. $y = 3x$
$2x + y = 15$

4. $x = -4y$
$3x + 2y = 20$

5. $y = x - 1$
$x + y = 3$

6. $x = y - 7$
$x + 8y = 2$

7. $y = 4x - 1$
$y = 2x - 5$

8. $y = 3x + 8$
$5x + 2y = 5$

9. $2x - 3y = 21$
$y = 3 - x$

10. $y = 5x - 8$
$4x + 3y = 33$

11. $x + 2y = 13$
$3x - 5y = 6$

12. $x + 5y = 4$
$3x + 15y = -1$

13. $3x - y = 4$
$2x - 3y = -9$

14. $x + 4y = 8$
$2x - 5y = 29$

15. $x - 5y = 10$
$2x - 10y = 20$

16. $5x - 2y = 14$
$2x - y = 5$

17. $2x + 5y = 38$
$x - 3y = -3$

18. $x - 4y = 27$
$3x + y = -23$

19. $2x + 2y = 7$
$x - 2y = -1$

20. $2.5x + y = -2$
$3x + 2y = 0$

Lesson 7-2

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7-2 Practice

Substitution

Use substitution to solve each system of equations. If the system does *not* have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

1. $y = 6x$
$2x + 3y = -20$

2. $x = 3y$
$3x - 5y = 12$

3. $x = 2y + 7$
$x = y + 4$

4. $y = 2x - 2$
$y = x + 2$

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

6. $3x + y = 12$
$y = -x - 2$

7. $x + 2y = 13$
$-2x - 3y = -18$

8. $x - 2y = 3$
$4x - 8y = 12$

9. $x - 5y = 36$
$2x + y = -16$

10. $2x - 3y = -24$
$x + 6y = 18$

11. $x + 14y = 84$
$2x - 7y = -7$

12. $0.3x - 0.2y = 0.5$
$x - 2y = -5$

13. $0.5x + 4y = -1$
$x + 2.5y = 3.5$

14. $3x - 2y = 11$
$x - \frac{1}{2}y = 4$

15. $\frac{1}{2}x + 2y = 12$
$x - 2y = 6$

16. $\frac{1}{3}x - y = 3$
$2x + y = 25$

17. $4x - 5y = -7$
$y = 5x$

18. $x - 3y = -4$
$2x + 6y = 5$

EMPLOYMENT For Exercises 19–21, use the following information.

Kenisha sells athletic shoes part-time at a department store. She can earn either \$500 per month plus a 4% commission on her total sales, or \$400 per month plus a 5% commission on total sales.

19. Write a system of equations to represent the situation.

20. What is the total price of the athletic shoes Kenisha needs to sell to earn the same income from each pay scale?

21. Which is the better offer?

MOVIE TICKETS For Exercises 22 and 23, use the following information.

Tickets to a movie cost \$7.25 for adults and \$5.50 for students. A group of friends purchased 8 tickets for \$52.75.

22. Write a system of equations to represent the situation.

23. How many adult tickets and student tickets were purchased?

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7-2 Reading to Learn Mathematics

Substitution

Pre-Activity **How can a system of equations be used to predict media use?**

Read the introduction to Lesson 7-2 at the top of page 376 in your textbook.

- What is the system of equations?
- Based on the graph, are there 0, 1, or infinitely many solutions of the system?

Reading the Lesson

1. Describe how you would use substitution to solve each system of equations.

a. $y = -2x$
$x + 3y = 15$

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

c. $x + 2y = 7$
$2x - 8y = 8$

d. $-3x + 5y = 81$
$2x + y = 24$

2. Jess solved a system of equations and her result was $-8 = -8$. All of her work was correct. Describe the graph of the system. Explain.

3. Miguel solved a system of equations and his result was $5 = -2$. All of his work was correct. Describe the graph of the system. Explain.

Helping You Remember

4. What is usually the first step in solving a system of equations by substitution?

Lesson 7-2

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7-2 Enrichment

Equations of Lines and Planes in Intercept Form

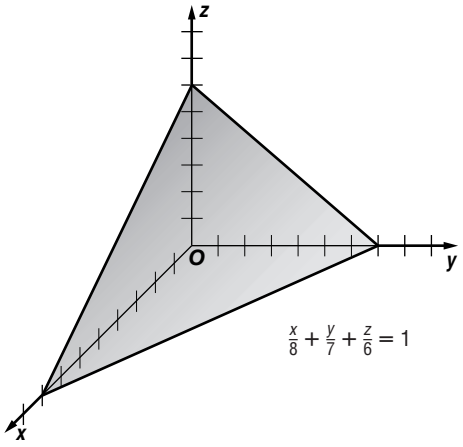
One form that a linear equation may take is **intercept form**. The constants a and b are the x- and y-intercepts of the graph.

$$\frac{x}{a} + \frac{y}{b} = 1$$

In three-dimensional space, the equation of a plane takes a similar form.

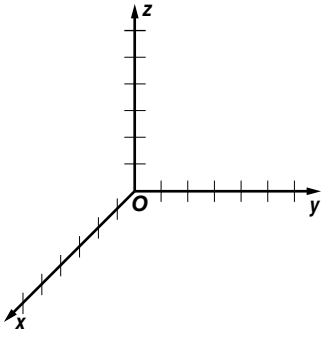
$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$$

Here, the constants a, b, and c are the points where the plane meets the x, y, and z-axes.



Solve each problem.

1. Graph the equation $\frac{x}{3} + \frac{y}{2} + \frac{z}{1} = 1$.

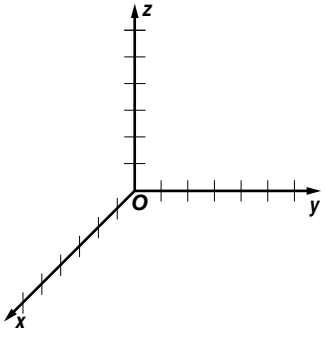


2. For the plane in Exercise 1, write an equation for the line where the plane intersects the xy-plane. Use intercept forms.

3. Write an equation for the line where the plane intersects the xz-plane.

4. Write an equation for the line where the plane intersects the yz-plane.

5. Graph the equation $\frac{x}{1} + \frac{y}{4} + \frac{z}{2} = 1$.



6. Write an equation for the xy-plane.

7. Write an equation for the yz-plane.

8. Write an equation for a plane parallel to the xy-plane with a z-intercept of 2.

9. Write an equation for a plane parallel to the yz-plane with an x-intercept of 23.

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7-3 Study Guide and Intervention

Elimination Using Addition and Subtraction

Elimination Using Addition In systems of equations in which the coefficients of the x or y terms are additive inverses, solve the system by adding the equations. Because one of the variables is eliminated, this method is called **elimination**.

Example 1 **Use addition to solve the system of equations.**

$x - 3y = 7$
$3x + 3y = 9$

Write the equations in column form and add to eliminate y.

$$\begin{array}{rl} x - 3y = & 7 \\ (+)\ 3x + 3y = & 9 \\ \hline 4x \qquad = & 16 \end{array}$$

Solve for x.

$$\frac{4x}{4} = \frac{16}{4}$$
$$x = 4$$

Substitute 4 for x in either equation and solve for y.

$$\begin{aligned} 4 - 3y &= 7 \\ 4 - 3y - 4 &= 7 - 4 \\ -3y &= 3 \\ \frac{-3y}{-3} &= \frac{3}{-3} \\ y &= -1 \end{aligned}$$

The solution is $(4, -1)$.

Example 2 **The sum of two numbers is 70 and their difference is 24. Find the numbers.**

Let x represent one number and y represent the other number.

$$\begin{array}{rl} x + y = & 70 \\ (+)\ x - y = & 24 \\ \hline 2x \qquad = & 94 \end{array}$$

$$\frac{2x}{2} = \frac{94}{2}$$
$$x = 47$$

Substitute 47 for x in either equation.

$$\begin{aligned} 47 + y &= 70 \\ 47 + y - 47 &= 70 - 47 \\ y &= 23 \end{aligned}$$

The numbers are 47 and 23.

Exercises

Use elimination to solve each system of equations.

1. $x + y = -4$
$x - y = 2$

2. $2m - 3n = 14$
$m + 3n = -11$

3. $3a - b = -9$
$-3a - 2b = 0$

4. $-3x - 4y = -1$
$3x - y = -4$

5. $3c + d = 4$
$2c - d = 6$

6. $-2x + 2y = 9$
$2x - y = -6$

7. $2x + 2y = -2$
$3x - 2y = 12$

8. $4x - 2y = -1$
$-4x + 4y = -2$

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

10. $2x - 3y = 12$
$4x + 3y = 24$

11. $-0.2x + y = 0.5$
$0.2x + 2y = 1.6$

12. $0.1x + 0.3y = 0.9$
$0.1x - 0.3y = 0.2$

13. Rema is older than Ken. The difference of their ages is 12 and the sum of their ages is 50. Find the age of each.

14. The sum of the digits of a two-digit number is 12. The difference of the digits is 2. Find the number if the units digit is larger than the tens digit.

Lesson 7-3

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Study Guide and Intervention *(continued)*

Elimination Using Addition and Subtraction

Elimination Using Subtraction In systems of equations where the coefficients of the x or y terms are the same, solve the system by subtracting the equations.

Use subtraction to solve the system of equations.

$2x - 3y = 11$
$5x - 3y = 14$

$2x - 3y = 11$ $(-)\ 5x - 3y = 14$	Write the equations in column form and subtract.
$-3x = -3$	Subtract the two equations. y is eliminated.
$\frac{-3x}{-3} = \frac{-3}{-3}$	Divide each side by -3.
$x = 1$	Simplify.
$2(1) - 3y = 11$	Substitute 1 for x in either equation.
$2 - 3y = 11$	Simplify.
$2 - 3y - 2 = 11 - 2$	Subtract 2 from each side.
$-3y = 9$	Simplify.
$\frac{-3y}{-3} = \frac{9}{-3}$	Divide each side by -3.
$y = -3$	Simplify.

The solution is $(1, -3)$.

Use elimination to solve each system of equations.

1. $6x + 5y = 4$
$6x - 7y = -20$

2. $3m - 4n = -14$
$3m + 2n = -2$

3. $3a + b = 1$
$a + b = 3$

4. $-3x - 4y = -23$
$-3x + y = 2$

5. $c - 3d = 11$
$2c - 3d = 16$

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

7. $2a - 3b = -13$
$2a + 2b = 7$

8. $4x + 2y = 6$
$4x + 4y = 10$

9. $5s - t = 6$
$5s + 2t = 3$

10. $6x - 3y = 12$
$4x - 3y = 24$

11. $x + 2y = 3.5$
$x - 3y = -9$

12. $0.2x + y = 0.7$
$0.2x + 2y = 1.2$

13. The sum of two numbers is 70. One number is ten more than twice the other number. Find the numbers.

14. GEOMETRY Two angles are supplementary. The measure of one angle is 10° more than three times the other. Find the measure of each angle.

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7-3 Skills Practice

Elimination Using Addition and Subtraction

Use elimination to solve each system of equations.

1. $x - y = 1$
$x + y = 3$

2. $-x + y = 1$
$x + y = 11$

3. $x + 4y = 11$
$x - 6y = 11$

4. $-x + 3y = 6$
$x + 3y = 18$

5. $3x + 4y = 19$
$3x + 6y = 33$

6. $x + 4y = -8$
$x - 4y = -8$

7. $3a + 4b = 2$
$4a - 4b = 12$

8. $3c - d = -1$
$-3c - d = 5$

9. $2x - 3y = 9$
$-5x - 3y = 30$

10. $x - y = 4$
$2x + y = -4$

11. $3m - n = 26$
$-2m - n = -24$

12. $5x - y = -6$
$-x + y = 2$

13. $6x - 2y = 32$
$4x - 2y = 18$

14. $3x + 2y = -19$
$-3x - 5y = 25$

15. $7m + 4n = 2$
$7m + 2n = 8$

16. $2x - 5y = -28$
$4x + 5y = 4$

17. The sum of two numbers is 28 and their difference is 4. What are the numbers?

18. Find the two numbers whose sum is 29 and whose difference is 15.

19. The sum of two numbers is 24 and their difference is 2. What are the numbers?

20. Find the two numbers whose sum is 54 and whose difference is 4.

21. Two times a number added to another number is 25. Three times the first number minus the other number is 20. Find the numbers.

Lesson 7-3

NAME _____ DATE _____ PERIOD _____

7-3 Practice

Elimination Using Addition and Subtraction

Use elimination to solve each system of equations.

1. $x - y = 1$
$x + y = -9$

2. $p + q = -2$
$p - q = 8$

3. $4x + y = 23$
$3x - y = 12$

4. $2x + 5y = -3$
$2x + 2y = 6$

5. $3x + 2y = -1$
$4x + 2y = -6$

6. $5x + 3y = 22$
$5x - 2y = 2$

7. $5x + 2y = 7$
$-2x + 2y = -14$

8. $3x - 9y = -12$
$3x - 15y = -6$

9. $-4c - 2d = -2$
$2c - 2d = -14$

10. $2x - 6y = 6$
$2x + 3y = 24$

11. $7x + 2y = 2$
$7x - 2y = -30$

12. $4.25x - 1.28y = -9.2$
$x + 1.28y = 17.6$

13. $2x + 4y = 10$
$x - 4y = -2.5$

14. $2.5x + y = 10.7$
$2.5x + 2y = 12.9$

15. $6m - 8n = 3$
$2m - 8n = -3$

16. $4a + b = 2$
$4a + 3b = 10$

17. $-\frac{1}{3}x - \frac{4}{3}y = -2$
$\frac{1}{3}x - \frac{2}{3}y = 4$

18. $\frac{3}{4}x - \frac{1}{2}y = 8$
$\frac{3}{2}x + \frac{1}{2}y = 19$

19. The sum of two numbers is 41 and their difference is 5. What are the numbers?

20. Four times one number added to another number is 36. Three times the first number minus the other number is 20. Find the numbers.

21. One number added to three times another number is 24. Five times the first number added to three times the other number is 36. Find the numbers.

22. LANGUAGES English is spoken as the first or primary language in 78 more countries than Farsi is spoken as the first language. Together, English and Farsi are spoken as a first language in 130 countries. In how many countries is English spoken as the first language? In how many countries is Farsi spoken as the first language?

23. DISCOUNTS At a sale on winter clothing, Cody bought two pairs of gloves and four hats for $43.00. Tori bought two pairs of gloves and two hats for $30.00. What were the prices for the gloves and hats?

NAME _____ DATE _____ PERIOD _____

7-3 Reading to Learn Mathematics

Elimination Using Addition and Subtraction

Pre-Activity **How can you use a system of equations to solve problems about weather?**

Read the introduction to Lesson 7-3 at the top of page 382 in your textbook.

What fact explains why the variable d gets eliminated from the system of equations?

Reading the Lesson

1. Write *addition* or *subtraction* to tell which operation it would be easiest to use to eliminate a variable of the system. Explain your choice.

	System of Equations	Operation	Explanation
a.	$3x + 5y = 12$ $-3x + 2y = 6$		
b.	$3x + 5y = 7$ $3x - 2y = 8$		
c.	$-x - 4y = 9$ $4x - 4y = 6$		
d.	$5x - 7y = 17$ $8x + 7y = 9$		

Helping You Remember

2. Tell how you can decide whether to use addition or subtraction to eliminate a variable in a system of equations.

Lesson 7-3

NAME _____ DATE _____ PERIOD _____

7-3 Enrichment

Rózsa Péter

Rózsa Péter (1905–1977) was a Hungarian mathematician dedicated to teaching others about mathematics. As professor of mathematics at a teachers' college in Budapest, she wrote several mathematics textbooks and championed reforms in the teaching of mathematics. In 1945 she wrote *Playing with Infinity: Mathematical Explorations and Excursions,* a popular work in which she attempted to convey the spirit of mathematics to the general public.

By far Péter's greatest contribution to mathematics was her pioneering research in the field of recursive function theory. When you evaluate a function *recursively*, you begin with one initial value of x. Working from this single number, you can use the function to generate an entire sequence of numbers. For instance, here is how you use an initial value of $x = 1$ to evaluate the function $f(x) = 3x$ recursively.

$$f(1) = 3(1) = 3 \rightarrow f(3) = 3(3) = 9 \rightarrow f(9) = 3(9) = 27 \rightarrow f(27) = 3(27) = 81 \rightarrow f(81) = 3(81) = 243 \rightarrow$$

The first five numbers of the sequence generated by this function are 3, 9, 27, 81, and 243.

Write the first five numbers of the sequence generated by each function, using the given number as the initial value of x.

1. $f(x) = 3x; x = 2$

2. $g(x) = x - 5; x = 1$

3. $f(x) = 2x + 1; x = -3$

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

5. $h(x) = -x; x = 3$

6. $k(x) = \frac{1}{x}; x = 10$

NAME _____ DATE _____ PERIOD _____

7-4 Study Guide and Intervention

Elimination Using Multiplication

Elimination Using Multiplication Some systems of equations cannot be solved simply by adding or subtracting the equations. In such cases, one or both equations must first be multiplied by a number before the system can be solved by elimination.

Example 1 **Use elimination to solve the system of equations.**

$x + 10y = 3$
$4x + 5y = 5$

If you multiply the second equation by -2, you can eliminate the y terms.

$$\begin{array}{rrl} x + 10y = & 3 \\ (+)\ -8x - 10y = & -10 \\ \hline -7x = & -7 \end{array}$$

$$\frac{-7x}{-7} = \frac{-7}{-7}$$

$$x = 1$$

Substitute 1 for x in either equation.

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

The solution is $\left(1, \frac{1}{5}\right)$.

Example 2 **Use elimination to solve the system of equations.**

$3x - 2y = -7$
$2x - 5y = 10$

If you multiply the first equation by 2 and the second equation by -3, you can eliminate the x terms.

$$\begin{array}{rrl} 6x - & 4y = & -14 \\ (+)\ -6x + & 15y = & -30 \\ \hline & 11y = & -44 \end{array}$$

$$\frac{11y}{11} = \frac{-44}{11}$$

$$y = -4$$

Substitute -4 for y in either equation.

$$3x - 2(-4) = -7$$
$$3x + 8 = -7$$
$$3x + 8 - 8 = -7 - 8$$
$$3x = -15$$
$$\frac{3x}{3} = \frac{-15}{3}$$
$$x = -5$$

The solution is $(-5, -4)$.

Exercises

Use elimination to solve each system of equations.

1. $2x + 3y = 6$
$x + 2y = 5$

2. $2m + 3n = 4$
$-m + 2n = 5$

3. $3a - b = 2$
$a + 2b = 3$

4. $4x + 5y = 6$
$6x - 7y = -20$

5. $4c - 3d = 22$
$2c - d = 10$

6. $3x - 4y = -4$
$x + 3y = -10$

7. $4s - t = 9$
$5s + 2t = 8$

8. $4a - 3b = -8$
$2a + 2b = 3$

9. $2x + 2y = 5$
$4x - 4y = 10$

10. $6x - 4y = -8$
$4x + 2y = -3$

11. $4x + 2y = -5$
$-2x - 4y = 1$

12. $2x + y = 3.5$
$-x + 2y = 2.5$

13. GARDENING The length of Sally's garden is 4 meters greater than 3 times the width. The perimeter of her garden is 72 meters. What are the dimensions of Sally's garden?

14. Anita is $4\frac{1}{2}$ years older than Basilio. Three times Anita's age added to six times Basilio's age is 36. How old are Anita and Basilio?

Lesson 7-4

NAME _____ DATE _____ PERIOD _____

7-4 Study Guide and Intervention *(continued)*

Elimination Using Multiplication

Determine the Best Method The methods to use for solving systems of linear equations are summarized in the table below.

Method	The Best Time to Use
Graphing	to estimate the solution, since graphing usually does not give an exact solution
Substitution	if one of the variables in either equation has a coefficient of 1 or -1
Elimination Using Addition	if one of the variables has opposite coefficients in the two equations
Elimination Using Subtraction	if one of the variables has the same coefficient in the two equations
Elimination Using Multiplication	if none of the coefficients are 1 or -1 and neither of the variables can be eliminated by simply adding or subtracting the equations

Example **Determine the best method to solve the system of equations. Then solve the system.**

$6x + 2y = 20$
$-2x + 4y = -16$

Since the coefficients of x will be additive inverses of each other if you multiply the second equation by 3, use elimination.

$$\begin{array}{rl} 6x + 2y = 20 & \\ (+)\ -6x + 12y = -48 & \text{Multiply the second equation by 3.} \\ \hline 14y = -28 & \text{Add the two equations. } x \text{ is eliminated.} \\ \frac{14y}{14} = \frac{-28}{14} & \text{Divide each side by 14.} \\ y = -2 & \text{Simplify.} \end{array}$$

$$\begin{array}{rl} 6x + 2(-2) = 20 & \text{Substitute } -2 \text{ for } y \text{ in either equation.} \\ 6x - 4 = 20 & \text{Simplify.} \\ 6x - 4 + 4 = 20 + 4 & \text{Add 4 to each side.} \\ 6x = 24 & \text{Simplify.} \\ \frac{6x}{6} = \frac{24}{6} & \text{Divide each side by 6.} \\ x = 4 & \text{Simplify.} \end{array}$$

The solution is $(4, -2)$.

Exercises

Determine the best method to solve each system of equations. Then solve the system.

1. $x + 2y = 3$
$x + y = 1$

2. $m + 6n = -8$
$m = 2n + 8$

3. $a - b = 6$
$a = 2b + 7$

4. $4x + y = 15$
$-x - 3y = -12$

5. $3c - d = 14$
$c - d = 2$

6. $x + 2y = -9$
$y = 4x$

7. $4x = 2y - 10$
$x + 2y = 5$

8. $x = -2y$
$4x + 4y = -10$

9. $2s - 3t = 42$
$3s + 2t = 24$

10. $4a - 4b = -10$
$2a + 4b = -2$

11. $4x + 10y = -6$
$-2x - 10y = 2$

12. $2x = y - 3$
$-x + y = 0$

NAME _____ DATE _____ PERIOD _____

7-4 Skills Practice

Elimination Using Multiplication

Use elimination to solve each system of equations.

1. $x + y = -9$
$5x - 2y = 32$

2. $3x + 2y = -9$
$x - y = -13$

3. $2x + 5y = 3$
$-x + 3y = -7$

4. $2x + y = 3$
$-4x - 4y = -8$

5. $4x - 2y = -14$
$3x - y = -8$

6. $2x + y = 0$
$5x + 3y = 2$

7. $5x + 3y = -10$
$3x + 5y = -6$

8. $2x + 3y = 14$
$3x - 4y = 4$

9. $2x - 3y = 21$
$5x - 2y = 25$

10. $3x + 2y = -26$
$4x - 5y = -4$

11. $3x - 6y = -3$
$2x + 4y = 30$

12. $5x + 2y = -3$
$3x + 3y = 9$

13. Two times a number plus three times another number equals 13. The sum of the two numbers is 7. What are the numbers?

14. Four times a number minus twice another number is -16. The sum of the two numbers is -1. Find the numbers.

Determine the best method to solve each system of equations. Then solve the system.

15. $2x + 3y = 10$
$5x + 2y = -8$

16. $8x - 7y = 18$
$3x + 7y = 26$

17. $y = 2x$
$3x + 2y = 35$

18. $3x + y = 6$
$3x + y = 3$

19. $3x - 4y = 17$
$4x + 5y = 2$

20. $y = 3x + 1$
$3x - y = -1$

Lesson 7-4

NAME _____ DATE _____ PERIOD _____

7-4 Practice

Elimination Using Multiplication

Use elimination to solve each system of equations.

1. $2x - y = -1$
$3x - 2y = 1$

2. $5x - 2y = -10$
$3x + 6y = 66$

3. $7x + 4y = -4$
$5x + 8y = 28$

4. $2x - 4y = -22$
$3x + 3y = 30$

5. $3x + 2y = -9$
$5x - 3y = 4$

6. $4x - 2y = 32$
$-3x - 5y = -11$

7. $3x + 4y = 27$
$5x - 3y = 16$

8. $0.5x + 0.5y = -2$
$x - 0.25y = 6$

9. $2x - \frac{3}{4}y = -7$
$x + \frac{1}{2}y = 0$

10. Eight times a number plus five times another number is -13. The sum of the two numbers is 1. What are the numbers?

11. Two times a number plus three times another number equals 4. Three times the first number plus four times the other number is 7. Find the numbers.

Determine the best method to solve each system of equations. Then solve the system.

12. $5x + 7y = 3$
$2x - 7y = -38$

13. $7x + 2y = 2$
$2x - 3y = -28$

14. $-6x - 2y = 14$
$6x + 8y = -20$

15. $x = 2y + 6$
$\frac{1}{2}x - y = 3$

16. $4x + 3y = -2$
$4x + 3y = 3$

17. $y = \frac{1}{2}x$
$\frac{5}{2}x - 2y = 9$

18. FINANCE Gunther invested \$10,000 in two mutual funds. One of the funds rose 6% in one year, and the other rose 9% in one year. If Gunther's investment rose a total of \$684 in one year, how much did he invest in each mutual fund?

19. CANOEING Laura and Brent paddled a canoe 6 miles upstream in four hours. The return trip took three hours. Find the rate at which Laura and Brent paddled the canoe in still water.

20. NUMBER THEORY The sum of the digits of a two-digit number is 11. If the digits are reversed, the new number is 45 more than the original number. Find the number.

NAME _____ DATE _____ PERIOD _____

7-4 Reading to Learn Mathematics

Elimination Using Multiplication

Pre-Activity **How can a manager use a system of equations to plan employee time?**

Read the introduction to Lesson 7-4 at the top of page 387 in your textbook.

Can the system of equations be solved by elimination with addition or subtraction? Explain.

Reading the Lesson

1. Could elimination by multiplication be used to solve the system shown below? Explain.
$3x - 5y = 15$
$-6x + 7y = 11$

2. Tell whether it would be easiest to use substitution, elimination by addition, elimination by subtraction, or elimination by multiplication to solve the system. Explain your choice.

	System of Equations	Solution Method	Explanation
a.	$-3x + 4y = 2$ $3x + 2y = 10$		
b.	$x - 2y = 0$ $5x - 4y = 8$		
c.	$6x - 5y = -18$ $2x + 10y = 27$		
d.	$-2x + 3y = 9$ $3x + 3y = 12$		

Helping You Remember

3. If you are going to solve a system by elimination, how do you decide whether you will need to multiply one or both equations by a number?

Lesson 7-4

NAME _____ DATE _____ PERIOD _____

7-4 Enrichment

George Washington Carver and Percy Julian

In 1990, George Washington Carver and Percy Julian became the first African Americans elected to the National Inventors Hall of Fame. Carver (1864–1943) was an agricultural scientist known worldwide for developing hundreds of uses for the peanut and the sweet potato. His work revitalized the economy of the southern United States because it was no longer dependent solely upon cotton. Julian (1898–1975) was a research chemist who became famous for inventing a method of making a synthetic cortisone from soybeans. His discovery has had many medical applications, particularly in the treatment of arthritis.

There are dozens of other African American inventors whose accomplishments are not as well known. Their inventions range from common household items like the ironing board to complex devices that have revolutionized manufacturing. The exercises that follow will help you identify just a few of these inventors and their inventions.

Match the inventors with their inventions by matching each system with its solution. (Not all the solutions will be used.)

1. Sara Boone	$x + y = 2$ $x - y = 10$	**A.** (1, 4)	automatic traffic signal
2. Sarah Goode	$x = 2 - y$ $2y + x = 9$	**B.** (4, −2)	eggbeater
3. Frederick M. Jones	$y = 2x + 6$ $y = -x - 3$	**C.** (−2, 3)	fire extinguisher
4. J. L. Love	$2x + 3y = 8$ $2x - y = -8$	**D.** (−5, 7)	folding cabinet bed
5. T. J. Marshall	$y - 3x = 9$ $2y + x = 4$	**E.** (6, −4)	ironing board
6. Jan Matzeliger	$y + 4 = 2x$ $6x - 3y = 12$	**F.** (−2, 4)	pencil sharpener
7. Garrett A. Morgan	$3x - 2y = -5$ $3y - 4x = 8$	**G.** (−3, 0)	portable X-ray machine
8. Norbert Rillieux	$3x - y = 12$ $y - 3x = 15$	**H.** (2, −3)	player piano
		I. no solution	evaporating pan for refining sugar
		J. infinitely many solutions	lasting (shaping) machine for manufacturing shoes

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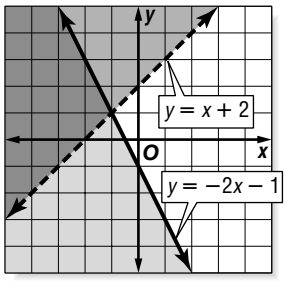
7-5 Study Guide and Intervention

Graphing Systems of Inequalities

Systems of Inequalities The solution of a **system of inequalities** is the set of all ordered pairs that satisfy both inequalities. If you graph the inequalities in the same coordinate plane, the solution is the region where the graphs overlap.

Example 1 **Solve the system of inequalities by graphing.**

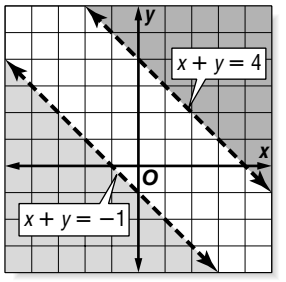
$y > x + 2$
$y \leq -2x - 1$



The solution includes the ordered pairs in the intersection of the graphs. This region is shaded at the right. The graphs of $y = x + 2$ and $y = -2x - 1$ are boundaries of this region. The graph of $y = x + 2$ is dashed and is not included in the graph of $y > x + 2$.

Example 2 **Solve the system of inequalities by graphing.**

$x + y > 4$
$x + y < -1$

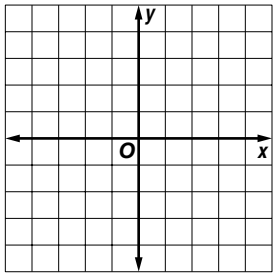


The graphs of $x + y = 4$ and $x + y = -1$ are parallel. Because the two regions have no points in common, the system of inequalities has no solution.

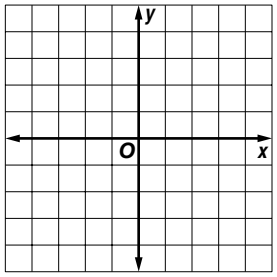
Exercises

Solve each system of inequalities by graphing.

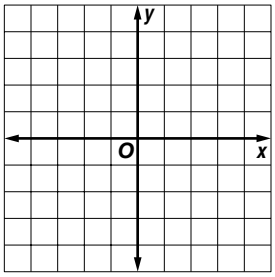
1. $y > -1$
$x < 0$



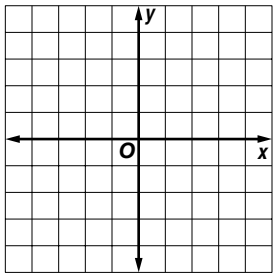
2. $y > -2x + 2$
$y \leq x + 1$



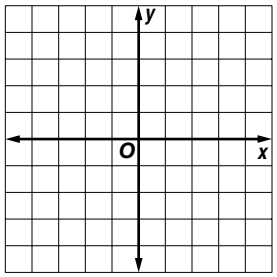
3. $y < x + 1$
$3x + 4y \geq 12$



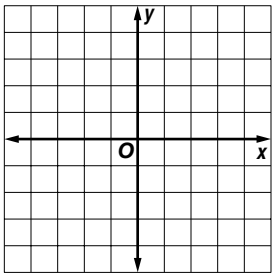
4. $2x + y \geq 1$
$x - y \geq -2$



5. $y \leq 2x + 3$
$y \geq -1 + 2x$



6. $5x - 2y < 6$
$y > -x + 1$



Lesson 7-5

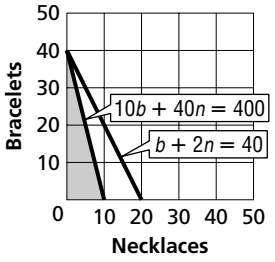
NAME _____ DATE _____ PERIOD _____

7-5 Study Guide and Intervention *(continued)*

Graphing Systems of Inequalities

Real-World Problems In real-world problems, sometimes only whole numbers make sense for the solution, and often only positive values of x and y make sense.

Example **BUSINESS** **AAA Gem Company produces necklaces and bracelets. In a 40-hour week, the company has 400 gems to use. A necklace requires 40 gems and a bracelet requires 10 gems. It takes 2 hours to produce a necklace and a bracelet requires one hour. How many of each type can be produced in a week?**



Let n = the number of necklaces that will be produced and b = the number of bracelets that will be produced. Neither n or b can be a negative number, so the following system of inequalities represents the conditions of the problems.

$n \geq 0$

$b \geq 0$

$b + 2n \leq 40$

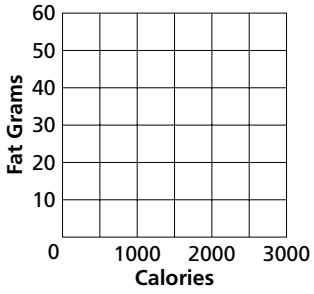
$10b + 40n \leq 400$

The solution is the set ordered pairs in the intersection of the graphs. This region is shaded at the right. Only whole-number solutions, such as (5, 20) make sense in this problem.

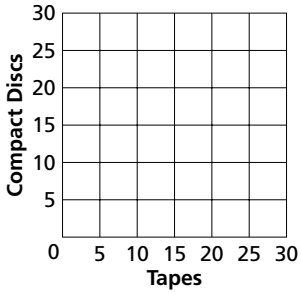
Exercises

For each exercise, graph the solution set. List three possible solutions to the problem.

1. **HEALTH** Mr. Flowers is on a restricted diet that allows him to have between 1600 and 2000 Calories per day. His daily fat intake is restricted to between 45 and 55 grams. What daily Calorie and fat intakes are acceptable?



2. **RECREATION** Maria had $150 in gift certificates to use at a record store. She bought fewer than 20 recordings. Each tape cost $5.95 and each CD cost $8.95. How many of each type of recording might she have bought?



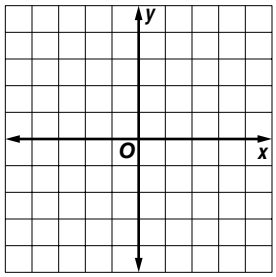
NAME _____ DATE _____ PERIOD _____

7-5 Skills Practice

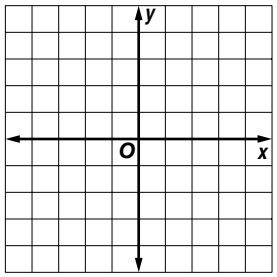
Graphing Systems of Inequalities

Solve each system of inequalities by graphing.

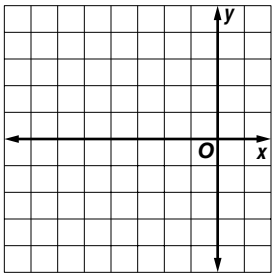
1. $x > -1$
$y \leq -3$



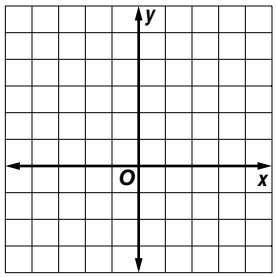
2. $y > 2$
$x < -2$



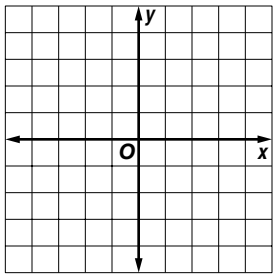
3. $y > x + 3$
$y \leq -1$



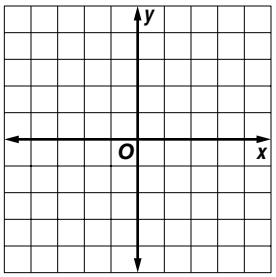
4. $x < 2$
$y - x \leq 2$



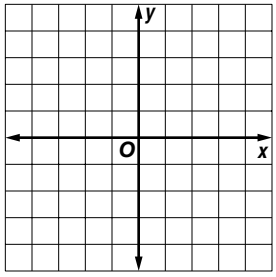
5. $x + y \leq -1$
$x + y \geq 3$



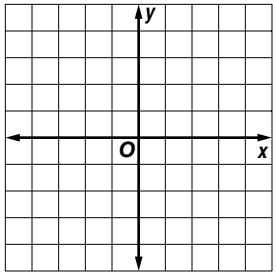
6. $y - x > 4$
$x + y > 2$



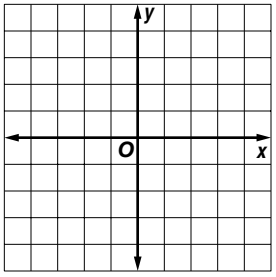
7. $y > x + 1$
$y \geq -x + 1$



8. $y \geq -x + 2$
$y < 2x - 2$

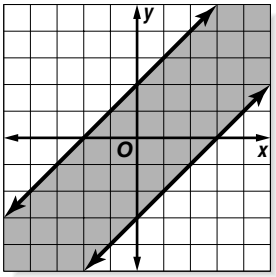


9. $y < 2x + 4$
$y \geq x + 1$



Write a system of inequalities for each graph.

10.



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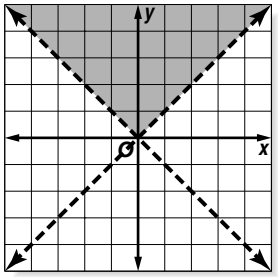
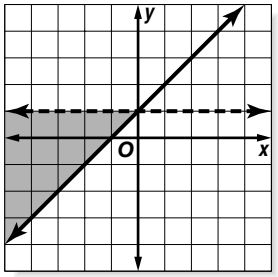


12.



Lesson 7-5

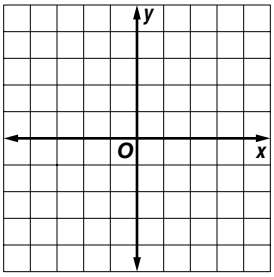
NAME _____ DATE _____ PERIOD _____

7-5 Practice

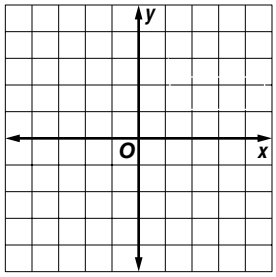
Graphing Systems of Inequalities

Solve each system of inequalities by graphing.

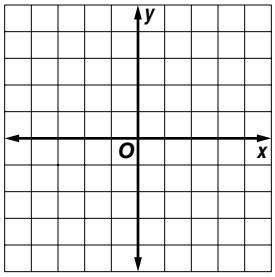
1. $y > x - 2$
$y \leq x$



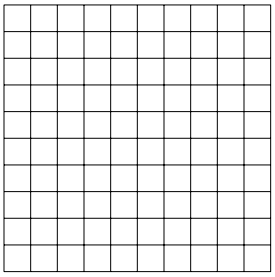
2. $y \geq x + 2$
$y > 2x + 3$



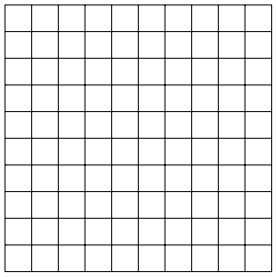
3. $x + y \geq 1$
$x + 2y > 1$



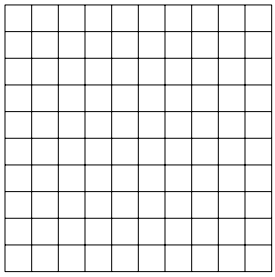
4. $y < 2x - 1$
$y > 2 - x$



5. $y > x - 4$
$2x + y \leq 2$



6. $2x - y \geq 2$
$x - 2y \geq 2$

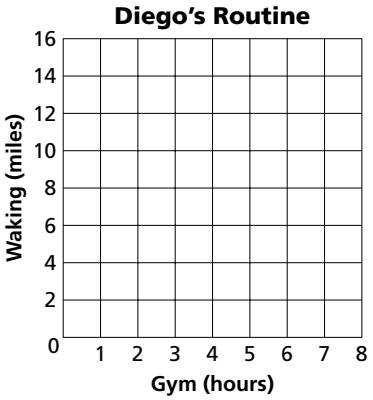


FITNESS For Exercises 7 and 8, use the following information.

Diego started an exercise program in which each week he works out at the gym between 4.5 and 6 hours and walks between 9 and 12 miles.

7. Make a graph to show the number of hours Diego works out at the gym and the number of miles he walks per week.

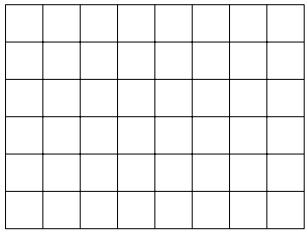
8. List three possible combinations of working out and walking that meet Diego's goals.



SOUVENIRS For Exercises 9 and 10, use the following information.

Emily wants to buy turquoise stones on her trip to New Mexico to give to at least 4 of her friends. The gift shop sells stones for either \$4 or \$6 per stone. Emily has no more than \$30 to spend.

9. Make a graph showing the numbers of each price of stone Emily can purchase.



10. List three possible solutions.

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7-5 Reading to Learn Mathematics

Graphing Systems of Inequalities

Pre-Activity **How can you use a system of inequalities to plan a sensible diet?**

Read the introduction to Lesson 7-5 at the top of page 394 in your textbook.

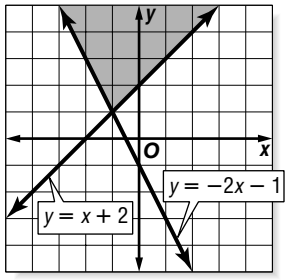
The green section on the graph represents a range of _____

Calories a day and _____ grams of fat per day.

Reading the Lesson

Write the inequality symbols that you need to get a system whose graph looks like the one shown. Use <, ≤, >, or ≥.

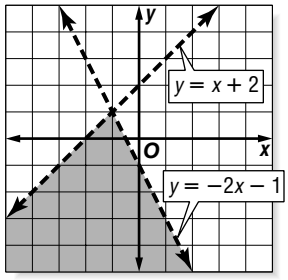
1.



y _____ $x + 2$

y _____ $-2x - 1$

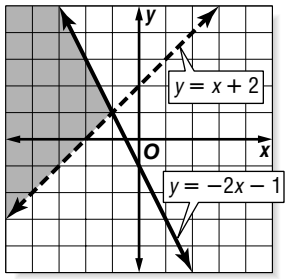
2.



y _____ $x + 2$

y _____ $-2x - 1$

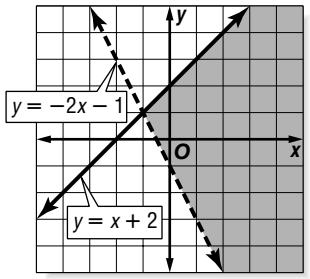
3.



y _____ $x + 2$

y _____ $-2x - 1$

4.



y _____ $x + 2$

y _____ $-2x - 1$

Helping You Remember

5. Describe how you would explain the process of using a graph to solve a system of inequalities to a friend who missed Lesson 7-5.

Lesson 7-5

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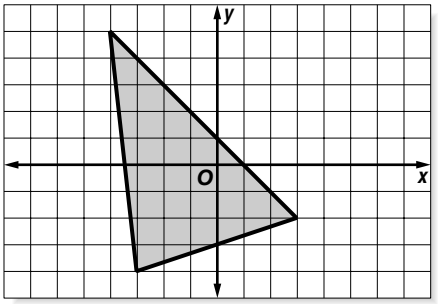
7-5 Enrichment

Describing Regions

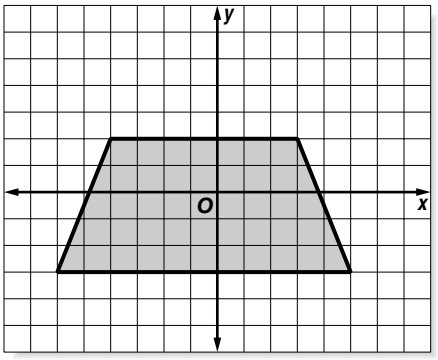
The shaded region inside the triangle can be described with a system of three inequalities.

$$y < 2x + 1$$
$$y > \frac{1}{3}x - 3$$
$$y > 29x - 31$$

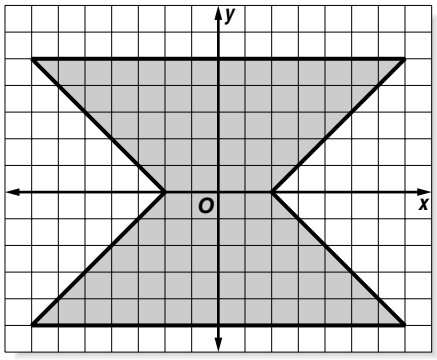


Write systems of inequalities to describe each region. You may first need to divide a region into triangles or quadrilaterals.

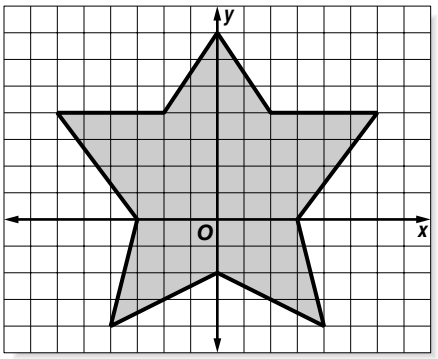
1.



2.



3.



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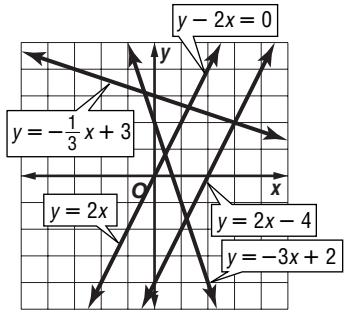
Chapter 7 Test, Form 1

SCORE _____

Assessment

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

Use the graph for Questions 1–4.



1. The ordered pair (3, 2) is the solution of which system of equations?

A. $y = -\frac{1}{3}x + 3$, $y = -3x + 2$

B. $y = -\frac{1}{3}x + 3$, $y = 2x$

C. $y = -\frac{1}{3}x + 3$, $y = 2x - 4$

D. $y = -3x + 2$, $y = 2x - 4$

1. _____

For Questions 2–4, find how many solutions exist for each system of equations.

A. no solution **B.** one solution **C.** infinitely many solutions **D.** cannot be determined

2. $y = 2x$, $y = 2x - 4$ **2.** _____

3. $y = 2x$, $y - 2x = 0$ **3.** _____

4. $y = -3x + 2$, $y = 2x$ **4.** _____

5. When solving the system of equations, which expression could be substituted for r in the second equation?

$r = 4 - s$
$3r + 2s = 15$

A. $4 - s$ **B.** $4 - r$ **C.** $s - 4$ **D.** $\frac{4}{s}$ **5.** _____

6. If $x = 2$ and $3x + y = 5$, what is the value of y?

A. 0 **B.** −1 **C.** 11 **D.** 10 **6.** _____

7. Use substitution to solve the system of equations.

$n = 3m - 11$
$2m + 3n = 0$

A. (−2, 3) **B.** (−3, 2) **C.** (3, −2) **D.** (2, −3) **7.** _____

8. Use elimination to solve the system of equations.

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

A. (4, 1) **B.** (4, −1) **C.** (−4, 1) **D.** (−4, −1) **8.** _____

9. Use elimination to solve the system of equations.

$x + 6y = 10$
$x + 5y = 9$

A. (1, 4) **B.** (4, 1) **C.** (−1, −4) **D.** (−4, −1) **9.** _____

10. Use elimination to find the value of x in the solution for the system of equations.

$2x + 2y = 10$
$2x - 3y = 5$

A. 1 **B.** 10 **C.** 4 **D.** −2 **10.** _____

11. To eliminate the variable y in the system of equations, multiply the second equation by which number?

$6x + 4y = 22$
$2x - y = 1$

A. 3 **B.** 9 **C.** 22 **D.** 4 **11.** _____

12. Use elimination to solve the system of equations.

$2x + 5y = 7$
$3x + 6y = 3$

A. (−9, 5) **B.** (5, −9) **C.** (−1, 1) **D.** (1, −1) **12.** _____

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Chapter 7 Test, Form 1 *(continued)*

For Questions 13 and 14, determine the best method to solve the system of equations.

A. substitution **B.** elimination using addition

C. elimination using subtraction **D.** elimination using multiplication

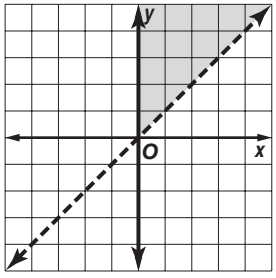
13. $5x - 2y = 4$
$2x + 2y = 8$

14. $y = 3x + 12$
$2x + y = 16$

13. _____

14. _____

15. Determine which ordered pair represents a solution of the system of inequalities graphed at the right.



A. (2, 1) **B.** (−3, −1)

C. (1, 3) **D.** (−2, 3)

15. _____

16. Which system of inequalities is represented by the graph at the right?

A. $y \geq 0$
$y > x$

B. $x \geq 0$
$y \geq x$

C. $x \geq 0$
$y < x$

D. $x \geq 0$
$y > x$

16. _____

17. An airport shuttle company owns sedans that have a maximum capacity of 3 passengers and vans that have a maximum capacity of 8 passengers. Their 12 vehicles have a combined maximum capacity of 61 passengers. How many vans does the company own?

A. 5 **B.** 8 **C.** 12 **D.** 7 **17.** _____

18. Find the two numbers whose sum is 26 and whose difference is 12.

A. 26 and 12 **B.** 19 and 7 **C.** 14 and 12 **D.** 31 and 19 **18.** _____

19. Yancy wrote two novels that together contain 580 pages. His longer novel has 160 pages more than his shorter novel. How many pages are contained in Yancy's shorter novel?

A. 290 **B.** 370 **C.** 210 **D.** 130 **19.** _____

20. The Foxtail Toy Company makes toy cars and toy dump trucks. They are scaled so that the door handles and wheels are interchangeable. The table gives the door handle and wheel requirements of each type of toy. Which system of inequalities represents the given information?

	Wheels	Door Handles
Parts per Toy Car	4	4
Parts per Toy Dump truck	6	2
Total Available Parts per day	28	16

A. $4x + 2y \geq 28$
$4x + 6y \geq 16$

B. $4x + 4y \leq \leq 28$
$6x + 2y \leq 16$

C. $28x + 16y \leq 10$
$28x + 16y \geq 6$

D. $4x + 6y \leq 28$
$4x + 2y \leq 16$

20. _____

Bonus Determine the best method to solve the system of equations. Then solve the system.

$x - 3y = 0$
$2x - 7y = 0$

B: _____

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Chapter 7 Test, Form 2A

SCORE _____

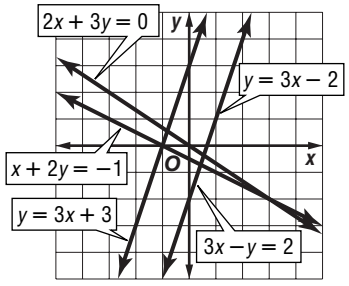
Assessment

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

Use the graph for Questions 1–4.

For Questions 1 and 2, determine how many solutions exist for each system of equations.

A. no solution
B. one solution
C. infinitely many solutions
D. cannot be determined



1. $y = 3x + 3$
$3x - y = 2$ _____

2. $x + 2y = -1$
$2x + 3y = 0$ _____

3. The solution to which system of equations has an x value larger than 2?

A. $x + 2y = -1$, $y = 3x + 3$ **B.** $3x - y = 2$, $x + 2y = -1$ **C.** $y = 3x + 3$, $2x + 3y = 0$ **D.** $2x + 3y = 0$, $x + 2y = -1$ _____

4. The solution to which system of equations has a positive y value?

A. $x + 2y = -1$, $y = 3x + 3$ **B.** $3x - y = 2$, $x + 2y = -1$ **C.** $y = 3x + 3$, $2x + 3y = 0$ **D.** $2x + 3y = 0$, $x + 2y = -1$ _____

5. When solving the system of equations, $x + 2y = 15$, $5x + y = 21$, which expression could be substituted for x in the second equation?

A. $15 - 2y$ **B.** $21 - 5x$ **C.** $\frac{15 - x}{2}$ **D.** $\frac{21 - y}{5}$ _____

6. If $x = 2y + 3$ and $4x - 5y = 9$, what is the value of y?

A. 2 **B.** 1 **C.** -1 **D.** -2 _____

7. Use elimination to solve the system $x + 7y = 16$ and $3x - 7y = 4$ for x.

A. 3 **B.** 4 **C.** 5 **D.** -6 _____

8. Use elimination to solve the system $x - 5y = 20$ and $x + 3y = -4$ for x.

A. 5 **B.** -3 **C.** 10 **D.** -40 _____

9. Use elimination to solve the system $8x - 7y = 5$ and $3x - 5y = 9$ for y.

A. -2 **B.** 8 **C.** -3 **D.** -1 _____

10. Use elimination to solve the system $4x + 6y = 10$ and $2x + 5y = 1$ for x.

A. 11 **B.** $5\frac{1}{2}$ **C.** -2 **D.** $-\frac{1}{2}$ _____

11. The substitution method should be used to solve which system of equations?

A. $4x + 3y = 6$, $5x - 3y = 2$ **B.** $2x + 5y = 1$, $2x - 3y = 4$ **C.** $6x + 2y = 1$, $3x + 4y = 7$ **D.** $y = 3x + 1$, $2x + 4y = 5$ _____

12. The elimination method using multiplication should be used to solve which system of equations?

A. $x = 7y + 1$, $2x - y = 8$ **B.** $3x + 2y = 1$, $4x - 3y = 12$ **C.** $x - y = 16$, $2x + y = 9$ **D.** $3x + y = -15$, $3x + 5y = 10$ _____

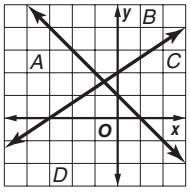
7

Chapter 7 Test, Form 2A *(continued)*

13. State which region in the graph is the solution of the system.

$y \geq -x + 1$

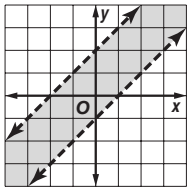
$y \leq \frac{2}{3}x + 2$



A. A **B.** B

C. C **D.** D **13.** _____

14. Which system of inequalities is represented by the graph?



A. $x < y + 1$, $y < x + 2$ **B.** $y > x - 1$, $x < y - 2$

C. $y > x + 2$, $y < x - 1$ **D.** $x > y + 1$, $x > y - 2$ **14.** _____

For Questions 15 and 16, solve the system and find values of y.

15. $3x - 5y = -35$, $2x - 5y = -30$ **A.** 4 **B.** $\frac{4}{5}$ **C.** -4 **D.** $-\frac{4}{5}$ **15.** _____

16. $3x + 4y = -30$, $2x - 5y = 72$ **A.** -6 **B.** 6 **C.** -12 **D.** 12 **16.** _____

17. Two times one number added to three times a second number is 21. Five times the first number added to three times the second number is 30. What are the numbers?

A. 21 and 30 **B.** 3 and 2 **C.** 6 and 1 **D.** 3 and 5 **17.** _____

18. Coffee Cafe makes 90 pounds of coffee that costs \$6 per pound. The types of coffee used to make this mixture cost \$7 per pound and \$4 per pound. How many pounds of the \$7-per-pound coffee should be used in this mixture?

A. 30 lb **B.** 40 lb **C.** 50 lb **D.** 60 lb **18.** _____

19. In 1999, there were 59,549 physicians specializing in Pediatrics in the United States and its possessions. The number of male physicians minus the number of female physicians in this category is 2551. How many female physicians were there that specialized in Pediatrics in the United States?

A. 29,774 **B.** 28,499 **C.** 31,050 **D.** 27,223 **19.** _____

20. Laurie and Maya make get well cards and friendship cards. They have enough materials to make 50 cards. Laurie and Maya will make at least 25 friendship cards. They also want to make more than 10 get well cards. Which system of inequalities represents this information?

A. $10 < g \leq 25$, $25 < f < 40$ **B.** $10 + f \leq 50$, $g + 25 \leq 50$ **C.** $10 < g \leq 50$, $25 \leq f \leq 50$ **D.** $g + f \leq 50$, $f \geq 25$, $g > 10$ **20.** _____

Bonus Where on the graph of $2x - 6y = 7$ is the x-coordinate twice the y-coordinate? **B:** _____

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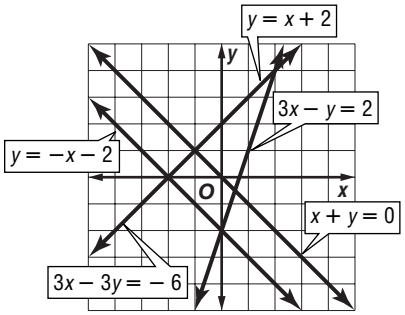
Chapter 7 Test, Form 2B

SCORE _____

Assessment

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

Use the graph for Questions 1–4.



For Questions 1 and 2, determine how many solutions exist for each system of equations.

A. no solution
B. one solution
C. infinitely many solutions
D. cannot be determined

1. $3x - 3y = -6$
$y = x + 2$ _____

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

3. The solution to which system of equations has a positive x value? _____

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

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

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

D. $y = -x - 2$
$x + y = 0$

4. The solution to which system of equations has a y value less than -1? _____

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

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

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

D. $y = -x - 2$
$x + y = 0$

5. When solving the system of equations, which expression could be substituted for y in the second equation? _____

$3x + y = 14$
$x + 4y = 3$

A. $3 - 4y$ **B.** $\frac{3 - x}{4}$ **C.** $\frac{14 - y}{3}$ **D.** $14 - 3x$

6. If $x = 5y - 1$ and $2x + 5y = -32$, what is the value of y? _____

A. -2 **B.** 2 **C.** 1 **D.** -1

7. Use elimination to solve the system $3x + 5y = 16$ and $8x - 5y = 28$ for x. _____

A. -6 **B.** 5 **C.** 4 **D.** $\frac{4}{5}$

8. Use elimination to solve the system $x - 4y = 1$ and $x + 2y = 19$ for x. _____

A. -11 **B.** 3 **C.** 25 **D.** 13

9. Use elimination to solve the system $4x + 7y = -14$ and $8x + 5y = 8$ for x. _____

A. $3\frac{1}{2}$ **B.** $-1\frac{1}{2}$ **C.** 8 **D.** -4

10. Use elimination to solve the system $5x + 4y = -10$ and $3x + 6y = -6$ for y. _____

A. -2 **B.** -5 **C.** 0 **D.** 2

11. The substitution method should be used to solve which system of equations? _____

A. $5x - 7y = 16$
$2x - 7y = 12$

B. $4x + 3y = -5$
$6x - 3y = 2$

C. $x = 3y + 1$
$2x + y = 7$

D. $2x + 6y = 3$
$3x + 2y = -1$

12. The elimination method using addition should be used to solve which system of equations? _____

A. $y = -4x + 1$
$x - 2y = 7$

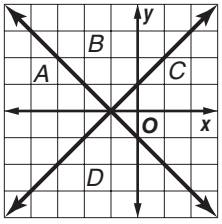
B. $x + 2y = -4$
$3x - 2y = -1$

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

D. $x - 4y = -9$
$-8x - y = 1$

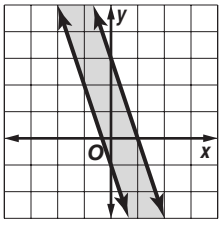
7 Chapter 7 Test, Form 2B *(continued)*

13. State which region in the graph is the solution of the system.
$x + 1 \le y$
$-x - 1 \le y$



A. A **B.** B
C. C **D.** D **13.** _____

14. Which system of inequalities is represented by the graph?



A. $y < -3x + 3$
$y > -3x - 1$

B. $y \ge -3x + 3$
$y \le -3x - 1$

C. $y \le -3x + 3$
$y \ge -3x - 1$

D. $y > -3x + 3$
$y < -3x - 1$

14. _____

For Questions 15 and 16, solve the system and find the value of y.

15. $2x + 3y = 1$
$5x - 4y = -32$

A. $-8\frac{3}{7}$ **B.** $8\frac{3}{7}$ **C.** -3 **D.** 3 **15.** _____

16. $6x + 3y = 12$
$5x + 3y = 0$

A. -20 **B.** $-1\frac{9}{11}$ **C.** 20 **D.** $1\frac{9}{11}$ **16.** _____

17. Five times one number minus two times a second number is 11. Three times the first number minus two times the second number is 1. What are the numbers?

A. 5 and 7 **B.** 2 and 5 **C.** 11 and 1 **D.** 4 and -6 **17.** _____

18. Colortime Bakers wants to make 30 pounds of a berry mix that costs \$3 per pound to use in their pancake mix. They are using blueberries that cost \$2 per pound and blackberries that cost \$3.50 per pound. How many pounds of blackberries should be used in this mixture?

A. 15 lb **B.** 20 lb **C.** 10 lb **D.** 30 lb **18.** _____

19. In 1999, there were 69,063 physicians specializing in Family Practice in the United States and its possessions. The number of male physicians minus the number of female physicians in this category is 31,289. How many female physicians were there that specialized in Family Practice in the United States?

A. 50,176 **B.** 34,531 **C.** 3243 **D.** 18,887 **19.** _____

20. Beng and Shim make boat-shaped candles and dog-shaped candles. They have enough materials to make 40 candles. Beng and Shim will make at most 20 boat-shaped candles. They will also make less than 35 dog-shaped candles. Which system of inequalities represents this information?

A. $5 < b \le 20$
$20 \le d < 35$

B. $20 + d \le 40$
$b + 35 \le 40$

C. $b + d \le 40$
$0 \le b \le 20$
$0 \le d < 35$

D. $0 \le b < 20$
$0 \le d \le 35$

20. _____

Bonus Manuel is 8 years older than his sister. Three years ago he was 3 times older than his sister. How old is each now? **B:** _____

NAME _____ DATE _____ PERIOD _____

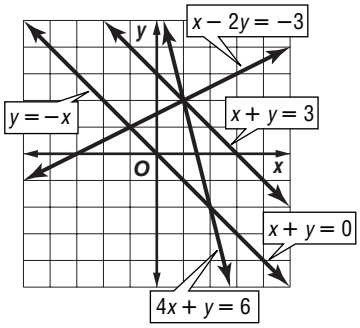
7

Chapter 7 Test, Form 2C

SCORE _____

Assessment

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $y = -x$
$x + y = 3$

2. $x - 2y = -3$
$4x + y = 6$

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

3. $y = -x + 4$
$y = x - 4$

4. $2x - y = -3$
$6x - 3y = -9$

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

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

6. $y = 3x$
$x + y = 4$

7. $5x - y = 10$
$7x - 2y = 11$

8. $x - 6y = 4$
$3x - 18y = 4$

9. $x - 5y = 10$
$2x - 10y = 20$

Use elimination to solve each system of equations.

10. $x + 4y = -8$
$x - 4y = -8$

11. $2x + 5y = 3$
$-x + 3y = -7$

12. $2x - 5y = -16$
$-2x + 3y = 12$

13. $2x + 5y = 9$
$2x + y = 13$

14. $2x - 3y = 1$
$5x + 4y = 14$

15. $x - 3y = 10$
$x + 2y = 15$

Determine the best method to solve each system of equations. Then solve the system.

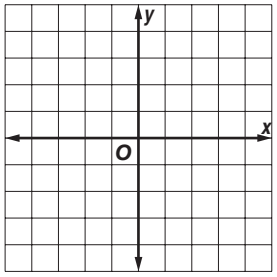
16. $x = 2y - 1$
$3x + y = 11$

17. $5x - y = 17$
$3x - y = 13$

1. _____

2. _____

3.



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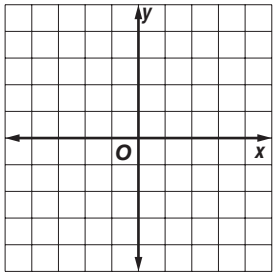

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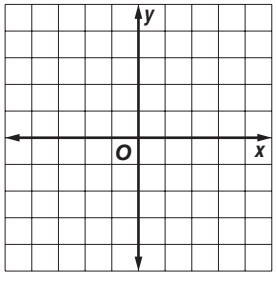


6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

NAME _____ DATE _____ PERIOD _____

7

Chapter 7 Test, Form 2C *(continued)*

For Questions 18 and 19, solve each system of inequalities by graphing.

18. $y < x - 1$
$y \leq 2x + 1$

19. $x + y \geq 2$
$2x - y < 1$

20. The sum of two numbers is 17 and their difference is 29. What are the two numbers?

21. Adult tickets for the school musical sold for \$3.50 and student tickets sold for \$2.50. Three hundred twenty-one tickets were sold altogether for \$937.50. How many of each kind of ticket were sold?

22. Ayana has \$2.35 in nickels and dimes. If she has 33 coins in all, find the number of nickels and dimes.

23. The largest county in the state of New York is 1769 square miles larger than the smallest county in the same state. The size of the largest county is 64 times the size of the smallest county plus five square miles. How large is the smallest county in the state of New York?

For Questions 24 and 25, use the following information.

The Martinez Company manufactures two types of industrial fans, standard and economy. These items are built using machines and manual labor. The table gives the time requirements at each type of workstation for each type of fan.

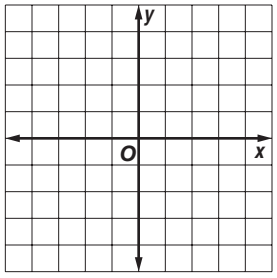
	Hours per Standard Fan	Hours per Economy Fan	Total Available Hours Each Week
Machines	3	3	1500
Manual Labor	2	1	800

24. Make a graph showing the number of standard fans and the number of economy fans that can be made in a week.

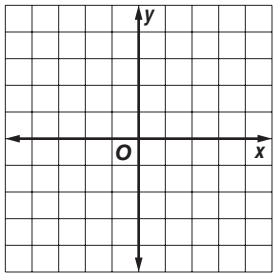
25. List three possible solutions.

Bonus Mavis is 5 years older than her brother. Five years ago she was 2 times older than her brother. How old is each now?

18.



19.



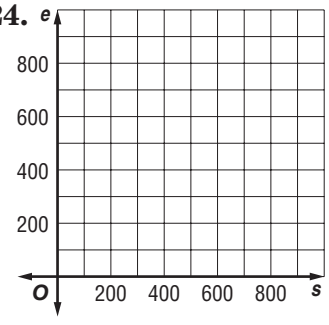
20. _____

21. _____

22. _____

23. _____

24.



25. _____

B: _____

NAME _____ DATE _____ PERIOD _____

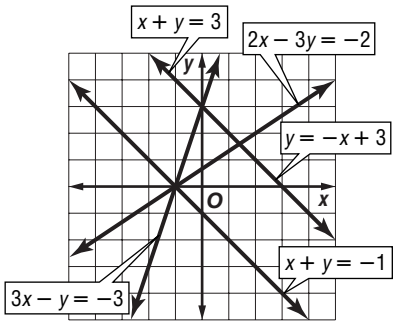
7

Chapter 7 Test, Form 2D

SCORE _____

Assessment

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $x + y = 3$
$y = -x + 3$

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

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

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

4. $2x - y = 5$
$4x - 2y = 10$

5. $x + y = 0$
$x + y = 2$

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

6. $y = 2x$
$2x + y = 8$

7. $2x - y = 3$
$5x + 7y = 17$

8. $x - 5y = 2$
$4x - 20y = 8$

9. $x + 3y = -2$
$4x + 12y = 7$

Use elimination to solve each system of equations.

10. $2x + 3y = 19$
$2x - 3y = 1$

11. $6x + 4y = 20$
$4x - 2y = 4$

12. $2x + 2y = 6$
$3x - 2y = -11$

13. $7x + 3y = 1$
$9x + 3y = -3$

14. $2x - 3y = 23$
$3x + 5y = 6$

15. $x + 3y = 0$
$x - 5y = 16$

Determine the best method to solve each system of equations. Then solve the system.

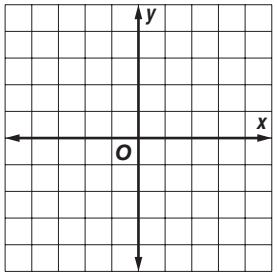
16. $y = 3x + 1$
$x - 2y = 8$

17. $5x - 15y = -20$
$5x - 4y = -9$

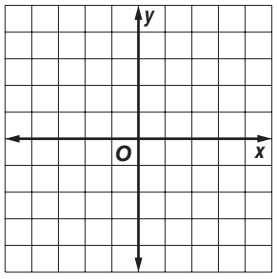
1. _____

2. _____

3.



4.



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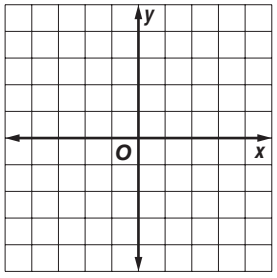


6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

NAME _____ DATE _____ PERIOD _____

7

Chapter 7 Test, Form 2D *(continued)*

For Questions 18 and 19, solve each system of inequalities by graphing.

18. $y > -2x + 1$
$y \leq x + 1$

19. $2x - y \geq -3$
$2x - y < 1$

20. The sum of two numbers is 16 and their difference is 20. What are the two numbers?

21. Kyle just started a new job that pays \$7 per hour. He had been making \$5 per hour at his old job. Kyle worked a total of 54 hours last month and made \$338 before deductions. How many hours did he work at his new job?

22. So far this basketball season, all of Nikki's points have come from two-point and three-point field goals. She has scored a total of 43 points. The number of three-point field goals she has made is one more than twice as many two-point field goals. How many of each type of field goal has Nikki made?

23. The largest county in the state of Texas is 6064 square miles larger than the smallest county in the same state. The size of the largest county is 48 times the size of the smallest county plus one square mile. How large is the smallest county in the state of Texas?

For Questions 24 and 25, use the following information.

The Tadashi Corporation manufactures a large speaker and a small speaker for phone headsets. The speakers are used on the Tadashi 200 and the Tadashi 500 phone systems. The table gives the speaker requirement for each phone system.

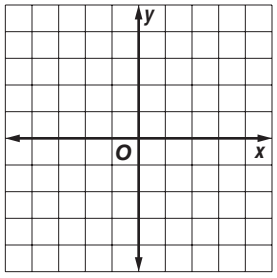
	Speakers on Tadashi 200	Speakers on Tadashi 500	Total Available Speakers Each Week
Large Speaker	2	3	900
Small Speaker	2	4	1000

24. Make a graph showing the number of Tadashi 200 and Tadashi 500 phone systems that can be made in a week.

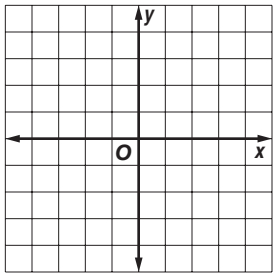
25. List three possible solutions.

Bonus Find the point on the graph of $3x - 4y = 9$ where the y-coordinate is 3 times the x-coordinate.

18.



19.



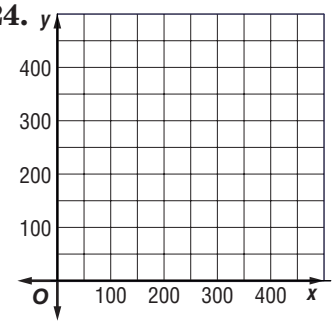
20. _____

21. _____

22. _____

23. _____

24.



25. _____

B: _____

NAME _____ DATE _____ PERIOD _____

7 **Chapter 7 Test, Form 3**

SCORE _____

Assessment

Determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions by graphing each system.

1. $x - 2y = -3$
$y = 3x - 1$

2. $y = -x + 3$
$x + y = -1$

Graph each system of equations. Determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

3. $\frac{1}{3}y = x$
$y + x + 4 = 0$

4. $x + 3y = 3$
$3y = -x + 9$

5. $\frac{1}{5} + \frac{7}{5}y = x$
$10x - 14y = 2$

Use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

6. $y = 2x - 7$
$3x - 4y = 8$

7. $4y - 3x = 5$
$\frac{3}{4}x = y - 4$

8. $\frac{1}{2}x - 5y = 19$
$x - 2y = -10$

9. $0.5x + 3.5y = 1$
$x = 2 - 7y$

Use elimination to solve each system of equations.

10. $6x - 7y = 21$
$3x + 7y = 6$

11. $0.2x + 0.5y = 0.7$
$-0.2x - 0.6y = -1.4$

12. $2x + \frac{2}{3}y = -8$
$\frac{1}{2}x - \frac{1}{3}y = 1$

13. $\frac{1}{2}x + \frac{2}{5}y = -10$
$3x + 6y = -6$

14. $0.4x - 0.1y = 1$
$0.5x - 0.1y = 1.6$

15. $\frac{3}{4}x + \frac{1}{2}y = 1\frac{1}{2}$
$\frac{3}{4}x + y = 4\frac{1}{2}$

Determine the best method to solve each system of equations. Then solve the system.

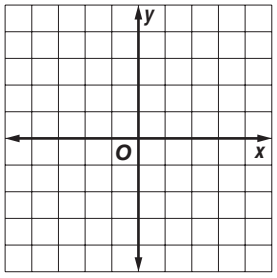
16. $x + y = 147$
$25x + 10y = 2415$

17. $7y = 2\frac{1}{2} - 2x$
$5x = 3y - 4$

1. _____

2. _____

3.



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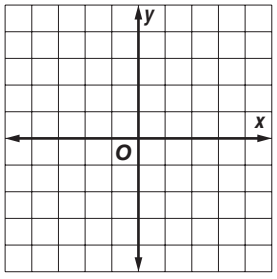

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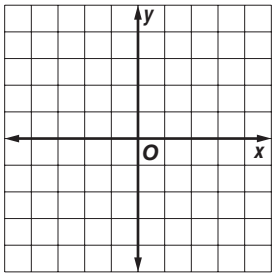


6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

16. _____

17. _____

NAME _____ DATE _____ PERIOD _____

7

Chapter 7 Test, Form 3 *(continued)*

For Questions 18 and 19, solve each system of inequalities by graphing.

18. $y \geq 2x$
$y < x + 1$
$x + 3y > -12$

19. $x \leq 1$
$x - y < 2$
$x + 2y < 3$
$y \leq 3x + 4$

20. Three times one number added to five times a second number is 68. Three times the second number minus four times the first number is 6. What are the two numbers?

21. The difference of two numbers is 5. Five times the lesser number minus the greater number is 9. What are the two numbers?

22. The sum of the digits of a 2-digit number is 13. If the digits are reversed, the new number is 9 more than the original number. Find the original number.

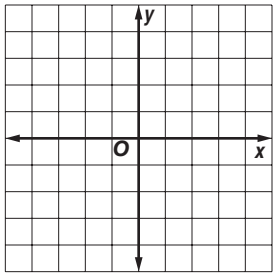
23. A trail mix that costs \$2.45 per pound is mixed with a trail mix that costs \$2.30 per pound. How much of each type of trail mix must be used to have 30 pounds of a trail mix that costs \$2.35 per pound?

24. A boat travels 60 miles downstream in the same time it takes to go 36 miles upstream. The speed of the boat in still water is 15 mph greater than the speed of the current. Find the speed of the current.

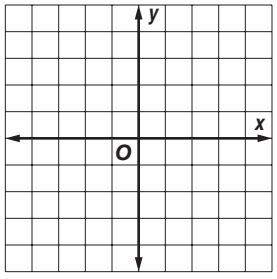
25. Mrs. Lewis needs to buy two types of grain, oats and barley, to mix as a feed supplement for her cattle. She has \$15,000 to spend on grain, and wants the mixture to be at most 3 parts oats per 2 parts barley. She can buy oats for \$1.10 per bushel and barley for \$2.05 per bushel. If Mrs. Lewis needs at least 7500 bushels of grain, make a graph showing the number of bushels of oats and the number of bushels of barley that she should buy, and list three possible solutions.

Bonus Graph the solution set of $-3 \leq 4x + y < 1$.

18.



19.



20. _____

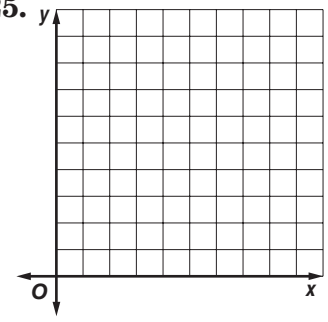
21. _____

22. _____

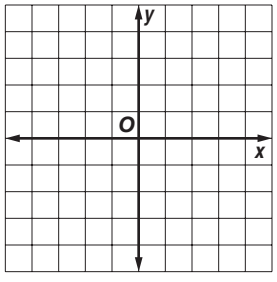
23. _____

24. _____

25.



B:



NAME _____ DATE _____ PERIOD _____

7 Chapter 7 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 solution in more than one way or investigate beyond the requirements of the problem.

1. Ruth invests \$10,000 in two accounts. One account has an annual interest rate of 7%, and the other account has an annual interest rate of 5%. Let I represent the total interest earned in one year. Then Ruth's investments can be modeled by the system of equations $x + y = 10{,}000$ and $0.07x + 0.05y = I$.

a. Determine a solution for this system of equations that represents a possible investment, and find the value of I that corresponds to your solution.

b. Find the solution for the system if $I = 800$. Explain why this solution does not represent a possible investment.

2. A car rental company wants to charge a rate of \$$A$ per day plus \$$B$ per mile to rent a compact car. Their leading competitor charges \$15 per day plus \$0.25 per mile to rent a compact car.

a. Explain how the system of equations $y = A + Bx$ and $y = 15 + 0.25x$ compares the total cost of renting a compact car for one day from this company and from their leading competitor.

b. Describe how the value of A and the value of B affects the comparison of the total cost of any one-day rental from these two companies.

3. A bookstore makes a profit of \$2.50 on each book they sell, and \$0.75 on each magazine they sell. Each week the store sells x books and y magazines. Let \$$P$ be the weekly profit, and \$$S$ be the weekly sales for the bookstore.

a. Write a system of equations that models the possible weekly sales and weekly profit for the book store. Then describe possible values for P and S.

b. Replace the equal signs in the system of equations from part **a** with inequality symbols to create a system of inequalities. Explain how these two systems differ in modeling the weekly profit and weekly sales of the bookstore. Explain how these two systems are the same.

c. Choose a value for P and a value for S, and substitute the values into the system of inequalities from part **b**. Make a graph of this system of inequalities, and describe what the graph represents.

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7

Chapter 7 Vocabulary Test/Review

SCORE _____

consistent	elimination	independent	system of equations
dependent	inconsistent	substitution	system of inequalities

Underline or circle the correct term to complete each sentence.

1. Two equations, such as $y = 3x - 6$ and $y = 12 + 4x$, together are called a ___?___.

system of inequalities system of equations solution of a system

2. If the graphs of the equations of a system intersect or coincide, the system of equations is ___?___.

consistent inconsistent independent

3. If the graphs of the equations of a system are parallel, the system is ___?___.

consistent inconsistent dependent

4. If a system of equations has exactly one solution, the system is ___?___.

inconsistent dependent independent

5. If a system of equations has an infinite number of solutions, the system is ___?___.

inconsistent dependent independent

6. Sometimes adding two equations of a system will give an equation with only one variable. This is helpful when you are solving the system by ___?___.

graphing substitution elimination

7. For a system where one variable is solved in terms of the other variable, you can solve the system by using ___?___.

addition substitution elimination

In your own words —
Define the term.

8. system of inequalities

NAME _____ DATE _____ PERIOD _____

7

Chapter 7 Quiz

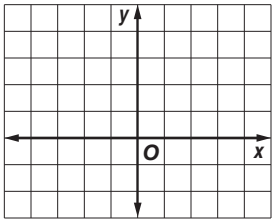
(Lessons 7–1 and 7–2)

SCORE _____

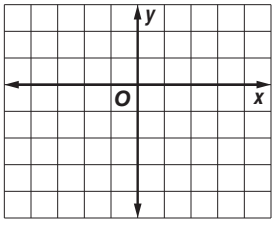
Assessment

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

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

1. 

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

2. 

For Questions 3 and 4, use substitution to solve each system of equations. If the system does not have exactly one solution, state whether it has *no* solutions or *infinitely many* solutions.

3. $3x - 2y = -7$
$y = x + 4$

3. _____

4. $-6x - 2y = -20$
$y = -3x + 10$

4. _____

5. In order for José and Marty to compete against each other during the wrestling season next year they need to be in the same weight category. José weighs 180 pounds and plans to gain 2 pounds per week. Marty weighs 250 pounds and plans to lose 1 pound per week. In which week will they weigh the same?

5. _____

NAME _____ DATE _____ PERIOD _____

7

Chapter 7 Quiz

(Lesson 7–3)

SCORE _____

For Questions 1–4, use elimination to solve each system of equations.

1. $x + y = 4$
$x - y = 7$

1. _____

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

2. _____

3. _____

3. $5r - 3s = 17$
$2r - 3s = 9$

4. $3x = 2 - 7y$
$-4x = 30 - 7y$

4. _____

5. Standardized Test Practice If $x - 2y = 7$ and $3x - 2y = 1$, what is the value of y?

A. -3 **B.** -5 **C.** 2 **D.** $-2\frac{1}{2}$

5. _____

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7

Chapter 7 Quiz

(Lesson 7–4)

SCORE _____

Use elimination to solve each system of equations.

1. $x - 4y = 11$
$5x - 7y = -10$ **1.** _____

2. $2r + 3s = 9$
$3r + 2s = 12$ **2.** _____

3. $4c + 6d = -10$
$8c - 3d = -5$ **3.** _____

Determine the best method to solve each system of equations. Then solve the system. **4.** _____

4. $x = 2y + 1$
$3x + y = 17$

5. $7x + 5y = 29$
$21x - 25y = -33$ **5.** _____

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7

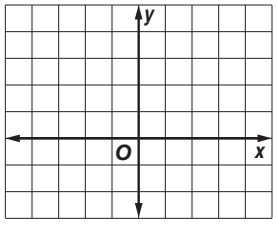
Chapter 7 Quiz

(Lesson 7–5)

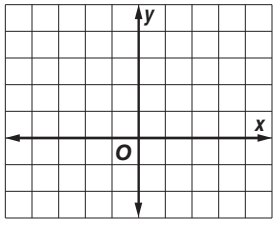
SCORE _____

For Questions 1–3, solve each system of inequalities by graphing.

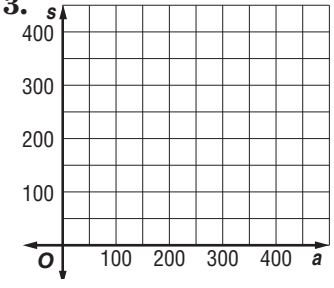
1. $y \geq 2$
$x + y \leq 3$ **1.**



2. $y < 2x - 1$
$y \leq -x + 4$ **2.**



3. Adult tickets to the school musical are \$5 and student tickets are \$2. There are 300 seats in the auditorium where the musical is being performed. The goal for ticket sales for one performance is at least \$900. Make a graph showing the number of each kind of ticket needed to be sold to reach the goal. List three possible solutions. **3.**



NAME _____ DATE _____ PERIOD _____

7

Chapter 7 Mid-Chapter Test

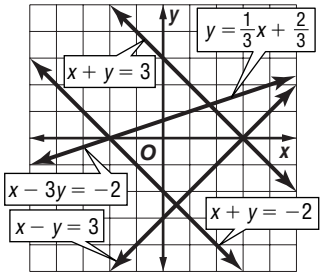
(Lessons 7–1 through 7–3)

SCORE _____

Assessment

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

Use the graph for Questions 1–3.



For Questions 1 and 2, determine how many solutions exist for each system of equations.

A. no solution
B. one solution
C. infinitely many solutions
D. cannot be determined

1. $x + y = 3$
$x - y = 3$ **1.** _____

2. $x - 3y = -2$
$y = \frac{1}{3}x + \frac{2}{3}$ **2.** _____

3. The solution to which system of equations has a positive y value? **3.** _____

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

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

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

D. $x + y = 3$
$x - y = 3$

4. If $y = 5x - 3$ and $3x - y = -1$, what is the value of y? **4.** _____

A. 2 **B.** -1 **C.** 7 **D.** -8

5. Use elimination to solve the system of equations for y.
$x - 5y = -6$
$x + 2y = 8$ **5.** _____

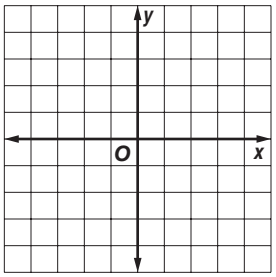
A. $-\frac{2}{3}$ **B.** 2 **C.** 4 **D.** $4\frac{2}{3}$

6. How many solutions does the system $2y = 10x - 14$ and $5x - y = 7$ have? **6.** _____

A. one **B.** two **C.** none **D.** infinitely many

Part II

7. Graph the system of equations. Then determine whether it has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution name it. **7.**



$x - 3y = -3$
$x + 3y = 9$

8. Use substitution to solve the system of equations.
$4x + y = 0$
$2y + x = -7$ **8.** _____

For Questions 9–11, use elimination to solve each system of equations.

9. $\frac{1}{2}x + y = 7$
$-\frac{1}{2}x + 3y = -11$ **9.** _____

10. $2x - 7y = 20$
$3x + 7y = -5$ **10.** _____

11. $9x + 2y = -17$
$-11x + 2y = 3$ **11.** _____

12. At the end of the 2000 WNBA regular season, the Houston Comets had 22 more victories than losses. The number of victories they had was three less than six times the number of losses. How many regular season games did the Houston Comets play during the 2000 WNBA season? **12.** _____

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7

Chapter 7 Cumulative Review

(Chapters 1–7)

1. Solve $\frac{a}{6} - 5 = 12$. (Lesson 3-4) **1.** _____

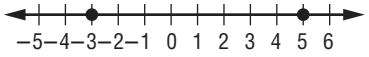
2. Find the coordinates of the vertices of triangle DEF with $D(1, 1)$, $E(5, 1)$, and $F(2, 4)$ rotated 90° clockwise about the origin. (Lesson 4-2) **2.** _____

3. Solve $y = \frac{1}{4}x - 1$ if the domain is $\{-4, -2, 0, 2, 4\}$. (Lesson 4-4) **3.** _____

4. Write the slope-intercept form of an equation of the line that passes through $(0, -4)$ and is parallel to the graph of $4x - y = 7$. (Lesson 5-6) **4.** _____

5. Solve $\frac{4}{5}a \leq -12$. (Lesson 6-2) **5.** _____

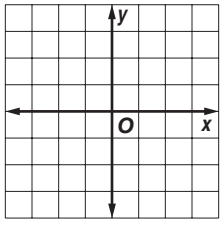
6. Write an open sentence involving absolute value for the graph. (Lesson 6-5) **6.** _____



7. Graph the system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. (Lesson 7-1) **7.** _____

$3x - y = 1$

$y = 3x + 1$



8. Jim's Brakes charges \$25 for parts and \$55 per hour to fix the brakes on a car. Myron's Auto charges \$40 for parts and \$30 per hour to do the same job. What length of job in hours would have the same cost at both shops? (Lesson 7-2) **8.** _____

9. The sum of two numbers is 21, and their difference is 7. What are the numbers? (Lesson 7-3) **9.** _____

10. Use elimination to solve the system of equations. (Lesson 7-4) **10.** _____

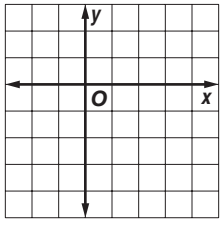
$2x - 4y = 26$

$3x + 2y = 15$

11. Solve the system of inequalities by graphing. (Lesson 7-5) **11.**

$y < x$

$y \geq x - 4$



NAME _____ DATE _____ PERIOD _____

7 Standardized Test Practice

(Chapters 1–7)

Assessment

Part 1: Multiple Choice

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

1. Which equation is *not* equivalent to $x - 7 = 12$? (Lesson 3-2)

A. $x - 9 = 14$ **B.** $x - 10 = 9$ **C.** $x = 19$ **D.** $x - 3 = 16$ **1.** Ⓐ Ⓑ Ⓒ Ⓓ

2. Find the value of y so that the line through $(2, 3)$ and $(5, y)$ has a slope of -2. (Lesson 5-1)

E. -3 **F.** $\frac{3}{2}$ **G.** 9 **H.** $\frac{9}{2}$ **2.** Ⓔ Ⓕ Ⓖ Ⓗ

3. Solve $-\frac{5}{3}r \geq \frac{10}{9}$. (Lesson 6-2)

A. $\left\{r \mid r \geq \frac{15}{9}\right\}$ **B.** $\left\{r \mid r \leq \frac{15}{9}\right\}$ **C.** $\left\{r \mid r \leq -\frac{2}{3}\right\}$ **D.** $\left\{r \mid r \geq \frac{2}{3}\right\}$ **3.** Ⓐ Ⓑ Ⓒ Ⓓ

4. Write a compound inequality for the graph. (Lesson 6-4)

E. $x \leq -2$ or $x > 3$ **F.** $x \leq -2$ and $x \geq 3$

G. $-2 \leq x < 3$ **H.** $-2 < x \leq 3$ **4.** Ⓔ Ⓕ Ⓖ Ⓗ

5. Which inequality is represented by a dashed line through $(0, 1)$ and $(2, 0)$, and is satisfied by $(2, 1)$? (Lesson 6-6)

A. $x + 2y < 2$ **B.** $x - 2y \leq 2$ **C.** $x - 2y \geq 2$ **D.** $x + 2y > 2$ **5.** Ⓐ Ⓑ Ⓒ Ⓓ

6. How many solutions exist for the system of equations? (Lesson 7-1)

$2x - 3y = 14$
$4x - 6y = 21$

E. no solutions **F.** one solution

G. two solutions **H.** infinitely many solutions **6.** Ⓔ Ⓕ Ⓖ Ⓗ

7. When solving the following system, which expression could be substituted for y? (Lesson 7-2)

$5x - 12y = 6$
$7x + y = 3$

A. $7x - 3$ **B.** $-7x + 3$ **C.** $5x - 6$ **D.** $-5x + 6$ **7.** Ⓐ Ⓑ Ⓒ Ⓓ

8. If $4x + 5y = 6$ and $7x + 5y = 3$, what is the value of y? (Lesson 7-3)

E. -1 **F.** 2 **G.** 1 **H.** -3 **8.** Ⓔ Ⓕ Ⓖ Ⓗ

9. Which ordered pair satisfies the system of inequalities? (Lesson 7-5)

$x + 2y > 8$
$3x - 2y \leq 10$

A. $(0, 4)$ **B.** $(3, 3)$ **C.** $(4, -2)$ **D.** $(5, 1)$ **9.** Ⓐ Ⓑ Ⓒ Ⓓ

NAME _____ DATE _____ PERIOD _____

7

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.

10. Find $-\frac{8}{9} \div (-64)$. (Lesson 2-4)

11. If $f(x) = x^2 - 4x$, find $f(-3)$. (Lesson 4-6)

10.

	/	/	
.	.	.	.
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

11.

	/	/	
.	.	.	.
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

12. What is the slope of a line parallel to the line that passes through $(-2, 1)$ and $(3, 7)$? (Lesson 5-6)

13. If $4x + 7y = -3$ and $3x + 2y = 14$, what is the value of x? (Lesson 7-4)

12.

	/	/	
.	.	.	.
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

13.

	/	/	
.	.	.	.
	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

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.

14.

Column A	Column B
$-\sqrt{\frac{5}{7}}$	$-\sqrt{\frac{9}{11}}$

14. (A) (B) (C) (D)

(Lesson 2-7)

15. Given: parallelogram $ABCD$ with $A(-1, 3)$, $B(3, 2)$, $C(2, -2)$, and $D(-2, -1)$ rotated 90° counterclockwise about the origin. (Lesson 4-2)

15. (A) (B) (C) (D)

the x-coordinate of B'	the y-coordinate of D'

16. Given: $-2x \geq -4$ and $y - 6 > -3$. (Lessons 6-1 and 6-2)

16. (A) (B) (C) (D)

x	y

NAME _____ DATE _____ PERIOD _____

Unit 2 Test

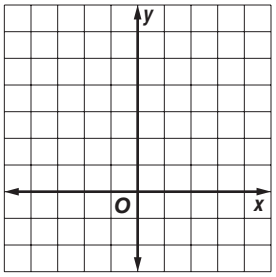
(Chapters 4–7)

SCORE _____

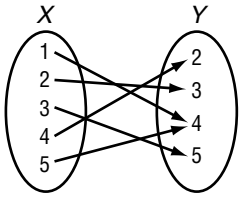
Assessment

1. Trapezoid $WXYZ$ with $W(-2, 1)$, $X(-4, 1)$, $Y(-4, 4)$, and $Z(-2, 5)$ is translated 3 units right. Find the coordinates of the vertices of the figure after the transformation is performed. Then graph the preimage and its image.

1. _____



2. Express the relation shown in the mapping as a set of ordered pairs. Then write the inverse of the relation.



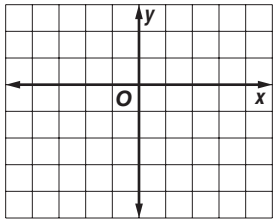
2. _____

3. Solve $2x - 3 = y$ if the domain is $\{-2, -1, 0, 3, 5\}$.

3. _____

4. Graph $3x - y = 1$.

4.



5. If $g(x) = 2x^2 - 3$, find $g(-4)$.

5. _____

6. Find the 25th term of the arithmetic sequence with first term 7 and common difference -2.

6. _____

7. Find the next three terms in the sequence 5, 6, 8, 11, … .

7. _____

8. A giraffe can travel 800 feet in 20 seconds. Write a direct variation equation for the distance traveled in any time.

8. _____

9. Write an equation of the line whose slope is 2 and whose y-intercept is 9.

9. _____

10. Write an equation of the line that passes through $(-1, -7)$ and $(1, 3)$.

10. _____

11. Write $y - 4 = -\frac{3}{2}(x + 6)$ in standard form.

11. _____

12. Write the slope-intercept form of an equation of the line that passes through $(-2, 0)$ and is parallel to the graph of $y = -3x - 2$.

12. _____

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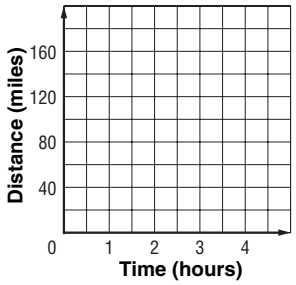
Unit 2 Test *(continued)*

13. The table below shows the distance driven during four different trips and the duration of each trip. Draw a scatter plot and determine what relationship exists, if any, in the data. Write an equation for a line of fit for the data.

Time (hours)	1	2	2.5	4
Distance (miles)	50	85	120	180

13.



Solve each inequality.

14. $4x - 5 < 7x + 10$ **14.** _____

15. $2(5a - 4) - 3(6 + 2a) \leq 6$ **15.** _____

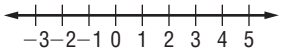
Solve each compound inequality.

16. $5 < 2t + 7 < 11$ **16.** _____

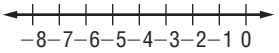
17. $13 < 4 - 3v$ or $2v - 14 > 8$ **17.** _____

For Questions 18 and 19, solve each open sentence. Then graph the solution set.

18. $|3b - 5| = 7$ **18.** _____



19. $|w + 5| > 1$ **19.** _____



20. Use a graph to determine whether the system $x - y = 4$ and $y = x$ has *no* solution, *one* solution, or *infinitely many* solutions. **20.** _____

For Questions 21–24, determine the best method to solve each system of equations. Then solve the system.

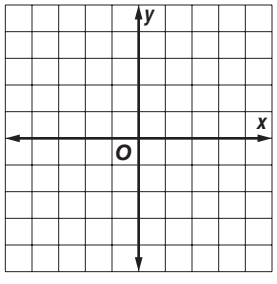
21. $x + y = 2$
$y = 2x - 1$ **21.** _____

22. $-x - 5y = 7$
$x + y = 1$ **22.** _____

23. $3x + y = -6$
$3x + 3y = 18$ **23.** _____

24. $3x + 3y = -6$
$7x + 4y = 1$ **24.** _____

25. Solve the system of inequalities by graphing.
$2x - y > 3$
$x + 2y \leq 4$ **25.**



NAME _____ DATE _____ PERIOD _____

7 Standardized Test Practice

Student Record Sheet *(Use with pages 404–405 of the Student Edition.)*

Part 1 Multiple Choice

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

1 Ⓐ Ⓑ Ⓒ Ⓓ	**4** Ⓐ Ⓑ Ⓒ Ⓓ	**7** Ⓐ Ⓑ Ⓒ Ⓓ	**9** Ⓐ Ⓑ Ⓒ Ⓓ
2 Ⓐ Ⓑ Ⓒ Ⓓ	**5** Ⓐ Ⓑ Ⓒ Ⓓ	**8** Ⓐ Ⓑ Ⓒ Ⓓ	**10** Ⓐ Ⓑ Ⓒ Ⓓ
3 Ⓐ Ⓑ Ⓒ Ⓓ	**6** Ⓐ Ⓑ Ⓒ Ⓓ		

Part 2 Short Response/Grid In

Solve the problem and write your answer in the blank.

For Questions 11–13, also enter your answer by writing each number or symbol in a box. Then fill in the corresponding oval for that number or symbol.

11 _____ (grid in)

12 _____ (grid in)

13 _____ (grid in)

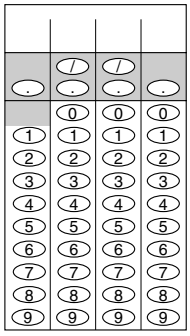
14 _____

15 _____

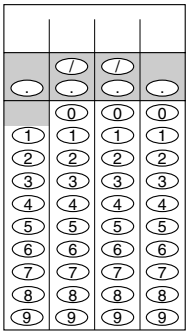
16 _____

17 _____

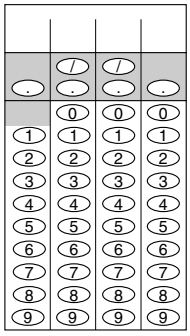
11



12



13



Part 3 Extended Response

Record your answers for Questions 18–19 on the back of this paper.

Answers

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NAME _____ DATE _____ PERIOD ____

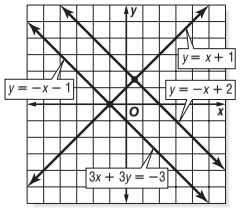
7-1 Study Guide and Intervention

Graphing Systems of Equations

Number of Solutions Two or more linear equations involving the same variables form a **system of equations**. A solution of the system of equations is an ordered pair of numbers that satisfies both equations. The table below summarizes information about systems of linear equations.

Graph of a System	intersecting lines	same line	parallel lines
Number of Solutions	exactly one solution	infinitely many solutions	no solution
Terminology	consistent and independent	consistent and dependent	inconsistent

Example **Use the graph at the right to determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions.**



a. $y = -x + 2$
$y = x + 1$

Since the graphs of $y = -x + 2$ and $y = x + 1$ intersect, there is one solution.

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

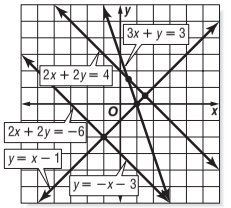
Since the graphs of $y = -x + 2$ and $3x + 3y = -3$ are parallel, there are no solutions.

c. $3x + 3y = -3$
$y = -x - 1$

Since the graphs of $3x + 3y = -3$ and $y = -x - 1$ coincide, there are infinitely many solutions.

Exercises

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $y = -x - 3$
$y = x - 1$
one

2. $2x + 2y = -6$
$y = -x - 3$
infinitely many

3. $y = -x - 3$
$2x + 2y = 4$
none

4. $2x + 2y = -6$
$3x + y = 3$
one

NAME _____ DATE _____ PERIOD ____

7-1 Study Guide and Intervention *(continued)*

Graphing Systems of Equations

Solve by Graphing One method of solving a system of equations is to graph the equations on the same coordinate plane.

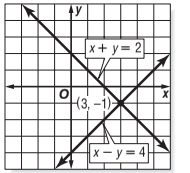
Example **Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.**

a. $x + y = 2$
$x - y = 4$

The graphs intersect. Therefore, there is one solution. The point $(3, -1)$ seems to lie on both lines. Check this estimate by replacing x with 3 and y with -1 in each equation.

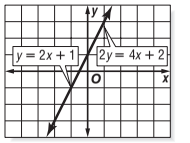
$x + y = 2$
$3 + (-1) = 2$ ✓
$x - y = 4$
$3 - (-1) = 3 + 1$ or 4 ✓

The solution is $(3, -1)$.



b. $y = 2x + 1$
$2y = 4x + 2$

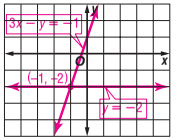
The graphs coincide. Therefore there are infinitely many solutions.



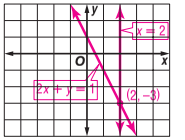
Exercises

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

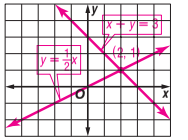
1. $y = -2$ **one; (−1, −2)**
$3x - y = -1$



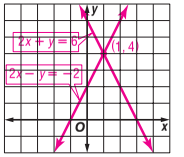
2. $x = 2$ **one; (2, −3)**
$2x + y = 1$



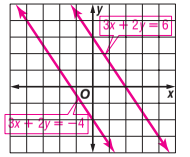
3. $y = \frac{1}{2}x$ **one; (2, 1)**
$x + y = 3$



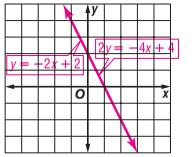
4. $2x + y = 6$ **one; (1, 4)**
$2x - y = -2$



5. $3x + 2y = 6$ **no solution**
$3x + 2y = -4$



6. $2y = -4x + 4$ **infinitely many**
$y = -2x + 2$



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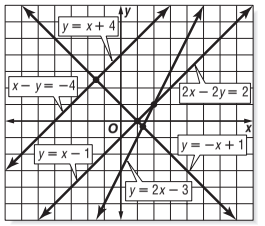
NAME _____ DATE _____ PERIOD ____

7-1 Skills Practice

Graphing Systems of Equations

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $y = x - 1$
   $y = -x + 1$ **one**

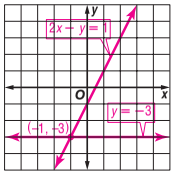
2. $x - y = -4$ **infinitely many**
   $y = x + 4$

3. $y = x + 4$
   $2x - 2y = 2$
   no solution

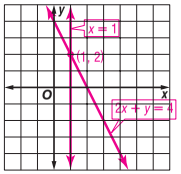
4. $y = 2x - 3$
   $2x - 2y = 2$
   one

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

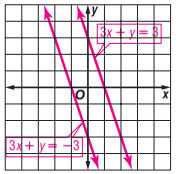
5. $2x - y = 1$
   $y = -3$ **one; (−1, −3)**



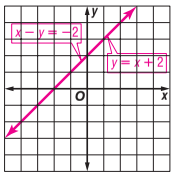
6. $x = 1$
   $2x + y = 4$ **one; (1, 2)**



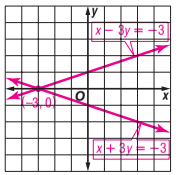
7. $3x + y = -3$
   $3x + y = 3$ **no solution**



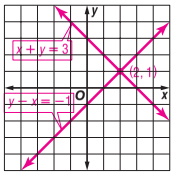
8. $y = x + 2$ **infinitely many**
   $x - y = -2$



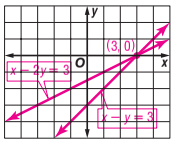
9. $x + 3y = -3$ **one; (−3, 0)**
   $x - 3y = -3$



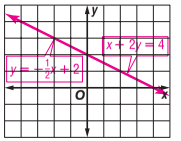
10. $y - x = -1$
    $x + y = 3$ **one; (2, 1)**



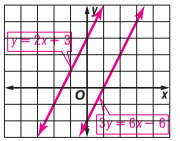
11. $x - y = 3$
    $x - 2y = 3$ **one; (3, 0)**



12. $x + 2y = 4$ **infinitely many**
    $y = -\frac{1}{2}x + 2$



13. $y = 2x + 3$ **no solution**
    $3y = 6x - 6$

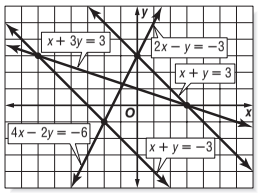


NAME _____ DATE _____ PERIOD ____

7-1 Practice (Average)

Graphing Systems of Equations

Use the graph at the right to determine whether each system has *no* solution, *one* solution, or *infinitely many* solutions.



1. $x + y = 3$
   $x + y = -3$
   no solution

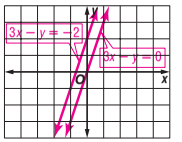
2. $2x - y = -3$
   $4x - 2y = -6$
   infinitely many

3. $x + 3y = 3$
   $x + y = -3$ **one**

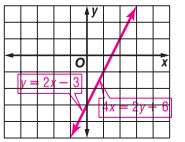
4. $x + 3y = 3$
   $2x - y = -3$ **one**

Graph each system of equations. Then determine whether the system has *no* solution, *one* solution, or *infinitely many* solutions. If the system has one solution, name it.

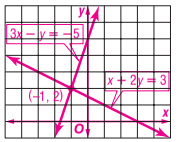
5. $3x - y = -2$ **no solution**
   $3x - y = 0$



6. $y = 2x - 3$ **infinitely many**
   $4x = 2y + 6$



7. $x + 2y = 3$ **one; (−1, 2)**
   $3x - y = -5$

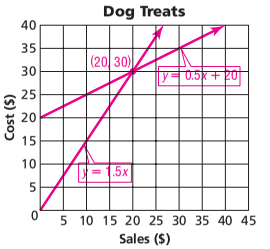


BUSINESS For Exercises 8 and 9, use the following information.

Nick plans to start a home-based business producing and selling gourmet dog treats. He figures it will cost \$20 in operating costs per week plus \$0.50 to produce each treat. He plans to sell each treat for \$1.50.

8. Graph the system of equations $y = 0.5x + 20$ and $y = 1.5x$ to represent the situation.

9. How many treats does Nick need to sell per week to break even? **20**



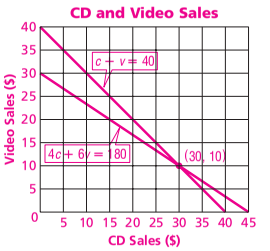
SALES For Exercises 10–12, use the following information.

A used book store also started selling used CDs and videos. In the first week, the store sold 40 used CDs and videos, at \$4.00 per CD and \$6.00 per video. The sales for both CDs and videos totaled \$180.00

10. Write a system of equations to represent the situation. **$c + v = 40$**
    $4c + 6v = 180$

11. Graph the system of equations.

12. How many CDs and videos did the store sell in the first week? **30 CDs and 10 videos**



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NAME _____ DATE _____ PERIOD ____

7-1

Reading to Learn Mathematics

Graphing Systems of Equations

Pre-Activity **How can you use graphs to compare the sales of two products?**

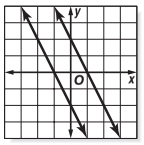
Read the introduction to Lesson 7-1 at the top of page 369 in your textbook.

- What is meant by the term linear function? **Sample answer: a function whose graph is a line**
- What does it mean to say that two lines intersect? **Sample answer: The lines cross.**

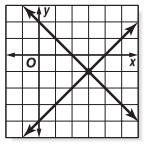
Reading the Lesson

1. Each figure shows the graph of a system of two equations. Write the letter of the figures that illustrate each statement.

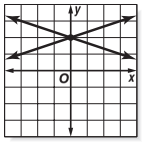
A.



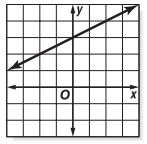
B.



C.



D.



a. A system of two linear equations can have an infinite number of solutions. **D**

b. A system of equations is consistent if there is at least one ordered pair that satisfies both equations. **B, C, D**

c. If two graphs are parallel, there are no ordered pairs that satisfy both equations. **A**

d. If a system of equations has exactly one solution, it is independent. **B, C**

e. If a system of equations has an infinite number of solutions, it is dependent. **D**

Helping You Remember

2. Describe how you can solve a system of equations by graphing. **Sample answer: Graph the equations on the same coordinate plane. Locate any points of intersection.**

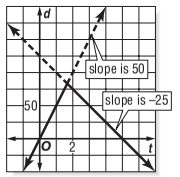
NAME _____ DATE _____ PERIOD ____

7-1

Enrichment

Graphing a Trip

The distance formula, $d = rt$, is used to solve many types of problems. If you graph an equation such as $d = 50t$, the graph is a model for a car going at 50 mi/h. The time the car travels is t; the distance in miles the car covers is d. The slope of the line is the speed.



Suppose you drive to a nearby town and return. You average 50 mi/h on the trip out but only 25 mi/h on the trip home. The round trip takes 5 hours. How far away is the town?

The graph at the right represents your trip. Notice that the return trip is shown with a negative slope because you are driving in the opposite direction.

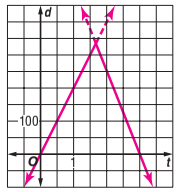
Solve each problem.

1. Estimate the answer to the problem in the above example. About how far away is the town?

about 80 miles

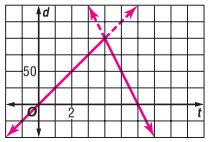
2. Graph this trip and solve the problem. An airplane has enough fuel for 3 hours of safe flying. On the trip out the pilot averages 200 mi/h flying against a headwind. On the trip back, the pilot averages 250 mi/h. How long a trip out can the pilot make?

about $1\frac{2}{3}$ hours and 330 miles



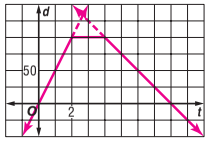
3. Graph this trip and solve the problem. You drive to a town 100 miles away. On the trip out you average 25 mi/h. On the trip back you average 50 mi/h. How many hours do you spend driving?

6 hours



4. Graph this trip and solve the problem. You drive at an average speed of 50 mi/h to a discount shopping plaza, spend 2 hours shopping, and then return at an average speed of 25 mi/h. The entire trip takes 8 hours. How far away is the shopping plaza?

100 miles



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7-2 Study Guide and Intervention

Substitution

Substitution One method of solving systems of equations is **substitution**.

Example 1 **Use substitution to solve the system of equations.**
$y = 2x$
$4x - y = -4$

Substitute $2x$ for y in the second equation.

$4x - y = -4$	Second equation
$4x - 2x = -4$	$y = 2x$
$2x = -4$	Combine like terms.
$\frac{2x}{2} = \frac{-4}{2}$	Divide each side by 2.
$x = -2$	Simplify.

Use $y = 2x$ to find the value of y.

$y = 2x$	First equation
$y = 2(-2)$	$x = -2$
$y = -4$	Simplify.

The solution is $(-2, -4)$.

Example 2 **Solve for one variable, then substitute.**
$x + 3y = 7$
$2x - 4y = -6$

Solve the first equation for x since the coefficient of x is 1.

$x + 3y = 7$	First equation
$x + 3y - 3y = 7 - 3y$	Subtract $3y$ from each side.
$x = 7 - 3y$	Simplify.

Find the value of y by substituting $7 - 3y$ for x in the second equation.

$2x - 4y = -6$	Second equation
$2(7 - 3y) - 4y = -6$	$x = 7 - 3y$
$14 - 6y - 4y = -6$	Distributive Property
$14 - 10y = -6$	Combine like terms.
$14 - 10y - 14 = -6 - 14$	Subtract 14 from each side.
$-10y = -20$	Simplify.
$\frac{-10y}{-10} = \frac{-20}{-10}$	Divide each side by -10.
$y = 2$	Simplify.

Use $y = 2$ to find the value of x.

$x = 7 - 3y$	
$x = 7 - 3(2)$	
$x = 1$	

The solution is $(1, 2)$.

Exercises

Use substitution to solve each system of equations. If the system does *not* have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

1. $y = 4x$
   $3x - y = 1$ **$(-1, -4)$**

2. $x = 2y$
   $y = x - 2$ **$(4, 2)$**

3. $x = 2y - 3$
   $x = 2y + 4$ **no solution**

4. $x - 2y = -1$
   $3y = x + 4$ **$(5, 3)$**

5. $c - 4d = 1$ **infinitely many**
   $2c - 8d = 2$

6. $x + 2y = 0$
   $3x + 4y = 4$ **$(4, -2)$**

7. $2b = 6a - 14$ **infinitely many**
   $3a - b = 7$

8. $x + y = 16$
   $2y = -2x + 2$ **no solution**

9. $y = -x + 3$ **no solution**
   $2y + 2x = 4$

10. $x = 2y$ **$(20, 10)$**
    $0.25x + 0.5y = 10$

11. $x - 2y = -5$
    $x + 2y = -1$ **$(-3, 1)$**

12. $-0.2x + y = 0.5$
    $0.4x + y = 1.1$ **$(1, 0.7)$**

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

Substitution

Real-World Problems Substitution can also be used to solve real-world problems involving systems of equations. It may be helpful to use tables, charts, diagrams, or graphs to help you organize data.

Example **CHEMISTRY How much of a 10% saline solution should be mixed with a 20% saline solution to obtain 1000 milliliters of a 12% saline solution?**

Let s = the number of milliliters of 10% saline solution.
Let t = the number of milliliters of 20% saline solution.

Use a table to organize the information.

	10% saline	20% saline	12% saline
Total milliliters	s	t	1000
Milliliters of saline	$0.10s$	$0.20t$	$0.12(1000)$

Write a system of equations.
$s + t = 1000$
$0.10s + 0.20t = 0.12(1000)$

Use substitution to solve this system.

$s + t = 1000$	First equation
$s = 1000 - t$	Solve for s.
$0.10s + 0.20t = 0.12(1000)$	Second equation
$0.10(1000 - t) + 0.20t = 0.12(1000)$	$s = 1000 - t$
$100 - 0.10t + 0.20t = 0.12(1000)$	Distributive Property
$100 + 0.10t = 0.12(1000)$	Combine like terms.
$0.10t = 20$	Simplify.
$\frac{0.10t}{0.10} = \frac{20}{0.10}$	Divide each side by 0.10.
$t = 200$	Simplify.
$s + t = 1000$	First equation
$s + 200 = 1000$	$t = 200$
$s = 800$	Solve for s.

800 milliliters of 10% solution and 200 milliliters of 20% solution should be used.

Exercises

1. **SPORTS** At the end of the 2000-2001 football season, 31 Super Bowl games had been played with the current two football leagues, the American Football Conference (AFC) and the National Football Conference (NFC). The NFC won five more games than the AFC. How many games did each conference win? **Source:** *New York Times Almanac* **AFC 13; NFC 18**

2. **CHEMISTRY** A lab needs to make 100 gallons of an 18% acid solution by mixing a 12% acid solution with a 20% solution. How many gallons of each solution are needed? **25 gal of 12% solution and 75 gal of 20% solution**

3. **GEOMETRY** The perimeter of a triangle is 24 inches. The longest side is 4 inches longer than the shortest side, and the shortest side is three-fourths the length of the middle side. Find the length of each side of the triangle. **6 in., 8 in., 10 in.**

Answers

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7-2 Skills Practice

Substitution

Use substitution to solve each system of equations. If the system does *not* have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

1. $y = 4x$
$x + y = 5$ **(1, 4)**

2. $y = 2x$
$x + 3y = -14$ **(−2, −4)**

3. $y = 3x$
$2x + y = 15$ **(3, 9)**

4. $x = -4y$
$3x + 2y = 20$ **(8, −2)**

5. $y = x - 1$
$x + y = 3$ **(2, 1)**

6. $x = y - 7$
$x + 8y = 2$ **(−6, 1)**

7. $y = 4x - 1$
$y = 2x - 5$ **(−2, −9)**

8. $y = 3x + 8$
$5x + 2y = 5$ **(−1, 5)**

9. $2x - 3y = 21$
$y = 3 - x$ **(6, −3)**

10. $y = 5x - 8$
$4x + 3y = 33$ **(3, 7)**

11. $x + 2y = 13$
$3x - 5y = 6$ **(7, 3)**

12. $x + 5y = 4$
$3x + 15y = -1$ **no solution**

13. $3x - y = 4$
$2x - 3y = -9$ **(3, 5)**

14. $x + 4y = 8$
$2x - 5y = 29$ **(12, −1)**

15. $x - 5y = 10$
$2x - 10y = 20$ **infinitely many**

16. $5x - 2y = 14$
$2x - y = 5$ **(4, 3)**

17. $2x + 5y = 38$
$x - 3y = -3$ **(9, 4)**

18. $x - 4y = 27$
$3x + y = -23$ **(−5, −8)**

19. $2x + 2y = 7$
$x - 2y = -1$ $\left(2, \frac{3}{2}\right)$

20. $2.5x + y = -2$
$3x + 2y = 0$ **(−2, 3)**

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7-2 Practice (Average)

Substitution

Use substitution to solve each system of equations. If the system does *not* have exactly one solution, state whether it has *no* solution or *infinitely many* solutions.

1. $y = 6x$
$2x + 3y = -20$ **(−1, −6)**

2. $x = 3y$
$3x - 5y = 12$ **(9, 3)**

3. $x = 2y + 7$
$x = y + 4$ **(1, −3)**

4. $y = 2x - 2$
$y = x + 2$ **(4, 6)**

5. $y = 2x + 6$
$2x - y = 2$ **no solution**

6. $3x + y = 12$
$y = -x - 2$ **(7, −9)**

7. $x + 2y = 13$ **(−3, 8)**
$-2x - 3y = -18$

8. $x - 2y = 3$ **infinitely many**
$4x - 8y = 12$

9. $x - 5y = 36$ **(−4, −8)**
$2x + y = -16$

10. $2x - 3y = -24$
$x + 6y = 18$ **(−6, 4)**

11. $x + 14y = 84$
$2x - 7y = -7$ **(14, 5)**

12. $0.3x - 0.2y = 0.5$
$x - 2y = -5$ **(5, 5)**

13. $0.5x + 4y = -1$
$x + 2.5y = 3.5$ **(6, −1)**

14. $3x - 2y = 11$
$x - \frac{1}{2}y = 4$ **(5, 2)**

15. $\frac{1}{2}x + 2y = 12$
$x - 2y = 6$ **(12, 3)**

16. $\frac{1}{3}x - y = 3$
$2x + y = 25$
(12, 1)

17. $4x - 5y = -7$
$y = 5x$
$\left(\frac{1}{3}, 1\frac{2}{3}\right)$

18. $x - 3y = -4$
$2x + 6y = 5$
$\left(-\frac{3}{4}, 1\frac{1}{12}\right)$

EMPLOYMENT For Exercises 19–21, use the following information.

Kenisha sells athletic shoes part-time at a department store. She can earn either \$500 per month plus a 4% commission on her total sales, or \$400 per month plus a 5% commission on total sales.

19. Write a system of equations to represent the situation.
$y = 0.04x + 500$ and $y = 0.05x + 400$

20. What is the total price of the athletic shoes Kenisha needs to sell to earn the same income from each pay scale? **\$10,000**

21. Which is the better offer? **the first offer if she expects to sell less than \$10,000 in shoes, and the second offer if she expects to sell more than \$10,000 in shoes**

MOVIE TICKETS For Exercises 22 and 23, use the following information.

Tickets to a movie cost \$7.25 for adults and \$5.50 for students. A group of friends purchased 8 tickets for \$52.75.

22. Write a system of equations to represent the situation.
$x + y = 8$ and $7.25x + 5.5y = 52.75$

23. How many adult tickets and student tickets were purchased? **5 adult and 3 student**

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7-2 Reading to Learn Mathematics

Substitution

Pre-Activity **How can a system of equations be used to predict media use?**

Read the introduction to Lesson 7-2 at the top of page 376 in your textbook.

- What is the system of equations? $y = -2.8x + 170$, $y = 14.4x + 2$
- Based on the graph, are there 0, 1, or infinitely many solutions of the system? 1 solution

Reading the Lesson

1. Describe how you would use substitution to solve each system of equations.

a. $y = -2x$
$x + 3y = 15$

Substitute $-2x$ for y in the second equation. Simplify and solve for x. Then use the value of x to find the value of y.

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

Substitute $2y$ for x in the first equation. Simplify and solve for y. Then use the value of y to find the value of x.

c. $x + 2y = 7$
$2x - 8y = 8$

Solve the first equation for x. Substitute the expression you find for x in the second equation. Simplify and solve for y. Then use the value of y to find the value of x.

d. $-3x + 5y = 81$
$2x + y = 24$

Solve the second equation for y. Substitute the expression you find for y in the first equation. Simplify and solve for x. Then use the value of x to find the value of y.

2. Jess solved a system of equations and her result was $-8 = -8$. All of her work was correct. Describe the graph of the system. Explain. It is a line. There are infinitely many solutions, since $-8 = -8$ is always true.

3. Miguel solved a system of equations and his result was $5 = -2$. All of his work was correct. Describe the graph of the system. Explain. The graph has two parallel lines, since $5 = -2$ is always false.

Helping You Remember

4. What is usually the first step in solving a system of equations by substitution? Sample answer: Solve one of the equations for one variable in terms of the other.

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7-2 Enrichment

Equations of Lines and Planes in Intercept Form

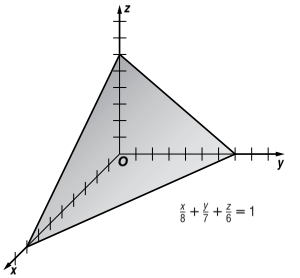
One form that a linear equation may take is **intercept form**. The constants a and b are the x- and y-intercepts of the graph.

$$\frac{x}{a} + \frac{y}{b} = 1$$

In three-dimensional space, the equation of a plane takes a similar form.

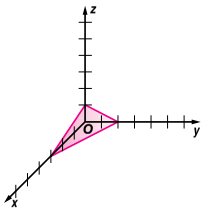
$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$$

Here, the constants a, b, and c are the points where the plane meets the x, y, and z-axes.



Solve each problem.

1. Graph the equation $\frac{x}{3} + \frac{y}{2} + \frac{z}{1} = 1$.



2. For the plane in Exercise 1, write an equation for the line where the plane intersects the xy-plane. Use intercept forms.

$\frac{x}{3} + \frac{y}{2} = 1$

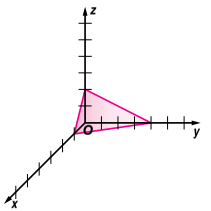
3. Write an equation for the line where the plane intersects the xz-plane.

$\frac{x}{3} + \frac{z}{1} = 1$

4. Write an equation for the line where the plane intersects the yz-plane.

$\frac{y}{2} + \frac{z}{1} = 1$

5. Graph the equation $\frac{x}{1} + \frac{y}{4} + \frac{z}{2} = 1$.



6. Write an equation for the xy-plane.

$z = 0$

7. Write an equation for the yz-plane.

$x = 0$

8. Write an equation for a plane parallel to the xy-plane with a z-intercept of 2.

$z = 2$

9. Write an equation for a plane parallel to the yz-plane with an x-intercept of 23.

$x = -3$

Answers

7-3 Study Guide and Intervention

Elimination Using Addition and Subtraction

Elimination Using Addition In systems of equations in which the coefficients of the x or y terms are additive inverses, solve the system by adding the equations. Because one of the variables is eliminated, this method is called **elimination**.

Example 1 **Use addition to solve the system of equations.**

$x - 3y = 7$
$3x + 3y = 9$

Write the equations in column form and add to eliminate y.

$$\begin{array}{rl} x - 3y = & 7 \\ (+)\ 3x + 3y = & 9 \\ \hline 4x \quad\ = & 16 \end{array}$$

Solve for x.

$\frac{4x}{4} = \frac{16}{4}$

$x = 4$

Substitute 4 for x in either equation and solve for y.

$4 - 3y = 7$
$4 - 3y - 4 = 7 - 4$
$-3y = 3$
$\frac{-3y}{-3} = \frac{3}{-3}$
$y = -1$

The solution is $(4, -1)$.

Example 2 **The sum of two numbers is 70 and their difference is 24. Find the numbers.**

Let x represent one number and y represent the other number.

$x + y = 70$
$(+)\ x - y = 24$
$2x = 94$
$\frac{2x}{2} = \frac{94}{2}$
$x = 47$

Substitute 47 for x in either equation.

$47 + y = 70$
$47 + y - 47 = 70 - 47$
$y = 23$

The numbers are 47 and 23.

Exercises

Use elimination to solve each system of equations.

1. $x + y = -4$, $x - y = 2$ **(−1, −3)**
2. $2m - 3n = 14$, $m + 3n = -11$ **(1, −4)**
3. $3a - b = -9$, $-3a - 2b = 0$ **(−2, 3)**
4. $-3x - 4y = -1$, $3x - y = -4$ **(−1, 1)**
5. $3c + d = 4$, $2c - d = 6$ **(2, −2)**
6. $-2x + 2y = 9$, $2x - y = -6$ **$\left(-\frac{3}{2}, 3\right)$**
7. $2x + 2y = -2$, $3x - 2y = 12$ **(2, −3)**
8. $4x - 2y = -1$, $-4x + 4y = -2$ **$\left(-1, -\frac{3}{2}\right)$**
9. $x - y = 2$, $x + y = -3$ **$\left(-\frac{1}{2}, -\frac{5}{2}\right)$**
10. $2x - 3y = 12$, $4x + 3y = 24$ **(6, 0)**
11. $-0.2x + y = 0.5$, $0.2x + 2y = 1.6$ **(1, 0.7)**
12. $0.1x + 0.3y = 0.9$, $0.1x - 0.3y = 0.2$ **$\left(\frac{11}{2}, \frac{7}{6}\right)$**

13. Rema is older than Ken. The difference of their ages is 12 and the sum of their ages is 50. Find the age of each. **Rema is 31 and Ken is 19.**

14. The sum of the digits of a two-digit number is 12. The difference of the digits is 2. Find the number if the units digit is larger than the tens digit. **57**

7-3 Study Guide and Intervention *(continued)*

Elimination Using Addition and Subtraction

Elimination Using Subtraction In systems of equations where the coefficients of the x or y terms are the same, solve the system by subtracting the equations.

Example **Use subtraction to solve the system of equations.**

$2x - 3y = 11$
$5x - 3y = 14$

$2x - 3y = 11$ $(-)\ 5x - 3y = 14$	Write the equations in column form and subtract.
$-3x \quad = -3$	Subtract the two equations. y is eliminated.
$\frac{-3x}{-3} = \frac{-3}{-3}$	Divide each side by -3.
$x = 1$	Simplify.
$2(1) - 3y = 11$	Substitute 1 for x in either equation.
$2 - 3y = 11$	Simplify.
$2 - 3y - 2 = 11 - 2$	Subtract 2 from each side.
$-3y = 9$	Simplify.
$\frac{-3y}{-3} = \frac{9}{-3}$	Divide each side by -3.
$y = -3$	Simplify.

The solution is $(1, -3)$.

Exercises

Use elimination to solve each system of equations.

1. $6x + 5y = 4$, $6x - 7y = -20$ **(−1, 2)**
2. $3m - 4n = -14$, $3m + 2n = -2$ **(−2, 2)**
3. $3a + b = 1$, $a + b = 3$ **(−1, 4)**
4. $-3x - 4y = -23$, $-3x + y = 2$ **(1, 5)**
5. $c - 3d = 11$, $2c - 3d = 16$ **(5, −2)**
6. $x - 2y = 6$, $x + y = 3$ **(4, −1)**
7. $2a - 3b = -13$, $2a + 2b = 7$ **$\left(-\frac{1}{2}, 4\right)$**
8. $4x + 2y = 6$, $4x + 4y = 10$ **$\left(\frac{1}{2}, 2\right)$**
9. $5s - t = 6$, $5s + 2t = 3$ **(1, −1)**
10. $6x - 3y = 12$, $4x - 3y = 24$ **(−6, −16)**
11. $x + 2y = 3.5$, $x - 3y = -9$ **(−1.5, 2.5)**
12. $0.2x + y = 0.7$, $0.2x + 2y = 1.2$ **(1, 0.5)**

13. The sum of two numbers is 70. One number is ten more than twice the other number. Find the numbers. **50; 20**

14. **GEOMETRY** Two angles are supplementary. The measure of one angle is 10° more than three times the other. Find the measure of each angle. **42.5°; 137.5°**

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7-3 Skills Practice

Elimination Using Addition and Subtraction

Use elimination to solve each system of equations.

1. $x - y = 1$
$x + y = 3$ **(2, 1)**

2. $-x + y = 1$
$x + y = 11$ **(5, 6)**

3. $x + 4y = 11$
$x - 6y = 11$ **(11, 0)**

4. $-x + 3y = 6$
$x + 3y = 18$ **(6, 4)**

5. $3x + 4y = 19$
$3x + 6y = 33$ **(−3, 7)**

6. $x + 4y = -8$
$x - 4y = -8$ **(−8, 0)**

7. $3a + 4b = 2$
$4a - 4b = 12$ **(2, −1)**

8. $3c - d = -1$
$-3c - d = 5$ **(−1, −2)**

9. $2x - 3y = 9$
$-5x - 3y = 30$ **(−3, −5)**

10. $x - y = 4$
$2x + y = -4$ **(0, −4)**

11. $3m - n = 26$
$-2m - n = -24$ **(10, 4)**

12. $5x - y = -6$
$-x + y = 2$ **(−1, 1)**

13. $6x - 2y = 32$
$4x - 2y = 18$ **(7, 5)**

14. $3x + 2y = -19$
$-3x - 5y = 25$ **(−5, −2)**

15. $7m + 4n = 2$
$7m + 2n = 8$ **(2, −3)**

16. $2x - 5y = -28$
$4x + 5y = 4$ **(−4, 4)**

17. The sum of two numbers is 28 and their difference is 4. What are the numbers? **12, 16**

18. Find the two numbers whose sum is 29 and whose difference is 15. **7, 22**

19. The sum of two numbers is 24 and their difference is 2. What are the numbers? **13, 11**

20. Find the two numbers whose sum is 54 and whose difference is 4. **25, 29**

21. Two times a number added to another number is 25. Three times the first number minus the other number is 20. Find the numbers. **9, 7**

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7-3 Practice (Average)

Elimination Using Addition and Subtraction

Use elimination to solve each system of equations.

1. $x - y = 1$
$x + y = -9$
(−4, −5)

2. $p + q = -2$
$p - q = 8$
(3, −5)

3. $4x + y = 23$
$3x - y = 12$
(5, 3)

4. $2x + 5y = -3$
$2x + 2y = 6$
(6, −3)

5. $3x + 2y = -1$
$4x + 2y = -6$
(−5, 7)

6. $5x + 3y = 22$
$5x - 2y = 2$
(2, 4)

7. $5x + 2y = 7$
$-2x + 2y = -14$
(3, −4)

8. $3x - 9y = -12$
$3x - 15y = -6$
(−7, −1)

9. $-4c - 2d = -2$
$2c - 2d = -14$
(−2, 5)

10. $2x - 6y = 6$
$2x + 3y = 24$
(9, 2)

11. $7x + 2y = 2$
$7x - 2y = -30$
(−2, 8)

12. $4.25x - 1.28y = -9.2$
$x + 1.28y = 17.6$
(1.6, 12.5)

13. $2x + 4y = 10$
$x - 4y = -2.5$
(2.5, 1.25)

14. $2.5x + y = 10.7$
$2.5x + 2y = 12.9$
(3.4, 2.2)

15. $6m - 8n = 3$
$2m - 8n = -3$
$\left(1\frac{1}{2}, \frac{3}{4}\right)$

16. $4a + b = 2$
$4a + 3b = 10$
$\left(-\frac{1}{2}, 4\right)$

17. $-\frac{1}{3}x - \frac{4}{3}y = -2$
$\frac{1}{3}x - \frac{2}{3}y = 4$
(10, −1)

18. $\frac{3}{4}x - \frac{1}{2}y = 8$
$\frac{3}{2}x + \frac{1}{2}y = 19$
(12, 2)

19. The sum of two numbers is 41 and their difference is 5. What are the numbers? **18, 23**

20. Four times one number added to another number is 36. Three times the first number minus the other number is 20. Find the numbers. **8, 4**

21. One number added to three times another number is 24. Five times the first number added to three times the other number is 36. Find the numbers. **3, 7**

22. LANGUAGES English is spoken as the first or primary language in 78 more countries than Farsi is spoken as the first language. Together, English and Farsi are spoken as a first language in 130 countries. In how many countries is English spoken as the first language? In how many countries is Farsi spoken as the first language?
English: 104 countries, Farsi: 26 countries

23. DISCOUNTS At a sale on winter clothing, Cody bought two pairs of gloves and four hats for $43.00. Tori bought two pairs of gloves and two hats for $30.00. What were the prices for the gloves and hats? **gloves: $8.50, hats: $6.50.**

Answers

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7-3

Reading to Learn Mathematics

Elimination Using Addition and Subtraction

Pre-Activity **How can you use a system of equations to solve problems about weather?**

Read the introduction to Lesson 7-3 at the top of page 382 in your textbook.

What fact explains why the variable d gets eliminated from the system of equations? **$d - d = 0$**

Reading the Lesson

1. Write *addition* or *subtraction* to tell which operation it would be easiest to use to eliminate a variable of the system. Explain your choice.

	System of Equations	Operation	Explanation
a.	$3x + 5y = 12$ $-3x + 2y = 6$	addition	The coefficients of the x terms are additive inverses.
b.	$3x + 5y = 7$ $3x - 2y = 8$	subtraction	The coefficients of the x terms are the same.
c.	$-x - 4y = 9$ $4x - 4y = 6$	subtraction	The coefficients of the y terms are the same.
d.	$5x - 7y = 17$ $8x + 7y = 9$	addition	The coefficients of the y terms are additive inverses.

Helping You Remember

2. Tell how you can decide whether to use addition or subtraction to eliminate a variable in a system of equations. **Sample answer: Look at the coefficients of each variable. If the coefficients of one of the variables are additive inverses, you can use addition to eliminate the variable. If the coefficients of one variable are the same, you can use subtraction to eliminate the variable.**

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7-3

Enrichment

Rózsa Péter

Rózsa Péter (1905–1977) was a Hungarian mathematician dedicated to teaching others about mathematics. As professor of mathematics at a teachers' college in Budapest, she wrote several mathematics textbooks and championed reforms in the teaching of mathematics. In 1945 she wrote *Playing with Infinity: Mathematical Explorations and Excursions*, a popular work in which she attempted to convey the spirit of mathematics to the general public.

By far Péter's greatest contribution to mathematics was her pioneering research in the field of recursive function theory. When you evaluate a function *recursively*, you begin with one initial value of x. Working from this single number, you can use the function to generate an entire sequence of numbers. For instance, here is how you use an initial value of $x = 1$ to evaluate the function $f(x) = 3x$ recursively.

$$f(1) = 3(1) = 3 \rightarrow f(3) = 3(3) = 9 \rightarrow f(9) = 3(9) = 27 \rightarrow f(27) = 3(27) = 81 \rightarrow f(81) = 3(81) = 243 \rightarrow$$

The first five numbers of the sequence generated by this function are 3, 9, 27, 81, and 243.

Write the first five numbers of the sequence generated by each function, using the given number as the initial value of x.

1. $f(x) = 3x; x = 2$
6, 18, 54, 162, 486

2. $g(x) = x - 5; x = 1$
−4, −9, −14, −19, −24

3. $f(x) = 2x + 1; x = -3$
−5, −9, −17, −33, −65

4. $f(x) = x^2; x = 2$
4; 16; 256; 65,536; 4,294,967,296

5. $h(x) = -x; x = 3$
−3, 3, −3, 3, −3

6. $k(x) = \frac{1}{x}; x = 10$
$\frac{1}{10}$, 10, $\frac{1}{10}$, 10, $\frac{1}{10}$

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7-4 Study Guide and Intervention

Elimination Using Multiplication

Elimination Using Multiplication Some systems of equations cannot be solved simply by adding or subtracting the equations. In such cases, one or both equations must first be multiplied by a number before the system can be solved by elimination.

Example 1 **Use elimination to solve the system of equations.**

$x + 10y = 3$
$4x + 5y = 5$

If you multiply the second equation by -2, you can eliminate the y terms.

$$\begin{array}{rl} x + 10y = & 3 \\ (+)\ -8x - 10y = & -10 \\ \hline -7x = & -7 \end{array}$$

$$\frac{-7x}{-7} = \frac{-7}{-7}$$

$$x = 1$$

Substitute 1 for x in either equation.

$$\begin{aligned} 1 + 10y &= 3 \\ 1 + 10y - 1 &= 3 - 1 \\ 10y &= 2 \\ \frac{10y}{10} &= \frac{2}{10} \\ y &= \frac{1}{5} \end{aligned}$$

The solution is $\left(1, \frac{1}{5}\right)$.

Example 2 **Use elimination to solve the system of equations.**

$3x - 2y = -7$
$2x - 5y = 10$

If you multiply the first equation by 2 and the second equation by -3, you can eliminate the x terms.

$$\begin{array}{rl} 6x - 4y = & -14 \\ (+)\ -6x + 15y = & -30 \\ \hline 11y = & -44 \end{array}$$

$$\frac{11y}{11} = \frac{-44}{11}$$

$$y = -4$$

Substitute -4 for y in either equation.

$$\begin{aligned} 3x - 2(-4) &= -7 \\ 3x + 8 &= -7 \\ 3x + 8 - 8 &= -7 - 8 \\ 3x &= -15 \\ \frac{3x}{3} &= \frac{-15}{3} \\ x &= -5 \end{aligned}$$

The solution is $(-5, -4)$.

Exercises

Use elimination to solve each system of equations.

1. $2x + 3y = 6$, $x + 2y = 5$ **(−3, 4)**
2. $2m + 3n = 4$, $-m + 2n = 5$ **(−1, 2)**
3. $3a - b = 2$, $a + 2b = 3$ **(1, 1)**
4. $4x + 5y = 6$, $6x - 7y = -20$ **(−1, 2)**
5. $4c - 3d = 22$, $2c - d = 10$ **(4, −2)**
6. $3x - 4y = -4$, $x + 3y = -10$ **(−4, −2)**
7. $4s - t = 9$, $5s + 2t = 8$ **(2, −1)**
8. $4a - 3b = -8$, $2a + 2b = 3$ **$\left(-\frac{1}{2}, 2\right)$**
9. $2x + 2y = 5$, $4x - 4y = 10$ **$\left(\frac{5}{2}, 0\right)$**
10. $6x - 4y = -8$, $4x + 2y = -3$ **$\left(-1, \frac{1}{2}\right)$**
11. $4x + 2y = -5$, $-2x - 4y = 1$ **$\left(-\frac{3}{2}, \frac{1}{2}\right)$**
12. $2x + y = 3.5$, $-x + 2y = 2.5$ **(0.9, 1.7)**

13. **GARDENING** The length of Sally's garden is 4 meters greater than 3 times the width. The perimeter of her garden is 72 meters. What are the dimensions of Sally's garden? **28 m by 8 m**

14. Anita is $4\frac{1}{2}$ years older than Basilio. Three times Anita's age added to six times Basilio's age is 36. How old are Anita and Basilio? **Anita: 7 yr; Basilio: $2\frac{1}{2}$ yr**

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7-4 Study Guide and Intervention *(continued)*

Elimination Using Multiplication

Determine the Best Method The methods to use for solving systems of linear equations are summarized in the table below.

Method	The Best Time to Use
Graphing	to estimate the solution, since graphing usually does not give an exact solution
Substitution	if one of the variables in either equation has a coefficient of 1 or −1
Elimination Using Addition	if one of the variables has opposite coefficients in the two equations
Elimination Using Subtraction	if one of the variables has the same coefficient in the two equations
Elimination Using Multiplication	if none of the coefficients are 1 or −1 and neither of the variables can be eliminated by simply adding or subtracting the equations

Example **Determine the best method to solve the system of equations. Then solve the system.**

$6x + 2y = 20$
$-2x + 4y = -16$

Since the coefficients of x will be additive inverses of each other if you multiply the second equation by 3, use elimination.

$$\begin{array}{rl} 6x + 2y = & 20 \\ (+)\ -6x + 12y = & -48 \quad \text{Multiply the second equation by 3.} \\ \hline 14y = & -28 \quad \text{Add the two equations. } x \text{ is eliminated.} \\ \frac{14y}{14} = & \frac{-28}{14} \quad \text{Divide each side by 14.} \\ y = & -2 \quad \text{Simplify.} \end{array}$$

$$\begin{array}{rl} 6x + 2(-2) = & 20 \quad \text{Substitute } -2 \text{ for } y \text{ in either equation.} \\ 6x - 4 = & 20 \quad \text{Simplify.} \\ 6x - 4 + 4 = & 20 + 4 \quad \text{Add 4 to each side.} \\ 6x = & 24 \quad \text{Simplify.} \\ \frac{6x}{6} = & \frac{24}{6} \quad \text{Divide each side by 6.} \\ x = & 4 \quad \text{Simplify.} \end{array}$$

The solution is $(4, -2)$.

Exercises

Determine the best method to solve each system of equations. Then solve the system.

1. $x + 2y = 3$, $x + y = 1$ **elimination (−); (−1, 2)**
2. $m + 6n = -8$, $m = 2n + 8$ **substitution; (4, −2)**
3. $a - b = 6$, $a = 2b + 7$ **substitution; (5, −1)**
4. $4x + y = 15$, $-x - 3y = -12$ **substitution; (3, 3)**
5. $3c - d = 14$, $c - d = 2$ **elimination (−); (6, 4)**
6. $x + 2y = -9$, $y = 4x$ **substitution; (−1, −4)**
7. $4x = 2y - 10$, $x + 2y = 5$ **substitution; (−1, 3)**
8. $x = -2y$, $4x + 4y = -10$ **substitution; $\left(-5, \frac{5}{2}\right)$**
9. $2s - 3t = 42$, $3s + 2t = 24$ **elimination (×); (12, −6)**
10. $4a - 4b = -10$, $2a + 4b = -2$ **elimination (+); $\left(-2, \frac{1}{2}\right)$**
11. $4x + 10y = -6$, $-2x - 10y = 2$ **elimination (+); $\left(-2, \frac{1}{5}\right)$**
12. $2x = y - 3$, $-x + y = 0$ **substitution; (−3, −3)**

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7-4 Skills Practice

Elimination Using Multiplication

Use elimination to solve each system of equations.

1. $x + y = -9$
   $5x - 2y = 32$ **(2, −11)**

2. $3x + 2y = -9$
   $x - y = -13$ **(−7, 6)**

3. $2x + 5y = 3$
   $-x + 3y = -7$ **(4, −1)**

4. $2x + y = 3$
   $-4x - 4y = -8$ **(1, 1)**

5. $4x - 2y = -14$
   $3x - y = -8$ **(−1, 5)**

6. $2x + y = 0$
   $5x + 3y = 2$ **(−2, 4)**

7. $5x + 3y = -10$
   $3x + 5y = -6$ **(−2, 0)**

8. $2x + 3y = 14$
   $3x - 4y = 4$ **(4, 2)**

9. $2x - 3y = 21$
   $5x - 2y = 25$ **(3, −5)**

10. $3x + 2y = -26$
    $4x - 5y = -4$ **(−6, −4)**

11. $3x - 6y = -3$
    $2x + 4y = 30$ **(7, 4)**

12. $5x + 2y = -3$
    $3x + 3y = 9$ **(−3, 6)**

13. Two times a number plus three times another number equals 13. The sum of the two numbers is 7. What are the numbers? **8, −1**

14. Four times a number minus twice another number is −16. The sum of the two numbers is −1. Find the numbers. **−3, 2**

Determine the best method to solve each system of equations. Then solve the system.

15. $2x + 3y = 10$ **elimination (×);**
    $5x + 2y = -8$ **(−4, 6)**

16. $8x - 7y = 18$ **elimination (+);**
    $3x + 7y = 26$ **(4, 2)**

17. $y = 2x$ **substitution;**
    $3x + 2y = 35$ **(5, 10)**

18. $3x + y = 6$ **elimination (−);**
    $3x + y = 3$ **no solution**

19. $3x - 4y = 17$ **elimination (×);**
    $4x + 5y = 2$ **(3, −2)**

20. $y = 3x + 1$ **substitution;**
    $3x - y = -1$ **infinitely many solutions**

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7-4 Practice (Average)

Elimination Using Multiplication

Use elimination to solve each system of equations.

1. $2x - y = -1$
   $3x - 2y = 1$
   (−3, −5)

2. $5x - 2y = -10$
   $3x + 6y = 66$
   (2, 10)

3. $7x + 4y = -4$
   $5x + 8y = 28$
   (−4, 6)

4. $2x - 4y = -22$
   $3x + 3y = 30$
   (3, 7)

5. $3x + 2y = -9$
   $5x - 3y = 4$
   (−1, −3)

6. $4x - 2y = 32$
   $-3x - 5y = -11$
   (7, −2)

7. $3x + 4y = 27$
   $5x - 3y = 16$
   (5, 3)

8. $0.5x + 0.5y = -2$
   $x - 0.25y = 6$
   (4, −8)

9. $2x - \frac{3}{4}y = -7$
   $x + \frac{1}{2}y = 0$
   (−2, 4)

10. Eight times a number plus five times another number is −13. The sum of the two numbers is 1. What are the numbers? **−6, 7**

11. Two times a number plus three times another number equals 4. Three times the first number plus four times the other number is 7. Find the numbers. **5, −2**

Determine the best method to solve each system of equations. Then solve the system.

12. $5x + 7y = 3$
    $2x - 7y = -38$
    elimination (+); (−5, 4)

13. $7x + 2y = 2$
    $2x - 3y = -28$
    elimination (×); (−2, 8)

14. $-6x - 2y = 14$
    $6x + 8y = -20$
    elimination (+); (−2, −1)

15. $x = 2y + 6$
    $\frac{1}{2}x - y = 3$
    substitution; infinitely many solutions

16. $4x + 3y = -2$
    $4x + 3y = 3$
    elimination (−); no solution

17. $y = \frac{1}{2}x$
    $\frac{5}{2}x - 2y = 9$
    substitution; (6, 3)

18. **FINANCE** Gunther invested $10,000 in two mutual funds. One of the funds rose 6% in one year, and the other rose 9% in one year. If Gunther's investment rose a total of $684 in one year, how much did he invest in each mutual fund?
    $7200 in the 6% fund and $2800 in the 9% fund

19. **CANOEING** Laura and Brent paddled a canoe 6 miles upstream in four hours. The return trip took three hours. Find the rate at which Laura and Brent paddled the canoe in still water. **1.75 mi/h**

20. **NUMBER THEORY** The sum of the digits of a two-digit number is 11. If the digits are reversed, the new number is 45 more than the original number. Find the number. **38**

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7-4 Reading to Learn Mathematics

Elimination Using Multiplication

Pre-Activity **How can a manager use a system of equations to plan employee time?**

Read the introduction to Lesson 7-4 at the top of page 387 in your textbook.

Can the system of equations be solved by elimination with addition or subtraction? Explain. **No; neither variable has coefficients that are additive inverses or equal.**

Reading the Lesson

1. Could elimination by multiplication be used to solve the system shown below? Explain.

$3x - 5y = 15$
$-6x + 7y = 11$

Yes; you can multiply the first equation by 2 to make the coefficients of the *x* terms additive inverses.

2. Tell whether it would be easiest to use substitution, elimination by addition, elimination by subtraction, or elimination by multiplication to solve the system. Explain your choice.

	System of Equations	Solution Method	Explanation
a.	$-3x + 4y = 2$ $3x + 2y = 10$	**elimination by addition**	**The coefficients of the *x* terms are additive inverses.**
b.	$x - 2y = 0$ $5x - 4y = 8$	**substitution**	**It is easy to solve the first equation for *x*.**
c.	$6x - 5y = -18$ $2x + 10y = 27$	**elimination by multiplication**	**Sample answer: You can multiply the first equation by 2 to eliminate *y* by addition.**
d.	$-2x + 3y = 9$ $3x + 3y = 12$	**elimination by subtraction**	**The coefficients of the *y* terms are the same.**

Helping You Remember

3. If you are going to solve a system by elimination, how do you decide whether you will need to multiply one or both equations by a number? **Sample answer: If both adding the equations and subtracting the equations result in equations that still have two variables, you will need to use multiplication.**

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7-4 Enrichment

George Washington Carver and Percy Julian

In 1990, George Washington Carver and Percy Julian became the first African Americans elected to the National Inventors Hall of Fame. Carver (1864–1943) was an agricultural scientist known worldwide for developing hundreds of uses for the peanut and the sweet potato. His work revitalized the economy of the southern United States because it was no longer dependent solely upon cotton. Julian (1898–1975) was a research chemist who became famous for inventing a method of making a synthetic cortisone from soybeans. His discovery has had many medical applications, particularly in the treatment of arthritis.

There are dozens of other African American inventors whose accomplishments are not as well known. Their inventions range from common household items like the ironing board to complex devices that have revolutionized manufacturing. The exercises that follow will help you identify just a few of these inventors and their inventions.

Match the inventors with their inventions by matching each system with its solution. (Not all the solutions will be used.)

1. Sara Boone	$x + y = 2$ **E** $x - y = 10$	**A.** (1, 4)	automatic traffic signal
2. Sarah Goode	$x = 2 - y$ **D** $2y + x = 9$	**B.** (4, −2)	eggbeater
3. Frederick M. Jones	$y = 2x + 6$ **G** $y = -x - 3$	**C.** (−2, 3)	fire extinguisher
4. J. L. Love	$2x + 3y = 8$ **F** $2x - y = -8$	**D.** (−5, 7)	folding cabinet bed
5. T. J. Marshall	$y - 3x = 9$ **C** $2y + x = 4$	**E.** (6, −4)	ironing board
6. Jan Matzeliger	$y + 4 = 2x$ **J** $6x - 3y = 12$	**F.** (−2, 4)	pencil sharpener
7. Garrett A. Morgan	$3x - 2y = -5$ **A** $3y - 4x = 8$	**G.** (−3, 0)	portable X-ray machine
8. Norbert Rillieux	$3x - y = 12$ **I** $y - 3x = 15$	**H.** (2, −3)	player piano
		I. no solution	evaporating pan for refining sugar
		J. infinitely many solutions	lasting (shaping) machine for manufacturing shoes

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7-5 Study Guide and Intervention

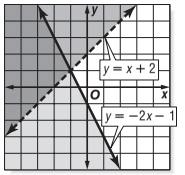
Graphing Systems of Inequalities

Systems of Inequalities The solution of a **system of inequalities** is the set of all ordered pairs that satisfy both inequalities. If you graph the inequalities in the same coordinate plane, the solution is the region where the graphs overlap.

Example 1 **Solve the system of inequalities by graphing.**

$y > x + 2$

$y \leq -2x - 1$

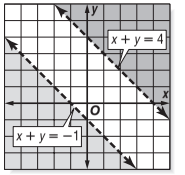


The solution includes the ordered pairs in the intersection of the graphs. This region is shaded at the right. The graphs of $y = x + 2$ and $y = -2x - 1$ are boundaries of this region. The graph of $y = x + 2$ is dashed and is not included in the graph of $y > x + 2$.

Example 2 **Solve the system of inequalities by graphing.**

$x + y > 4$

$x + y < -1$

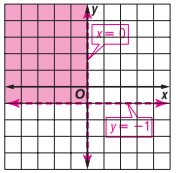


The graphs of $x + y = 4$ and $x + y = -1$ are parallel. Because the two regions have no points in common, the system of inequalities has no solution.

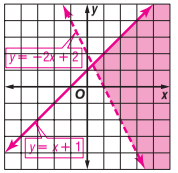
Exercises

Solve each system of inequalities by graphing.

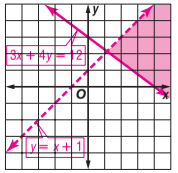
1. $y > -1$
   $x < 0$



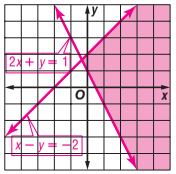
2. $y > -2x + 2$
   $y \leq x + 1$



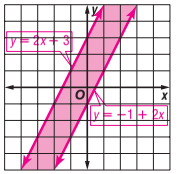
3. $y < x + 1$
   $3x + 4y \geq 12$



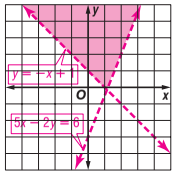
4. $2x + y \geq 1$
   $x - y \geq -2$



5. $y \leq 2x + 3$
   $y \geq -1 + 2x$



6. $5x - 2y < 6$
   $y > -x + 1$



Lesson 7-5

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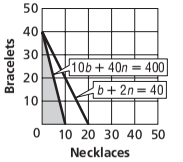
7-5 Study Guide and Intervention *(continued)*

Graphing Systems of Inequalities

Real-World Problems In real-world problems, sometimes only whole numbers make sense for the solution, and often only positive values of x and y make sense.

Example **BUSINESS** **AAA Gem Company produces necklaces and bracelets. In a 40-hour week, the company has 400 gems to use. A necklace requires 40 gems and a bracelet requires 10 gems. It takes 2 hours to produce a necklace and a bracelet requires one hour. How many of each type can be produced in a week?**



Let n = the number of necklaces that will be produced and b = the number of bracelets that will be produced. Neither n or b can be a negative number, so the following system of inequalities represents the conditions of the problems.

$n \geq 0$

$b \geq 0$

$b + 2n \leq 40$

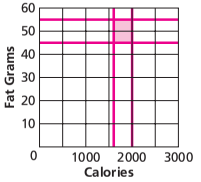
$10b + 40n \leq 400$

The solution is the set ordered pairs in the intersection of the graphs. This region is shaded at the right. Only whole-number solutions, such as (5, 20) make sense in this problem.

Exercises

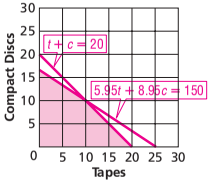
For each exercise, graph the solution set. List three possible solutions to the problem.

1. **HEALTH** Mr. Flowers is on a restricted diet that allows him to have between 1600 and 2000 Calories per day. His daily fat intake is restricted to between 45 and 55 grams. What daily Calorie and fat intakes are acceptable?



Sample answers: 1600 Calories, 45 fat grams; 1800 Calories, 50 fat grams; 2000 Calories, 55 fat grams

2. **RECREATION** Maria had $150 in gift certificates to use at a record store. She bought fewer than 20 recordings. Each tape cost $5.95 and each CD cost $8.95. How many of each type of recording might she have bought?



Sample answers: 10 tapes, 9 CDs; 0 tapes, 16 CDs; 14 tapes, 5 CDs

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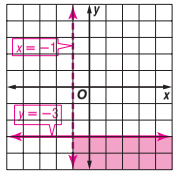
NAME _____ DATE _____ PERIOD ____

7-5 Skills Practice

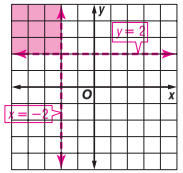
Graphing Systems of Inequalities

Solve each system of inequalities by graphing.

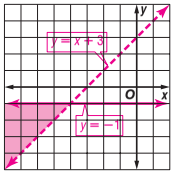
1. $x > -1$
$y \leq -3$



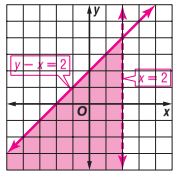
2. $y > 2$
$x < -2$



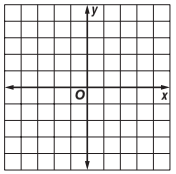
3. $y > x + 3$
$y \leq -1$



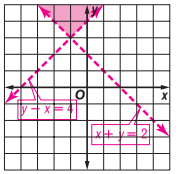
4. $x < 2$
$y - x \leq 2$



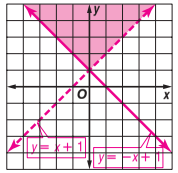
5. $x + y \leq -1$
$x + y \geq 3$ ∅



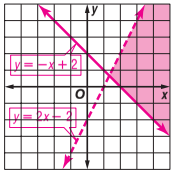
6. $y - x > 4$
$x + y > 2$



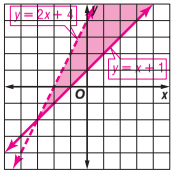
7. $y > x + 1$
$y \geq -x + 1$



8. $y \geq -x + 2$
$y < 2x - 2$

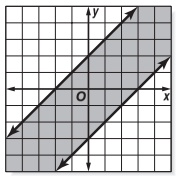


9. $y < 2x + 4$
$y \geq x + 1$



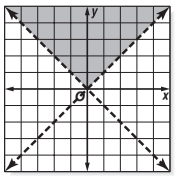
Write a system of inequalities for each graph.

10.



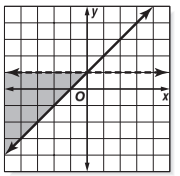
$y \leq x + 2, y \geq x - 3$

11.



$y > -x, y > x$

12.



$y \geq x + 1, y < 1$

Lesson 7-5

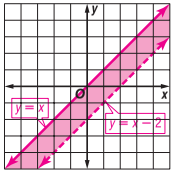
NAME _____ DATE _____ PERIOD ____

7-5 Practice (Average)

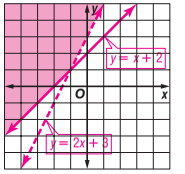
Graphing Systems of Inequalities

Solve each system of inequalities by graphing.

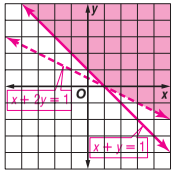
1. $y > x - 2$
$y \leq x$



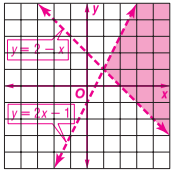
2. $y \geq x + 2$
$y > 2x + 3$



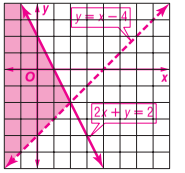
3. $x + y \geq 1$
$x + 2y > 1$



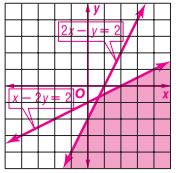
4. $y < 2x - 1$
$y > 2 - x$



5. $y > x - 4$
$2x + y \leq 2$

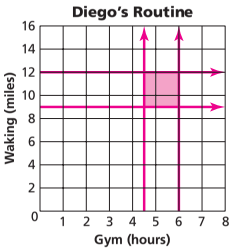


6. $2x - y \geq 2$
$x - 2y \geq 2$



FITNESS For Exercises 7 and 8, use the following information.

Diego started an exercise program in which each week he works out at the gym between 4.5 and 6 hours and walks between 9 and 12 miles.

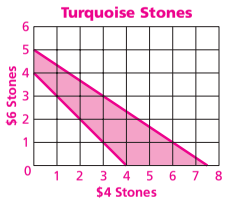


7. Make a graph to show the number of hours Diego works out at the gym and the number of miles he walks per week.

8. List three possible combinations of working out and walking that meet Diego's goals. **Sample answers: gym 5 h, walk 9 mi; gym 6 h, walk 10 mi, gym 5.5 h, walk 11 mi**

SOUVENIRS For Exercises 9 and 10, use the following information.

Emily wants to buy turquoise stones on her trip to New Mexico to give to at least 4 of her friends. The gift shop sells stones for either \$4 or \$6 per stone. Emily has no more than \$30 to spend.



9. Make a graph showing the numbers of each price of stone Emily can purchase.

10. List three possible solutions. **Sample answer: one \$4 stone and four \$6 stones; three \$4 stones and three \$6 stones; five \$4 stones and one \$6 stone**

Answers

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NAME _____ DATE _____ PERIOD ____

7-5 Reading to Learn Mathematics

Graphing Systems of Inequalities

Pre-Activity **How can you use a system of inequalities to plan a sensible diet?**

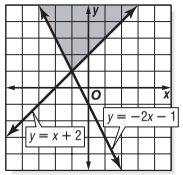
Read the introduction to Lesson 7-5 at the top of page 394 in your textbook.

The green section on the graph represents a range of 2000 to 2400 Calories a day and 60 to 75 grams of fat per day.

Reading the Lesson

Write the inequality symbols that you need to get a system whose graph looks like the one shown. Use <, ≤, >, or ≥.

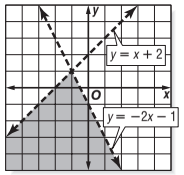
1.



y ≥ $x + 2$

y ≥ $-2x - 1$

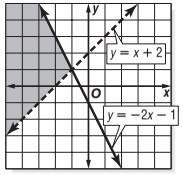
2.



y < $x + 2$

y < $-2x - 1$

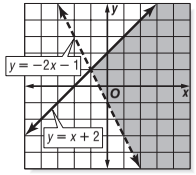
3.



y > $x + 2$

y ≤ $-2x - 1$

4.



y ≤ $x + 2$

y > $-2x - 1$

Helping You Remember

5. Describe how you would explain the process of using a graph to solve a system of inequalities to a friend who missed Lesson 7-5. Graph each inequality on the same coordinate plane. The solutions are the ordered pairs for the points in both graphs.

Lesson 7-5

NAME _____ DATE _____ PERIOD ____

7-5 Enrichment

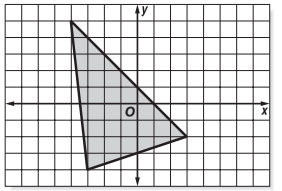
Describing Regions

The shaded region inside the triangle can be described with a system of three inequalities.

$y < 2x + 1$

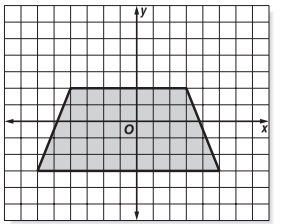
$y > \frac{1}{3}x - 3$

$y > 29x - 31$



Write systems of inequalities to describe each region. You may first need to divide a region into triangles or quadrilaterals.

1.

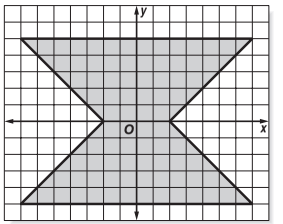


$y < \frac{5}{2}x + 12$

$y < -\frac{5}{2}x + \frac{19}{2}$

$y < 2 \quad y > -3$

2.

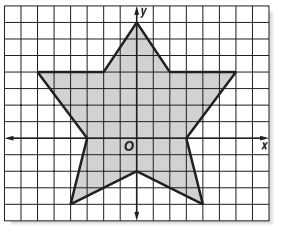


$y > -x - 2 \quad y < x + 2$

$y > x - 2 \quad y < -x + 2$

$y < 5 \quad y > -5$

3.



top: $y < \frac{3}{2}x + 7$, $y < -\frac{3}{2}x + 7$, $y > 4$

middle: $y < 4$, $y > 0$, $y > -\frac{4}{3}x - 4$, $y > \frac{4}{3}x - 4$

bottom left: $y < 4x + 12$, $y > \frac{1}{2}x - 2$, $y < 0$, $x < 0$

bottom right: $y < -4x + 12$, $y > -\frac{1}{2}x - 2$, $y < 0$, $x \not< 0$

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Chapter 7 Assessment Answer Key

Form 1

Page 433

1. C
2. A
3. C
4. B
5. A
6. B
7. C
8. B
9. B
10. C
11. D
12. A

Page 434

13. B
14. A
15. C
16. D
17. A
18. B
19. C
20. D

B: substitution; (0, 0)

Form 2A

Page 435

1. A
2. B
3. D
4. C
5. A
6. C
7. C
8. A
9. C
10. B
11. D
12. B

(continued on the next page)

Chapter 7 Assessment Answer Key

Form 2A *(continued)*
Page 436

13. C

14. A

15. A

16. C

17. D

18. D

19. B

20. D

B: $\left(-7, -3\frac{1}{2}\right)$

Form 2B
Page 437

1. C
2. B
3. A
4. B
5. D
6. A
7. C
8. D
9. A
10. C
11. C
12. B

Page 438

13. B

14. C

15. D

16. A

17. A

18. B

19. D

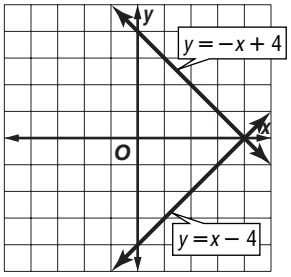
20. C

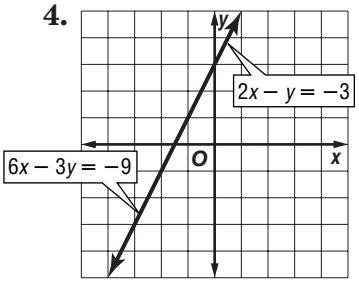
B: Manuel is 15 years old; his sister is 7 years old.

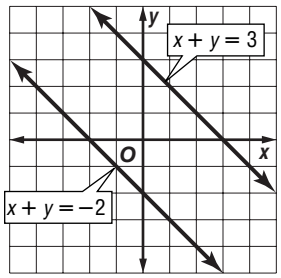
Chapter 7 Assessment Answer Key

Form 2C

Page 439

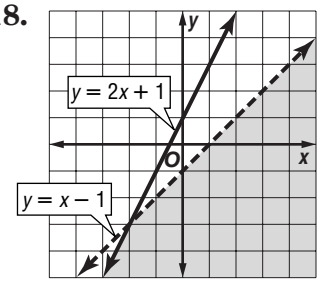
1. no solution
2. one solution
3. 

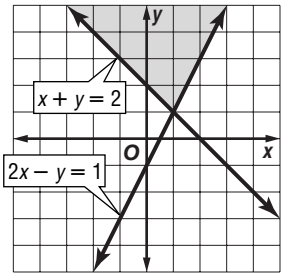
one solution; (4, 0)
4. 

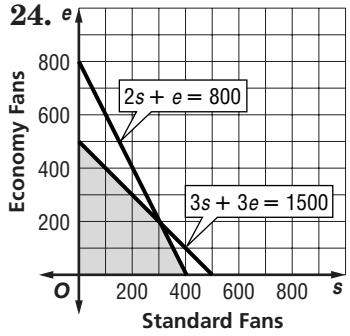
infinitely many solutions
5. 

no solution
6. (1, 3)
7. (3, 5)
8. no solution
9. infinitely many solutions
10. (−8, 0)
11. (4, −1)
12. (−3, 2)
13. (7, −1)
14. (2, 1)
15. (13, 1)
16. substitution; (3, 2)
17. elimination with subtraction; (2, −7)

Page 440

18. 

19. 

20. 23 and −6
21. 186 student tickets; 135 adult tickets
22. 14 dimes; 19 nickels
23. 28 square miles
24. 

25. Sample answers: 100 standard fans, 400 economy fans; 200 standard fans, 300 economy fans; 400 standard fans, 0 economy fans

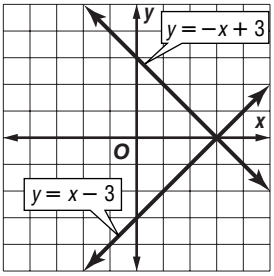
B: Mavis is 15 years old; her brother is 10 years old

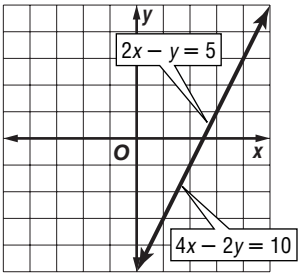
Answers

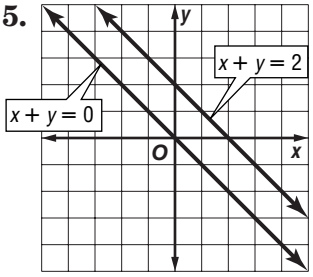
Chapter 7 Assessment Answer Key

Form 2D

Page 441

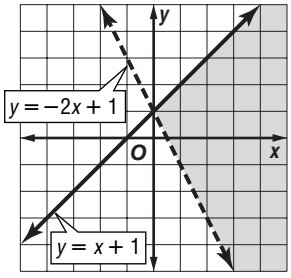
1. infinitely many solutions
2. one solution
3. 

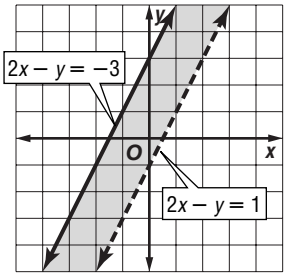
one solution; (3, 0)
4. 

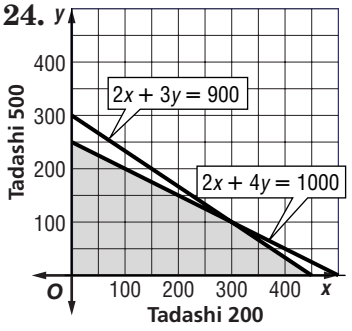
infinitely many solutions
5. 

no solution
6. (2, 4)
7. (2, 1)
8. infinitely many solutions
9. no solution
10. (5, 3)
11. (2, 2)
12. (−1, 4)
13. (−2, 5)
14. (7, −3)
15. (6, −2)
16. substitution; (−2, −5)
17. elimination with subtraction; (−1, 1)

Page 442

18. 

19. 

20. 18 and −2
21. 34 hours
22. 5 two-point goals; 11 three-point goals
23. 129 square miles
24. 

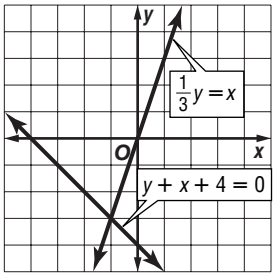
25. Sample answers: 100 Tadashi 200, 200 Tadashi 500; 250 Tadashi 200, 125 Tadashi 500; 350 Tadashi 200, 75 Tadashi 500

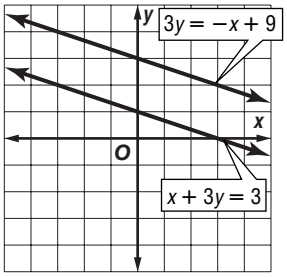
B: (−1, −3)

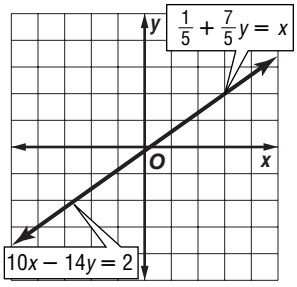
Chapter 7 Assessment Answer Key

Form 3

Page 443

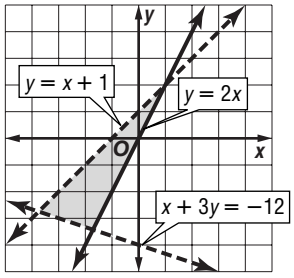
1. one solution
2. no solution
3. 

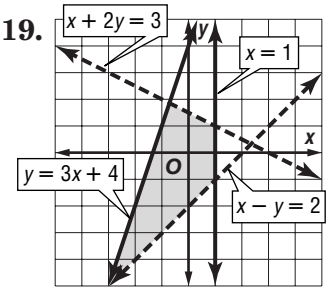
one solution; (−1, −3)
4. 

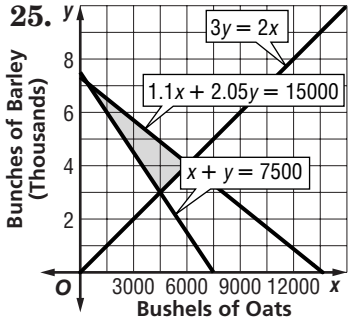
no solution
5. 

infinitely many solutions
6. (4, 1)
7. no solution
8. (−22, −6)
9. infinitely many solutions
10. $\left(3, -\frac{3}{7}\right)$
11. (−14, 7)
12. (−2, −6)
13. (−32, 15)
14. (6, 14)
15. (−2, 6)
16. substitution; (63, 84)
17. elimination using multiplication; $\left(-\frac{1}{2}, \frac{1}{2}\right)$

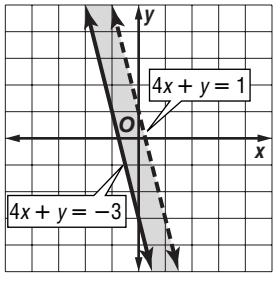
Page 444

18. 

19. 

20. 6, 10
21. $3\frac{1}{2}, 8\frac{1}{2}$
22. 67
23. 10 lb of \$2.45 mix; 20 lb of \$2.30 mix
24. 5 mph
25. 

Sample answers:
2000 bushels of oat, 6000 bushels of barley;
4000 bushels of oats, 4000 bushels of barley;
6000 bushels of oats, 4000 bushels of barley

B: 

Answers

Chapter 7 Assessment Answer Key

Page 445, 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 *solving systems of equations* and *solving systems of inequalities.* • Uses appropriate strategies to solve problems. • Computations are correct. • Written explanations are exemplary. • Graphs are accurate and appropriate. • 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 *solving systems of equations* and *solving systems of inequalities.* • Uses appropriate strategies to solve problems. • Computations are mostly correct. • Written explanations are effective. • Graphs are mostly accurate and appropriate. • 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 *solving systems of equations* and *solving systems of inequalities.* • May not use appropriate strategies to solve problems. • Computations are mostly correct. • Written explanations are satisfactory. • Graphs are mostly accurate. • 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. • Graphs may be accurate but lack detail or explanation. • 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 *solving systems of equations* and *solving systems of inequalities.* • Does not use appropriate strategies to solve problems. • Computations are incorrect. • Written explanations are unsatisfactory. • Graphs are inaccurate or inappropriate. • Does not satisfy requirements of problems. • No answer may be given.

Chapter 7 Assessment Answer Key

Page 445, Open-Ended Assessment
Sample Answers

In addition to the scoring rubric found on page A22, the following sample answers may be used as guidance in evaluating open-ended assessment items.

1a. Sample answer: (5000, 5000); $600

1b. (15,000, −5000); To represent a possible investment both x and y must be positive. Thus, there is no interpretation for a negative value for y.

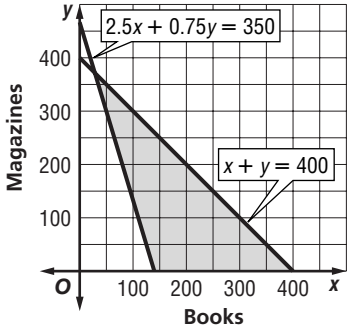
2a. The student should recognize that the total cost of a one-day rental of a compact car from the car rental company is modeled by the equation $y = A + Bx$, where y is the total cost and x is the number of miles driven during the day. Likewise, the total cost of a one-day rental of a compact car from the leading competitor is modeled by the equation $y = 15 + 0.25x$. The solution to the system is the number of miles driven during the day that makes the cost of renting a compact car from the two companies for one day equal, and the corresponding total cost.

2b. The value of A determines if the one-day fee for the rental of the compact car from the car rental company will be less than, greater than, or equal to the one-day fee from their leading competitor. The value of B determines whether the number of miles driven will keep the total cost less than, greater than, or equal to the total cost of renting from the leading competitor, or change which company has the higher total cost for the rental.

3a. $x + y = S$
$2.5x + 0.75y = P$
Both S and P must be positive. The student may recognize that the maximum profit is 2.5 times the weekly sales, and the minimum profit is 0.75 times the weekly sales. i.e., $0.75S \leq P \leq 2.5S$.

3b. Sample answer: $x + y \leq S$
$2.5x + 0.75y \geq P$
The solution of the system of equations is the ordered pair that corresponds to weekly sales of S and weekly profit of $\$P$. The solution of the system of inequalities is the set of ordered pairs that correspond to weekly sales less than or equal to S and weekly profit greater than or equal to $\$P$. The graph of the system of equations corresponds to the boundaries of the graph of the system of inequalities. The two systems consist of the same terms.

3c. Sample answer: $x + y \leq 400$
$2.5x + 0.75y \geq 350$



The graph of this system of inequalities is the set of ordered pairs that correspond to weekly sales less than or equal to 400, and weekly profit greater than or equal to $350.

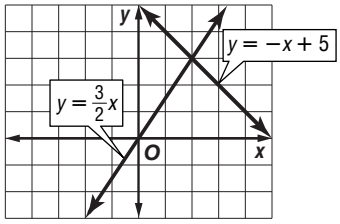
Answers

Chapter 7 Assessment Answer Key

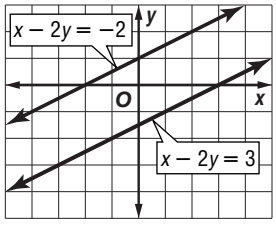
Vocabulary Test/Review
Page 446

1. system of equations
2. consistent
3. inconsistent
4. independent
5. dependent
6. elimination
7. substitution
8. Sample answer: two or more inequalities that are used together

Quiz (Lessons 7-1 and 7-2)
Page 447

1. 

one solution; (2, 3)

2. 

no solution

3. (1, 5)
4. infinitely many solutions
5. in the 23rd week

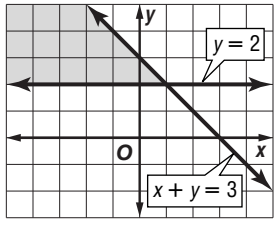
Quiz (Lesson 7-3)
Page 447

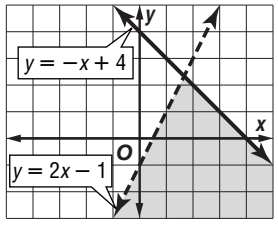
1. $\left(5\frac{1}{2}, -1\frac{1}{2}\right)$
2. $\left(-1\frac{1}{2}, 2\right)$
3. $\left(2\frac{2}{3}, -1\frac{2}{9}\right)$
4. (−4, 2)
5. B

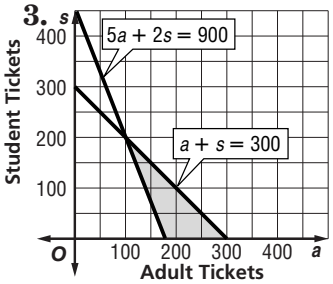
Quiz (Lesson 7-4)
Page 448

1. (−9, −5)
2. $\left(3\frac{3}{5}, \frac{3}{5}\right)$
3. (−1, −1)
4. substitution; (5, 2)
5. elimination using multiplication; (2, 3)

Quiz (Lesson 7-5)
Page 448

1. 

2. 

3. 

Answers:
200 adult, 50 student;
150 adult, 100 student;
250 adult, 250 student

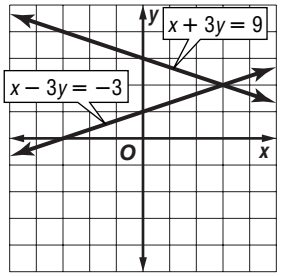
Chapter 7 Assessment Answer Key

Mid-Chapter Test
Page 449

Part I

1. B
2. C
3. A
4. C
5. B
6. D

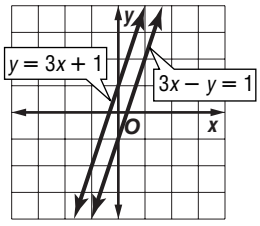
Part II

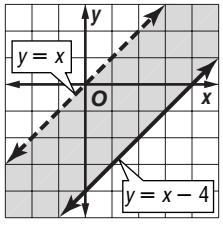
7. 

one solution; (3, 2)

8. (1, −4)
9. (16, −1)
10. (3, −2)
11. (−1, −4)
12. 32 games

Cumulative Review
Page 450

1. 102
2. $D'(1, -1)$, $E'(1, -5)$, $F'(4, -2)$
3. {(−4, −2), (−2, −1.5), (0, −1), (2, −0.5), (4, 0)};
4. $y = 4x - 4$
5. $a \leq -15$
6. $|x - 1| = 4$
7. no solution
8. 

$\frac{3}{5}$ hr
9. 7, 14
10. (7, −3)
11. 

Answers

Chapter 7 Assessment Answer Key

Standardized Test Practice

Page 451

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)

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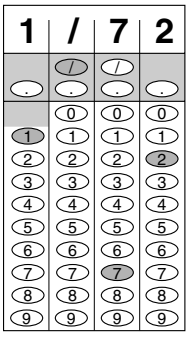
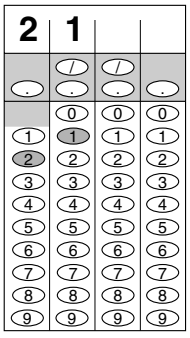
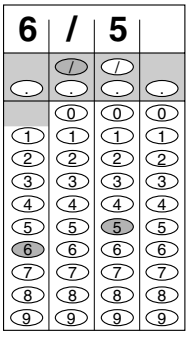
10.



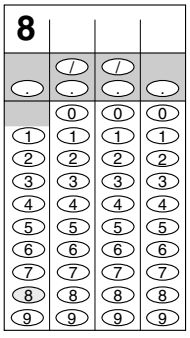
11.



12.



13.



14. (A) (B) (C) (D)

15. (A) (B) (C) (D)

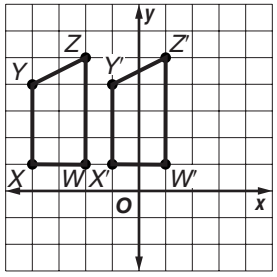
16. (A) (B) (C) (D)

Chapter 7 Assessment Answer Key

Unit 2 Test

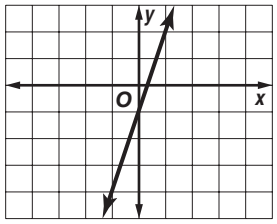
Page 453

1. $W'(1, 1), X'(-1, 1), Y'(-1, 4), Z'(1, 5)$;



2. {(1, 4), (2, 3), (3, 5), (4, 2), (5, 4)}; {(4, 1), (3, 2), (5, 3), (2, 4), (4, 5)}

3. {(−2, −7), (−1, −5), (0, −3), (3, 3), (5, 7)}

4. 

5. 29

6. −41

7. 15, 20, 26

8. $d = 40t$

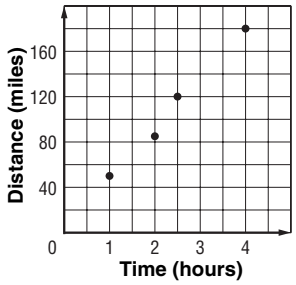
9. $y = 2x + 9$

10. $y = 5x - 2$

11. $3x + 2y = -10$

12. $y = -3x - 6$

Page 454

13. 

positive; Sample answer: $y = \frac{130}{3}x + \frac{20}{3}$

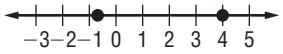
14. $\{x \mid x > -5\}$

15. $\{a \mid a \leq 8\}$

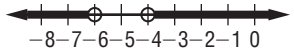
16. $\{t \mid -1 < t < 2\}$

17. $\{v \mid v < -3 \text{ or } v > 11\}$

18. $\left\{-\frac{2}{3}, 4\right\}$



19. $\{w \mid w < -6 \text{ or } w > -4\}$



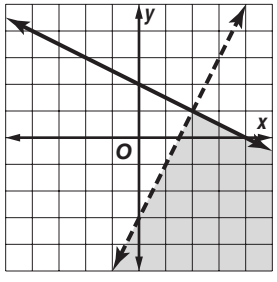
20. no solution

21. substitution; (1, 1)

22. elimination (+); (3, −2)

23. elimination (−); (−6, 12)

24. elimination (×); (3, −5)

25. 

Answers