GLENCOE MATHEMATICS

# Algebra 1

## Chapter 3 Resource Masters

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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 |

**ANSWERS FOR WORKBOOKS** The answers for Chapter 3 of these workbooks can be found in the back of this Chapter Resource Masters booklet.

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*Algebra 1*
*Chapter 3 Resource Masters*

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# Teacher's Guide to Using the Chapter 3 Resource Masters

The ***Fast File*** Chapter Resource system allows you to conveniently file the resources you use most often. The *Chapter 3 Resource Masters* includes the core materials needed for Chapter 3. 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 3-1. 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 3 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 186–187. 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.

NAME _____ DATE _____ PERIOD _____

3

# Reading to Learn Mathematics

## *Vocabulary Builder*



**This is an alphabetical list of the key vocabulary terms you will learn in Chapter 3. 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 |
|---|---|---|
| consecutive integers<br>kuhn-SEH-kyuh-tihv | | |
| defining a variable | | |
| dimensional analysis<br>duh·MEHNCH·nuhl | | |
| equivalent equation<br>ih·KWIHV·luhnt | | |
| extremes | | |
| formula | | |
| identity | | |
| means | | |
| multi-step equations | | |

*(continued on the next page)*

## *Vocabulary Builder* *(continued)*

| Vocabulary Term | Found on Page | Definition/Description/Example |
|---|---|---|
| number theory | | |
| percent of change | | |
| percent of decrease | | |
| percent of increase | | |
| proportion<br>pruh·POHR·shun | | |
| ratio | | |
| rate | | |
| scale | | |
| solve an equation | | |
| weighted average | | |
| work backward | | |

NAME _____ DATE _____ PERIOD _____

# 3-1 Study Guide and Intervention

## *Writing Equations*

**Write Equations** Writing equations is one strategy for solving problems. You can use a variable to represent an unspecified number or measure referred to in a problem. Then you can write a verbal expression as an algebraic expression.

**Example 1** **Translate each sentence into an equation or a formula.**

**a. Ten times a number *x* is equal to 2.8 times the difference *y* minus *z*.**

$10 \times x = 2.8 \times (y - z)$

The equation is $10x = 2.8(y - z)$.

**b. A number *m* minus 8 is the same as a number *n* divided by 2.**

$m - 8 = n \div 2$

The equation is $m - 8 = \frac{n}{2}$.

**c. The area of a rectangle equals the length times the width. Translate this sentence into a formula.**

Let $A$ = area, $\ell$ = length, and $w$ = width.

Formula: *Area equals length times width.*

$A = \ell \times w$

The formula for the area of a rectangle is $A = \ell w$.

**Example 2** **Use the Four-Step Problem-Solving Plan.**

**The population of the United States in 2001 was about 284,000,000, and the land area of the United States is about 3,500,000 square miles. Find the average number of people per square mile in the United States.**

**Source:** www.census.gov

**Step 1** *Explore* You know that there are 284,000,000 people. You want to know the number of people per square mile.

**Step 2** *Plan* Write an equation to represent the situation. Let $p$ represent the number of people per square mile.

$3{,}500{,}000 \times p = 284{,}000{,}000$

**Step 3** *Solve* $3{,}500{,}000 \times p = 284{,}000{,}000$.

$3{,}500{,}000p = 284{,}000{,}000$ Divide each side by 3,500,000.

$p \approx 81.14$

There about 81 people per square mile.

**Step 4** *Examine* If there are 81 people per square mile and there are 3,500,000 square miles, $81 \times 3{,}500{,}000 = 283{,}500{,}000$, or about 284,000,000 people. The answer makes sense.

Lesson 3-1

### Exercises

**Translate each sentence into an equation or formula.**

**1.** Three times a number $t$ minus twelve equals forty.

**2.** One-half of the difference of $a$ and $b$ is 54.

**3.** Three times the sum of $d$ and 4 is 32.

**4.** The area $A$ of a circle is the product of $\pi$ and the radius $r$ squared.

**WEIGHT LOSS For Exercises 5–6, use the following information.**

Lou wants to lose weight to audition for a part in a play. He weighs 160 pounds now. He wants to weigh 150 pounds.

**5.** If $p$ represents the number of pounds he wants to lose, write an equation to represent this situation.

**6.** How many pounds does he need to lose to reach his goal?

NAME _____ DATE _____ PERIOD _____

# 3-1 Study Guide and Intervention *(continued)*

## *Writing Equations*

**Write Verbal Sentences** You can translate equations into verbal sentences.

**Example** **Translate each equation into a verbal sentence.**

**a. $4n - 8 = 12$.**

$4n \quad - \quad 8 \quad = \quad 12$

Four times $n$ minus eight equals twelve.

**b. $a^2 + b^2 = c^2$**

$a^2 + b^2 \quad = \quad c^2$

The sum of the squares of $a$ and $b$ is equal to the square of $c$.

**Exercises**

**Translate each equation into a verbal sentence.**

**1.** $4a - 5 = 23$

**2.** $10 + k = 4k$

**3.** $6xy = 24$

**4.** $x^2 + y^2 = 8$

**5.** $p + 3 = 2p$

**6.** $b = \frac{1}{3}(h - 1)$

**7.** $100 - 2x = 80$

**8.** $3(g + h) = 12$

**9.** $p^2 - 2p = 9$

**10.** $C = \frac{5}{9}(F - 32)$

**11.** $V = \frac{1}{3}Bh$

**12.** $A = \frac{1}{2}hb$

NAME _____ DATE _____ PERIOD _____

# 3-1 Skills Practice

## *Writing Equations*

**Translate each sentence into an equation.**

**1.** Two added to three times a number $m$ is the same as 18.

**2.** Twice $a$ increased by the cube of $a$ equals $b$.

**3.** Seven less than the sum of $p$ and $q$ is as much as 6.

**4.** The sum of $x$ and its square is equal to $y$ times $z$.

**5.** Four times the sum of $f$ and $g$ is identical to six times $g$.

**Translate each sentence into a formula.**

**6.** The perimeter $P$ of a square equals four times the length of a side $s$.

**7.** The area $A$ of a square is the length of a side $s$ squared.

**8.** The perimeter $P$ of a triangle is equal to the sum of the lengths of sides $a$, $b$, and $c$.

**9.** The area $A$ of a circle is pi times the radius $r$ squared.

**10.** The volume $V$ of a rectangular prism equals the product of the length $\ell$, the width $w$, and the height $h$.

**Translate each equation into a verbal sentence.**

**11.** $g + 10 = 3g$

**12.** $2p + 4q = 20$

**13.** $4(a + b) = 9a$

**14.** $8 - 6x = 4 + 2x$

**15.** $\frac{1}{2}(f + y) = f - 5$

**16.** $s^2 - n^2 = 2b$

**Write a problem based on the given information.**

**17.** $c$ = cost per pound of plain coffee beans
$c + 3$ = cost per pound of flavored coffee beans
$2c + (c + 3) = 21$

**18.** $p$ = cost of dinner
$0.15p$ = cost of a 15% tip
$p + 0.15p = 23$

Lesson 3-1

NAME _____ DATE _____ PERIOD _____

# 3-1 Practice

## *Writing Equations*

**Translate each sentence into an equation.**

**1.** Fifty-three plus four times $c$ is as much as 21.

**2.** The sum of five times $h$ and twice $g$ is equal to 23.

**3.** One fourth the sum of $r$ and ten is identical to $r$ minus 4.

**4.** Three plus the sum of the squares of $w$ and $x$ is 32.

**Translate each sentence into a formula.**

**5.** Degrees Kelvin $K$ equals 273 plus degrees Celsius $C$.

**6.** The total cost $C$ of gas is the price $p$ per gallon times the number of gallons $g$.

**7.** The sum $S$ of the measures of the angles of a polygon is equal to 180 times the difference of the number of sides $n$ and 2.

**Translate each equation into a verbal sentence.**

**8.** $q - (4 + p) = \frac{1}{3}q$

**9.** $\frac{3}{5}t + 2 = t$

**10.** $9(y^2 + x) = 18$

**11.** $2(m - n) = v + 7$

**Write a problem based on the given information.**

**12.** $a$ = cost of one adult's ticket to zoo
$a - 4$ = cost of one children's ticket to zoo
$2a + 4(a - 4) = 38$

**13.** $c$ = regular cost of one airline ticket
$0.20c$ = amount of 20% promotional discount
$3(c - 0.20c) = 330$

**14. GEOGRAPHY** About 15% of all federally-owned land in the 48 contiguous states of the United States is in Nevada. If $F$ represents the area of federally-owned land in these states, and $N$ represents the portion in Nevada, write an equation for this situation.

**FITNESS For Exercises 15–17, use the following information.**

Deanna and Pietra each go for walks around a lake a few times per week. Last week, Deanna walked 7 miles more than Pietra.

**15.** If $p$ represents the number of miles Pietra walked, write an equation that represents the total number of miles $T$ the two girls walked.

**16.** If Pietra walked 9 miles during the week, how many miles did Deanna walk?

**17.** If Pietra walked 11 miles during the week, how many miles did the two girls walk together?

NAME _____ DATE _____ PERIOD _____

# 3-1 Reading to Learn Mathematics

## *Writing Equations*

**Pre-Activity** **How are equations used to describe heights?**

Read the introduction to Lesson 3-1 at the top of page 120 in your textbook.

Does the equation $305 - s = 154$ also represent the situation? Explain.



## Reading the Lesson

**1.** Translate each sentence into an equation.

**a.**

| Two | times | the sum of *x* and three | minus | four | equals | four | times | *x*. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

**b.**

| The difference of *k* and 3 | is | two | times | *k* | divided by | five. |
|---|---|---|---|---|---|---|
| | | | | | | |

**2.** A 1 oz serving of chips has 140 calories. There are about 14 servings of chips in a bag. How many calories are there in a bag of chips? Write what your solution would be as you use each step in the Four-Step Problem-Solving Plan.

*Explore* What do you know?

What do you want to know?

*Plan* Write an equation.

*Solve* Solve the problem.

*Examine* Does your answer make sense?

## Helping You Remember

**3.** If you cannot remember all the steps of the Four-Step Problem-Solving Plan, try to remember the first letters of the first word in each step. Write those letters here with their associated words.

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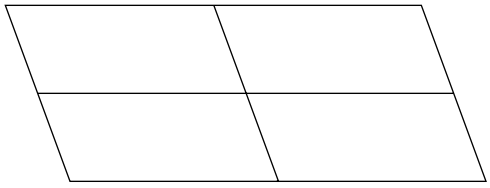
NAME _____ DATE _____ PERIOD _____

# 3-1 Enrichment

## *Rep-Tiles*

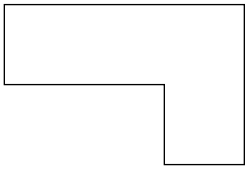
A rep-tile is a figure that can be subdivided into smaller copies of itself. The large figure is similar to the small ones and the small figures are all congruent.



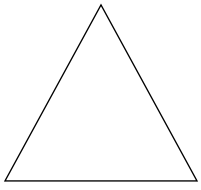
**Show that each figure is a rep-tile by subdividing it into four smaller and similar figures.**

**1.**

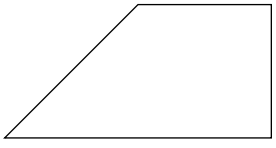
**2.**



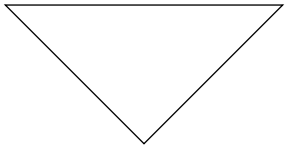
**3.**



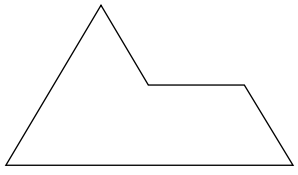
**4.**



**5.**

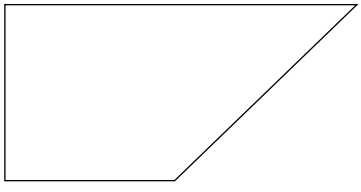


**6.**

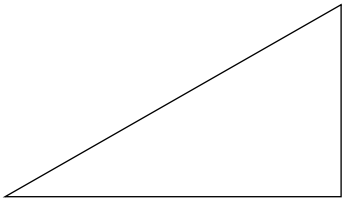


**Subdivide each rep-tile into nine smaller and similar figures.**

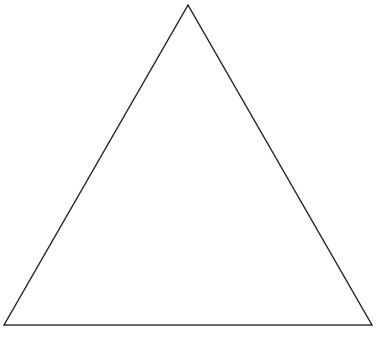
**7.**



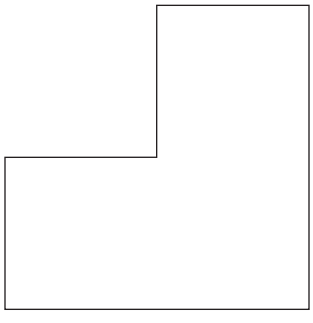
**8.**



**9.**



**10.**



NAME _____ DATE _____ PERIOD _____

3-2

# Study Guide and Intervention

## *Solving Equations by Using Addition and Subtraction*

**Solve Using Addition** If the same number is added to each side of an equation, the resulting equation is equivalent to the original one. In general if the original equation involves subtraction, this property will help you solve the equation.

| **Addition Property of Equality** | For any numbers $a$, $b$, and $c$, if $a = b$, then $a + c = b + c$. |
|---|---|

**Example 1** **Solve $m - 32 = 18$.**

| | |
|---|---|
| $m - 32 = 18$ | Original equation |
| $m - 32 + 32 = 18 + 32$ | Add 32 to each side. |
| $m = 50$ | Simplify. |

The solution is 50.

**Example 2** **Solve $-18 = p - 12$.**

| | |
|---|---|
| $-18 = p - 12$ | Original equation |
| $-18 + 12 = p - 12 + 12$ | Add 12 to each side. |
| $p = -6$ | Simplify. |

The solution is $-6$.

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $h - 3 = -2$

**2.** $m - 8 = -12$

**3.** $p - 5 = 15$

**4.** $20 = y - 8$

**5.** $k - 0.5 = 2.3$

**6.** $w - \frac{1}{2} = \frac{5}{8}$

**7.** $h - 18 = -17$

**8.** $-12 = -24 + k$

**9.** $j - 0.2 = 1.8$

**10.** $b - 40 = -40$

**11.** $m - (-12) = 10$

**12.** $w - \frac{3}{2} = \frac{1}{4}$

**Write an equation for each problem. Then solve the equation and check the solution.**

**13.** Twelve subtracted from a number equals 25. Find the number.

**14.** What number decreased by 52 equals $-12$?

**15.** Fifty subtracted from a number equals eighty. Find the number.

**16.** What number minus one-half is equal to negative one-half?

**17.** The difference of a number and eight is equal to 14. What is the number?

**18.** A number decreased by fourteen is equal to eighteen. What is the number?

Lesson 3-2

NAME _____ DATE _____ PERIOD _____

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

## *Solving Equations by Using Addition and Subtraction*

**Solve Using Subtraction** If the same number is subtracted from each side of an equation, the resulting equation is equivalent to the original one. In general if the original equation involves addition, this property will help you solve the equation.

| **Subtraction Property of Equality** | For any numbers $a$, $b$, and $c$, if $a = b$, then $a - c = b - c$. |
|---|---|

**Example** **Solve $22 + p = -12$.**

| | |
|---|---|
| $22 + p = -12$ | Original equation |
| $22 + p - 22 = -12 - 22$ | Subtract 22 from each side. |
| $p = -34$ | Simplify. |

The solution is $-34$.

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $x + 12 = 6$

**2.** $z + 2 = -13$

**3.** $-17 = b + 4$

**4.** $s + (-9) = 7$

**5.** $-3.2 = \ell + (-0.2)$

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

**7.** $19 + h = -4$

**8.** $-12 = k + 24$

**9.** $j + 1.2 = 2.8$

**10.** $b + 80 = -80$

**11.** $m + (-8) = 2$

**12.** $w + \frac{3}{2} = \frac{5}{8}$

**Write an equation for each problem. Then solve the equation and check the solution.**

**13.** Twelve added to a number equals 18. Find the number.

**14.** What number increased by 20 equals $-10$?

**15.** The sum of a number and fifty equals eighty. Find the number.

**16.** What number plus one-half is equal to four?

**17.** The sum of a number and 3 is equal to $-15$. What is the number?

NAME _____ DATE _____ PERIOD _____

# 3-2 Skills Practice

## *Solving Equations by Using Addition and Subtraction*

**Solve each equation. Then check your solution.**

**1.** $y - 7 = 8$

**2.** $w + 14 = -8$

**3.** $p - 4 = 6$

**4.** $-13 = 5 + x$

**5.** $98 = b + 34$

**6.** $y - 32 = -1$

**7.** $s + (-28) = 0$

**8.** $y + (-10) = 6$

**9.** $-1 = s + (-19)$

**10.** $j - (-17) = 36$

**11.** $14 = d + (-10)$

**12.** $u + (-5) = -15$

**13.** $11 = -16 + y$

**14.** $c - (-3) = 100$

**15.** $47 = w - (-8)$

**16.** $x - (-74) = -22$

**17.** $4 - (-h) = 68$

**18.** $-56 = 20 - (-e)$

**Write an equation for each problem. Then solve the equation and check your solution.**

**19.** A number decreased by 14 is $-46$. Find the number.

**20.** Thirteen subtracted from a number is $-5$. Find the number.

**21.** The sum of a number and 67 is equal to $-34$. Find the number.

**22.** What number minus 28 equals $-2$?

**23.** A number plus $-73$ is equal to 27. What is the number?

**24.** A number plus $-17$ equals $-1$. Find the number.

**25.** What number less 5 is equal to $-39$?

Lesson 3-2

NAME _____ DATE _____ PERIOD _____

# 3-2 Practice

## *Solving Equations by Using Addition and Subtraction*

**Solve each equation. Then check your solution.**

**1.** $d - 8 = 17$

**2.** $v + 12 = -5$

**3.** $b - 2 = -11$

**4.** $-16 = s + 71$

**5.** $29 = a - 76$

**6.** $-14 + y = -2$

**7.** $8 - (-c) = 1$

**8.** $78 + r = -15$

**9.** $f + (-3) = -9$

**10.** $4.2 = n + 7.3$

**11.** $w + 1.9 = -2.5$

**12.** $4.6 - (-b) = -0.4$

**13.** $y - (-1.5) = 0.5$

**14.** $a - 0.13 = -0.58$

**15.** $k + (-4.21) = -19$

**16.** $r + \frac{1}{5} = \frac{9}{10}$

**17.** $\frac{5}{9} + q = \frac{2}{3}$

**18.** $\frac{1}{3} = h + \frac{2}{5}$

**19.** $\frac{1}{4} + x = -\frac{7}{12}$

**20.** $y + \frac{4}{5} = \frac{3}{4}$

**21.** $-\frac{7}{8} - (-n) = -\frac{7}{12}$

**Write an equation for each problem. Then solve the equation and check your solution.**

**22.** What number minus 9 is equal to $-18$?

**23.** A number plus 15 equals $-12$. What is the number?

**24.** The sum of a number and $-3$ is equal to $-91$. Find the number.

**25.** Negative seventeen equals 63 plus a number. What is the number?

**26.** The sum of negative 14, a number, and 6 is $-5$. What is the number?

**27.** What number plus one half is equal to three eighths?

**HISTORY For Exercises 28 and 29, use the following information.**

Galileo Galilei was born in 1564. Many years later, in 1642, Sir Isaac Newton was born.

**28.** Write an addition equation to represent the situation.

**29.** How many years after Galileo was born was Isaac Newton born?

**HURRICANES For Exercises 30 and 31, use the following information.**

The day after a hurricane, the barometric pressure in a coastal town has risen to 29.7 inches of mercury, which is 2.9 inches of mercury higher than the pressure when the eye of the hurricane passed over.

**30.** Write an addition equation to represent the situation.

**31.** What was the barometric pressure when the eye passed over?

NAME _____ DATE _____ PERIOD _____

# 3-2 Reading to Learn Mathematics

## *Solving Equations by Using Addition and Subtraction*

### Pre-Activity

**How can equations be used to compare data?**

Read the introduction to Lesson 3-2 at the top of page 128 in your textbook.

In the equation $m - 66 = 5$, the number 5 represents

_____

_____

and the number 66 represents

_____

_____

### Reading the Lesson

**1.** To solve $x + 17 = 46$ using the Subtraction Property of Equality, you would subtract _____ from each side.

**2.** To solve $y - 9 = -30$ using the Addition Property of Equality, you would add _____ to each side.

**3.** Write an equation that you could solve by subtracting 32 from each side.

**4.** A student used the Subtraction Property of Equality to solve an equation. Explain why it would also be possible to use the Addition Property of Equality to solve the equation.

### Helping You Remember

**5.** Explain how you decide whether to use the Addition Property or the Subtraction Property of Equality to solve an equation.

Lesson 3-2

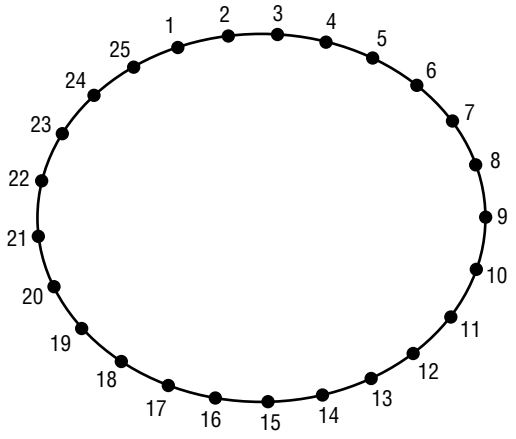
NAME _____ DATE _____ PERIOD _____

# 3-2 Enrichment

## *Counting-Off Puzzles*

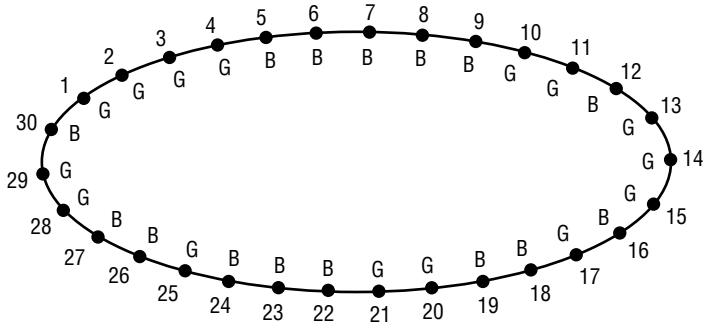
**Solve each puzzle.**

**1.** Twenty-five people are standing in a circle. Starting with person 1, they count off from 1 to 7 and then start over with 1. Each person who says "7" drops out of the circle. Who is the last person left?




**2.** Forty people stand in a circle. They count off so that every third person drops out. Which two people are the last ones left?

**3.** Only half of the 30 students in Sharon's class can go on a field trip. Sharon arranges the boys and girls as shown. They count off from 1 to 9 and every ninth person drops out until only 15 people are left. Who gets to go on the field trip.




**A group of people stand in a circle and count off 1, 2, 1, 2, 1 and so on. Every second person drops out. Person number 1 is the last person left.**

**4.** Draw a diagram to show why the number of people in the circle must be even. Then, explain your answer.

**5.** When the count returns to person number 1 for the first time, how many people have dropped out?

**6.** Find the number of people in the circle if the number is between 10 and 20. Do the same if the number is between 30 and 40. What can you conclude about the original number of people?

NAME _____ DATE _____ PERIOD _____

3-3

# Study Guide and Intervention

## *Solving Equations by Using Multiplication and Division*

**Solve Using Multiplication** If each side of an equation is multiplied by the same number, the resulting equation is equivalent to the given one. You can use the property to solve equations involving multiplication and division.

| **Multiplication Property of Equality** | For any numbers $a$, $b$, and $c$, if $a = b$, then $ac = bc$. |
|---|---|

**Example 1** **Solve $3\frac{1}{2}p = 1\frac{1}{2}$.**

| | |
|---|---|
| $3\frac{1}{2}p = 1\frac{1}{2}$ | Original equation |
| $\frac{7}{2}p = \frac{3}{2}$ | Rewrite each mixed number as an improper fraction. |
| $\frac{2}{7}\left(\frac{7}{2}p\right) = \frac{2}{7}\left(\frac{3}{2}\right)$ | Multiply each side by $\frac{2}{7}$. |
| $p = \frac{3}{7}$ | Simplify. |

The solution is $\frac{3}{7}$.

**Example 2** **Solve $-\frac{1}{4}n = 16$.**

| | |
|---|---|
| $-\frac{1}{4}n = 16$ | Original equation |
| $-4\left(-\frac{1}{4}n\right) = -4(16)$ | Multiply each side by $-4$. |
| $n = -64$ | Simplify. |

The solution is $-64$.

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $\frac{h}{3} = -2$

**2.** $\frac{1}{8}m = 6$

**3.** $\frac{1}{5}p = \frac{3}{5}$

**4.** $5 = \frac{y}{12}$

**5.** $-\frac{1}{4}k = -2.5$

**6.** $-\frac{m}{8} = \frac{5}{8}$

**7.** $-1\frac{1}{2}h = 4$

**8.** $-12 = -\frac{3}{2}k$

**9.** $\frac{j}{3} = \frac{2}{5}$

**10.** $-3\frac{1}{3}b = 5$

**11.** $\frac{7}{10}m = 10$

**12.** $\frac{p}{5} = -\frac{1}{4}$

**Write an equation for each problem. Then solve the equation.**

**13.** One-fifth of a number equals 25. Find the number.

**14.** What number divided by 2 equals $-18$?

**15.** A number divided by eight equals 3. Find the number.

**16.** One and a half times a number equals 6. Find the number.

Lesson 3-3

NAME _____ DATE _____ PERIOD _____

3-3

# Study Guide and Intervention *(continued)*

## *Solving Equations by Using Multiplication and Division*

**Solve Using Division** To solve equations with multiplication and division, you can also use the Division Property of Equality. If each side of an equation is divided by the same number, the resulting equation is true.

| **Division Property of Equality** | For any numbers $a$, $b$, and $c$, with $c \neq 0$, if $a = b$, then $\frac{a}{c} = \frac{b}{c}$. |
|---|---|

**Example 1** **Solve $8n = 64$.**

| | |
|---|---|
| $8n = 64$ | Original equation |
| $\frac{8n}{8} = \frac{64}{8}$ | Divide each side by 8. |
| $n = 8$ | Simplify. |

The solution is 8.

**Example 2** **Solve $-5n = 60$.**

| | |
|---|---|
| $-5n = 60$ | Original equation |
| $\frac{-5n}{-5} = \frac{60}{-5}$ | Divide each side by $-5$. |
| $n = -12$ | Simplify. |

The solution is $-12$.

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $3h = -42$

**2.** $8m = 16$

**3.** $-3t = 51$

**4.** $-3r = -24$

**5.** $8k = -64$

**6.** $-2m = 16$

**7.** $12h = 4$

**8.** $-2.4p = 7.2$

**9.** $0.5j = 5$

**10.** $-25 = 5m$

**11.** $6m = 15$

**12.** $-1.5p = -75$

**Write an equation for each problem. Then solve the equation.**

**13.** Four times a number equals 64. Find the number.

**14.** What number multiplied by $-4$ equals $-16$?

**15.** A number times eight equals $-36$. Find the number.

NAME _____ DATE _____ PERIOD _____

# 3-3 Skills Practice

## *Solving Equations by Using Multiplication and Division*

**Solve each equation. Then check your solution.**

**1.** $12z = 108$

**2.** $-7t = 49$

**3.** $18e = -216$

**4.** $-22 = 11v$

**5.** $-6d = -42$

**6.** $96 = -24a$

**7.** $\frac{c}{4} = 16$

**8.** $\frac{a}{16} = 9$

**9.** $-84 = \frac{d}{3}$

**10.** $-\frac{d}{7} = -13$

**11.** $\frac{t}{4} = -13$

**12.** $31 = -\frac{1}{6}n$

**13.** $-6 = \frac{2}{3}z$

**14.** $\frac{2}{7}q = -4$

**15.** $\frac{5}{9}p = -10$

**16.** $\frac{a}{10} = \frac{2}{5}$

**17.** $-0.4b = 5.2$

**18.** $1.6m = -4$

**Write an equation for each problem. Then solve the equation.**

**19.** The opposite of a number is $-9$. What is the number?

**20.** Fourteen times a number is $-42$. Find the number.

**21.** Eight times a number equals 128. What is the number?

**22.** Negative twelve times a number equals $-132$. Find the number.

**23.** Negative eighteen times a number is $-54$. What is the number?

**24.** One sixth of a number is $-17$. Find the number.

**25.** Negative three fifths of a number is $-15$. What is the number?

Lesson 3-3

NAME _____ DATE _____ PERIOD _____

# 3-3 Practice

## *Solving Equations by Using Multiplication and Division*

**Solve each equation. Then check your solution.**

**1.** $8j = 96$

**2.** $-13z = -39$

**3.** $-180 = 15m$

**4.** $243 = 27c$

**5.** $\frac{y}{9} = -8$

**6.** $-\frac{j}{12} = -8$

**7.** $\frac{a}{15} = \frac{4}{5}$

**8.** $\frac{g}{27} = \frac{2}{9}$

**9.** $\frac{q}{24} = \frac{1}{6}$

**10.** $-1 = -\frac{4}{7}t$

**11.** $-\frac{3}{8}w = -9$

**12.** $-\frac{3}{15}s = 4$

**13.** $-3x = \frac{3}{2}$

**14.** $\frac{8}{5}a = \frac{4}{3}$

**15.** $\frac{5}{3}h = \frac{11}{6}$

**16.** $5n = \frac{11}{4}$

**17.** $2.5k = 20$

**18.** $-3.4e = -3.74$

**19.** $-1.7b = 2.21$

**20.** $0.26p = 0.104$

**21.** $4.2q = -3.36$

**Write an equation for each problem. Then solve the equation.**

**22.** Negative nine times a number equals $-117$. Find the number.

**23.** Negative one eighth of a number is $-\frac{3}{4}$. What is the number?

**24.** Five sixths of a number is $-\frac{5}{9}$. Find the number.

**25.** 2.7 times a number equals 8.37. What is the number?

**26.** One and one fourth times a number is one and one third. What is the number?

**27. PUBLISHING** Two units of measure used in publishing are the *pica* and the *point*. A pica is one sixth of an inch. There are 12 points in a pica, so Points = 12 · Picas. How many picas are equivalent to 108 points?

**ROLLER COASTERS For Exercises 28 and 29, use the following information.**

*Superman the Escape* in California is the fastest roller coaster in the world. Riders fall 415 feet in 7 seconds. Speeds reach a maximum of 100 miles per hour.

**28.** If $x$ represents the average rate of fall of the roller coaster, write an expression to represent the situation (*Hint:* Use the distance formula $d = rt$.)

**29.** What is the average rate that riders fall in feet per second?

NAME _____ DATE _____ PERIOD _____

3-3

# Reading to Learn Mathematics

## *Solving Equations by Using Multiplication and Division*

### Pre-Activity

**How can equations be used to find how long it takes light to reach Earth?**

Read the introduction to Lesson 3-3 at the top of page 135 in your textbook.

- In the equation $d = rt$, shown in the introduction, what number is used for $r$? for $d$?

- What equation could you use to find the time it takes light to reach Earth from the farthest star in the Big Dipper?

### Reading the Lesson

**Complete the sentence after each equation to tell how you would solve the equation.**

**1.** $\frac{x}{7} = 16$ _____ each side by _____.

**2.** $5x = 125$ _____ each side by _____, or multiply each side by _____.

**3.** $-8k = 96$ Divide each side by _____, or multiply each side by _____

**4.** Explain how rewriting $4\frac{1}{3}x = 2\frac{1}{8}$ as $\frac{13}{3}x = \frac{17}{8}$ helps you solve the equation.

Lesson 3-3

### Helping You Remember

**5.** One way to remember something is to explain it to someone else. Write how you would explain to a classmate how to solve the equation $\frac{2}{3}x = 12$.

NAME _____ DATE _____ PERIOD _____

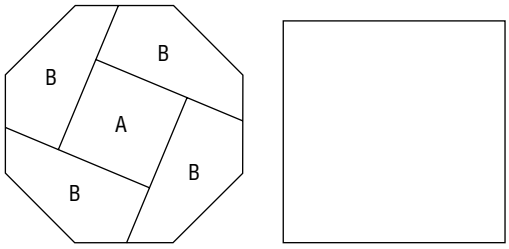
# 3-3 Enrichment

## *Dissection Puzzles: Make the Square*

In a dissection puzzle, you are to cut apart one figure using only straight cuts and then rearrange the pieces to make a new figure. Usually the puzzle-solver must figure out where to make the given number of cuts. However, for these puzzles, the cut lines are shown. You must discover how to rearrange the pieces.

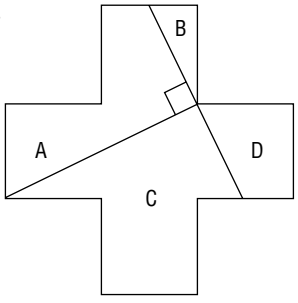
**Cut apart each figure. Then rearrange the pieces to form a square.**

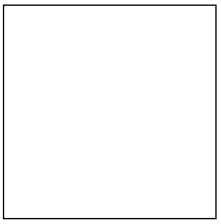
**1.**



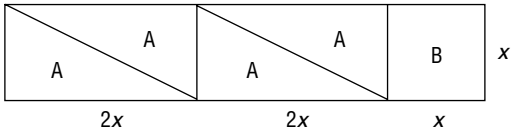


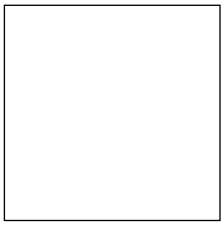

**2.**



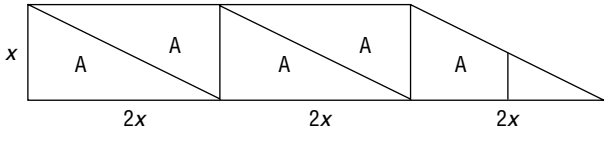



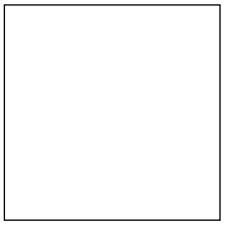
**3.**



**4.** *Hint:* Cut one of the triangles into two pieces to make this square.



NAME _____ DATE _____ PERIOD _____

# 3-4 Study Guide and Intervention

## *Solving Multi-Step Equations*

**Work Backward** **Working backward** is one of many problem-solving strategies that you can use to solve problems. To work backward, start with the result given at the end of a problem and undo each step to arrive at the beginning number.

**Example 1** **A number is divided by 2, and then 8 is subtracted from the quotient. The result is 16. What is the number?**

Solve the problem by working backward.

The final number is 16. Undo subtracting 8 by adding 8 to get 24. To undo dividing 24 by 2, multiply 24 by 2 to get 48.

The original number is 48.

**Example 2** **A bacteria culture doubles each half hour. After 3 hours, there are 6400 bacteria. How many bacteria were there to begin with?**

Solve the problem by working backward.

The bacteria have grown for 3 hours. Since there are 2 one-half hour periods in one hour, in 3 hours there are 6 one-half hour periods. Since the bacteria culture has grown for 6 time periods, it has doubled 6 times. Undo the doubling by halving the number of bacteria 6 times.

$$6{,}400 \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = 6{,}400 \times \frac{1}{64}$$

$$= 100$$

There were 100 bacteria to begin with.

**Exercises**

**Solve each problem by working backward.**

1. A number is divided by 3, and then 4 is added to the quotient. The result is 8. Find the number.

2. A number is multiplied by 5, and then 3 is subtracted from the product. The result is 12. Find the number.

3. Eight is subtracted from a number, and then the difference is multiplied by 2. The result is 24. Find the number.

4. Three times a number plus 3 is 24. Find the number.

5. **CAR RENTAL** Angela rented a car for $29.99 a day plus a one-time insurance cost of $5.00. Her bill was $124.96. For how many days did she rent the car?

6. **MONEY** Mike withdrew an amount of money from his bank account. He spent one fourth for gasoline and had $90 left. How much money did he withdraw?

7. **TELEVISIONS** In 1999, 68% of households with TV's subscribed to cable TV. If 8,000 more subscribers are added to the number of households with cable, the total number of households with cable TV would be 67,600,000. How many households were there with TV in 1999? **Source:** *World Almanac*

Lesson 3-4

NAME _____ DATE _____ PERIOD _____

# 3-4 Study Guide and Intervention *(continued)*

## *Solving Multi-Step Equations*

**Solve Multi-Step Equations** To solve equations with more than one operation, often called **multi-step equations**, undo operations by working backward. Reverse the usual order of operations as you work.

**Example** **Solve $5x + 3 = 23$.**

| | |
|---|---|
| $5x + 3 = 23$ | Original equation. |
| $5x + 3 - 3 = 23 - 3$ | Subtract 3 from each side. |
| $5x = 20$ | Simplify. |
| $\frac{5x}{5} = \frac{20}{5}$ | Divide each side by 5. |
| $x = 4$ | Simplify. |

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $5x + 2 = 27$

**2.** $6x + 9 = 27$

**3.** $5x + 16 = 51$

**4.** $14n - 8 = 34$

**5.** $0.6x - 1.5 = 1.8$

**6.** $\frac{7}{8}p - 4 = 10$

**7.** $16 = \frac{d - 12}{14}$

**8.** $8 + \frac{3n}{12} = 13$

**9.** $\frac{g}{-5} + 3 = -13$

**10.** $\frac{4b + 8}{-2} = 10$

**11.** $0.2x - 8 = -2$

**12.** $3.2y - 1.8 = 3$

**13.** $-4 = \frac{7x - (-1)}{-8}$

**14.** $8 = -12 + \frac{k}{-4}$

**15.** $0 = 10y - 40$

**Write an equation and solve each problem.**

**16.** Find three consecutive integers whose sum is 96.

**17.** Find two consecutive odd integers whose sum is 176.

**18.** Find three consecutive integers whose sum is $-93$.

NAME _____ DATE _____ PERIOD _____

# 3-4 Skills Practice

## *Solving Multi-Step Equations*

**Solve each problem by working backward.**

**1.** A number is divided by 2, and then the quotient is added to 8. The result is 33. Find the number.

**2.** Two is subtracted from a number, and then the difference is divided by 3. The result is 30. Find the number.

**3.** A number is multiplied by 2, and then the product is added to 9. The result is 49. What is the number?

**4. ALLOWANCE** After Ricardo received his allowance for the week, he went to the mall with some friends. He spent half of his allowance on a new paperback book. Then he bought himself a snack for $1.25. When he arrived home, he had $5.00 left. How much was his allowance?

**Solve each equation. Then check your solution.**

**5.** $5x + 3 = 23$

**6.** $4 = 3a - 14$

**7.** $2y + 5 = 19$

**8.** $6 + 5c = -29$

**9.** $8 - 5w = -37$

**10.** $18 - 4v = 42$

**11.** $\frac{n}{3} - 8 = -2$

**12.** $5 + \frac{x}{4} = 1$

**13.** $-\frac{h}{3} - 4 = 13$

**14.** $-\frac{d}{6} + 12 = -7$

**15.** $\frac{a}{5} - 2 = 9$

**16.** $\frac{w}{7} + 3 = -1$

**17.** $\frac{3}{4}q - 7 = 8$

**18.** $\frac{2}{3}g + 6 = -12$

**19.** $\frac{5}{2}z - 8 = -3$

**20.** $\frac{4}{5}m + 2 = 6$

**21.** $\frac{c - 5}{4} = 3$

**22.** $\frac{b + 1}{3} = 2$

**Write an equation and solve each problem.**

**23.** Twice a number plus four equals 6. What is the number?

**24.** Sixteen is seven plus three times a number. Find the number.

**25.** Find two consecutive integers whose sum is 35.

**26.** Find three consecutive integers whose sum is 36.

Lesson 3-4

NAME _____ DATE _____ PERIOD _____

# 3-4 Practice

## *Solving Multi-Step Equations*

**Solve each problem by working backward.**

**1.** Three is added to a number, and then the sum is multiplied by 4. The result is 16. Find the number.

**2.** A number is divided by 4, and the quotient is added to 3. The result is 24. What is the number?

**3.** Two is subtracted from a number, and then the difference is multiplied by 5. The result is 30. Find the number.

**4. BIRD WATCHING** While Michelle sat observing birds at a bird feeder, one fourth of the birds flew away when they were startled by a noise. Two birds left the feeder to go to another stationed a few feet away. Three more birds flew into the branches of a nearby tree. Four birds remained at the feeder. How many birds were at the feeder initially?

**Solve each equation. Then check your solution.**

**5.** $-12n - 19 = 77$

**6.** $17 + 3f = 14$

**7.** $15t + 4 = 49$

**8.** $\frac{u}{5} + 6 = 2$

**9.** $\frac{d}{-4} + 3 = 15$

**10.** $\frac{b}{3} - 6 = -2$

**11.** $\frac{1}{2}y - \frac{1}{8} = \frac{7}{8}$

**12.** $-32 - \frac{3}{5}f = -17$

**13.** $8 - \frac{3}{8}k = -4$

**14.** $\frac{r + 13}{12} = 1$

**15.** $\frac{15 - a}{3} = -9$

**16.** $\frac{3k - 7}{5} = 16$

**17.** $\frac{x}{7} - 0.5 = 2.5$

**18.** $2.5g + 0.45 = 0.95$

**19.** $0.4m - 0.7 = 0.22$

**Write an equation and solve each problem.**

**20.** Seven less than four times a number equals 13. What is the number?

**21.** Find two consecutive odd integers whose sum is 116.

**22.** Find two consecutive even integers whose sum is 126.

**23.** Find three consecutive odd integers whose sum is 117.

**24. COIN COLLECTING** Jung has a total of 92 coins in his coin collection. This is 8 more than three times the number of quarters in the collection. How many quarters does Jung have in his collection?

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# 3-4 Reading to Learn Mathematics

## *Solving Multi-Step Equations*

**Pre-Activity** **How can equations be used to estimate the age of an animal?**

Read the introduction to Lesson 3-4 at the top of page 142 in your textbook.

- Write the equation $8 + 12a = 124$ in words.

- How many operations are involved in the equation?

## Reading the Lesson

**1.** What does the phrase *undo the operations* mean to you? Give an example.

**2. a.** If we undo operations in reverse of the order of operations, what operations do we do first?

**b.** What operations do we do last?

**3.** Suppose you want to solve $\frac{x + 3}{5} = 6$.

**a.** What is the grouping symbol in the equation $\frac{x + 3}{5} = 6$?

**b.** What is the first step in solving the equation?

**c.** What is the next step in solving the equation?

**4.** Write an equation for the problem below.

| Seven | times | *k* | minus | five | equals | negative forty-seven |
|---|---|---|---|---|---|---|
| | | | | | | |

## Helping You Remember

**5.** Explain why working backward is a useful strategy for solving equations.

Lesson 3-4

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# 3-4 Enrichment

## Consecutive Integer Problems

Many types of problems and puzzles involve the idea of consecutive integers. Knowing how to represent these integers algebraically can help to solve the problem.

**Example** **Find four consecutive odd integers whose sum is −80.**

An odd integer can be written as $2n + 1$, where $n$ is any integer.

If 2n + 1 is the first odd integer, then add 2 to get the next largest odd integer, and so on.

Now write an equation to solve this problem.

$(2n + 1) + (2n + 3) + (2n + 5) + (2n + 7) = -80$

**Exercises**

**Write an equation for each problem. Then solve.**

**1.** Complete the solution to the problem in the example.

**2.** Find three consecutive even integers whose sum is 132.

**3.** Find two consecutive integers whose sum is 19.

**4.** Find two consecutive integers whose sum is 100.

**5.** The lesser of two consecutive even integers is 10 more than one-half the greater. Find the integers.

**6.** The greater of two consecutive even integers is 6 less than three times the lesser. Find the integers.

**7.** Find four consecutive integers such that twice the sum of the two greater integers exceeds three times the first by 91.

**8.** Find a set of four consecutive positive integers such that the greatest integer in the set is twice the least integer in the set.

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# 3-5 Study Guide and Intervention

## *Solving Equations with the Variable on Each Side*

**Variables on Each Side** To solve an equation with the same variable on each side, first use the Addition or the Subtraction Property of Equality to write an equivalent equation that has the variable on just one side of the equation. Then solve the equation.

**Example 1** **Solve $5y - 8 = 3y + 12$.**

$$\begin{aligned} 5y - 8 &= 3y + 12 \\ 5y - 8 - 3y &= 3y + 12 - 3y \\ 2y - 8 &= 12 \\ 2y - 8 + 8 &= 12 + 8 \\ 2y &= 20 \\ \frac{2y}{2} &= \frac{20}{2} \\ y &= 10 \end{aligned}$$

The solution is 10.

**Example 2** **Solve $-11 - 3y = 8y + 1$.**

$$\begin{aligned} -11 - 3y &= 8y + 1 \\ -11 - 3y + 3y &= 8y + 1 + 3y \\ -11 &= 11y + 1 \\ -11 - 1 &= 11y + 1 - 1 \\ -12 &= 11y \\ \frac{-12}{11} &= \frac{11y}{11} \\ -1\frac{1}{11} &= y \end{aligned}$$

The solution is $-1\frac{1}{11}$.

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $6 - b = 5b + 30$

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

**3.** $5x + 2 = 2x - 10$

**4.** $4n - 8 = 3n + 2$

**5.** $1.2x + 4.3 = 2.1 - x$

**6.** $4.4s + 6.2 = 8.8s - 1.8$

**7.** $\frac{1}{2}b + 4 = \frac{1}{8}b + 88$

**8.** $\frac{3}{4}k - 5 = \frac{1}{4}k - 1$

**9.** $8 - 5p = 4p - 1$

**10.** $4b - 8 = 10 - 2b$

**11.** $0.2x - 8 = -2 - x$

**12.** $3y - 1.8 = 3y - 1.8$

**13.** $-4 - 3x = 7x - 6$

**14.** $8 + 4k = -10 + k$

**15.** $20 - a = 10a - 2$

**16.** $\frac{2}{3}n + 8 = \frac{1}{2}n + 2$

**17.** $\frac{2}{5}y - 8 = 9 - \frac{3}{5}y$

**18.** $-4r + 5 = 5 - 4r$

**19.** $-4 - 3x = 6x - 6$

**20.** $18 - 4k = -10 - 4k$

**21.** $12 + 2y = 10y - 12$

Lesson 3-5

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# 3-5 Study Guide and Intervention *(continued)*

## *Solving Equations with the Variable on Each Side*

**Grouping Symbols** When solving equations that contain grouping symbols, first use the Distributive Property to eliminate grouping symbols. Then solve.

**Example** **Solve $4(2a - 1) = -10(a - 5)$.**

| | |
|---|---|
| $4(2a - 1) = -10(a - 5)$ | Original equation |
| $8a - 4 = -10a + 50$ | Distributive Property |
| $8a - 4 + 10a = -10a + 50 + 10a$ | Add $10a$ to each side. |
| $18a - 4 = 50$ | Simplify. |
| $18a - 4 + 4 = 50 + 4$ | Add 4 to each side. |
| $18a = 54$ | Simplify. |
| $\frac{18a}{18} = \frac{54}{18}$ | Divide each side by 18. |
| $a = 3$ | Simplify. |

The solution is 3.

**Exercises**

**Solve each equation. Then check your solution.**

**1.** $-3(x + 5) = 3(x - 1)$

**2.** $2(7 + 3t) = -t$

**3.** $3(a + 1) - 5 = 3a - 2$

**4.** $75 - 9g = 5(-4 + 2g)$

**5.** $5(f + 2) = 2(3 - f)$

**6.** $4(p + 3) = 36$

**7.** $18 = 3(2c + 2)$

**8.** $3(d - 8) = 3d$

**9.** $5(p + 3) + 9 = 3(p - 2) + 6$

**10.** $4(b - 2) = 2(5 - b)$

**11.** $1.2(x - 2) = 2 - x$

**12.** $\frac{3 + y}{4} = \frac{-y}{8}$

**13.** $\frac{a - 8}{12} = \frac{2a + 5}{3}$

**14.** $2(4 + 2k) + 10 = k$

**15.** $2(w - 1) + 4 = 4(w + 1)$

**16.** $6(n - 1) = 2(2n + 4)$

**17.** $2[2 + 3(y - 1)] = 22$

**18.** $-4(r + 2) = 4(2 - 4r)$

**19.** $-3(x - 8) = 24$

**20.** $4(4 - 4k) = -10 - 16k$

**21.** $6(2 - 2y) = 5(2y - 2)$

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# 3-5 Skills Practice

## *Solving Equations with the Variable on Each Side*

**Justify each step.**

**1.** $4k - 3 = 2k + 5$

| | |
|---|---|
| $4k - 3 - 2k = 2k + 5 - 2k$ | **a.** _____ |
| $2k - 3 = 5$ | **b.** _____ |
| $2k - 3 + 3 = 5 + 3$ | **c.** _____ |
| $2k = 8$ | **d.** _____ |
| $\frac{2k}{2} = \frac{8}{2}$ | **e.** _____ |
| $k = 4$ | **f.** _____ |

**2.** $2(8u + 2) = 3(2u - 7)$

| | |
|---|---|
| $16u + 4 = 6u - 21$ | **a.** _____ |
| $16u + 4 - 6u = 6u - 21 - 6u$ | **b.** _____ |
| $10u + 4 = -21$ | **c.** _____ |
| $10u + 4 - 4 = -21 - 4$ | **d.** _____ |
| $10u = -25$ | **e.** _____ |
| $\frac{10u}{10} = \frac{-25}{10}$ | **f.** _____ |
| $u = -2.5$ | **g.** _____ |

**Solve each equation. Then check your solution.**

**3.** $2m + 12 = 3m - 31$

**4.** $2h - 8 = h + 17$

**5.** $7a - 3 = 3 - 2a$

**6.** $4n - 12 = 12 - 4n$

**7.** $4x - 9 = 7x + 12$

**8.** $-6y - 3 = 3 - 6y$

**9.** $5 + 3r = 5r - 19$

**10.** $-9 + 8k = 7 + 4k$

**11.** $8q + 12 = 4(3 + 2q)$

**12.** $3(5j + 2) = 2(3j - 6)$

**13.** $6(-3v + 1) = 5(-2v - 2)$

**14.** $-7(2b - 4) = 5(-2b + 6)$

**15.** $3(8 - 3t) = 5(2 + t)$

**16.** $2(3u + 7) = -4(3 - 2u)$

**17.** $8(2f - 2) = 7(3f + 2)$

**18.** $5(-6 - 3d) = 3(8 + 7d)$

**19.** $6(w - 1) = 3(3w + 5)$

**20.** $7(-3y + 2) = 8(3y - 2)$

**21.** $\frac{2}{3}v - 6 = 6 - \frac{2}{3}v$

**22.** $\frac{1}{2} - \frac{5}{8}x = \frac{7}{8}x + \frac{7}{2}$

Lesson 3-5

NAME _____ DATE _____ PERIOD _____

# 3-5 Practice

## *Solving Equations with the Variable on Each Side*

**Solve each equation. Then check your solution.**

**1.** $5x - 3 = 13 - 3x$

**2.** $-4c - 11 = 4c + 21$

**3.** $1 - s = 6 - 6s$

**4.** $14 + 5n = -4n + 17$

**5.** $\frac{1}{2}k - 3 = 2 - \frac{3}{4}k$

**6.** $\frac{1}{2}(6 - z) = z$

**7.** $3(-2 - 3x) = -9x - 4$

**8.** $4(4 - w) = 3(2w + 2)$

**9.** $9(4b - 1) = 2(9b + 3)$

**10.** $3(6 + 5y) = 2(-5 + 4y)$

**11.** $-5x - 10 = 2 - (x + 4)$

**12.** $6 + 2(3j - 2) = 4(1 + j)$

**13.** $\frac{5}{2}t - t = 3 + \frac{3}{2}t$

**14.** $1.4f + 1.1 = 8.3 - f$

**15.** $\frac{2}{3}x - \frac{1}{6} = \frac{1}{2}x + \frac{5}{6}$

**16.** $2 - \frac{3}{4}z = \frac{1}{8}z + 9$

**17.** $\frac{1}{2}(3g - 2) = \frac{g}{6}$

**18.** $\frac{1}{3}(c + 1) = \frac{1}{6}(3c - 5)$

**19.** $\frac{1}{4}(5 - 2h) = \frac{h}{2}$

**20.** $\frac{1}{9}(2m - 16) = \frac{1}{3}(2m + 4)$

**21.** $3(d - 8) - 5 = 9(d + 2) + 1$

**22.** $2(a - 8) + 7 = 5(a + 2) - 3a - 19$

**23.** Two thirds of a number reduced by 11 is equal to 4 more than the number. Find the number.

**24.** Five times the sum of a number and 3 is the same as 3 multiplied by 1 less than twice the number. What is the number?

**25. NUMBER THEORY** Tripling the greater of two consecutive even integers gives the same result as subtracting 10 from the lesser even integer. What are the integers?

**26. GEOMETRY** The formula for the perimeter of a rectangle is $P = 2\ell + 2w$, where $\ell$ is the length and $w$ is the width. A rectangle has a perimeter of 24 inches. Find its dimensions if its length is 3 inches greater than its width.

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# 3-5 Reading to Learn Mathematics

## *Solving Equations with the Variable on Each Side*

**Pre-Activity** **How can an equation be used to determine when two populations are equal?**

Read the introduction to Lesson 3-5 at the top of page 149 in your textbook.

In the equation $12 + 7.6x = 6 + 8x$, what do $7.6x$ and $8x$ represent?

## Reading the Lesson

**1.** Suppose you want to help a friend solve $6k + 7 = 3k - 8$. What would you advise her to do first? Why?

**2.** When solving $2(3x - 4) = 3(x + 5)$, why is it helpful first to use the Distributive Property to remove the grouping symbols?

**3.** On a quiz, Jason solved three equations. His teacher said all the work was correct, but she asked him to write short sentences to tell what the solutions were. In what follows, you see the *last* equation in his work for each equation. Write sentences to describe the solutions.

**a.** $x = -4$

**b.** $6m = 6m$

**c.** $12 = 37$

**4.** In Question 3, one of the equations Jason solved was an identity. Which equation was it? Explain how you know.

## Helping You Remember

**5.** An equation with variables is an identity when the equation is always true. In other words, the expressions on the left and right sides always have the same value. Look up the word *identity* in the dictionary. Write all the definitions that are similar to the mathematical definition.

Lesson 3-5

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# 3-5 Enrichment

## Identities

An equation that is true for every value of the variable is called an **identity**. When you try to solve an identity, you end up with a statement that is always true. Here is an example.

**Example** **Solve $8 - (5 - 6x) = 3(1 + 2x)$.**

$$\begin{aligned} 8 - (5 - 6x) &= 3(1 + 2x) \\ 8 - 5 - (-6x) &= 3(1 + 2x) \\ 8 - 5 + 6x &= 3 + 6x \\ 3 + 6x &= 3 + 6x \end{aligned}$$

**Exercises**

**State whether each equation is an identity. If it is not, find its solution.**

**1.** $2(2 - 3x) = 3(3 + x) + 4$

**2.** $5(m + 1) + 6 = 3(4 + m) + (2m - 1)$

**3.** $(5t + 9) - (3t - 13) = 2(11 + t)$

**4.** $14 - (6 - 3c) = 4c - c$

**5.** $3y - 2(y + 19) = 9y - 3(9 - y)$

**6.** $3(3h - 1) = 4(h + 3)$

**7.** Use the true equation $3x - 2 = 3x - 2$ to create an identity of your own.

**8.** Use the false equation $1 = 2$ to create an equation with no solution.

**9.** Create an equation whose solution is $x = 3$.

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# 3-6 Study Guide and Intervention

## *Ratios and Proportions*



**Ratios and Proportions** A **ratio** is a comparison of two numbers by division. The ratio of $x$ to $y$ can be expressed as $x$ to $y$, $x:y$ or $\frac{x}{y}$. Ratios are usually expressed in simplest form.

An equation stating that two ratios are equal is called a **proportion**. To determine whether two ratios form a proportion, express both ratios in simplest form or check cross products.

**Example 1** **Determine whether the ratios $\frac{24}{36}$ and $\frac{12}{18}$ form a proportion.**

$\frac{24}{36} = \frac{2}{3}$ when expressed in simplest form.

$\frac{12}{18} = \frac{2}{3}$ when expressed in simplest form.

The ratios $\frac{24}{36}$ and $\frac{12}{18}$ form a proportion because they are equal when expressed in simplest form.

**Example 2** **Use cross products to determine whether $\frac{10}{18}$ and $\frac{25}{45}$ form a proportion.**

$\frac{10}{18} \stackrel{?}{=} \frac{25}{45}$ Write the proportion.

$10(45) \stackrel{?}{=} 18(25)$ Cross products

$450 = 450$ Simplify.

The cross products are equal, so $\frac{10}{18} = \frac{25}{45}$. Since the ratios are equal, they form a proportion.

**Exercises**

**Use cross products to determine whether each pair of ratios forms a proportion.**

**1.** $\frac{1}{2}, \frac{16}{32}$

**2.** $\frac{5}{8}, \frac{10}{15}$

**3.** $\frac{10}{20}, \frac{25}{49}$

**4.** $\frac{25}{36}, \frac{15}{20}$

**5.** $\frac{12}{32}, \frac{3}{16}$

**6.** $\frac{4}{9}, \frac{12}{27}$

**7.** $\frac{0.1}{2}, \frac{5}{100}$

**8.** $\frac{15}{20}, \frac{9}{12}$

**9.** $\frac{14}{21}, \frac{20}{30}$

**10.** 2:3, 20:30

**11.** 5 to 9, 25 to 45

**12.** $\frac{72}{64}, \frac{9}{8}$

**13.** 5:5, 30:20

**14.** 18 to 24, 50 to 75

**15.** 100:75, 44:33

**16.** $\frac{0.05}{1}, \frac{1}{20}$

**17.** $\frac{1.5}{2}, \frac{6}{8}$

**18.** $\frac{0.1}{0.2}, \frac{0.45}{0.9}$

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# 3-6 Study Guide and Intervention *(continued)*

## *Ratios and Proportions*

**Solve Proportions** If a proportion involves a variable, you can use cross products to solve the proportion. In the proportion $\frac{x}{5} = \frac{10}{13}$, $x$ and 13 are called **extremes** and 5 and 10 are called **means**. In a proportion, the product of the extremes is equal to the product of the means.

| Means-Extremes Property of Proportions | For any numbers $a$, $b$, $c$, and $d$, if $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$. |
|---|---|

**Example** **Solve $\frac{x}{5} = \frac{10}{13}$.**

| | |
|---|---|
| $\frac{x}{5} = \frac{10}{13}$ | Original proportion |
| $13(x) = 5(10)$ | Cross products |
| $13x = 50$ | Simplify. |
| $\frac{13x}{13} = \frac{50}{13}$ | Divide each side by 13. |
| $x = 3\frac{11}{13}$ | Simplify. |

The solution is $3\frac{11}{13}$.

**Exercises**

**Solve each proportion.**

**1.** $\frac{-3}{x} = \frac{2}{8}$

**2.** $\frac{1}{t} = \frac{5}{3}$

**3.** $\frac{0.1}{2} = \frac{0.5}{x}$

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

**5.** $\frac{4}{6} = \frac{8}{x}$

**6.** $\frac{x}{21} = \frac{3}{63}$

**7.** $\frac{9}{y+1} = \frac{18}{54}$

**8.** $\frac{3}{d} = \frac{18}{3}$

**9.** $\frac{5}{8} = \frac{p}{24}$

**10.** $\frac{4}{b-2} = \frac{4}{12}$

**11.** $\frac{1.5}{x} = \frac{12}{x}$

**12.** $\frac{3+y}{4} = \frac{-y}{8}$

**13.** $\frac{a-8}{12} = \frac{15}{3}$

**14.** $\frac{12}{k} = \frac{24}{k}$

**15.** $\frac{2+w}{6} = \frac{12}{9}$

**Use a proportion to solve each problem.**

**16. MODELS** To make a model of the Guadeloupe River bed, Hermie used 1 inch of clay for 5 miles of the river's actual length. His model river was 50 inches long. How long is the Guadeloupe River?

**17. EDUCATION** Josh finished 24 math problems in one hour. At that rate, how many hours will it take him to complete 72 problems?

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3-6

# Skills Practice

## *Ratios and Proportions*



**Use cross products to determine whether each pair of ratios forms a proportion. Write *yes* or *no*.**

**1.** $\frac{4}{5}, \frac{20}{25}$

**2.** $\frac{5}{9}, \frac{7}{11}$

**3.** $\frac{6}{7}, \frac{24}{28}$

**4.** $\frac{8}{9}, \frac{72}{81}$

**5.** $\frac{7}{16}, \frac{42}{90}$

**6.** $\frac{13}{19}, \frac{26}{38}$

**7.** $\frac{3}{14}, \frac{21}{98}$

**8.** $\frac{12}{17}, \frac{50}{85}$

**Solve each proportion. If necessary, round to the nearest hundredth.**

**9.** $\frac{1}{a} = \frac{2}{14}$

**10.** $\frac{5}{b} = \frac{3}{9}$

**11.** $\frac{9}{g} = \frac{15}{10}$

**12.** $\frac{3}{a} = \frac{1}{6}$

**13.** $\frac{6}{z} = \frac{3}{5}$

**14.** $\frac{5}{e} = \frac{35}{21}$

**15.** $\frac{12}{7} = \frac{36}{s}$

**16.** $\frac{6}{23} = \frac{y}{69}$

**17.** $\frac{42}{56} = \frac{6}{f}$

**18.** $\frac{7}{b} = \frac{1}{9}$

**19.** $\frac{10}{14} = \frac{30}{m}$

**20.** $\frac{11}{15} = \frac{n}{60}$

**21.** $\frac{9}{c} = \frac{27}{39}$

**22.** $\frac{5}{12} = \frac{20}{g}$

**23.** $\frac{4}{21} = \frac{s}{84}$

**24.** $\frac{22}{x} = \frac{11}{30}$

**25. BOATING** Hue's boat used 5 gallons of gasoline in 4 hours. At this rate, how many gallons of gasoline will the boat use in 10 hours?

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# 3-6 Practice

## *Ratios and Proportions*

**Use cross products to determine whether each pair of ratios forms a proportion. Write *yes* or *no*.**

**1.** $\frac{7}{6}, \frac{52}{48}$

**2.** $\frac{3}{11}, \frac{15}{66}$

**3.** $\frac{18}{24}, \frac{36}{48}$

**4.** $\frac{12}{11}, \frac{108}{99}$

**5.** $\frac{8}{9}, \frac{72}{81}$

**6.** $\frac{1.5}{9}, \frac{1}{6}$

**7.** $\frac{3.4}{5.2}, \frac{7.14}{10.92}$

**8.** $\frac{1.7}{1.2}, \frac{2.9}{2.4}$

**9.** $\frac{7.6}{1.8}, \frac{3.9}{0.9}$

**Solve each proportion. If necessary, round to the nearest hundredth.**

**10.** $\frac{5}{a} = \frac{30}{54}$

**11.** $\frac{v}{46} = \frac{34}{23}$

**12.** $\frac{40}{56} = \frac{k}{7}$

**13.** $\frac{28}{49} = \frac{4}{w}$

**14.** $\frac{3}{u} = \frac{27}{162}$

**15.** $\frac{y}{3} = \frac{48}{9}$

**16.** $\frac{2}{y} = \frac{10}{60}$

**17.** $\frac{5}{11} = \frac{35}{x}$

**18.** $\frac{3}{51} = \frac{z}{17}$

**19.** $\frac{6}{61} = \frac{12}{h}$

**20.** $\frac{g}{16} = \frac{6}{4}$

**21.** $\frac{14}{49} = \frac{2}{a}$

**22.** $\frac{7}{9} = \frac{8}{c}$

**23.** $\frac{3}{q} = \frac{5}{6}$

**24.** $\frac{m}{6} = \frac{5}{8}$

**25.** $\frac{v}{0.23} = \frac{7}{1.61}$

**26.** $\frac{3}{0.72} = \frac{12}{b}$

**27.** $\frac{6}{n} = \frac{3}{0.51}$

**28.** $\frac{7}{a - 4} = \frac{14}{6}$

**29.** $\frac{3}{12} = \frac{2}{y + 6}$

**30.** $\frac{m - 1}{8} = \frac{2}{4}$

**31.** $\frac{5}{12} = \frac{x + 1}{4}$

**32.** $\frac{r + 2}{7} = \frac{5}{7}$

**33.** $\frac{3}{7} = \frac{x - 2}{6}$

**34. PAINTING** Ysidra paints a room that has 400 square feet of wall space in $2\frac{1}{2}$ hours. At this rate, how long will it take her to paint a room that has 720 square feet of wall space?

**35. VACATION PLANS** Walker is planning a summer vacation. He wants to visit Petrified National Forest and Meteor Crater, Arizona, the 50,000-year-old impact site of a large meteor. On a map with a scale where 2 inches equals 75 miles, the two areas are about $1\frac{1}{2}$ inches apart. What is the distance between Petrified National Forest and Meteor Crater?

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3-6

# Reading to Learn Mathematics

## *Ratios and Proportions*



### Pre-Activity **How are ratios used in recipes?**

Read the introduction to Lesson 3-6 at the top of page 155 in your textbook.

- How many servings of honey frozen yogurt are made by this recipe?

- How many recipes would be needed to make enough honey frozen yogurt for all the students in your class?

### Reading the Lesson

**1.** Complete the following sentence.

A ratio is a comparison of two numbers by _____.

**2.** Describe two ways to decide whether the sentence $\frac{2}{5} = \frac{8}{20}$ is a proportion.

**3.** For each proportion, tell what the extremes are and what the means are.

**a.** $\frac{14}{35} = \frac{6}{15}$ Extremes: _____ Means: _____

**b.** $\frac{6}{8} = \frac{12}{16}$ Extremes: _____ Means: _____

**4.** A jet flying at a steady speed traveled 825 miles in 2 hours. If you solved the proportion $\frac{825}{2} = \frac{x}{1.5}$, what would the answer tell you about the jet?

### Helping You Remember

**5.** Write how you would explain solving a proportion to a friend who missed Lesson 3-6.

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# 3-6 Enrichment

## *Angles of a Triangle*

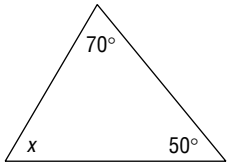
In geometry, many statements about physical space are proven to be true. Such statements are called **theorems**. Here are two examples of geometric theorems.

**a.** The sum of the measures of the angles of a triangle is 180°.

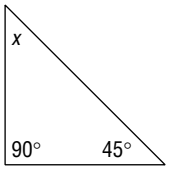
**b.** If two sides of a triangle have equal measure, then the two angles opposite those sides also have equal measure.

**For each of the triangles, write an equation and then solve for $x$. (A tick mark on two or more sides of a triangle indicates that the sides have equal measure.)**

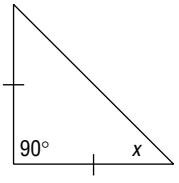
**1.**



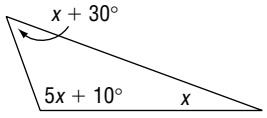

**2.**



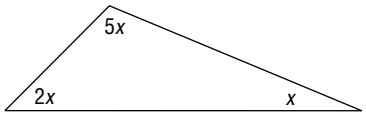

**3.**



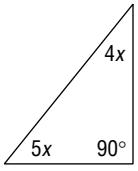

**4.**



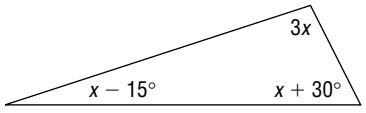

**5.**



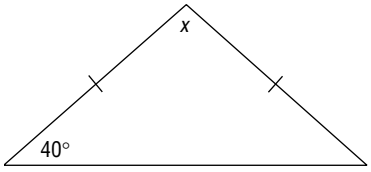

**6.**



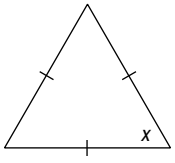

**7.**



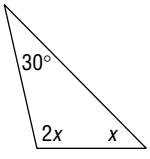

**8.**




**9.**




**10.**




**11.** Two angles of a triangle have the same measure. The sum of the measures of these angles is one-half the measure of the third angle. Find the measures of the angles of the triangle.

**12.** The measure of one angle of a triangle is twice the measure of a second angle. The measure of the third angle is 12 less than the sum of the other two. Find the measures of the angles of the triangle.

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# 3-7 Study Guide and Intervention

## *Percent of Change*

**Percent of Change** When an increase or decrease in an amount is expressed as a percent, the percent is called the **percent of change**. If the new number is greater than the original number, the percent of change is a **percent of increase**. If the new number is less than the original number, the percent of change is the **percent of decrease**.



### Example 1

**Find the percent of increase.**
**original: 48**
**new: 60**

First, subtract to find the amount of increase. The amount of increase is $60 - 48 = 12$.

Then find the percent of increase by using the original number, 48, as the base.

$\frac{12}{48} = \frac{r}{100}$ Percent proportion

$12(100) = 48(r)$ Cross products

$1200 = 48r$ Simplify.

$\frac{1200}{48} = \frac{48r}{48}$ Divide each side by 48.

$25 = r$ Simplify.

The percent of increase is 25%.

### Example 2

**Find the percent of decrease.**
**original: 30**
**new: 22**

First, subtract to find the amount of decrease. The amount of decrease is $30 - 22 = 8$.

Then find the percent of decrease by using the original number, 30, as the base.

$\frac{8}{30} = \frac{r}{100}$ Percent proportion

$8(100) = 30(r)$ Cross products

$800 = 30r$ Simplify.

$\frac{800}{30} = \frac{30r}{30}$ Divide each side by 30.

$26\frac{2}{3} = r$ Simplify.

The percent of decrease is $26\frac{2}{3}\%$, or about 27%.

### Exercises

**State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.**

**1.** original: 50
new: 80

**2.** original: 90
new: 100

**3.** original: 45
new: 20

**4.** original: 77.5
new: 62

**5.** original: 140
new: 150

**6.** original: 135
new: 90

**7.** original: 120
new: 180

**8.** original: 90
new: 270

**9.** original: 27.5
new: 25

**10.** original: 84
new: 98

**11.** original: 12.5
new: 10

**12.** original: 250
new: 500

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# 3-7 Study Guide and Intervention *(continued)*

## *Percent of Change*

**Solve Problems** Discounted prices and prices including tax are applications of percent of change. Discount is the amount by which the regular price of an item is reduced. Thus, the discounted price is an example of percent of decrease. Sales tax is amount that is added to the cost of an item, so the price including tax is an example of percent of increase.

*Example* **A coat is on sale for 25% off the original price. If the original price of the coat is $75, what is the discounted price?**

The discount is 25% of the original price.

$25\%$ of $\$75 = 0.25 \times 75$ 25% = 0.25

$= 18.75$ Use a calculator.

Subtract $18.75 from the original price.

$\$75 - \$18.75 = \$56.25$

The discounted price of the coat is $56.25.

*Exercises*

**Find the final price of each item. When a discount and a sales tax are listed, compute the discount price before computing the tax.**

**1.** Compact disc: $16
Discount: 15%

**2.** Two concert tickets: $28
Student discount: 28%

**3.** Airline ticket: $248.00
Superair discount: 33%

**4.** Shirt: $24.00
Sales tax: 4%

**5.** CD player: $142.00
Sales tax: 5.5%

**6.** Celebrity calendar: $10.95
Sales tax: 7.5%

**7.** Class ring: $89.00
Group discount: 17%
Sales tax: 5%

**8.** Software: $44.00
Discount: 21%
Sales tax: 6%

**9.** Video recorder: $110.95
Discount: 20%
Sales tax: 5%

**10. VIDEOS** The original selling price of a new sports video was $65.00. Due to the demand the price was increased to $87.75. What was the percent of increase over the original price?

**11. SCHOOL** A high school paper increased its sales by 75% when it ran an issue featuring a contest to win a class party. Before the contest issue, 10% of the school's 800 students bought the paper. How many students bought the contest issue?

**12. BASEBALL** Baseball tickets cost $15 for general admission or $20 for box seats. The sales tax on each ticket is 8%, and the municipal tax on each ticket is an additional 10% of the base price. What is the final cost of each type of ticket?

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# 3-7 Skills Practice

## *Percent of Change*

**State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.**

**1.** original: 25
new: 10

**2.** original: 50
new: 75

**3.** original: 55
new: 50

**4.** original: 25
new: 28

**5.** original: 50
new: 30

**6.** original: 90
new: 95

**7.** original: 48
new: 60

**8.** original: 60
new: 45

**Find the total price of each item.**

**9.** dress: $69.00
tax: 5%

**10.** binder: $14.50
tax: 7%

**11.** hardcover book: $28.95
tax: 6%

**12.** groceries: $47.52
tax: 3%

**13.** filler paper: $6.00
tax: 6.5%

**14.** shoes: $65.00
tax: 4%

**15.** basketball: $17.00
tax: 6%

**16.** concert tickets: $48.00
tax: 7.5%

**Find the discounted price of each item.**

**17.** backpack: $56.25
discount: 20%

**18.** monitor: $150.00
discount: 50%

**19.** CD: $15.99
discount: 20%

**20.** shirt: $25.50
discount: 40%

**21.** sleeping bag: $125
discount: 25%

**22.** coffee maker: $102.00
discount: 45%

Lesson 3-7

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# 3-7 Practice

## *Percent of Change*

**State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.**

**1.** original: 18
new: 10

**2.** original: 140
new: 160

**3.** original: 200
new: 320

**4.** original: 10
new: 25

**5.** original: 76
new: 60

**6.** original: 128
new: 120

**7.** original: 15
new: 35.5

**8.** original: 98.6
new: 64

**9.** original: 58.8
new: 65.7

**Find the total price of each item.**

**10.** concrete blocks: $95.00
tax: 6%

**11.** crib: $240.00
tax: 6.5%

**12.** jacket: $125.00
tax: 5.5%

**13.** class ring: $325.00
tax: 6%

**14.** blanket: $24.99
tax: 7%

**15.** kite: $18.90
tax: 5%

**Find the discounted price of each item.**

**16.** dry cleaning: $25.00
discount: 15%

**17.** computer game: $49.99
discount: 25%

**18.** luggage: $185.00
discount: 30%

**19.** stationery: $12.95
discount: 10%

**20.** prescription glasses: $149
discount: 20%

**21.** pair of shorts: $24.99
discount: 45%

**Find the final price of each item.**

**22.** television: $375.00
discount: 25%
tax: 6%

**23.** DVD player: $269.00
discount: 20%
tax: 7%

**24.** printer: $255.00
discount: 30%
tax: 5.5%

**25. INVESTMENTS** The price per share of an internet-related stock decreased from $90 per share to $36 per share early in 2001. By what percent did the price of the stock decrease?

**26. HEATING COSTS** Customers of a utility company received notices in their monthly bills that heating costs for the average customer had increased 125% over last year because of an unusually severe winter. In January of last year, the Garcia's paid $120 for heating. What should they expect to pay this January if their bill increased by 125%?

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3-7

# Reading to Learn Mathematics

## *Percent of Change*

**Pre-Activity** **How can percents describe growth over time?**

Read the introduction to Lesson 3-7 at the top of page 160 in your textbook.

- How many area codes were in use in 1947?
- How many *more* area codes were in use in 1999?



## Reading the Lesson

**1.** If you use (original amount) — (new amount) to find the change for a percent of change problem, then the problem involves a percent of _____ (increase/decrease).

**2.** If you use (new amount) — (original amount) to find the change for a percent of change problem, then the problem involves a percent of _____ (increase/decrease).

**Complete the chart.**

| | Original Amount | New Amount | Percent Proportion | Percent Increase or Percent Decrease? |
|---|---|---|---|---|
| **3.** | 10 | 13 | | |
| **4.** | 10 | 7 | | |
| **5.** | 50 | 42 | | |
| **6.** | 50 | 58 | | |

**7.** When you find a discount price, do you add to or subtract from the original price?

## Helping You Remember

**8.** If you remember only two things about the ratio used for finding percent of change, what should they be?

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# 3-7 Enrichment

## Using Percent

**Use what you have learned about percent to solve each problem.**

A TV movie had a "rating" of 15 and a 25 "share." The rating is the percentage of the nation's total TV households that were tuned in to this show. The share is the percentage of homes with TVs turned on that were tuned to the movie. How many TV households had their TVs turned off at this time?

To find out, let $T$ = the number of TV households
and $x$ = the number of TV households with the TV off.
Then $T - x$ = the number of TV households with the TV on.

Since $0.15T$ and $0.25(T - x)$ both represent the number of households tuned to the movie,

$$0.15T = 0.25(T - x)$$
$$0.15T = 0.25T - 0.25x.$$

Solve for $x$. $0.25x = 0.10T$

$$x = \frac{0.10T}{0.25} = 0.40T$$

Forty percent of the TV households had their TVs off when the movie was aired.

**Answer each question.**

**1.** During that same week, a sports broadcast had a rating of 22.1 and a 43 share. Show that the percent of TV households with their TVs off was about 48.6%.

**2.** Find the percent of TV households with their TVs turned off during a show with a rating of 18.9 and a 29 share.

**3.** Show that if T is the number of TV households, r is the rating, and s is the share, then the number of TV households with the TV off is $\frac{(s - r)T}{s}$.

**4.** If the fraction of TV households with no TV on is $\frac{s - r}{s}$ then show that the fraction of TV households with TVs on is $\frac{r}{s}$.

**5.** Find the percent of TV households with TVs on during the most watched serial program in history: the last episode of M*A*S*H, which had a 60.3 rating and a 77 share.

**6.** A local station now has a 2 share. Each share is worth $50,000 in advertising revenue per month. The station is thinking of going commercial free for the three months of summer to gain more listeners. What would its new share have to be for the last 4 months of the year to make more money for the year than it would have made had it not gone commercial free?

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# 3-8 Study Guide and Intervention

## *Solving Equations and Formulas*

**Solve for Variables** Sometimes you may want to solve an equation such as $V = \ell wh$ for one of its variables. For example, if you know the values of $V$, $w$, and $h$, then the equation $\ell = \frac{V}{wh}$ is more useful for finding the value of $\ell$. If an equation that contains more than one variable is to be solved for a specific variable, use the properties of equality to isolate the specified variable on one side of the equation.

**Example 1** **Solve $2x - 4y = 8$ for $y$.**

$$\begin{aligned} 2x - 4y &= 8 \\ 2x - 4y - 2x &= 8 - 2x \\ -4y &= 8 - 2x \\ \frac{-4y}{-4} &= \frac{8 - 2x}{-4} \\ y &= \frac{8 - 2x}{-4} \text{ or } \frac{2x - 8}{4} \end{aligned}$$

The value of $y$ is $\frac{2x - 8}{4}$.

**Example 2** **Solve $3m - n = km - 8$ for $m$.**

$$\begin{aligned} 3m - n &= km - 8 \\ 3m - n - km &= km - 8 - km \\ 3m - n - km &= -8 \\ 3m - n - km + n &= -8 + n \\ 3m - km &= -8 + n \\ m(3 - k) &= -8 + n \\ \frac{m(3 - k)}{3 - k} &= \frac{-8 + n}{3 - k} \\ m &= \frac{-8 + n}{3 - k}, \text{ or } \frac{n - 8}{3 - k} \end{aligned}$$

The value of $m$ is $\frac{n - 8}{3 - k}$. Since division by 0 is undefined, $3 - k \neq 0$, or $k \neq 3$.

Lesson 3-8

### Exercises

**Solve each equation or formula for the variable specified.**

**1.** $ax - b = c$ for $x$

**2.** $15x + 1 = y$ for $x$

**3.** $(x + f) + 2 = j$ for $x$

**4.** $xy + z = 9$ for $y$

**5.** $x(4 - k) = p$ for $k$

**6.** $7x + 3y = m$ for $y$

**7.** $4(c + 3) = t$ for $c$

**8.** $2x + b = c$ for $x$

**9.** $x(1 + y) = z$ for $x$

**10.** $16z + 4x = y$ for $x$

**11.** $d = rt$ for $r$

**12.** $A = \frac{h(a + b)}{2}$ for $h$

**13.** $C = \frac{5}{9}(F - 32)$ for $F$

**14.** $P = 2\ell + 2w$ for $w$

**15.** $A = \ell w$ for $\ell$

NAME _____ DATE _____ PERIOD _____

# 3-8 Study Guide and Intervention *(continued)*

## *Solving Equations and Formulas*

**Use Formulas** Many real-world problems require the use of formulas. Sometimes solving a formula for a specified variable will help solve the problem.

**Example** **The formula $C = \pi d$ represents the circumference of a circle, or the distance around the circle, where $d$ is the diameter. If an airplane could fly around Earth at the equator without stopping, it would have traveled about 24,900 miles. Find the diameter of Earth.**

$C = \pi d$ Given formula

$d = \frac{C}{\pi}$ Solve for $d$.

$d = \frac{24{,}900}{3.14}$ Use $\pi = 3.14$.

$d \approx 7930$ Simplify.

The diameter of Earth is about 7930 miles.

**Exercises**

1. **GEOMETRY** The volume of a cylinder $V$ is given by the formula $V = \pi r^2 h$, where $r$ is the radius and $h$ is the height.

   **a.** Solve the formula for $h$.

   **b.** Find the height of a cylinder with volume $2500\pi$ feet and radius 10 feet.

2. **WATER PRESSURE** The water pressure on a submerged object is given by $P = 64d$, where $P$ is the pressure in pounds per square foot, and $d$ is the depth of the object in feet.

   **a.** Solve the formula for $d$.

   **b.** Find the depth of a submerged object if the pressure is 672 pounds per square foot.

3. **GRAPHS** The equation of a line containing the points $(a, 0)$ and $(0, b)$ is given by the formula $\frac{x}{a} + \frac{y}{b} = 1$.

   **a.** Solve the equation for $y$.

   **b.** Suppose the line contains the points $(4, 0)$, and $(0, -2)$. If $x = 3$, find $y$.

4. **GEOMETRY** The surface area of a rectangular solid is given by the formula $S = 2\ell w + 2\ell h + 2wh$, where $\ell$ = length, $w$ = width, and $h$ = height.

   **a.** Solve the formula for $h$.

   **b.** The surface area of a rectangular solid with length 6 centimeters and width 3 centimeters is 72 square centimeters. Find the height.

NAME _____ DATE _____ PERIOD _____

# 3-8 Skills Practice

## *Solving Equations and Formulas*

**Solve each equation or formula for the variable specified.**

**1.** $7t = x$, for $t$

**2.** $e = wp$, for $p$

**3.** $q - r = r$, for $r$

**4.** $4m - n = m$, for $m$

**5.** $7a - b = 15a$, for $a$

**6.** $-5c + d = 2c$, for $c$

**7.** $x - 2y = 1$, for $y$

**8.** $m + 3n = 1$, for $n$

**9.** $7f + g = 5$, for $f$

**10.** $ax - c = b$, for $x$

**11.** $rt - 2n = y$, for $t$

**12.** $bc + 3g = 2k$, for $c$

**13.** $kn + 4f = 9v$, for $n$

**14.** $8c + 6j = 5p$, for $c$

**15.** $\frac{x - c}{2} = d$, for $x$

**16.** $\frac{x - c}{2} = d$, for $c$

**17.** $\frac{p + 9}{5} = q$, for $p$

**18.** $\frac{b - 4z}{7} = a$, for $b$

**Write an equation and solve for the variable specified.**

**19.** Five more than a number $g$ is six less than twice a number $h$. Solve for $g$.

**20.** One fourth of a number $q$ is three more than three times a number $w$. Solve for $q$.

**21.** Eight less than a number $s$ is three more than four times a number $t$. Solve for $s$.

Lesson 3-8

NAME _____ DATE _____ PERIOD _____

# 3-8 Practice

## *Solving Equations and Formulas*

**Solve each equation or formula for the variable specified.**

**1.** $d = rt$, for $r$

**2.** $6w - y = 2z$, for $w$

**3.** $mx + 4y = 3c$, for $x$

**4.** $9s - 5g = -4u$, for $s$

**5.** $ab + 3c = 2d$, for $b$

**6.** $2p = kx - q$, for $x$

**7.** $\frac{2}{3}m + a = a + c$, for $m$

**8.** $\frac{2}{5}h + g = d$, for $h$

**9.** $\frac{2}{3}y + v = s$, for $y$

**10.** $\frac{3}{4}a - q = k$, for $a$

**11.** $\frac{rx + 9}{5} = h$, for $x$

**12.** $\frac{3b - 4}{2} = c$, for $b$

**13.** $2w - y = 7w - 2$, for $w$

**14.** $3\ell + y = 5 + 5\ell$, for $\ell$

**Write an equation and solve for the variable specified.**

**15.** Three times a number $s$ plus 4 times a number $y$ is 1 more than 6 times the number $s$. Solve for $s$.

**16.** Five times a number $k$ minus 9 is two thirds of a number $j$. Solve for $j$.

**ELECTRICITY For Exercises 17 and 18, use the following information.**

The formula for Ohm's Law is $E = IR$, where $E$ represents voltage measured in volts, $I$ represents current measured in amperes, and $R$ represents resistance measured in ohms.

**17.** Solve the formula for $R$.

**18.** Suppose a current of 0.25 ampere flows through a resistor connected to a 12-volt battery. What is the resistance in the circuit?

**MOTION For Exercises 19 and 20, use the following information.**

In *uniform circular motion*, the speed $v$ of a point on the edge of a spinning disk is $v = \frac{2\pi}{T}r$, where $r$ is the radius of the disk and $T$ is the time it takes the point to travel once around the circle.

**19.** Solve the formula for $r$.

**20.** Suppose a merry-go-round is spinning once every 3 seconds. If a point on the outside edge has a speed of 12.56 feet per second, what is the radius of the merry-go-round? (Use 3.14 for $\pi$.)

NAME _____ DATE_____ PERIOD _____

# 3-8 Reading to Learn Mathematics

## *Solving Equations and Formulas*

**Pre-Activity** **How are equations used to design roller coasters?**

Read the introduction to Lesson 3-8 at the top of page 166 in your textbook. The equation $g(195 - h) = \frac{1}{2}v^2$ contains several variables. What number values do you know for these variables in this situation?

## Reading the Lesson

**1.** Suppose you have an equation with several variables. You want to solve for a particular variable. How does the procedure compare with that for solving an equation with just one variable? How does the solution compare with the solution for an equation with one variable?

**2.** Describe what dimensional analysis involves.

**3.** What do you have to be careful about when you use variables in denominators of fractions?

## Helping You Remember

**4.** When you give the dimensions of a rectangle, you have to tell how many units long it is and how many units wide it is. How can this help you remember what dimensional analysis involves.

Lesson 3-8

NAME _____ DATE_____ PERIOD _____

# 3-8 Enrichment

## *Dr. Bernardo Houssay*

Even though researchers have been studying the disease *diabetes mellitus* for hundreds of years, scientists have only recently discovered the cause of the disease and developed methods for reducing its severity. Dr. Bernardo Houssay, an Argentine physiologist, was one of the pioneers of this more modern research. He studied the relationship between diabetes and the pituitary gland, and in 1947 became the first Latin American to win the Nobel Prize in Medicine and Physiology.

Though there is no cure for diabetes, specific diets and exercise can help people control the disease. The American Diabetes Association (ADA) has helped establish flexible dietary guidelines for consumers to follow. These guidelines include some of the following general nutrition rules.

- Fat intake should be equal to or less than 30% of daily calories.
- Saturated fat intake should be equal to or less than 10% of daily calories.
- Protein should be limited to 10% to 20% of daily calories. Persons showing the initial signs of diabetes-induced kidney disease should limit protein to 10% of daily calories.
- Cholesterol intake should be 300 milligrams or less daily.

**Refer to the information above for Exercises 1–4.**

**1.** Robert consumed 2100 calories on Tuesday. His fat intake totaled 70 grams, and of that 70 grams, 14 were saturated.

**a.** What percentage of his calorie consumption was fat, and what percentage of that fat was saturated? (To find the percentage of calories from fat, multiply the number of fat grams by 9 before dividing by the number of calories.)

**b.** Did Robert stay within the recommended allowance of fats?

**2.** Anna's cholesterol intake was 330 milligrams on Sunday. By what percentage does she need to reduce her cholesterol consumption to remain within the guidelines?

**3.** What number of fat grams is 30% of 240 calories?

**4.** Sharon follows a diet that provides about 50 grams of protein each day. Sharon's doctor has just told her to reduce her daily protein intake by 30%. About how much protein will be in her reduced protein diet?

NAME _____ DATE _____ PERIOD _____

# 3-9 Study Guide and Intervention

## *Weighted Averages*

### Mixture Problems

| Weighted Average | The weighted average $M$ of a set of data is the sum of the product of each number in the set and its weight divided by the sum of all the weights. |
|---|---|

**Mixture Problems** are problems where two or more parts are combined into a whole. They involve weighted averages. In a mixture problem, the weight is usually a price or a percent of something.

*Example* **Delectable Cookie Company sells chocolate chip cookies for $6.95 per pound and white chocolate cookies for $5.95 per pound. How many pounds of chocolate chip cookies should be mixed with 4 pounds of white chocolate cookies to obtain a mixture that sells for $6.75 per pound.**

Let $w$ = the number of pounds of chocolate chip cookies

| | Number of Pounds | Price per Pound | Total Price |
|---|---|---|---|
| **Chocolate Chip** | $w$ | 6.95 | $6.95w$ |
| **White Chocolate** | 4 | 5.95 | $4(5.95)$ |
| **Mixture** | $w + 4$ | 6.75 | $6.75(w + 4)$ |

Equation: $6.95w + 4(5.95) = 6.75(w + 4)$

Solve the equation.

$$\begin{aligned}
6.95w + 4(5.95) &= 6.75(w + 4) && \text{Original equation}\\
6.95w + 23.80 &= 6.75w + 27 && \text{Simplify.}\\
6.95w + 23.80 - 6.75w &= 6.75w + 27 - 6.75w && \text{Subtract } 6.75w \text{ from each side.}\\
0.2w + 23.80 &= 27 && \text{Simplify.}\\
0.2w + 23.80 - 23.80 &= 27 - 23.80 && \text{Subtract 23.80 from each side.}\\
0.2w &= 3.2 && \text{Simplify.}\\
w &= 16 && \text{Simplify.}
\end{aligned}$$

16 pounds of chocolate chip cookies should be mixed with 4 pounds of white chocolate cookies.

*Exercises*

1. **SOLUTIONS** How many grams of sugar must be added to 60 grams of a solution that is 32% sugar to obtain a solution that is 50% sugar?

2. **NUTS** The Quik Mart has two kinds of nuts. Pecans sell for $1.55 per pound and walnuts sell for $1.95 per pound. How many pounds of walnuts must be added to 15 pounds of pecans to make a mixture that sells for $1.75 per pound?

3. **INVESTMENTS** Alice Gleason invested a portion of $32,000 at 9% interest and the balance at 11% interest. How much did she invest at each rate if her total income from both investments was $3,200.

4. **MILK** Whole milk is 4% butterfat. How much skim milk with 0% butterfat should be added to 32 ounces of whole milk to obtain a mixture that is 2.5% butterfat?

Lesson 3-9

NAME _____ DATE _____ PERIOD _____

# 3-9 Study Guide and Intervention *(continued)*

## *Weighted Averages*

**Uniform Motion Problems** Motion problems are another application of weighted averages. **Uniform motion problems** are problems where an object moves at a certain speed, or rate. Use the formula $d = rt$ to solve these problems, where $d$ is the distance, $r$ is the rate, and $t$ is the time.

**Example** **Bill Gutierrez drove at a speed of 65 miles per hour on an expressway for 2 hours. He then drove for 1.5 hours at a speed of 45 miles per hour on a state highway. What was his average speed?**

$$M = \frac{65 \cdot 2 + 45 \cdot 1.5}{2 + 1.5}$$ Definition of weighted average

$$\approx 56.4$$ Simplify.

Bill drove at an average speed of about 56.4 miles per hour.

**Exercises**

1. **TRAVEL** Mr. Anders and Ms. Rich each drove home from a business meeting. Mr. Anders traveled east at 100 kilometers per hour and Ms. Rich traveled west at 80 kilometers per hours. In how many hours were they 100 kilometers apart.

2. **AIRPLANES** An airplane flies 750 miles due west in $1\frac{1}{2}$ hours and 750 miles due south in 2 hours. What is the average speed of the airplane?

3. **TRACK** Sprinter A runs 100 meters in 15 seconds, while sprinter B starts 1.5 seconds later and runs 100 meters in 14 seconds. If each of them runs at a constant rate, who is further in 10 seconds after the start of the race? Explain.

4. **TRAINS** An express train travels 90 kilometers per hour from Smallville to Megatown. A local train takes 2.5 hours longer to travel the same distance at 50 kilometers per hour. How far apart are Smallville and Megatown?

5. **CYCLING** Two cyclists begin traveling in the same direction on the same bike path. One travels at 15 miles per hour, and the other travels at 12 miles per hour. When will the cyclists be 10 miles apart?

6. **TRAINS** Two trains leave Chicago, one traveling east at 30 miles per hour and one traveling west at 40 miles per hour. When will the trains be 210 miles apart?

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# 3-9 Skills Practice

## *Weighted Averages*

**SEASONING For Exercises 1–4, use the following information.**

A health food store sells seasoning blends in bulk. One blend contains 20% basil. Sheila wants to add pure basil to some 20% blend to make 16 ounces of her own 30% blend. Let $b$ represent the amount of basil Sheila should add to the 20% blend.

**1.** Complete the table representing the problem.

| | Ounces | Amount of Basil |
|---|---|---|
| 20% Basil Blend | | |
| 100% Basil | | |
| 30% Basil Blend | | |

**2.** Write an equation to represent the problem.

**3.** How many ounces of basil should Sheila use to make the 30% blend?

**4.** How many ounces of the 20% blend should she use?

**HIKING For Exercises 5–7, use the following information.**

At 7:00 A.M., two groups of hikers begin 21 miles apart and head toward each other. The first group, hiking at an average rate of 1.5 miles per hour, carries tents, sleeping bags, and cooking equipment. The second group, hiking at an average rate of 2 miles per hour, carries food and water. Let $t$ represent the hiking time.

**5.** Copy and complete the table representing the problem.

| | $r$ | $t$ | $d = rt$ |
|---|---|---|---|
| First group of hikers | | | |
| Second group of hikers | | | |

**6.** Write an equation using $t$ that describes the distances traveled.

**7.** How long will it be until the two groups of hikers meet?

**SALES For Exercises 8 and 9, use the following information.**

Sergio sells a mixture of Virginia peanuts and Spanish peanuts for $3.40 per pound. To make the mixture, he uses Virginia peanuts that cost $3.50 per pound and Spanish peanuts that cost $3.00 per pound. He mixes 10 pounds at a time.

**8.** How many pounds of Virginia peanuts does Sergio use?

**9.** How many pounds of Spanish peanuts does Sergio use?

Lesson 3-9

NAME _____ DATE _____ PERIOD _____

# 3-9 Practice

## *Weighted Averages*

**GRASS SEED For Exercises 1–4, use the following information.**

A nursery sells Kentucky Blue Grass seed for \$5.75 per pound and Tall Fescue seed for \$4.50 per pound. The nursery sells a mixture of the two kinds of seed for \$5.25 per pound. Let $k$ represent the amount of Kentucky Blue Grass seed the nursery uses in 5 pounds of the mixture.

**1.** Complete the table representing the problem.

| | Number of Pounds | Price per Pound | Cost |
|---|---|---|---|
| **Kentucky Blue Grass** | | | |
| **Tall Fescue** | | | |
| **Mixture** | | | |

**2.** Write an equation to represent the problem.

**3.** How much Kentucky Blue Grass does the nursery use in 5 pounds of the mixture?

**4.** How much Tall Fescue does the nursery use in 5 pounds of the mixture?

**TRAVEL For Exercises 5–7, use the following information.**

Two commuter trains carry passengers between two cities, one traveling east, and the other west, on different tracks. Their respective stations are 150 miles apart. Both trains leave at the same time, one traveling at an average speed of 55 miles per hour and the other at an average speed of 65 miles per hour. Let $t$ represent the time until the trains pass each other.

**5.** Copy and complete the table representing the problem.

| | $r$ | $t$ | $d = rt$ |
|---|---|---|---|
| **First Train** | | | |
| **Second Train** | | | |

**6.** Write an equation using $t$ that describes the distances traveled.

**7.** How long after departing will the trains pass each other?

**8. TRAVEL** Two trains leave Raleigh at the same time, one traveling north, and the other south. The first train travels at 50 miles per hour and the second at 60 miles per hour. In how many hours will the trains be 275 miles apart?

**9. JUICE** A pineapple drink contains 15% pineapple juice. How much pure pineapple juice should be added to 8 quarts of the drink to obtain a mixture containing 50% pineapple juice?

NAME _____ DATE _____ PERIOD _____

# 3-9 Reading to Learn Mathematics

## *Weighted Averages*

**Pre-Activity** **How are scores calculated in a figure skating competition?**

Read the introduction to Lesson 3-9 at the top of page 171 in your textbook.

Why is the sum of Ilia Kulik's scores divided by 3?

## Reading the Lesson

**1.** Read the definition of *weighted average* on page 171 of your textbook. What is meant by the weight of a number in a set of data?

**2.** Linda's quiz scores in science are 90, 85, 85, 75, 85, and 90. What is the weight of the score 85?

**3.** Suppose Clint drives at 50 miles per hour for 2 hours. Then he drives at 60 miles per hour for 3 hours.

**a.** Write his speed for each hour of the trip.

| **Speed** | | | | | |
|---|---|---|---|---|---|
| **Hour** | 1 | 2 | 3 | 4 | 5 |

**b.** What is the weight of each of the two speeds?

## Helping You Remember

**4.** Making a table can be helpful in solving mixture problems. In your own words, explain how you use a table to solve mixture problems.

Lesson 3-9

NAME _____ DATE _____ PERIOD _____

# 3-9 Enrichment

## Diophantine Equations

The first great algebraist, Diophantus of Alexandria (about A.D. 300), devoted much of his work to the solving of indeterminate equations. An indeterminate equation has more than one variable and an unlimited number of solutions. An example is $x + 2y = 4$.

When the coefficients of an indeterminate equation are integers and you are asked to find solutions that must be integers, the equation is called *diophantine*. Such equations can be quite difficult to solve, often involving trial and error—and some luck!

**Solve each diophantine equation by finding at least one pair of positive integers that makes the equation true. Some hints are given to help you.**

**1.** $2x + 5y = 32$

**a.** First solve the equation for $x$.

**b.** Why must $y$ be an even number?

**c.** Find at least one solution.

**2.** $5x + 2y = 42$

**a.** First solve the equation for $x$.

**b.** Rewrite your answer in the form $x = 8 +$ some expression.

**c.** Why must $(2 - 2y)$ be a multiple of 5?

**d.** Find at least one solution.

**3.** $2x + 7y = 29$

**4.** $7x + 5y = 118$

**5.** $8x - 13y = 100$

**6.** $3x + 4y = 22$

**7.** $5x - 14y = 11$

**8.** $7x + 3y = 40$

NAME _____ DATE _____ PERIOD _____

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# Chapter 3 Test, Form 1

SCORE _____

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

**1.** Solve $x + 19 = 5$.

**A.** 24 **B.** 14 **C.** $-24$ **D.** $-14$ **1.** _____

**2.** Solve $y - 18 = -3$.

**A.** $-21$ **B.** 21 **C.** $-15$ **D.** 15 **2.** _____

**3.** Solve $5n = 35$.

**A.** 30 **B.** 7 **C.** 40 **D.** 165 **3.** _____

**4.** Solve $\frac{c}{3} = 6$.

**A.** 3 **B.** 9 **C.** 2 **D.** 18 **4.** _____

**5.** Solve $\frac{3}{5}x = 15$.

**A.** 9 **B.** 5 **C.** 25 **D.** 75 **5.** _____

**6.** Solve $2t + 1 = 3$.

**A.** 1 **B.** $-1$ **C.** 2 **D.** $-2$ **6.** _____

**7.** Translate the following sentence into an equation.
*Twice a number m minus three equals the sum of m and five.*

**A.** $2(m - 3) = m + 5$ **B.** $2m - 3 = m + 5$

**C.** $2m - 3 = 5m$ **D.** $2(m - 3) = 5m$ **7.** _____

**8.** Translate the following equation into a verbal sentence.
$x + 5 = 2(7 + x)$

**A.** The quotient of $x$ and five is two times seven plus $x$.

**B.** The number $x$ plus five is two times the sum of seven and $x$.

**C.** The number $x$ plus five is two times seven plus $x$.

**D.** The product of $x$ and five is the sum of two times seven and $x$. **8.** _____

**9.** A number is added to 9. The result is then multiplied by 4 to give a new result of 120. What is the number?

**A.** 21 **B.** 39 **C.** 489 **D.** $4(n + 9) + 120$ **9.** _____

**10.** Which ratio forms a proportion with $\frac{7}{14}$?

**A.** $\frac{4}{9}$ **B.** $\frac{5}{12}$ **C.** $\frac{2}{5}$ **D.** $\frac{3}{6}$ **10.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

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# Chapter 3 Test, Form 1 *(continued)*

**11.** Solve the proportion $\frac{2}{7} = \frac{x}{42}$.

**A.** $\frac{1}{2}$ **B.** 12 **C.** $\frac{2}{7}$ **D.** 6 **11.** _____

**12.** Solve $3t - 6 = t - 2$.

**A.** $-2$ **B.** $-4$ **C.** 2 **D.** 1 **12.** _____

**13.** Solve $4(t + 1) = 6t - 1$.

**A.** $2\frac{1}{2}$ **B.** 1 **C.** 0 **D.** $1\frac{1}{2}$ **13.** _____

**14.** Solve $5(g - 2) + g = 6(g - 4)$.

**A.** all numbers **B.** 0 **C.** 2 **D.** no solution **14.** _____

**15.** Solve $ax - 5 = b$ for $a$.

**A.** $x(b + 5)$ **B.** $\frac{b-5}{x}$ **C.** $\frac{b + 5}{x}$ **D.** $x(b - 5)$ **15.** _____

**16.** Find the percent of change. original: 10 new: 12

**A.** 12% **B.** 25% **C.** 20% **D.** 18% **16.** _____

**17.** A baseball costs \$4.00. If the sales tax is 5%, what is the total price?

**A.** \$3.80 **B.** \$4.20 **C.** \$4.05 **D.** \$4.50 **17.** _____

**18.** How many liters of pure acid must be added to 3 liters of a 50% acid solution to obtain a 75% acid solution?

**A.** 1 L **B.** 4.5 L **C.** 1.5 L **D.** 3 L **18.** _____

**19.** Joe and Janna leave home at the same time, traveling in opposite directions. Joe drives 45 miles per hour and Janna drives 40 miles per hour. In how many hours will they be 510 miles apart?

**A.** 7 hours **B.** 6 hours **C.** 5 hours **D.** 4 hours **19.** _____

**20. TEMPERATURE** In Death Valley, California, the highest ground temperature recorded was 94°C on July 15, 1972. In the formula $C = \frac{5}{9}(F - 32)$, $C$ represents the temperature in degrees Celsius and $F$ represents the temperature in degrees Fahrenheit. To the nearest degree, what is the highest ground temperature in Death Valley in Fahrenheit?

**A.** 201°F **B.** 84°F **C.** 34°F **D.** 137°F **20.** _____

**Bonus** A concrete mixture is made with 3 parts water and 5 parts cement. If 27 parts of water are being used in the current batch of concrete, how many parts of cement are being used? **B:** _____

NAME _____ DATE _____ PERIOD _____

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# Chapter 3 Test, Form 2A

SCORE _____

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

**1.** Solve $m - (-4) = 7$.

**A.** 11 **B.** 3 **C.** $-3$ **D.** $-11$ **1.** _____

**2.** Solve $m - 13 = 8$.

**A.** 21 **B.** $-21$ **C.** 5 **D.** $-5$ **2.** _____

**3.** Solve $5w = -75$.

**A.** 15 **B.** $-80$ **C.** $-15$ **D.** 80 **3.** _____

**4.** Solve $-\frac{n}{4} = -12$.

**A.** 3 **B.** 48 **C.** $-8$ **D.** $-16$ **4.** _____

**5.** Solve $-\frac{3}{8}y = -24$.

**A.** $-9$ **B.** 9 **C.** $-64$ **D.** 64 **5.** _____

**6.** Solve $5x + 3 = 23$.

**A.** 4 **B.** $5\frac{1}{2}$ **C.** 25 **D.** 15 **6.** _____

**7.** Translate the following sentence into an equation.
*The sum of twice a number x and 13 is two less than three times x.*

**A.** $2(x + 13) = 3x - 2$ **B.** $2x + 13 = 2 - 3x$

**C.** $2x + 13 = 3x - 2$ **D.** $2x + 13 = 3(x - 2)$ **7.** _____

**8.** Translate the following equation into a verbal sentence.
$3x - y = 5(y + 2x)$

**A.** Three times the difference of $x$ and $y$ equals five times the sum of $y$ and two times $x$.

**B.** Three times $x$ less than $y$ is five times $y$ plus two times $x$.

**C.** The sum of three times $x$ and $y$ is five times $y$ plus two times $x$.

**D.** Three times $x$ minus $y$ is five times the sum of $y$ and two times $x$. **8.** _____

**9.** Six is subtracted from a number. The result is divided by four. This result is added to 10 to give 30. What is the number?

**A.** 4 **B.** 80 **C.** 86 **D.** 16 **9.** _____

**10.** Which ratio forms a proportion with $\frac{25}{35}$?

**A.** $\frac{3}{5}$ **B.** $\frac{15}{21}$ **C.** $\frac{24}{34}$ **D.** $\frac{5}{10}$ **10.** _____

Assessment

3

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

**11.** Solve the proportion $\frac{5}{3c} = \frac{1}{6}$.

**A.** 2 **B.** 10 **C.** 30 **D.** $\frac{11}{3}$ **11.** _____

**12.** Solve $2x + 7 = 5x + 16$.

**A.** $-3$ **B.** $\frac{2}{3}$ **C.** $-7\frac{2}{3}$ **D.** 3 **12.** _____

**13.** Solve $\frac{2}{3}(6x + 30) = x + 5(x + 4) - 2x$.

**A.** 6 **B.** 0 **C.** all numbers **D.** no solution **13.** _____

**14.** Solve $-3(h - 6) = 5(2h + 3)$.

**A.** $-\frac{3}{13}$ **B.** $\frac{3}{13}$ **C.** $-\frac{9}{13}$ **D.** $\frac{9}{13}$ **14.** _____

**15.** Solve $2x - y = y$ for $x$.

**A.** $2y - 2$ **B.** $y - 2$ **C.** $y$ **D.** 0 **15.** _____

**16.** Find the percent of change. original: 80 new: 64

**A.** 25% **B.** 20% **C.** 16% **D.** 10% **16.** _____

**17.** A calculator costs \$32.00. If the sales tax is 6%, what is the total price?

**A.** \$31.40 **B.** \$30.08 **C.** \$32.60 **D.** \$33.92 **17.** _____

**18.** How many liters of a 40% acid solution must be added to 12 liters of a 20% solution to obtain a 25% solution?

**A.** 4 **B.** 1 **C.** 16 **D.** $\frac{4}{5}$ **18.** _____

**19.** Mandy begins bicycling west at 30 miles per hour at 11 A.M. If Liz leaves from the same point 20 minutes later bicycling west at 36 miles per hour, when will she catch Mandy?

**A.** 2:00 P.M. **B.** 1:00 P.M. **C.** 1:30 P.M. **D.** 2:30 P.M. **19.** _____

**20. GEOMETRY** The formula for the volume of a cone is $V = \frac{1}{3}\pi r^2 h$ where $V$ represents the volume, $r$ represents the radius of the base, and $h$ represents the height. What is the height of a cone with a volume of 66 cubic centimeters and a base with a radius of 3 centimeters?

**A.** 21 cm **B.** 69.14 cm **C.** 7 cm **D.** 0.78 cm **20.** _____

**Bonus** A mixture of 10% acid and 90% water is added to 5 liters of pure acid. The final mixture is 40% water. How many liters of water are in the final mixture? **B:** _____

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Test, Form 2B

SCORE _____

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

**1.** Solve $4 = n - (-3)$.

**A.** 1 **B.** 7 **C.** $-1$ **D.** $-7$ **1.** _____

**2.** Solve $x - 12 = 5$.

**A.** $-17$ **B.** $-7$ **C.** 17 **D.** 7 **2.** _____

**3.** Solve $6z = -84$.

**A.** $-90$ **B.** $-78$ **C.** $-14$ **D.** $-504$ **3.** _____

**4.** Solve $-15 = -\frac{w}{3}$.

**A.** 5 **B.** 45 **C.** $-18$ **D.** $-12$ **4.** _____

**5.** Solve $-\frac{4}{7}s = -28$.

**A.** 49 **B.** $-49$ **C.** 16 **D.** $-16$ **5.** _____

**6.** Solve $2 + 7y = 44$.

**A.** $6\frac{4}{7}$ **B.** 35 **C.** 49 **D.** 6 **6.** _____

**7.** Translate the following sentence into an equation.
*The product of five and a number y is two less than the quotient of four and y.*

**A.** $5 + y = \frac{4}{y} - 2$ **B.** $5y = \frac{4}{y} - 2$

**C.** $5y = 2 - \frac{4}{y}$ **D.** $5 + y = 2 - \frac{4}{y}$ **7.** _____

**8.** Translate the following equation into a verbal sentence.
$x(7 - 5y) = \frac{x}{2}$

**A.** $x$ times seven minus five times $y$ equals $x$ divided by two.

**B.** The product of $x$ and seven minus five times $y$ equals the quotient of $x$ and two.

**C.** $x$ times the difference of seven and the product of five and $y$ equals the quotient of $x$ and two.

**D.** $x$ times the sum of seven and five times $y$ equals $x$ divided by two. **8.** _____

**9.** A number is divided by four. The result is added to five. This result is multiplied by three to give 27. What is the number?

**A.** 16 **B.** 1 **C.** $21\frac{1}{2}$ **D.** $3\frac{1}{2}$ **9.** _____

**10.** What ratio forms a proportion with $\frac{8}{36}$?

**A.** $\frac{1}{4}$ **B.** $\frac{6}{27}$ **C.** $\frac{7}{30}$ **D.** $\frac{2}{7}$ **10.** _____

Assessment

3

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

**11.** Solve the proportion $\frac{1}{8} = \frac{7}{2h}$.

**A.** 4 **B.** 28 **C.** 56 **D.** 16 **11.** _____

**12.** Solve $9a + 28 = 4a + 3$.

**A.** $-30$ **B.** $-20$ **C.** $6\frac{1}{5}$ **D.** $-5$ **12.** _____

**13.** Solve $3x + 4(x - 8) - x = \frac{3}{5}(10x + 15)$.

**A.** 0 **B.** all numbers **C.** no solution **D.** 41 **13.** _____

**14.** Solve $4(3r - 2) = -3(r + 7)$.

**A.** $-\frac{13}{15}$ **B.** $-1\frac{4}{15}$ **C.** $1\frac{14}{15}$ **D.** $-1\frac{3}{10}$ **14.** _____

**15.** Solve $3b = 6v - 3b$, for $v$.

**A.** $6b - 6$ **B.** $b$ **C.** $b - 6$ **D.** 0 **15.** _____

**16.** Find the percent of change. original: 45 new: 54

**A.** $33\frac{1}{3}\%$ **B.** 25% **C.** $16\frac{2}{3}\%$ **D.** 20% **16.** _____

**17.** Find the discounted price. radio: \$45.00 discount: 30%

**A.** \$15.00 **B.** \$31.50 **C.** \$36.00 **D.** \$42.00 **17.** _____

**18.** Nature Drinks wants to combine orange juice they sell for \$0.09 per ounce with guava juice they sell for \$0.14 per ounce to create an orange-guava drink. How many ounces of orange juice should they use to create a 16-ounce drink that would sell for \$1.74?

**A.** 10 **B.** 6 **C.** 16 **D.** 0 **18.** _____

**19.** Teri begins walking east at 2 miles per hour at 1 P.M. If Cindy leaves from the same point 30 minutes later walking east at 3 miles per hour, when will she catch Teri?

**A.** 2:30 P.M. **B.** 1:30 P.M. **C.** 2:00 P.M. **D.** 3:00 P.M. **19.** _____

**20. GEOMETRY** The formula for the volume of a cone is $V = \frac{1}{3}\pi r^2 h$, where $V$ represents the volume, $r$ represents the radius of the base, and $h$ represents the height. What is the height of a cone with a volume of 110 cubic centimeters and a base with a radius of 5 centimeters?

**A.** 21 cm **B.** 0.47 cm **C.** 4.2 cm **D.** 41.49 cm **20.** _____

**Bonus** In a bag of blue, green, and red marbles, 50% are blue and 30% are green. There are 6 red marbles in the bag. If you increase the number of blue marbles by 40%, how many blue marbles will be in the bag? **B:** _____

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# Chapter 3 Test, Form 2C

SCORE _____

**For Questions 1–8, solve each equation.**

**1.** $12 + r = 3$ **1.** _____

**2.** $\frac{1}{5} = x - \frac{2}{5}$ **2.** _____

**3.** $-12 = p - 7$ **3.** _____

**4.** $-7b = -35$ **4.** _____

**5.** $31 = -\frac{n}{6}$ **5.** _____

**6.** $-\frac{5}{8}w = -9$ **6.** _____

**7.** $\frac{9}{25} = \frac{p}{125}$ **7.** _____

**8.** $-3a + 4 = -14$ **8.** _____

**9.** Translate the following sentence into an equation. *A number x subtracted from 36 is three times the sum of four and x.* **9.** _____

**10.** Translate the following equation into a verbal sentence. $3(x + y) = 2y - x$ **10.** _____

**For Questions 11 and 12, write an equation for each problem. Then solve the equation.**

**11.** What number decreased by 3.5 equals 12.7? **11.** _____

**12.** Twelve is added to the product of a number and 5. The result is $-3$. Find the number. **12.** _____

**13.** Solve the following problem by working backward. Julie cashed a paycheck and repaid her brother $10 that she had borrowed from him. She then spent $30 on fuel for her car and half of the remaining money on a new tent for camping. She bought a pair of running shoes for $29.45 and had $17.75 left. How much did Julie receive when she cashed her paycheck? **13.** _____

**14.** Use cross products to determine whether the pair of ratios $\frac{4}{6}$ and $\frac{14}{21}$ form a proportion. Write *yes* or *no*. **14.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

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

**15.** Solve the proportion $\frac{x}{6} = \frac{2}{9}$. **15.** _____

**16.** Solve the proportion $\frac{12}{15} = \frac{18}{b}$. **16.** _____

**For Questions 17–19, solve each equation.**

**17.** $-x + 4 = x + 6$ **17.** _____

**18.** $5n + 7 = 7(n + 1) - 2n$ **18.** _____

**19.** $-4(p + 2) + 8 = 2(p - 1) - 7p + 15$ **19.** _____

**20.** Solve $\frac{a}{b}x - c = 0$ for $x$. **20.** _____

**21.** State whether the percent of change is a percent of increase or a percent of decrease. Then find the percent of change.
original: 55 new: 44 **21.** _____

**22.** A shirt costs \$12.00. If the sales tax is 7%, find the total cost. **22.** _____

**23.** How many liters of a 90% acid solution must be added to 6 liters of a 15% acid solution to obtain a 40% acid solution? **23.** _____

**24.** A freight train leaves a station traveling 60 miles per hour. Thirty minutes later a passenger train leaves the station in the same direction on a parallel track at a speed of 72 miles per hour. How long will it take the passenger train to catch the freight train? **24.** _____

**25. GEOMETRY** A container company wants to make a cylindrical can with a volume of 1188 cubic inches. The formula $V = \pi r^2 h$ represents the volume of a cylinder. In this formula, $V$ represents the volume, $r$ represents the radius of the cylinder's base, and $h$ represents the height of the cylinder. Solve for $h$. What height should the company make the can if the radius of the base must be 6 inches? **25.** _____

**Bonus** A clown is preparing for a party by inflating one balloon for every invited guest. Just when she has half of the necessary balloons inflated, 3 of them pop. She inflates 5 more balloons, and two pop. Then 6 balloons are carried away by the wind. She finishes by inflating 16 more balloons, and then learns that only 12 guests will attend the party. How many extra balloons did the clown inflate? **B:** _____

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Test, Form 2D

SCORE _____

**For Questions 1–8, solve each equation.**

**1.** $7 + t = 11$ **1.** _____

**2.** $\frac{1}{9} = y - \frac{5}{9}$ **2.** _____

**3.** $-5 = v - 12$ **3.** _____

**4.** $-8x = -56$ **4.** _____

**5.** $14 = -\frac{s}{5}$ **5.** _____

**6.** $-\frac{7}{9}y = -6$ **6.** _____

**7.** $\frac{10}{27} = \frac{a}{135}$ **7.** _____

**8.** $3 - 5b = -32$ **8.** _____

**9.** Translate the following sentence into an equation. *A number n added to 18 is seven times the difference of n and three.* **9.** _____

**10.** Translate the following equation into a verbal sentence. $\frac{3}{y} - 5 = x(y + 7)$ **10.** _____

**For Questions 11 and 12, write an equation for each problem. Then solve the equation.**

**11.** What number decreased by 8.1 equals 4.9? **11.** _____

**12.** Fifteen is added to the product of a number and 6. The result is 9. Find the number. **12.** _____

**13.** Solve the following problem by working backward. During an evening out, Dean paid a cab driver $20. He then spent $25 on dinner and half of his remaining money on a painting. He bought an umbrella for $23.75 and had $42.15 left. How much money did Dean have at the beginning of the weekend? **13.** _____

**14.** Use cross products to determine whether the pair of ratios $\frac{9}{21}$ and $\frac{12}{26}$ form a proportion. Write *yes* or *no*. **14.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

3

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

**15.** Solve the proportion $\frac{3}{25} = \frac{y}{15}$. **15.** _____

**16.** Solve the proportion $\frac{9}{12} = \frac{15}{a}$. **16.** _____

**For Questions 17–19, solve each equation.**

**17.** $9 - t = t + 3$ **17.** _____

**18.** $2(y - 6) = 3y + 12 - y$ **18.** _____

**19.** $17 + 3(z - 2) - 11z = -7(z + 2) + 14$ **19.** _____

**20.** Solve $\frac{r}{s} + t = 4v$ for $r$. **20.** _____

**21.** State whether the percent of change is a percent of *increase* or a percent of *decrease*. Then find the percent of change.
original: 60, new: 75 **21.** _____

**22.** Find the discounted price.
flashlight: \$18.00 discount: 25% **22.** _____

**23.** Nature's Best wants to combine nuts they sell for \$3.60 a pound with dried fruit they sell for \$2.40 a pound to create a trail mix. How much of each snack should they use to make 10 pounds of trail mix that would sell for \$3.30 a pound? **23.** _____

**24.** Paula leaves home driving 40 miles per hour. One hour later, her brother Dan leaves home, driving in the same direction at a speed of 50 miles per hour. How long will it take Dan to catch up to Paula? **24.** _____

**25. GEOMETRY** A container company wants to make a cylindrical cardboard container with a volume of 4752 cubic inches. The formula $V = \pi r^2 h$ represents the volume of a cylinder. In this formula, $V$ represents the volume, $r$ represents the radius of the cylinder's base, and $h$ represents the height of the cylinder. Solve for $h$. What height should the company make the container if the radius of the base must be 9 inches? **25.** _____

**Bonus** A store has all board games on sale for 25% off the regular price. A checker set has a sale price of \$12. It is then moved to a clearance table where every item is discounted 40% off its regular price. What is the clearance price of the checker set? **B:** _____

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Test, Form 3

SCORE _____

**For Questions 1–6, solve each equation.**

**1.** $n + 39 = 12$ **1.** _____

**2.** $w + (-8) = -21$ **2.** _____

**3.** $-6n = 16$ **3.** _____

**4.** $-13 = -\frac{n}{4}$ **4.** _____

**5.** $\frac{3}{4}h = -\frac{45}{52}$ **5.** _____

**6.** $-\frac{a}{6} + 7 = -14$ **6.** _____

**7.** If $x - 5 = 12$, what is the value of $x - 9$? **7.** _____

**8.** Translate the following into an equation. **8.** _____
*A number x is decreased by 45. The result is then divided by 12. Then 20 is added to this new result to give a final result of five times the difference of 32 and the number x.*

**For Questions 9 and 10, write an equation for each problem. Then solve the equation.**

**9.** Three-fifths of what number equals one? **9.** _____

**10.** The product of 2 more than a number and 10 is 36 more than 8 times the number. What is the number? **10.** _____

**11.** Translate the following equation into a verbal sentence. **11.** _____
$5(2x + 3y) = y^2 - 2x^3$

**12.** Solve the following problem by working backward. **12.** _____
Shyam invested money in the stock market. In the first year, his stock increased 20%. He paid his stock broker $300 and then lost $450. He withdrew $500, and then his remaining investment doubled. Shyam's investment is now worth $7100. How much was Shyam's original investment?

**13.** Use cross products to determine whether the pair of ratios $\frac{42}{48}$ and $\frac{63}{72}$ form a proportion. Write *yes* or *no*. **13.** _____

**14.** Solve the proportion $\frac{t+4}{t-2} = \frac{1}{4}$. **14.** _____

**15.** A blueprint for a house states that 2 inches represents 8 feet. If the width of a window is 2.5 inches on the blueprint, what is the width of the actual window? **15.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

3

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

**For Questions 16–18, solve each equation.**

**16.** $6 - 2y = 7y + 13$ **16.** _____

**17.** $3x - 5(x - 6) = 2(10 - x) + 10$ **17.** _____

**18.** $5(7 - a) - 3(a + 4) - 4 = 4(a - 3) + 7$ **18.** _____

**19.** Solve $ax - n = r$ for $x$. **19.** _____

**20.** Solve $\frac{4x + t}{r} = s$ for $x$. **20.** _____

**21.** State whether the percent of change is a percent of *increase* or a percent of *decrease*. Then find the percent of change.
original: 75, new: 84 **21.** _____

**22.** A jacket costs $75.00 retail. A warehouse outlet discounts the price by 20%. If the sales tax is 6%, find the final price. **22.** _____

**23.** Calvin invested $7500 for one year, part at 12% annual interest and the rest at 10% annual interest. His total interest for the year was $890. How much money did he invest at 12%? **23.** _____

**24.** Two airplanes leave the Atlanta airport at the same time, traveling in opposite directions. One plane travels 30 miles per hour faster than the other. After 3 hours, the planes are 3150 miles apart. What is the rate of each plane? **24.** _____

**25. PHYSICS** A ball is thrown straight up at an initial velocity of 53 feet per second. In the first 1.5 seconds, it travels 42 feet. The formula $s = \left(\frac{u + v}{2}\right)t$ represents the vertical distance $s$ that an object travels in $t$ seconds, where $u$ represents the initial velocity of the object and $v$ represents the velocity of the object at the end of $t$ seconds. Find the velocity of the ball at the end of 1.5 seconds. **25.** _____

**Bonus** Paloma Rey drove to work on Wednesday at 40 miles per hour and arrived one minute late. She left home at the same time on Thursday, drove 45 miles per hour, and arrived one minute early. How far does Ms. Rey drive to work? **B:** _____

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 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.** Phrase 1: $x$ times $y$ plus $z$
Phrase 2: $x$ times the sum of $y$ and $z$

**a.** Discuss what is different between the two phrases.

**b.** Find values for $x$, $y$ and $z$ that make the two phrases equal.

**2. a.** Solve $\frac{ry + s}{m} - t = x$ for $y$, and explain each step in your solution.

**b.** Would there be any limitations for the value of each variable? If so, explain the limitation.

**3.** You buy a stereo at a local store. The stereo has been discounted by 10%. The store then charges 10% tax.

**a.** Compare the final price with the original price.

**b.** Would the final price be different if the tax was added first and then the discount was applied to this new amount?

**4.** Tony and Ivia started walking south from the same location at the same time. Ivia walked 8 miles and walked 1 mile per hour faster than Tony who walked 6 miles. They each walked for the same amount of time.

**a.** Describe how a proportion could be used to find the rate that each person walked.

**b.** The next day they both walked 6 miles, and Ivia again walked 1 mile per hour faster than Tony, who walked 3 miles per hour. Determine whether a proportion could be used to find how long each person walked.

**5. a.** Write four equivalent equations to $x = 8$ using one of the four operations of addition, subtraction, multiplication and division for each equivalent equation. Use each operation only once.

**b.** Write an equivalent equation to $x = 8$ that has the variable $x$ on both sides.

**c.** Determine if $\frac{n}{6} = \frac{15}{18}$ and $2(n + 1) = 3(n - 1)$ are equivalent equations. Determine if either equation is equivalent to any of the equations created for parts **a** and **b**.

Assessment

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Vocabulary Test/Review

SCORE _____

| | | |
|---|---|---|
| Addition Property of Equality | means | rate |
| consecutive integers | mixture problem | ratio |
| defining a variable | Multiplication Property of Equality | scale |
| dimensional analysis | multi-step equations | solve an equation |
| Division Property of Equality | number theory | Subtraction Property of Equality |
| equivalent equation | percent of change | uniform motion problem |
| extremes | percent of decrease | weighted average |
| formula | percent of increase | work backward |
| four-step problem-solving plan | proportion | |
| identity | | |

**Write whether each sentence is *true* or *false*. If false, replace the underlined word or number to make a true sentence.**

**1.** The Addition Property of Equality states that if the same number is subtracted from each side of an equation, the resulting equation is true. **1.** _____

**2.** If the same number is added to each side of a true equation, then the result is a true equation. **2.** _____

**3.** The Multiplication Property of Equality states that if each side of a true equation is multiplied by the same number, the resulting equation is true. **3.** _____

**4.** Multi-step equations are equations with less than one operation. **4.** _____

**5.** An equation that is false for every value of the variable is called an identity. **5.** _____

**6.** A ratio is a comparison of two numbers by multiplication. **6.** _____

**7.** The ratio of two measurements having different units of measure is called a rate. **7.** _____

**8.** A percent of increase or decrease is called a percent of change. **8.** _____

**9.** If the new number is less than the original number, the percent of change is a percent of increase. **9.** _____

**10.** If the new number is greater than the original number, the percent of change is a percent of decrease. **10.** _____

***In your own words—***
**Define each term.**

**11.** proportion

**12.** formula

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Quiz *(Lessons 3–1 through 3–3)*

SCORE _____

**Translate each sentence into an equation.**

**1.** Two times a number $n$ is three times the sum of $n$ and nine. **1.** _____

**2.** The difference of the square of $y$ and twelve is the same as the product of five and $x$. **2.** _____

**Translate each equation into a verbal sentence.**

**3.** $2b - 10 = 4$ **3.** _____

**4.** $y + 3x^2 = 5x$ **4.** _____

**Solve each equation.**

**5.** $d - 8 = 6$ **5.** _____

**6.** $-28 = p + 21$ **6.** _____

**7.** $-3 - (-g) = -12$ **7.** _____

**8.** $-7x = 63$ **8.** _____

**9.** $-\frac{t}{5} = -8$ **9.** _____

**10.** $\frac{4}{5}d = -32$ **10.** _____

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Quiz *(Lessons 3–4 and 3–5)*

SCORE _____

**Solve each equation.**

**1.** $3x + 8 = 29$ **1.** _____

**2.** $\frac{a}{6} - 5 = 9$ **2.** _____

**3.** $5r - 14 = -42$ **3.** _____

**4.** $7n + 6 = 4n - 9$ **4.** _____

**5.** $3b - 13 + 4b = 7b + 1$ **5.** _____

**6.** $5 - 3(w + 4) = w - 7$ **6.** _____

**7.** $2x - 5(x - 3) = 2(x - 10)$ **7.** _____

**8. Standardized Test Practice** Solve $-6(2r + 8) = -10(r - 3)$. **8.** _____

**A.** $-11$ **B.** $-156$ **C.** $-39$ **D.** 9

**Solve each problem by working backward.**

**9.** A number is multiplied by 4, and then 5 is subtracted from the product. The result is 3. What is the number? **9.** _____

**10.** Three is subtracted from a number, and then the difference is divided by 11. The result is 12. What is the number? **10.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

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# Chapter 3 Quiz *(Lessons 3–6 and 3–7)*

SCORE _____

**Use cross products to determine whether each pair of ratios forms a proportion. Write *yes* or *no*.**

**1.** $\frac{5}{7}, \frac{20}{28}$ **2.** $\frac{11}{13}, \frac{22}{25}$ **3.** $\frac{4.2}{6.3}, \frac{0.3}{0.5}$

**Solve each proportion.**

**4.** $\frac{3}{4} = \frac{n}{20}$ **5.** $\frac{6}{4} = \frac{x}{18}$ **6.** $\frac{33}{b} = \frac{15}{45}$

**For Questions 7 and 8, state whether the percent of change is a percent of *increase* or a percent of *decrease*. Then find the percent of change.**

**7.** original: 25
new: 18

**8.** original: 36
new: 45

**9.** The cost of a compact disc is \$18. If the sales tax is 6%, find the total price.

**10.** Find the discounted price. camera: \$108
discount: 30%

**1.** _____
**2.** _____
**3.** _____
**4.** _____
**5.** _____
**6.** _____
**7.** _____
**8.** _____
**9.** _____
**10.** _____

---

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Quiz *(Lessons 3–8 and 3–9)*

SCORE _____

**For Questions 1 and 2, solve each equation or formula for the variable specified.**

**1.** $nx - m = p$, for $x$

**2.** $\frac{x - b}{a} = c$, for $b$

**3.** A chemist needs a 30% iron alloy. How many grams of a 70% iron alloy must be mixed with 16 grams of a 20% iron alloy to obtain the required 30% alloy?

**4.** On Mary's walk she covered the 3-mile distance to the park in one hour. However, the return trip took her one and a half hours. What was her average speed for the round trip?

**5.** The formula $p = 2\ell + 2w$ represents the perimeter of a rectangle. In this formula, $\ell$ is the length of the rectangle and $w$ is the width. Solve the formula for $\ell$. Find the length when the width is 4 meters and the perimeter is 36 meters.

**1.** _____
**2.** _____
**3.** _____
**4.** _____
**5.** _____

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Mid-Chapter Test

SCORE _____

*(Lessons 3–1 through 3–5)*

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

**1.** Translate the following sentence into an equation.
*The product of five and the sum of a number x and three is twelve.*

**A.** $5 + 3x = 12$ **B.** $5(x + 3) = 12$

**C.** $5x + 3 = 12$ **D.** $5x + 3 = x$ **1.** _____

**2.** Solve $y + (-16) = -12$.

**A.** 192 **B.** $-28$ **C.** $\frac{3}{4}$ **D.** 4 **2.** _____

**3.** Solve $-\frac{a}{6} + 5 = 2$.

**A.** 18 **B.** $-6$ **C.** $\frac{1}{2}$ **D.** $-9$ **3.** _____

**4.** Solve $\frac{3}{5}y = -9$.

**A.** $-5\frac{2}{5}$ **B.** $-5$ **C.** $-15$ **D.** $-\frac{5}{9}$ **4.** _____

**5.** Solve $-6d = -42$.

**A.** $-48$ **B.** 7 **C.** $-36$ **D.** 252 **5.** _____

**6.** Solve $-18 = v - (-4)$.

**A.** 22 **B.** $-14$ **C.** $-22$ **D.** 14 **6.** _____

**Part II**

**For Questions 7–9, solve each equation.**

**7.** $5(12 - 3p) = 15p + 60$ **7.** _____

**8.** $3(y - 2) = 6(y - 1) - 3y$ **8.** _____

**9.** $3a + 21 = 7 - 4a$ **9.** _____

**10.** Solve the following problem by working backward. **10.** _____
Liza earned some money delivering newspapers. She bought a battery for $1.95, and gave her mother $30. She bought a ring for $7.20, and then spent half of the remaining money on a radio. If Liza has $38.50 left, how much money did she earn delivering newspapers?

**For Questions 11 and 12, translate each equation into a verbal sentence.**

**11.** $4n = m(5 - n)$ **11.** _____

**12.** $3(y + 5) = 7y$ **12.** _____

Assessment

NAME _____ DATE _____ PERIOD _____

3

# Chapter 3 Cumulative Review

SCORE _____

*(Chapters 1–3)*

**1.** Evaluate $3y - x^2z$ if $x = 2$, $y = 14$, and $z = 5$. (Lesson 1–2) **1.** _____

**2.** Simplify $2(u + 3v) + 3(u + v)$. (Lesson 1–6) **2.** _____

**3.** Miguel was riding his bike to school. He got halfway there and realized he had forgotten his backpack. He turned around, went home, retrieved his backpack, and continued his ride to school. Sketch a reasonable graph to show his distance from school from the time he started to the time he arrived at school. Assume his rate is always the same. (Lesson 1–8) **3.**

**Find each of the following.** (Lessons 2–2 through 2–4, 2–7)

**4.** $13.7 - (-3.2)$ **4.** _____

**5.** $12(-32)$ **5.** _____

**6.** $52 \div (-4)$ **6.** _____

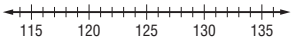
**7.** $-\sqrt{1.69}$ **7.** _____

**8.** The values of the 14 highest recorded temperatures in the United States are listed below. **8.**

| | | | | | | |
|---|---|---|---|---|---|---|
| 128 | 120 | 134 | 118 | 118 | 121 | 125 |
| 122 | 121 | 120 | 119 | 120 | 120 | 118 |

**Source:** *World Almanac*

Make a line plot of the data. (Lesson 2–5)




**9.** A baseball player has a batting average of 0.250. What are the odds that the next time the player bats he gets a hit? (Lesson 2–6) **9.** _____

**10.** Translate the following sentence into an algebraic equation. *Nine times a number y subtracted from 85 is seven times the sum of four and y.* (Lesson 3–1) **10.** _____

**11.** Solve the following problem by working backward. Three is added to a number. The result is divided by two, and then the new result is added to eighteen. The final result is 35. What is the number? (Lesson 3–4) **11.** _____

**For Questions 12–14, solve each equation.** (Lessons 3–2 through 3–5) **12.** _____

**12.** $-27 = -6 - 3p$ **13.** $7a + 2 = 3a - 10$ **13.** _____

**14.** $2(x - 3) + 6x = 3(9 - x)$ **14.** _____

**15.** Solve $q = \frac{m}{n} + p$ for $m$. (Lesson 3–8) **15.** _____

**16.** How many liters of water must be added to 7 liters of a 20% acid solution to obtain a 10% acid solution? (Lesson 3–9) **16.** _____

NAME _____ DATE _____ PERIOD _____

# 3 Standardized Test Practice

*(Chapters 1–3)*

## Part 1: Multiple Choice

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

**1.** Write an algebraic expression for the following verbal expression. *The sum of n and 5.* (Lesson 1–1)

**A.** $5n$ **B.** $\frac{n}{5}$ **C.** $n + 5$ **D.** $n - 5$ **1.** Ⓐ Ⓑ Ⓒ Ⓓ

**2.** State the hypothesis of the following statement. *If I complete my algebra homework daily, then I will learn the concepts.* (Lesson 1–7)

**E.** I will learn the concepts.

**F.** I don't do my algebra homework.

**G.** I won't learn the concepts.

**H.** I complete my algebra homework daily. **2.** Ⓔ Ⓕ Ⓖ Ⓗ

**3.** Simplify the expression $7(x - y) - 2(y - x) + 4x$. (Lesson 1–5)

**A.** $13x - 9y$ **B.** $9x - 5y$ **C.** $9x - 9y$ **D.** $13x - 5y$ **3.** Ⓐ Ⓑ Ⓒ Ⓓ

**4.** Evaluate $a(b - c^2)$ if $a = \frac{2}{3}$, $b = \frac{3}{4}$, and $c = \frac{1}{2}$. (Lesson 2–3)

**E.** $\frac{1}{6}$ **F.** $\frac{1}{3}$ **G.** $\frac{1}{4}$ **H.** $\frac{2}{3}$ **4.** Ⓔ Ⓕ Ⓖ Ⓗ

**5.** The heights in feet of the 10 largest National Champion trees are listed below. **Source:** *World Almanac*

275 321 159 191 281 83 108 232 219 102

Which measure of central tendency best represents the data? (Lesson 2–5)

**A.** the mode **B.** the mean or the median

**C.** the mean or the mode **D.** the median or the mode **5.** Ⓐ Ⓑ Ⓒ Ⓓ

**6.** A letter is chosen at random from the name *Antarctica*. What is the probability that the chosen letter is a vowel? (Lesson 2–6)

**E.** $\frac{2}{5}$ **F.** $\frac{3}{10}$ **G.** $\frac{1}{2}$ **H.** $\frac{3}{5}$ **6.** Ⓔ Ⓕ Ⓖ Ⓗ

**7.** Solve $-\frac{3}{4}y = \frac{8}{20}$. (Lesson 3–3)

**A.** $\frac{2}{5}$ **B.** $-\frac{3}{10}$ **C.** $\frac{8}{15}$ **D.** $-\frac{8}{15}$ **7.** Ⓐ Ⓑ Ⓒ Ⓓ

**8.** Which equation has a solution of $-2$? (Lesson 3–4)

**E.** $4n + 3 = 11$ **F.** $4 = 3n - 2$

**G.** $5(1 + n) = -5$ **H.** $3(n + 1) = 2$ **8.** Ⓔ Ⓕ Ⓖ Ⓗ

**9.** A car dealership has 180 cars on their lot. If they increase their inventory by 25%, how many cars will be on the lot? (Lesson 3–7)

**A.** 230 **B.** 225 **C.** 135 **D.** 205 **9.** Ⓐ Ⓑ Ⓒ Ⓓ

Assessment

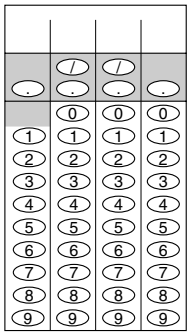
# 3 Standardized Test Practice *(continued)*

## 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.

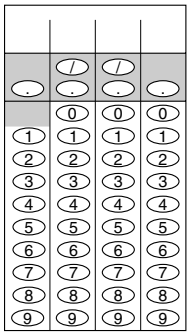
**10.** Solve $2\frac{1}{3} - \frac{5}{6} = t$. (Lesson 1–3)

**10.**



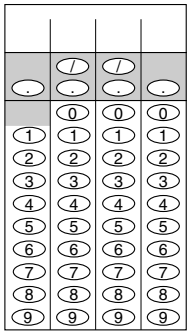
**11.** Find $\frac{1}{3} + (-\frac{1}{4})$. (Lesson 2–2)

**11.**



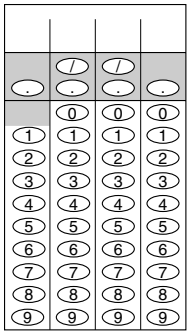
**12.** Solve $7 - 3x = 4 + 9x$. (Lesson 3–5)

**12.**



**13.** Sasha drove from her house to the grocery store in 20 minutes. Her return trip took 15 minutes. If the store is 7 miles from her house, what was Sasha's average speed for the round trip, in miles per hour? (Lesson 3–9)

**13.**



## Part 3: Quantitative Comparison

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

| | Column A | Column B | |
|---|---|---|---|
| **14.** | $(4 \cdot 1 - 4) + \frac{1}{5}(10 - 5)$ | $(2 + 0)\left(\frac{1}{2}\right) + 5(7 - 3 \cdot 2)$ | **14.** (A) (B) (C) (D) |

(Lesson 1–4)

**15.** Let $u = 4$, $v = -3$, and $t = 2$.

| | | |
|---|---|---|
| $uv \div t$ | $u \div vt$ | **15.** (A) (B) (C) (D) |

(Lesson 2–4)

**16.** Let $\frac{x}{7} = \frac{12}{28}$.

| | | |
|---|---|---|
| $\frac{x}{9}$ | $\frac{1}{x}$ | **16.** (A) (B) (C) (D) |

(Lesson 3–6)

NAME _____ DATE _____ PERIOD _____

# Unit 1 Test

*(Chapters 1–3)*

SCORE _____

**1.** Write an algebraic expression for *the difference of 5 and n cubed.* **1.** _____

**2.** Evaluate $2x + 5y^2 - 3z$ if $x = 6$, $y = 4$, and $z = 7$. **2.** _____

**3.** Find the solution set for $3b - 4 = 8$ if the replacement set is $\{1, 2, 3, 4, 5\}$. **3.** _____

**4.** Name the property used in the equation $1 = 6n$. Then find the value of $n$. **4.** _____

**For Questions 5–7, simplify each expression.**

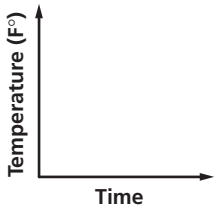
**5.** $2t^2 + 5t^2 + 3t$ **5.** _____

**6.** $7(r + 2t) - 5t$ **6.** _____

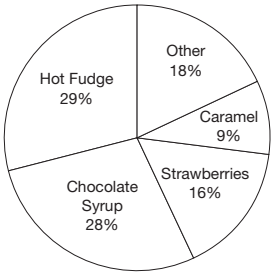
**7.** $5(4a + b) + 3a + b$ **7.** _____

**8.** Identify the hypothesis and conclusion of the statement. Then write the statement in if-then form.
*All triangles are polygons.* **8.** _____

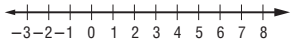
**9.** Draw a reasonable graph showing the relationship between the temperature of a pizza as it is removed from an oven and placed on a counter at room temperature, and time. **9.**




**10.** A recent survey asked consumers to identify their favorite ice cream topping. The results are displayed in the circle graph. If 250 people were surveyed, how many chose strawberries as their favorite topping? **10.** _____




**11.** Graph $\{4, 5, 6, 7, 8, \ldots\}$. **11.**




**Find each sum, product, or quotient.**

**12.** $31 + (-78)$ **12.** _____

**13.** $\left(-\frac{8}{9}\right)\left(\frac{3}{4}\right)$ **13.** _____

**14.** $37.6 \div (-8)$ **14.** _____

**15.** A card is selected at random from a standard deck of 52 cards. What is the probability of selecting a diamond? **15.** _____

**16.** Find the odds of rolling a number less than 6 on a die. **16.** _____

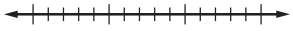
Assessment

NAME _____ DATE _____ PERIOD _____

# Unit 1 Test *(continued)*

**For Questions 17 and 18, use the list that shows the number of hours Mrs. Wentworth's piano students spent practicing last week.**

9 2 2 4 14 2 7 1 5 0 3 1 3 9 11 2

**17.** Make a line plot of the data. **17.** 

**18.** Which measure of central tendency best describes the data? Explain. **18.** _____

**19.** Name the set or sets of numbers to which $\sqrt{48}$ belongs. **19.** _____

**20.** Write $-3.\overline{65}$, $\sqrt{13}$, $\frac{75}{21}$, $-\frac{18}{5}$ in order from least to greatest. **20.** _____

**For Questions 21–27, solve each equation.**

**21.** $m - 5 = -23$ **21.** _____

**22.** $-4 = 8 + k$ **22.** _____

**23.** $\frac{a}{2} + 9 = 30$ **23.** _____

**24.** $-\frac{2}{7}x = -16$ **24.** _____

**25.** $5(c + 3) = 15 + 2(2c - 1)$ **25.** _____

**26.** $10(a + 1) - 14a = 9 - (4a - 1)$ **26.** _____

**27.** $\frac{7}{10} = \frac{3}{x + 1}$ **27.** _____

**28.** A magazine is on sale for 15% off the original price. If the original price of the magazine is \$4.60, what is the discounted price? **28.** _____

**29.** Solve $\frac{t - v}{r} = s$, for $v$. **29.** _____

**30.** How many pounds of peanuts costing \$3.00 a pound should be mixed with 4 pounds of cashews costing \$4.50 a pound to obtain a mixture costing \$3.50 a pound? **30.** _____

NAME _____ DATE _____ PERIOD _____

# 3 Standardized Test Practice

***Student Record Sheet*** *(Use with pages 186–187 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** | Ⓐ Ⓑ Ⓒ Ⓓ |
| **2** | Ⓐ Ⓑ Ⓒ Ⓓ | **5** | Ⓐ Ⓑ Ⓒ Ⓓ | **8** | Ⓐ Ⓑ Ⓒ Ⓓ |
| **3** | Ⓐ Ⓑ Ⓒ Ⓓ | **6** | Ⓐ Ⓑ Ⓒ Ⓓ | | |

## Part 2 Short Response/Grid In

**Solve the problem and write your answer in the blank.**

**For Questions 10, 12, and 14, also enter your answer by writing each number or symbol in a box. Then fill in the corresponding oval for that number or symbol.**

**9** _____

**10** _____ (grid in)

**11** _____

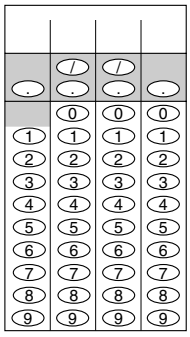
**12** _____ (grid in)

**13** _____

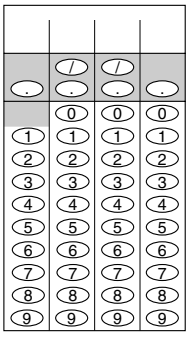
**14** _____ (grid in)

**15** _____

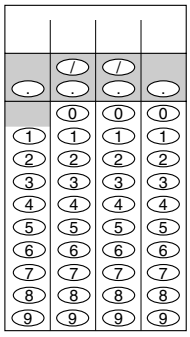
**10**



**12**



**14**



## Part 3 Quantitative Comparison

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

**16** Ⓐ Ⓑ Ⓒ Ⓓ

**17** Ⓐ Ⓑ Ⓒ Ⓓ

**18** Ⓐ Ⓑ Ⓒ Ⓓ

## Part 4 Open-Ended

**Record your answers for Questions 19–20 on the back of this paper.**

Answers

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3-1

# Study Guide and Intervention

## Writing Equations

**Write Equations** Writing equations is one strategy for solving problems. You can use a variable to represent an unspecified number or measure referred to in a problem. Then you can write a verbal expression as an algebraic expression.

**Example 1** **Translate each sentence into an equation or a formula.**

**a. Ten times a number $x$ is equal to 2.8 times the difference $y$ minus $z$.**

$10 \times x = 2.8 \times (y - z)$

The equation is $10x = 2.8(y - z)$.

**b. A number $m$ minus 8 is the same as a number $n$ divided by 2.**

$m - 8 = n \div 2$

The equation is $m - 8 = \frac{n}{2}$.

**c. The area of a rectangle equals the length times the width. Translate this sentence into a formula.**

Let $A$ = area, $\ell$ = length, and $w$ = width.

Formula: *Area equals length times width.*

$A = \ell \times w$

The formula for the area of a rectangle is $A = \ell w$.

**Example 2** **Use the Four-Step Problem-Solving Plan.**

**The population of the United States in 2001 was about 284,000,000, and the land area of the United States is about 3,500,000 square miles. Find the average number of people per square mile in the United States.**

**Source:** www.census.gov

**Step 1** *Explore* You know that there are 284,000,000 people. You want to know the number of people per square mile.

**Step 2** *Plan* Write an equation to represent the situation. Let $p$ represent the number of people per square mile.

$3{,}500{,}000 \times p = 284{,}000{,}000$

**Step 3** *Solve* $3{,}500{,}000 \times p = 284{,}000{,}000$.

$3{,}500{,}000p = 284{,}000{,}000$ Divide each side by 3,500,000.

$p \approx 81.14$

There about 81 people per square mile.

**Step 4** *Examine* If there are 81 people per square mile and there are 3,500,000 square miles, $81 \times 3{,}500{,}000 = 283{,}500{,}000$, or about 284,000,000 people. The answer makes sense.

### Exercises

**Translate each sentence into an equation or formula.**

1. Three times a number $t$ minus twelve equals forty. $3t - 12 = 40$
2. One-half of the difference of $a$ and $b$ is 54. $\frac{1}{2}(a - b) = 54$
3. Three times the sum of $d$ and 4 is 32. $3(d + 4) = 32$
4. The area $A$ of a circle is the product of $\pi$ and the radius $r$ squared. $A = \pi r^2$

**WEIGHT LOSS For Exercises 5–6, use the following information.**

Lou wants to lose weight to audition for a part in a play. He weighs 160 pounds now. He wants to weigh 150 pounds.

5. If $p$ represents the number of pounds he wants to lose, write an equation to represent this situation. $160 - p = 150$
6. How many pounds does he need to lose to reach his goal? 10 lb





NAME _____ DATE _____ PERIOD ____

3-1

# Study Guide and Intervention *(continued)*

## Writing Equations

**Write Verbal Sentences** You can translate equations into verbal sentences.

**Example** **Translate each equation into a verbal sentence.**

**a. $4n - 8 = 12$.**

$4n \quad - \quad 8 \quad = \quad 12$

Four times $n$ minus eight equals twelve.

**b. $a^2 + b^2 = c^2$**

$a^2 + b^2 \quad = \quad c^2$

The sum of the squares of $a$ and $b$ is equal to the square of $c$.

### Exercises

**Translate each equation into a verbal sentence.**

1. $4a - 5 = 23$

   4 times $a$ minus 5 is equal to 23.

2. $10 + k = 4k$

   The sum of 10 and $k$ is equal to 4 times $k$.

3. $6xy = 24$

   6 times the product of $x$ and $y$ is equal to 24.

4. $x^2 + y^2 = 8$

   The sum of the squares of $x$ and $y$ is equal to 8.

5. $p + 3 = 2p$

   The sum of $p$ and 3 is equal to 2 times $p$.

6. $b = \frac{1}{3}(h - 1)$

   $b$ is $\frac{1}{3}$ of the difference of $h$ and 1.

7. $100 - 2x = 80$

   100 minus 2 times $x$ is equal to 80.

8. $3(g + h) = 12$

   3 times the sum of $g$ and $h$ is 12.

9. $p^2 - 2p = 9$

   The square of $p$ minus 2 times $p$ is equal to 9.

10. $C = \frac{5}{9}(F - 32)$

    $C$ is equal to $\frac{5}{9}$ of the difference of $F$ and 32.

11. $V = \frac{1}{3}Bh$

    $V$ is equal to $\frac{1}{3}$ of the product of $B$ and $h$.

12. $A = \frac{1}{2}hb$

    $A$ is equal to $\frac{1}{2}$ of the product of $h$ and $b$.

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NAME _____ DATE _____ PERIOD ____

3-1

# Skills Practice

## Writing Equations

**Translate each sentence into an equation.**

1. Two added to three times a number $m$ is the same as 18. $3m + 2 = 18$
2. Twice $a$ increased by the cube of $a$ equals $b$. $2a + a^3 = b$
3. Seven less than the sum of $p$ and $q$ is as much as 6. $(p + q) - 7 = 6$
4. The sum of $x$ and its square is equal to $y$ times $z$. $x + x^2 = yz$
5. Four times the sum of $f$ and $g$ is identical to six times $g$. $4(f + g) = 6g$

**Translate each sentence into a formula.**

6. The perimeter $P$ of a square equals four times the length of a side $s$. $P = 4s$
7. The area $A$ of a square is the length of a side $s$ squared. $A = s^2$
8. The perimeter $P$ of a triangle is equal to the sum of the lengths of sides $a$, $b$, and $c$. $P = a + b + c$
9. The area $A$ of a circle is pi times the radius $r$ squared. $A = \pi r^2$
10. The volume $V$ of a rectangular prism equals the product of the length $\ell$, the width $w$, and the height $h$. $V = \ell wh$

**Translate each equation into a verbal sentence.**

11. $g + 10 = 3g$
    $g$ plus 10 is the same as 3 times $g$.
12. $2p + 4q = 20$
    Twice $p$ plus 4 times $q$ is 20.
13. $4(a + b) = 9a$
    4 times the sum of $a$ and $b$ is 9 times $a$.
14. $8 - 6x = 4 + 2x$
    8 minus 6 times $x$ is 4 plus 2 times $x$.
15. $\frac{1}{2}(f + y) = f - 5$
    Half of the sum of $f$ and $y$ is $f$ minus 5.
16. $s^2 - n^2 = 2b$
    $s$ squared minus $n$ squared is twice $b$.

**Write a problem based on the given information.**

17. $c$ = cost per pound of plain coffee beans
    $c + 3$ = cost per pound of flavored coffee beans
    $2c + (c + 3) = 21$
    Sample answer: The cost of two pounds of plain coffee beans plus one pound of flavored beans is $21. How much does 1 pound of plain beans cost?
18. $p$ = cost of dinner
    $0.15p$ = cost of a 15% tip
    $p + 0.15p = 23$
    Sample answer: The cost of dinner plus a 15% tip was $23. How much was the dinner?





NAME _____ DATE _____ PERIOD ____

3-1

# Practice (Average)

## Writing Equations

**Translate each sentence into an equation.**

1. Fifty-three plus four times $c$ is as much as 21. $53 + 4c = 21$
2. The sum of five times $h$ and twice $g$ is equal to 23. $5h + 2g = 23$
3. One fourth the sum of $r$ and ten is identical to $r$ minus 4. $\frac{1}{4}(r + 10) = r - 4$
4. Three plus the sum of the squares of $w$ and $x$ is 32. $3 + (w^2 + x^2) = 32$

**Translate each sentence into a formula.**

5. Degrees Kelvin $K$ equals 273 plus degrees Celsius $C$. $K = 273 + C$
6. The total cost $C$ of gas is the price $p$ per gallon times the number of gallons $g$. $C = pg$
7. The sum $S$ of the measures of the angles of a polygon is equal to 180 times the difference of the number of sides $n$ and 2. $S = 180(n - 2)$

**Translate each equation into a verbal sentence.**

8. $q - (4 + p) = \frac{1}{3}q$
   $q$ minus the sum of 4 and $p$ equals $\frac{1}{3}$ times $q$.
9. $\frac{3}{5}t + 2 = t$
   Two more than $\frac{3}{5}$ of $t$ equals $t$.
10. $9(y^2 + x) = 18$
    9 times the sum of $y$ squared and $x$ is 18.
11. $2(m - n) = v + 7$
    Twice the quantity $m$ minus $n$ is $v$ plus 7.

**Write a problem based on the given information.**

12. $a$ = cost of one adult's ticket to zoo
    $a - 4$ = cost of one children's ticket to zoo
    $2a + 4(a - 4) = 38$
    Sample answer: The cost of two adult's tickets and 4 children's tickets to the zoo is $38. How much is an adult's ticket?
13. $c$ = regular cost of one airline ticket
    $0.20c$ = amount of 20% promotional discount
    $3(c - 0.20c) = 330$
    Sample answer: The cost of three airline tickets that are discounted 20% is $330. What is the regular cost of a ticket?
14. **GEOGRAPHY** About 15% of all federally-owned land in the 48 contiguous states of the United States is in Nevada. If $F$ represents the area of federally-owned land in these states, and $N$ represents the portion in Nevada, write an equation for this situation. $0.15F = N$

**FITNESS For Exercises 15–17, use the following information.**

Deanna and Pietra each go for walks around a lake a few times per week. Last week, Deanna walked 7 miles more than Pietra.

15. If $p$ represents the number of miles Pietra walked, write an equation that represents the total number of miles $T$ the two girls walked. $T = p + (p + 7)$
16. If Pietra walked 9 miles during the week, how many miles did Deanna walk? 16 mi
17. If Pietra walked 11 miles during the week, how many miles did the two girls walk together? 29 mi







Answers

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NAME _____ DATE _____ PERIOD ____

3-1

# Reading to Learn Mathematics

## *Writing Equations*

**Pre-Activity** **How are equations used to describe heights?**

Read the introduction to Lesson 3-1 at the top of page 120 in your textbook.

Does the equation $305 - s = 154$ also represent the situation? Explain.

**Yes; the total height minus the height of the statue itself gives the height of the pedestal.**

### Reading the Lesson

**1.** Translate each sentence into an equation.

**a.**

| Two | times | the sum of $x$ and three | minus | four | equals | four | times | $x$. |
|---|---|---|---|---|---|---|---|---|
| 2 | × | $(x + 3)$ | − | 4 | = | 4 | × | $x$ |

**b.**

| The difference of $k$ and 3 | is | two | times | $k$ | divided by | five. |
|---|---|---|---|---|---|---|
| $k - 3$ | = | 2 | × | $k$ | ÷ | 5 |

**2.** A 1 oz serving of chips has 140 calories. There are about 14 servings of chips in a bag. How many calories are there in a bag of chips? Write what your solution would be as you use each step in the Four-Step Problem-Solving Plan.

*Explore* What do you know?

**A 1 oz serving of chips has 140 calories and there are 14 servings of chips in a bag.**

What do you want to know?

**How many calories are in a bag of chips?**

*Plan* Write an equation.

**$140 \cdot 14 = x$**

*Solve* Solve the problem.

**$140 \cdot 14 = 1960$; There are 1960 calories in a bag of chips.**

*Examine* Does your answer make sense?

**See students' work.**

### Helping You Remember

**3.** If you cannot remember all the steps of the Four-Step Problem-Solving Plan, try to remember the first letters of the first word in each step. Write those letters here with their associated words.

**EPSE; Explore, Plan, Solve, Examine**

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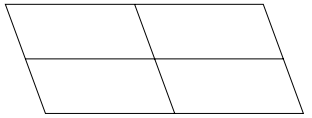
NAME _____ DATE _____ PERIOD ____

3-1

# Enrichment

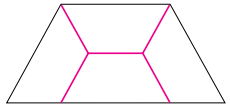
## *Rep-Tiles*

A rep-tile is a figure that can be subdivided into smaller copies of itself. The large figure is similar to the small ones and the small figures are all congruent.

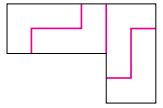


**Show that each figure is a rep-tile by subdividing it into four smaller and similar figures.**

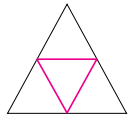
**1.**



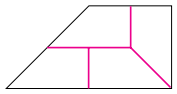
**2.**



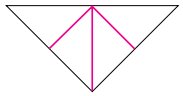
**3.**



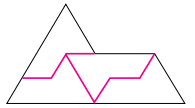
**4.**



**5.**

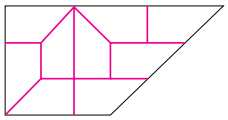


**6.**

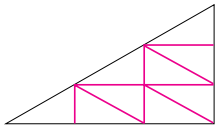


**Subdivide each rep-tile into nine smaller and similar figures.**

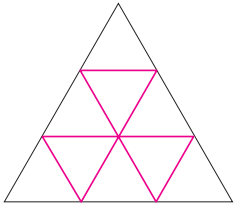
**7.**



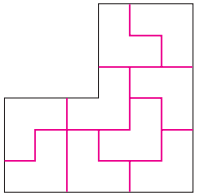
**8.**



**9.**



**10.**



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NAME _____ DATE _____ PERIOD ____

3-2

# Study Guide and Intervention

## Solving Equations by Using Addition and Subtraction

**Solve Using Addition** If the same number is added to each side of an equation, the resulting equation is equivalent to the original one. In general if the original equation involves subtraction, this property will help you solve the equation.

| Addition Property of Equality | For any numbers $a$, $b$, and $c$, if $a = b$, then $a + c = b + c$. |
|---|---|

**Example 1** **Solve $m - 32 = 18$.**

| | |
|---|---|
| $m - 32 = 18$ | Original equation |
| $m - 32 + 32 = 18 + 32$ | Add 32 to each side. |
| $m = 50$ | Simplify. |

The solution is 50.

**Example 2** **Solve $-18 = p - 12$.**

| | |
|---|---|
| $-18 = p - 12$ | Original equation |
| $-18 + 12 = p - 12 + 12$ | Add 12 to each side. |
| $p = -6$ | Simplify. |

The solution is $-6$.

**Exercises**

**Solve each equation. Then check your solution.**

1. $h - 3 = -2$ **1**
2. $m - 8 = -12$ **−4**
3. $p - 5 = 15$ **20**
4. $20 = y - 8$ **28**
5. $k - 0.5 = 2.3$ **2.8**
6. $w - \frac{1}{2} = \frac{5}{8}$ **$1\frac{1}{8}$**
7. $h - 18 = -17$ **1**
8. $-12 = -24 + k$ **12**
9. $j - 0.2 = 1.8$ **2**
10. $b - 40 = -40$ **0**
11. $m - (-12) = 10$ **−2**
12. $w - \frac{3}{2} = \frac{1}{4}$ **$\frac{7}{4}$**

**Write an equation for each problem. Then solve the equation and check the solution.**

13. Twelve subtracted from a number equals 25. Find the number. **$n - 12 = 25$; 37**
14. What number decreased by 52 equals −12? **$n - 52 = -12$; 40**
15. Fifty subtracted from a number equals eighty. Find the number. **$n - 50 = 80$; 130**
16. What number minus one-half is equal to negative one-half? **$n - \frac{1}{2} = -\frac{1}{2}$; 0**
17. The difference of a number and eight is equal to 14. What is the number? **$n - 8 = 14$; 22**
18. A number decreased by fourteen is equal to eighteen. What is the number? **$n - 14 = 18$; 32**





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# Study Guide and Intervention *(continued)*

## Solving Equations by Using Addition and Subtraction

**Solve Using Subtraction** If the same number is subtracted from each side of an equation, the resulting equation is equivalent to the original one. In general if the original equation involves addition, this property will help you solve the equation.

| Subtraction Property of Equality | For any numbers $a$, $b$, and $c$, if $a = b$, then $a - c = b - c$. |
|---|---|

**Example** **Solve $22 + p = -12$.**

| | |
|---|---|
| $22 + p = -12$ | Original equation |
| $22 + p - 22 = -12 - 22$ | Subtract 22 from each side. |
| $p = -34$ | Simplify. |

The solution is $-34$.

**Exercises**

**Solve each equation. Then check your solution.**

1. $x + 12 = 6$ **−6**
2. $z + 2 = -13$ **−15**
3. $-17 = b + 4$ **−21**
4. $s + (-9) = 7$ **16**
5. $-3.2 = \ell + (-0.2)$ **−3**
6. $-\frac{3}{8} + x = \frac{5}{8}$ **1**
7. $19 + h = -4$ **−23**
8. $-12 = k + 24$ **−36**
9. $j + 1.2 = 2.8$ **1.6**
10. $b + 80 = -80$ **−160**
11. $m + (-8) = 2$ **10**
12. $w + \frac{3}{2} = \frac{5}{8}$ **$-\frac{7}{8}$**

**Write an equation for each problem. Then solve the equation and check the solution.**

13. Twelve added to a number equals 18. Find the number. **$n + 12 = 18$; 6**
14. What number increased by 20 equals −10? **$n + 20 = -10$; −30**
15. The sum of a number and fifty equals eighty. Find the number. **$n + 50 = 80$; 30**
16. What number plus one-half is equal to four? **$n + \frac{1}{2} = 4$; $3\frac{1}{2}$**
17. The sum of a number and 3 is equal to −15. What is the number? **$n + 3 = -15$; −18**







Answers

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# Skills Practice

## Solving Equations by Using Addition and Subtraction

**Solve each equation. Then check your solution.**

1. $y - 7 = 8$ **15**
2. $w + 14 = -8$ **−22**
3. $p - 4 = 6$ **10**
4. $-13 = 5 + x$ **−18**
5. $98 = b + 34$ **64**
6. $y - 32 = -1$ **31**
7. $s + (-28) = 0$ **28**
8. $y + (-10) = 6$ **16**
9. $-1 = s + (-19)$ **18**
10. $j - (-17) = 36$ **19**
11. $14 = d + (-10)$ **24**
12. $u + (-5) = -15$ **−10**
13. $11 = -16 + y$ **27**
14. $c - (-3) = 100$ **97**
15. $47 = w - (-8)$ **39**
16. $x - (-74) = -22$ **−96**
17. $4 - (-h) = 68$ **64**
18. $-56 = 20 - (-e)$ **−76**

**Write an equation for each problem. Then solve the equation and check your solution.**

19. A number decreased by 14 is −46. Find the number. ***n* − 14 = −46; −32**
20. Thirteen subtracted from a number is −5. Find the number. ***n* − 13 = −5; 8**
21. The sum of a number and 67 is equal to −34. Find the number. ***n* + 67 = −34; −101**
22. What number minus 28 equals −2? ***n* − 28 = −2; 26**
23. A number plus −73 is equal to 27. What is the number? ***n* + (−73) = 27; 100**
24. A number plus −17 equals −1. Find the number. ***n* + (−17) = −1; 16**
25. What number less 5 is equal to −39? ***n* − 5 = −39; −34**





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3-2

# Practice (Average)

## Solving Equations by Using Addition and Subtraction

**Solve each equation. Then check your solution.**

1. $d - 8 = 17$ **25**
2. $v + 12 = -5$ **−17**
3. $b - 2 = -11$ **−9**
4. $-16 = s + 71$ **−87**
5. $29 = a - 76$ **105**
6. $-14 + y = -2$ **12**
7. $8 - (-c) = 1$ **−7**
8. $78 + r = -15$ **−93**
9. $f + (-3) = -9$ **−6**
10. $4.2 = n + 7.3$ **−3.1**
11. $w + 1.9 = -2.5$ **−4.4**
12. $4.6 - (-b) = -0.4$ **−5**
13. $y - (-1.5) = 0.5$ **−1**
14. $a - 0.13 = -0.58$ **−0.45**
15. $k + (-4.21) = -19$ **−14.79**
16. $r + \frac{1}{5} = \frac{9}{10}$ $\frac{7}{10}$
17. $\frac{5}{9} + q = \frac{2}{3}$ $\frac{1}{9}$
18. $\frac{1}{3} = h + \frac{2}{5}$ $-\frac{1}{15}$
19. $\frac{1}{4} + x = -\frac{7}{12}$ $-\frac{5}{6}$
20. $y + \frac{4}{5} = \frac{3}{4}$ $-\frac{1}{20}$
21. $-\frac{7}{8} - (-n) = -\frac{7}{12}$ $\frac{7}{24}$

**Write an equation for each problem. Then solve the equation and check your solution.**

22. What number minus 9 is equal to −18? ***n* − 9 = −18; −9**
23. A number plus 15 equals −12. What is the number? ***n* + 15 = −12; −27**
24. The sum of a number and −3 is equal to −91. Find the number. ***n* + (−3) = −91; −88**
25. Negative seventeen equals 63 plus a number. What is the number? **−17 = 63 + *n*; −80**
26. The sum of negative 14, a number, and 6 is −5. What is the number? **−14 + *n* + 6 = −5; 3**
27. What number plus one half is equal to three eighths? $n + \frac{1}{2} = \frac{3}{8}$; $-\frac{1}{8}$

**HISTORY For Exercises 28 and 29, use the following information.**

Galileo Galilei was born in 1564. Many years later, in 1642, Sir Isaac Newton was born.

28. Write an addition equation to represent the situation. **1564 + *y* = 1642**
29. How many years after Galileo was born was Isaac Newton born? **78**

**HURRICANES For Exercises 30 and 31, use the following information.**

The day after a hurricane, the barometric pressure in a coastal town has risen to 29.7 inches of mercury, which is 2.9 inches of mercury higher than the pressure when the eye of the hurricane passed over.

30. Write an addition equation to represent the situation. ***b* + 2.9 = 29.7**
31. What was the barometric pressure when the eye passed over? **26.8 in. of mercury**

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3-2

# Reading to Learn Mathematics

## *Solving Equations by Using Addition and Subtraction*

**Pre-Activity** **How can equations be used to compare data?**

Read the introduction to Lesson 3-2 at the top of page 128 in your textbook.

In the equation $m - 66 = 5$, the number 5 represents

**the difference between the percent of growth for medical assistants and the percent of growth for travel agents,**

and the number 66 represents

**the rate of growth for travel agents.**

### Reading the Lesson

1. To solve $x + 17 = 46$ using the Subtraction Property of Equality, you would subtract **17** from each side.

2. To solve $y - 9 = -30$ using the Addition Property of Equality, you would add **9** to each side.

3. Write an equation that you could solve by subtracting 32 from each side.
**Sample answer: $m + 32 = 50$**

4. A student used the Subtraction Property of Equality to solve an equation. Explain why it would also be possible to use the Addition Property of Equality to solve the equation.
**Subtracting one number from another gives the same result as adding the opposite of the number that was subtracted.**

### Helping You Remember

5. Explain how you decide whether to use the Addition Property or the Subtraction Property of Equality to solve an equation.
**Sample answer: If the given equation has a number added to the variable, then use the Subtraction Property of Equality. If the equation has a number subtracted from the variable, then use the Addition Property of Equality.**

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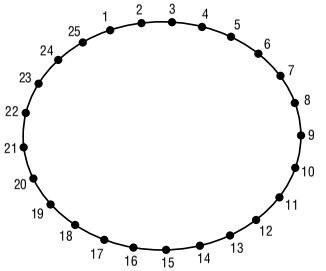
3-2

# Enrichment

## *Counting-Off Puzzles*

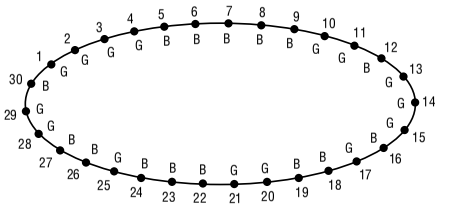
**Solve each puzzle.**

1. Twenty-five people are standing in a circle. Starting with person 1, they count off from 1 to 7 and then start over with 1. Each person who says "7" drops out of the circle. Who is the last person left? **number 15**




2. Forty people stand in a circle. They count off so that every third person drops out. Which two people are the last ones left? **13th and 28th people**

3. Only half of the 30 students in Sharon's class can go on a field trip. Sharon arranges the boys and girls as shown. They count off from 1 to 9 and every ninth person drops out until only 15 people are left. Who gets to go on the field trip. **the girls**




**A group of people stand in a circle and count off 1, 2, 1, 2, 1 and so on. Every second person drops out. Person number 1 is the last person left.**

4. Draw a diagram to show why the number of people in the circle must be even. Then, explain your answer. **If the number is odd, person 1 would drop out after the first round.**

5. When the count returns to person number 1 for the first time, how many people have dropped out? **half of the original number**

6. Find the number of people in the circle if the number is between 10 and 20. Do the same if the number is between 30 and 40. What can you conclude about the original number of people? **16; 32; The number must be a power of 2.**

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Answers

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# 3-3 Study Guide and Intervention

## Solving Equations by Using Multiplication and Division

**Solve Using Multiplication** If each side of an equation is multiplied by the same number, the resulting equation is equivalent to the given one. You can use the property to solve equations involving multiplication and division.

| Multiplication Property of Equality | For any numbers $a$, $b$, and $c$, if $a = b$, then $ac = bc$. |
|---|---|

**Example 1** **Solve $3\frac{1}{2}p = 1\frac{1}{2}$.**

| | |
|---|---|
| $3\frac{1}{2}p = 1\frac{1}{2}$ | Original equation |
| $\frac{7}{2}p = \frac{3}{2}$ | Rewrite each mixed number as an improper fraction. |
| $\frac{2}{7}\left(\frac{7}{2}p\right) = \frac{2}{7}\left(\frac{3}{2}\right)$ | Multiply each side by $\frac{2}{7}$. |
| $p = \frac{3}{7}$ | Simplify. |

The solution is $\frac{3}{7}$.

**Example 2** **Solve $-\frac{1}{4}n = 16$.**

| | |
|---|---|
| $-\frac{1}{4}n = 16$ | Original equation |
| $-4\left(-\frac{1}{4}n\right) = -4(16)$ | Multiply each side by $-4$. |
| $n = -64$ | Simplify. |

The solution is $-64$.

**Exercises**

**Solve each equation. Then check your solution.**

1. $\frac{h}{3} = -2$ **$-6$**
2. $\frac{1}{8}m = 6$ **48**
3. $\frac{1}{5}p = \frac{3}{5}$ **3**
4. $5 = \frac{y}{12}$ **60**
5. $-\frac{1}{4}k = -2.5$ **10**
6. $-\frac{m}{8} = \frac{5}{8}$ **$-5$**
7. $-1\frac{1}{2}h = 4$ **$-\frac{8}{3}$**
8. $-12 = -\frac{3}{2}k$ **8**
9. $\frac{j}{3} = \frac{2}{5}$ **$1\frac{1}{5}$**
10. $-3\frac{1}{3}b = 5$ **$-1\frac{1}{2}$**
11. $\frac{7}{10}m = 10$ **$14\frac{2}{7}$**
12. $\frac{p}{5} = -\frac{1}{4}$ **$-1\frac{1}{4}$**

**Write an equation for each problem. Then solve the equation.**

13. One-fifth of a number equals 25. Find the number. **$\frac{1}{5}n = 25$; 125**
14. What number divided by 2 equals $-18$? **$\frac{n}{2} = -18$; $-36$**
15. A number divided by eight equals 3. Find the number. **$\frac{n}{8} = 3$; 24**
16. One and a half times a number equals 6. Find the number. **$1\frac{1}{2}n = 6$; 4**





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

## Solving Equations by Using Multiplication and Division

**Solve Using Division** To solve equations with multiplication and division, you can also use the Division Property of Equality. If each side of an equation is divided by the same number, the resulting equation is true.

| Division Property of Equality | For any numbers $a$, $b$, and $c$, with $c \neq 0$, if $a = b$, then $\frac{a}{c} = \frac{b}{c}$. |
|---|---|

**Example 1** **Solve $8n = 64$.**

| | |
|---|---|
| $8n = 64$ | Original equation |
| $\frac{8n}{8} = \frac{64}{8}$ | Divide each side by 8. |
| $n = 8$ | Simplify. |

The solution is 8.

**Example 2** **Solve $-5n = 60$.**

| | |
|---|---|
| $-5n = 60$ | Original equation |
| $\frac{-5n}{-5} = \frac{60}{-5}$ | Divide each side by $-5$. |
| $n = -12$ | Simplify. |

The solution is $-12$.

**Exercises**

**Solve each equation. Then check your solution.**

1. $3h = -42$ **$-14$**
2. $8m = 16$ **2**
3. $-3t = 51$ **$-17$**
4. $-3r = -24$ **8**
5. $8k = -64$ **$-8$**
6. $-2m = 16$ **$-8$**
7. $12h = 4$ **$\frac{1}{3}$**
8. $-2.4p = 7.2$ **$-3$**
9. $0.5j = 5$ **10**
10. $-25 = 5m$ **$-5$**
11. $6m = 15$ **$2\frac{1}{2}$**
12. $-1.5p = -75$ **50**

**Write an equation for each problem. Then solve the equation.**

13. Four times a number equals 64. Find the number. **$4n = 64$; 16**
14. What number multiplied by $-4$ equals $-16$? **$-4n = -16$; 4**
15. A number times eight equals $-36$. Find the number. **$8n = -36$; $-4\frac{1}{2}$**

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3-3

# Skills Practice

## Solving Equations by Using Multiplication and Division

**Solve each equation. Then check your solution.**

1. $12z = 108$ **9**
2. $-7t = 49$ **−7**
3. $18e = -216$ **−12**
4. $-22 = 11v$ **−2**
5. $-6d = -42$ **7**
6. $96 = -24a$ **−4**
7. $\frac{c}{4} = 16$ **64**
8. $\frac{a}{16} = 9$ **144**
9. $-84 = \frac{d}{3}$ **−252**
10. $-\frac{d}{7} = -13$ **91**
11. $\frac{t}{4} = -13$ **−52**
12. $31 = -\frac{1}{6}n$ **−186**
13. $-6 = \frac{2}{3}z$ **−9**
14. $\frac{2}{7}q = -4$ **−14**
15. $\frac{5}{9}p = -10$ **−18**
16. $\frac{a}{10} = \frac{2}{5}$ **4**
17. $-0.4b = 5.2$ **−13**
18. $1.6m = -4$ **−2.5**

**Write an equation for each problem. Then solve the equation.**

19. The opposite of a number is −9. What is the number? **$-n = -9$; 9**
20. Fourteen times a number is −42. Find the number. **$14n = -42$; −3**
21. Eight times a number equals 128. What is the number? **$8n = 128$; 16**
22. Negative twelve times a number equals −132. Find the number. **$-12n = -132$; 11**
23. Negative eighteen times a number is −54. What is the number? **$-18n = -54$; 3**
24. One sixth of a number is −17. Find the number. **$\frac{1}{6}n = -17$; −102**
25. Negative three fifths of a number is −15. What is the number? **$-\frac{3}{5}n = -15$; 25**





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3-3

# Practice (Average)

## Solving Equations by Using Multiplication and Division

**Solve each equation. Then check your solution.**

1. $8j = 96$ **12**
2. $-13z = -39$ **3**
3. $-180 = 15m$ **−12**
4. $243 = 27c$ **9**
5. $\frac{y}{9} = -8$ **−72**
6. $-\frac{j}{12} = -8$ **96**
7. $\frac{a}{15} = \frac{4}{5}$ **12**
8. $\frac{g}{27} = \frac{2}{9}$ **6**
9. $\frac{q}{24} = \frac{1}{6}$ **4**
10. $-1 = -\frac{4}{7}t$ **$\frac{7}{4}$**
11. $-\frac{3}{8}w = -9$ **24**
12. $-\frac{3}{15}s = 4$ **−20**
13. $-3x = \frac{3}{2}$ **$-\frac{1}{2}$**
14. $\frac{8}{5}a = \frac{4}{3}$ **$\frac{5}{6}$**
15. $\frac{5}{3}h = \frac{11}{6}$ **$\frac{11}{10}$**
16. $5n = \frac{11}{4}$ **$\frac{11}{20}$**
17. $2.5k = 20$ **8**
18. $-3.4e = -3.74$ **1.1**
19. $-1.7b = 2.21$ **−1.3**
20. $0.26p = 0.104$ **0.4**
21. $4.2q = -3.36$ **−0.8**

**Write an equation for each problem. Then solve the equation.**

22. Negative nine times a number equals −117. Find the number. **$-9n = -117$; 13**
23. Negative one eighth of a number is $-\frac{3}{4}$. What is the number? **$-\frac{1}{8}n = -\frac{3}{4}$; 6**
24. Five sixths of a number is $-\frac{5}{9}$. Find the number. **$\frac{5}{6}n = -\frac{5}{9}$; $-\frac{2}{3}$**
25. 2.7 times a number equals 8.37. What is the number? **$2.7n = 8.37$; 3.1**
26. One and one fourth times a number is one and one third. What is the number? **$1\frac{1}{4}n = 1\frac{1}{3}$; $1\frac{1}{15}$**
27. **PUBLISHING** Two units of measure used in publishing are the *pica* and the *point*. A pica is one sixth of an inch. There are 12 points in a pica, so Points = 12 · Picas. How many picas are equivalent to 108 points? **9 picas**

**ROLLER COASTERS For Exercises 28 and 29, use the following information.**

*Superman the Escape* in California is the fastest roller coaster in the world. Riders fall 415 feet in 7 seconds. Speeds reach a maximum of 100 miles per hour.

28. If $x$ represents the average rate of fall of the roller coaster, write an expression to represent the situation (*Hint:* Use the distance formula $d = rt$.) **$7x = 415$**
29. What is the average rate that riders fall in feet per second? **about 59.3 ft/s**







Answers

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3-3

# Reading to Learn Mathematics

## *Solving Equations by Using Multiplication and Division*

**Pre-Activity** **How can equations be used to find how long it takes light to reach Earth?**

Read the introduction to Lesson 3-3 at the top of page 135 in your textbook.

- In the equation $d = rt$, shown in the introduction, what number is used for $r$? for $d$?

  5,870,000,000,000; 311,110,000,000,000

- What equation could you use to find the time it takes light to reach Earth from the farthest star in the Big Dipper?

  $5{,}870{,}000{,}000{,}000t = 821{,}800{,}000{,}000{,}000$

### Reading the Lesson

**Complete the sentence after each equation to tell how you would solve the equation.**

1. $\frac{x}{7} = 16$ ___Multiply___ each side by ___7___.

2. $5x = 125$ ___Divide___ each side by ___5___, or multiply each side by ___$\frac{1}{5}$___.

3. $-8k = 96$ Divide each side by ___$-8$___, or multiply each side by ___$-\frac{1}{8}$___.

4. Explain how rewriting $4\frac{1}{3}x = 2\frac{1}{8}$ as $\frac{13}{3}x = \frac{17}{8}$ helps you solve the equation.

   It makes it easier for you to see what number you need to multiply by on each side.

### Helping You Remember

5. One way to remember something is to explain it to someone else. Write how you would explain to a classmate how to solve the equation $\frac{2}{3}x = 12$.

   Sample answer: Multiply each side of the equation by the reciprocal of $\frac{2}{3}$ so you can isolate $x$ on the left side.



Lesson 3-3

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3-3

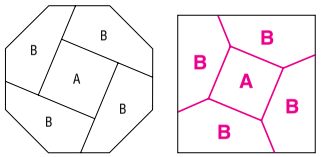
# Enrichment

## *Dissection Puzzles: Make the Square*

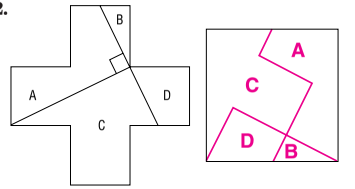
In a dissection puzzle, you are to cut apart one figure using only straight cuts and then rearrange the pieces to make a new figure. Usually the puzzle-solver must figure out where to make the given number of cuts. However, for these puzzles, the cut lines are shown. You must discover how to rearrange the pieces.

**Cut apart each figure. Then rearrange the pieces to form a square.**

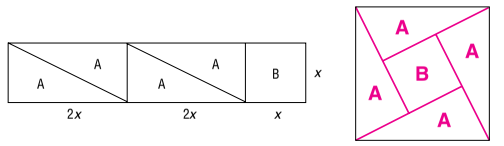
1.



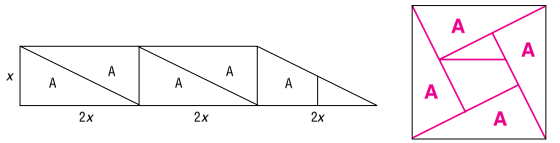

2.




3.




4. *Hint:* Cut one of the triangles into two pieces to make this square.



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3-4

# Study Guide and Intervention

## *Solving Multi-Step Equations*

**Work Backward** **Working backward** is one of many problem-solving strategies that you can use to solve problems. To work backward, start with the result given at the end of a problem and undo each step to arrive at the beginning number.

*Example 1* **A number is divided by 2, and then 8 is subtracted from the quotient. The result is 16. What is the number?**

Solve the problem by working backward.

The final number is 16. Undo subtracting 8 by adding 8 to get 24. To undo dividing 24 by 2, multiply 24 by 2 to get 48.

The original number is 48.

*Example 2* **A bacteria culture doubles each half hour. After 3 hours, there are 6400 bacteria. How many bacteria were there to begin with?**

Solve the problem by working backward.

The bacteria have grown for 3 hours. Since there are 2 one-half hour periods in one hour, in 3 hours there are 6 one-half hour periods. Since the bacteria culture has grown for 6 time periods, it has doubled 6 times. Undo the doubling by halving the number of bacteria 6 times.

$$6{,}400 \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = 6{,}400 \times \frac{1}{64}$$
$$= 100$$

There were 100 bacteria to begin with.

*Exercises*

**Solve each problem by working backward.**

1. A number is divided by 3, and then 4 is added to the quotient. The result is 8. Find the number. **12**

2. A number is multiplied by 5, and then 3 is subtracted from the product. The result is 12. Find the number. **3**

3. Eight is subtracted from a number, and then the difference is multiplied by 2. The result is 24. Find the number. **20**

4. Three times a number plus 3 is 24. Find the number. **7**

5. **CAR RENTAL** Angela rented a car for $29.99 a day plus a one-time insurance cost of $5.00. Her bill was $124.96. For how many days did she rent the car? **4 days**

6. **MONEY** Mike withdrew an amount of money from his bank account. He spent one fourth for gasoline and had $90 left. How much money did he withdraw? **$120**

7. **TELEVISIONS** In 1999, 68% of households with TV's subscribed to cable TV. If 8,000 more subscribers are added to the number of households with cable, the total number of households with cable TV would be 67,600,000. How many households were there with TV in 1999? **Source:** *World Almanac* **99,400,000 households**





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3-4

# Study Guide and Intervention *(continued)*

## *Solving Multi-Step Equations*

**Solve Multi-Step Equations** To solve equations with more than one operation, often called **multi-step equations**, undo operations by working backward. Reverse the usual order of operations as you work.

*Example* **Solve $5x + 3 = 23$.**

| | |
|---|---|
| $5x + 3 = 23$ | Original equation. |
| $5x + 3 - 3 = 23 - 3$ | Subtract 3 from each side. |
| $5x = 20$ | Simplify. |
| $\frac{5x}{5} = \frac{20}{5}$ | Divide each side by 5. |
| $x = 4$ | Simplify. |

*Exercises*

**Solve each equation. Then check your solution.**

1. $5x + 2 = 27$ **5**
2. $6x + 9 = 27$ **3**
3. $5x + 16 = 51$ **7**
4. $14n - 8 = 34$ **3**
5. $0.6x - 1.5 = 1.8$ **5.5**
6. $\frac{7}{8}p - 4 = 10$ **16**
7. $16 = \frac{d - 12}{14}$ **236**
8. $8 + \frac{3n}{12} = 13$ **20**
9. $\frac{g}{-5} + 3 = -13$ **80**
10. $\frac{4b + 8}{-2} = 10$ **−7**
11. $0.2x - 8 = -2$ **30**
12. $3.2y - 1.8 = 3$ **1.5**
13. $-4 = \frac{7x - (-1)}{-8}$ **$4\frac{3}{7}$**
14. $8 = -12 + \frac{k}{-4}$ **−80**
15. $0 = 10y - 40$ **4**

**Write an equation and solve each problem.**

16. Find three consecutive integers whose sum is 96.
**$n + (n + 1) + (n + 2) = 96$; 31, 32, 33**

17. Find two consecutive odd integers whose sum is 176.
**$n + (n + 2) = 176$; 87, 89**

18. Find three consecutive integers whose sum is −93.
**$n + (n + 1) + (n + 2) = -93$; −32, −31, −30**







Answers

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3-4

# Skills Practice

## *Solving Multi-Step Equations*

**Solve each problem by working backward.**

1. A number is divided by 2, and then the quotient is added to 8. The result is 33. Find the number. **50**

2. Two is subtracted from a number, and then the difference is divided by 3. The result is 30. Find the number. **92**

3. A number is multiplied by 2, and then the product is added to 9. The result is 49. What is the number? **20**

4. **ALLOWANCE** After Ricardo received his allowance for the week, he went to the mall with some friends. He spent half of his allowance on a new paperback book. Then he bought himself a snack for $1.25. When he arrived home, he had $5.00 left. How much was his allowance? **$12.50**

**Solve each equation. Then check your solution.**

5. $5x + 3 = 23$ **4**
6. $4 = 3a - 14$ **6**
7. $2y + 5 = 19$ **7**
8. $6 + 5c = -29$ **−7**
9. $8 - 5w = -37$ **9**
10. $18 - 4v = 42$ **−6**
11. $\frac{n}{3} - 8 = -2$ **18**
12. $5 + \frac{x}{4} = 1$ **−16**
13. $-\frac{h}{3} - 4 = 13$ **−51**
14. $-\frac{d}{6} + 12 = -7$ **114**
15. $\frac{a}{5} - 2 = 9$ **55**
16. $\frac{w}{7} + 3 = -1$ **−28**
17. $\frac{3}{4}q - 7 = 8$ **20**
18. $\frac{2}{3}g + 6 = -12$ **−27**
19. $\frac{5}{2}z - 8 = -3$ **2**
20. $\frac{4}{5}m + 2 = 6$ **5**
21. $\frac{c - 5}{4} = 3$ **17**
22. $\frac{b + 1}{3} = 2$ **5**

**Write an equation and solve each problem.**

23. Twice a number plus four equals 6. What is the number? **$2n + 4 = 6$; 1**

24. Sixteen is seven plus three times a number. Find the number. **$16 = 7 + 3n$; 3**

25. Find two consecutive integers whose sum is 35. **$n + (n + 1) = 35$; 17, 18**

26. Find three consecutive integers whose sum is 36. **$n + (n + 1) + (n + 2) = 36$; 11, 12, 13**



Lesson 3-4

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3-4

# Practice (Average)

## *Solving Multi-Step Equations*

**Solve each problem by working backward.**

1. Three is added to a number, and then the sum is multiplied by 4. The result is 16. Find the number. **1**

2. A number is divided by 4, and the quotient is added to 3. The result is 24. What is the number? **84**

3. Two is subtracted from a number, and then the difference is multiplied by 5. The result is 30. Find the number. **8**

4. **BIRD WATCHING** While Michelle sat observing birds at a bird feeder, one fourth of the birds flew away when they were startled by a noise. Two birds left the feeder to go to another stationed a few feet away. Three more birds flew into the branches of a nearby tree. Four birds remained at the feeder. How many birds were at the feeder initially? **12**

**Solve each equation. Then check your solution.**

5. $-12n - 19 = 77$ **−8**
6. $17 + 3f = 14$ **−1**
7. $15t + 4 = 49$ **3**
8. $\frac{u}{5} + 6 = 2$ **−20**
9. $\frac{d}{-4} + 3 = 15$ **−48**
10. $\frac{b}{3} - 6 = -2$ **12**
11. $\frac{1}{2}y - \frac{1}{8} = \frac{7}{8}$ **2**
12. $-32 - \frac{3}{5}f = -17$ **−25**
13. $8 - \frac{3}{8}k = -4$ **32**
14. $\frac{r + 13}{12} = 1$ **−1**
15. $\frac{15 - a}{3} = -9$ **42**
16. $\frac{3k - 7}{5} = 16$ **29**
17. $\frac{x}{7} - 0.5 = 2.5$ **21**
18. $2.5g + 0.45 = 0.95$ **0.2**
19. $0.4m - 0.7 = 0.22$ **2.3**

**Write an equation and solve each problem.**

20. Seven less than four times a number equals 13. What is the number? **$4n - 7 = 13$; 5**

21. Find two consecutive odd integers whose sum is 116. **$n + (n + 2) = 116$; 57, 59**

22. Find two consecutive even integers whose sum is 126. **$n + (n + 2) = 126$; 62, 64**

23. Find three consecutive odd integers whose sum is 117. **$n + (n + 2) + (n + 4) = 117$; 37, 39, 41**

24. **COIN COLLECTING** Jung has a total of 92 coins in his coin collection. This is 8 more than three times the number of quarters in the collection. How many quarters does Jung have in his collection? **28**

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3-4

# Reading to Learn Mathematics

## *Solving Multi-Step Equations*

**Pre-Activity** **How can equations be used to estimate the age of an animal?**

Read the introduction to Lesson 3-4 at the top of page 142 in your textbook.

- Write the equation $8 + 12a = 124$ in words.
  **Eight plus twelve times *a* equals one hundred twenty-four.**
- How many operations are involved in the equation? **two**

### Reading the Lesson

**1.** What does the phrase *undo the operations* mean to you? Give an example.
**Using the opposite operations in the opposite order undoes the operations; subtraction undoes addition.**

**2. a.** If we undo operations in reverse of the order of operations, what operations do we do first? **addition or subtraction**

**b.** What operations do we do last? **multiplication or division**

**3.** Suppose you want to solve $\frac{x+3}{5} = 6$.

**a.** What is the grouping symbol in the equation $\frac{x+3}{5} = 6$? **the fraction bar**

**b.** What is the first step in solving the equation? **Multiply each side by 5.**

**c.** What is the next step in solving the equation? **Subtract 3 from each side.**

**4.** Write an equation for the problem below.

| Seven | times | *k* | minus | five | equals | negative forty-seven |
|---|---|---|---|---|---|---|
| 7 | • | *k* | − | 5 | = | −47 |

### Helping You Remember

**5.** Explain why working backward is a useful strategy for solving equations.
**Sample answer: You can undo the operations to get back to the value of the variable that will make the equation true. That value is the solution.**





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3-4

# Enrichment

## *Consecutive Integer Problems*

Many types of problems and puzzles involve the idea of consecutive integers. Knowing how to represent these integers algebraically can help to solve the problem.

*Example* **Find four consecutive odd integers whose sum is −80.**

An odd integer can be written as $2n + 1$, where $n$ is any integer.

If 2n + 1 is the first odd integer, then add 2 to get the next largest odd integer, and so on.

Now write an equation to solve this problem.

$(2n + 1) + (2n + 3) + (2n + 5) + (2n + 7) = -80$

*Exercises*

**Write an equation for each problem. Then solve.**

**1.** Complete the solution to the problem in the example.
**−23, −21, −19, −17**

**2.** Find three consecutive even integers whose sum is 132.
**$2n + (2n + 2) + (2n + 4) = 132$; $n = 21$; 42, 44, 46**

**3.** Find two consecutive integers whose sum is 19.
**$n + (n + 1) = 19$; 9, 10**

**4.** Find two consecutive integers whose sum is 100.
**$n + (n + 1) = 100$; no solution**

**5.** The lesser of two consecutive even integers is 10 more than one-half the greater. Find the integers.
**$2n = 10 + \frac{1}{2}(2n + 2)$; 22 and 24**

**6.** The greater of two consecutive even integers is 6 less than three times the lesser. Find the integers.
**$2n + 2 = 3(2n) - 6$; 4, 6**

**7.** Find four consecutive integers such that twice the sum of the two greater integers exceeds three times the first by 91.
**$2[(n + 2) + (n + 3)] = 3n + 91$; 81, 82, 83, 84**

**8.** Find a set of four consecutive positive integers such that the greatest integer in the set is twice the least integer in the set.
**$n + 3 = 2n$; {3, 4, 5, 6}**







**Answers**

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3-5

# Study Guide and Intervention

## *Solving Equations with the Variable on Each Side*

**Variables on Each Side** To solve an equation with the same variable on each side, first use the Addition or the Subtraction Property of Equality to write an equivalent equation that has the variable on just one side of the equation. Then solve the equation.

**Example 1** **Solve $5y - 8 = 3y + 12$.**

$$\begin{aligned} 5y - 8 &= 3y + 12 \\ 5y - 8 - 3y &= 3y + 12 - 3y \\ 2y - 8 &= 12 \\ 2y - 8 + 8 &= 12 + 8 \\ 2y &= 20 \\ \frac{2y}{2} &= \frac{20}{2} \\ y &= 10 \end{aligned}$$

The solution is 10.

**Example 2** **Solve $-11 - 3y = 8y + 1$.**

$$\begin{aligned} -11 - 3y &= 8y + 1 \\ -11 - 3y + 3y &= 8y + 1 + 3y \\ -11 &= 11y + 1 \\ -11 - 1 &= 11y + 1 - 1 \\ -12 &= 11y \\ \frac{-12}{11} &= \frac{11y}{11} \\ -1\frac{1}{11} &= y \end{aligned}$$

The solution is $-1\frac{1}{11}$.

**Exercises**

**Solve each equation. Then check your solution.**

1. $6 - b = 5b + 30$ — **−4**
2. $5y - 2y = 3y + 2$ — **no solution**
3. $5x + 2 = 2x - 10$ — **−4**
4. $4n - 8 = 3n + 2$ — **10**
5. $1.2x + 4.3 = 2.1 - x$ — **−1**
6. $4.4s + 6.2 = 8.8s - 1.8$ — **$\frac{20}{11}$**
7. $\frac{1}{2}b + 4 = \frac{1}{8}b + 88$ — **224**
8. $\frac{3}{4}k - 5 = \frac{1}{4}k - 1$ — **8**
9. $8 - 5p = 4p - 1$ — **1**
10. $4b - 8 = 10 - 2b$ — **3**
11. $0.2x - 8 = -2 - x$ — **5**
12. $3y - 1.8 = 3y - 1.8$ — **all numbers**
13. $-4 - 3x = 7x - 6$ — **$\frac{1}{5}$**
14. $8 + 4k = -10 + k$ — **−6**
15. $20 - a = 10a - 2$ — **2**
16. $\frac{2}{3}n + 8 = \frac{1}{2}n + 2$ — **−36**
17. $\frac{2}{5}y - 8 = 9 - \frac{3}{5}y$ — **17**
18. $-4r + 5 = 5 - 4r$ — **all numbers**
19. $-4 - 3x = 6x - 6$ — **$\frac{2}{9}$**
20. $18 - 4k = -10 - 4k$ — **no solution**
21. $12 + 2y = 10y - 12$ — **3**





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3-5

# Study Guide and Intervention *(continued)*

## *Solving Equations with the Variable on Each Side*

**Grouping Symbols** When solving equations that contain grouping symbols, first use the Distributive Property to eliminate grouping symbols. Then solve.

**Example** **Solve $4(2a - 1) = -10(a - 5)$.**

| | |
|---|---|
| $4(2a - 1) = -10(a - 5)$ | Original equation |
| $8a - 4 = -10a + 50$ | Distributive Property |
| $8a - 4 + 10a = -10a + 50 + 10a$ | Add $10a$ to each side. |
| $18a - 4 = 50$ | Simplify. |
| $18a - 4 + 4 = 50 + 4$ | Add 4 to each side. |
| $18a = 54$ | Simplify. |
| $\frac{18a}{18} = \frac{54}{18}$ | Divide each side by 18. |
| $a = 3$ | Simplify. |

The solution is 3.

**Exercises**

**Solve each equation. Then check your solution.**

1. $-3(x + 5) = 3(x - 1)$ — **−2**
2. $2(7 + 3t) = -t$ — **−2**
3. $3(a + 1) - 5 = 3a - 2$ — **all numbers**
4. $75 - 9g = 5(-4 + 2g)$ — **5**
5. $5(f + 2) = 2(3 - f)$ — **$-\frac{4}{7}$**
6. $4(p + 3) = 36$ — **6**
7. $18 = 3(2c + 2)$ — **2**
8. $3(d - 8) = 3d$ — **no solution**
9. $5(p + 3) + 9 = 3(p - 2) + 6$ — **−12**
10. $4(b - 2) = 2(5 - b)$ — **3**
11. $1.2(x - 2) = 2 - x$ — **2**
12. $\frac{3 + y}{4} = \frac{-y}{8}$ — **−2**
13. $\frac{a - 8}{12} = \frac{2a + 5}{3}$ — **−4**
14. $2(4 + 2k) + 10 = k$ — **−6**
15. $2(w - 1) + 4 = 4(w + 1)$ — **−1**
16. $6(n - 1) = 2(2n + 4)$ — **7**
17. $2[2 + 3(y - 1)] = 22$ — **4**
18. $-4(r + 2) = 4(2 - 4r)$ — **$1\frac{1}{3}$**
19. $-3(x - 8) = 24$ — **0**
20. $4(4 - 4k) = -10 - 16k$ — **no solution**
21. $6(2 - 2y) = 5(2y - 2)$ — **1**

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3-5

# Skills Practice

## *Solving Equations with the Variable on Each Side*

**Justify each step.**

**1.** $4k - 3 = 2k + 5$

| | |
|---|---|
| $4k - 3 - 2k = 2k + 5 - 2k$ | a. Subtract $2k$ from each side. |
| $2k - 3 = 5$ | b. Simplify. |
| $2k - 3 + 3 = 5 + 3$ | c. Add 3 to each side. |
| $2k = 8$ | d. Simplify. |
| $\frac{2k}{2} = \frac{8}{2}$ | e. Divide each side by 2. |
| $k = 4$ | f. Simplify. |

**2.** $2(8u + 2) = 3(2u - 7)$

| | |
|---|---|
| $16u + 4 = 6u - 21$ | a. Distributive Property |
| $16u + 4 - 6u = 6u - 21 - 6u$ | b. Subtract $6u$ from each side. |
| $10u + 4 = -21$ | c. Simplify. |
| $10u + 4 - 4 = -21 - 4$ | d. Subtract 4 from each side. |
| $10u = -25$ | e. Simplify. |
| $\frac{10u}{10} = \frac{-25}{10}$ | f. Divide each side by 10. |
| $u = -2.5$ | g. Simplify. |

**Solve each equation. Then check your solution.**

**3.** $2m + 12 = 3m - 31$ 43

**4.** $2h - 8 = h + 17$ 25

**5.** $7a - 3 = 3 - 2a$ $\frac{2}{3}$

**6.** $4n - 12 = 12 - 4n$ 3

**7.** $4x - 9 = 7x + 12$ $-7$

**8.** $-6y - 3 = 3 - 6y$ no solution

**9.** $5 + 3r = 5r - 19$ 12

**10.** $-9 + 8k = 7 + 4k$ 4

**11.** $8q + 12 = 4(3 + 2q)$ all numbers

**12.** $3(5j + 2) = 2(3j - 6)$ $-2$

**13.** $6(-3v + 1) = 5(-2v - 2)$ 2

**14.** $-7(2b - 4) = 5(-2b + 6)$ $-0.5$ or $-\frac{1}{2}$

**15.** $3(8 - 3t) = 5(2 + t)$ 1

**16.** $2(3u + 7) = -4(3 - 2u)$ 13

**17.** $8(2f - 2) = 7(3f + 2)$ $-6$

**18.** $5(-6 - 3d) = 3(8 + 7d)$ $-1.5$ or $-1\frac{1}{2}$

**19.** $6(w - 1) = 3(3w + 5)$ $-7$

**20.** $7(-3y + 2) = 8(3y - 2)$ $\frac{2}{3}$

**21.** $\frac{2}{3}v - 6 = 6 - \frac{2}{3}v$ 9

**22.** $\frac{1}{2} - \frac{5}{8}x = \frac{7}{8}x + \frac{7}{2}$ $-2$





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3-5

# Practice (Average)

## *Solving Equations with the Variable on Each Side*

**Solve each equation. Then check your solution.**

**1.** $5x - 3 = 13 - 3x$ 2

**2.** $-4c - 11 = 4c + 21$ $-4$

**3.** $1 - s = 6 - 6s$ 1

**4.** $14 + 5n = -4n + 17$ $\frac{1}{3}$

**5.** $\frac{1}{2}k - 3 = 2 - \frac{3}{4}k$ 4

**6.** $\frac{1}{2}(6 - z) = z$ 2

**7.** $3(-2 - 3x) = -9x - 4$ no solution

**8.** $4(4 - w) = 3(2w + 2)$ 1

**9.** $9(4b - 1) = 2(9b + 3)$ $\frac{5}{6}$

**10.** $3(6 + 5y) = 2(-5 + 4y)$ $-4$

**11.** $-5x - 10 = 2 - (x + 4)$ $-2$

**12.** $6 + 2(3j - 2) = 4(1 + j)$ 1

**13.** $\frac{5}{2}t - t = 3 + \frac{3}{2}t$ no solution

**14.** $1.4f + 1.1 = 8.3 - f$ 3

**15.** $\frac{2}{3}x - \frac{1}{6} = \frac{1}{2}x + \frac{5}{6}$ 6

**16.** $2 - \frac{3}{4}z = \frac{1}{8}z + 9$ $-8$

**17.** $\frac{1}{2}(3g - 2) = \frac{g}{6}$ $\frac{3}{4}$

**18.** $\frac{1}{3}(c + 1) = \frac{1}{6}(3c - 5)$ 7

**19.** $\frac{1}{4}(5 - 2h) = \frac{h}{2}$ $1\frac{1}{4}$

**20.** $\frac{1}{9}(2m - 16) = \frac{1}{3}(2m + 4)$ $-7$

**21.** $3(d - 8) - 5 = 9(d + 2) + 1$ $-8$

**22.** $2(a - 8) + 7 = 5(a + 2) - 3a - 19$ all numbers

**23.** Two thirds of a number reduced by 11 is equal to 4 more than the number. Find the number. $-45$

**24.** Five times the sum of a number and 3 is the same as 3 multiplied by 1 less than twice the number. What is the number? 18

**25. NUMBER THEORY** Tripling the greater of two consecutive even integers gives the same result as subtracting 10 from the lesser even integer. What are the integers? $-8, -6$

**26. GEOMETRY** The formula for the perimeter of a rectangle is $P = 2\ell + 2w$, where $\ell$ is the length and $w$ is the width. A rectangle has a perimeter of 24 inches. Find its dimensions if its length is 3 inches greater than its width. 4.5 in. by 7.5 in.







Answers

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3-5

# Reading to Learn Mathematics

## *Solving Equations with the Variable on Each Side*

**Pre-Activity** **How can an equation be used to determine when two populations are equal?**

Read the introduction to Lesson 3-5 at the top of page 149 in your textbook.

In the equation $12 + 7.6x = 6 + 8x$, what do $7.6x$ and $8x$ represent?

**$7.6x$ represents the increase (in millions) in the number of male Internet users, and $8x$ represents the increase (in millions) in the number of female Internet users.**

### Reading the Lesson

**1.** Suppose you want to help a friend solve $6k + 7 = 3k - 8$. What would you advise her to do first? Why?

**Subtract $3k$ from each side; after she does that and simplifies, all of the variables will be on the left side.**

**2.** When solving $2(3x - 4) = 3(x + 5)$, why is it helpful first to use the Distributive Property to remove the grouping symbols?

**Once you have removed the grouping symbols, you can tell what you need to add or subtract to each side to get all of the variables on one side.**

**3.** On a quiz, Jason solved three equations. His teacher said all the work was correct, but she asked him to write short sentences to tell what the solutions were. In what follows, you see the *last* equation in his work for each equation. Write sentences to describe the solutions.

**a.** $x = -4$ **The solution is $-4$.**

**b.** $6m = 6m$ **All numbers are solutions.**

**c.** $12 = 37$ **There are no solutions.**

**4.** In Question 3, one of the equations Jason solved was an identity. Which equation was it? Explain how you know.

**The one for which the last step was $6m = 6m$; the expressions on the left and right sides are the same.**

### Helping You Remember

**5.** An equation with variables is an identity when the equation is always true. In other words, the expressions on the left and right sides always have the same value. Look up the word *identity* in the dictionary. Write all the definitions that are similar to the mathematical definition. **See students' work.**





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3-5

# Enrichment

## *Identities*

An equation that is true for every value of the variable is called an **identity**. When you try to solve an identity, you end up with a statement that is always true. Here is an example.

**Example** **Solve $8 - (5 - 6x) = 3(1 + 2x)$.**

$$\begin{aligned} 8 - (5 - 6x) &= 3(1 + 2x) \\ 8 - 5 - (-6x) &= 3(1 + 2x) \\ 8 - 5 + 6x &= 3 + 6x \\ 3 + 6x &= 3 + 6x \end{aligned}$$

**Exercises**

**State whether each equation is an identity. If it is not, find its solution.**

**1.** $2(2 - 3x) = 3(3 + x) + 4$
**$x = -1$**

**2.** $5(m + 1) + 6 = 3(4 + m) + (2m - 1)$
**identity**

**3.** $(5t + 9) - (3t - 13) = 2(11 + t)$
**identity**

**4.** $14 - (6 - 3c) = 4c - c$
**no solution**

**5.** $3y - 2(y + 19) = 9y - 3(9 - y)$
**$y = -1$**

**6.** $3(3h - 1) = 4(h + 3)$
**$h = 3$**

**7.** Use the true equation $3x - 2 = 3x - 2$ to create an identity of your own.
**Sample answer: $6x - 4 = 2(3x - 2)$**

**8.** Use the false equation $1 = 2$ to create an equation with no solution.
**Sample answer: $2x + 1 = 2x + 2$**

**9.** Create an equation whose solution is $x = 3$.
**Sample answer: $3x + 2(x + 1) = 20$**

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# 3-6 Study Guide and Intervention

## Ratios and Proportions

**Ratios and Proportions** A **ratio** is a comparison of two numbers by division. The ratio of $x$ to $y$ can be expressed as $x$ to $y$, $x$:$y$ or $\frac{x}{y}$. Ratios are usually expressed in simplest form.

An equation stating that two ratios are equal is called a **proportion**. To determine whether two ratios form a proportion, express both ratios in simplest form or check cross products.

**Example 1** **Determine whether the ratios $\frac{24}{36}$ and $\frac{12}{18}$ form a proportion.**

$\frac{24}{36} = \frac{2}{3}$ when expressed in simplest form.

$\frac{12}{18} = \frac{2}{3}$ when expressed in simplest form.

The ratios $\frac{24}{36}$ and $\frac{12}{18}$ form a proportion because they are equal when expressed in simplest form.

**Example 2** **Use cross products to determine whether $\frac{10}{18}$ and $\frac{25}{45}$ form a proportion.**

$\frac{10}{18} \stackrel{?}{=} \frac{25}{45}$ Write the proportion.

$10(45) \stackrel{?}{=} 18(25)$ Cross products

$450 = 450$ Simplify.

The cross products are equal, so $\frac{10}{18} = \frac{25}{45}$. Since the ratios are equal, they form a proportion.

**Exercises**

**Use cross products to determine whether each pair of ratios forms a proportion.**

1. $\frac{1}{2}, \frac{16}{32}$ yes
2. $\frac{5}{8}, \frac{10}{15}$ no
3. $\frac{10}{20}, \frac{25}{49}$ no
4. $\frac{25}{36}, \frac{15}{20}$ no
5. $\frac{12}{32}, \frac{3}{16}$ no
6. $\frac{4}{9}, \frac{12}{27}$ yes
7. $\frac{0.1}{2}, \frac{5}{100}$ yes
8. $\frac{15}{20}, \frac{9}{12}$ yes
9. $\frac{14}{21}, \frac{20}{30}$ yes
10. 2:3, 20:30 yes
11. 5 to 9, 25 to 45 yes
12. $\frac{72}{64}, \frac{9}{8}$ yes
13. 5:5, 30:20 no
14. 18 to 24, 50 to 75 no
15. 100:75, 44:33 yes
16. $\frac{0.05}{1}, \frac{1}{20}$ yes
17. $\frac{1.5}{2}, \frac{6}{8}$ yes
18. $\frac{0.1}{0.2}, \frac{0.45}{0.9}$ yes





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# 3-6 Study Guide and Intervention *(continued)*

## Ratios and Proportions

**Solve Proportions** If a proportion involves a variable, you can use cross products to solve the proportion. In the proportion $\frac{x}{5} = \frac{10}{13}$, $x$ and 13 are called **extremes** and 5 and 10 are called **means**. In a proportion, the product of the extremes is equal to the product of the means.

| Means-Extremes Property of Proportions | For any numbers $a$, $b$, $c$, and $d$, if $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$. |
|---|---|

**Example** **Solve $\frac{x}{5} = \frac{10}{13}$.**

$\frac{x}{5} = \frac{10}{13}$ Original proportion

$13(x) = 5(10)$ Cross products

$13x = 50$ Simplify.

$\frac{13x}{13} = \frac{50}{13}$ Divide each side by 13.

$x = 3\frac{11}{13}$ Simplify.

The solution is $3\frac{11}{13}$.

**Exercises**

**Solve each proportion.**

1. $\frac{-3}{x} = \frac{2}{8}$ −12
2. $\frac{1}{t} = \frac{5}{3}$ $\frac{3}{5}$
3. $\frac{0.1}{2} = \frac{0.5}{x}$ 10
4. $\frac{x+1}{4} = \frac{3}{4}$ 2
5. $\frac{4}{6} = \frac{8}{x}$ 12
6. $\frac{x}{21} = \frac{3}{63}$ 1
7. $\frac{9}{y+1} = \frac{18}{54}$ 26
8. $\frac{3}{d} = \frac{18}{3}$ $\frac{1}{2}$
9. $\frac{5}{8} = \frac{p}{24}$ 15
10. $\frac{4}{b-2} = \frac{4}{12}$ 14
11. $\frac{1.5}{x} = \frac{12}{x}$ no solution
12. $\frac{3+y}{4} = \frac{-y}{8}$ −2
13. $\frac{a-8}{12} = \frac{15}{3}$ 68
14. $\frac{12}{k} = \frac{24}{k}$ no solution
15. $\frac{2+w}{6} = \frac{12}{9}$ 6

**Use a proportion to solve each problem.**

16. **MODELS** To make a model of the Guadeloupe River bed, Hermie used 1 inch of clay for 5 miles of the river's actual length. His model river was 50 inches long. How long is the Guadeloupe River? 250 mi

17. **EDUCATION** Josh finished 24 math problems in one hour. At that rate, how many hours will it take him to complete 72 problems? 3 h







Answers

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# 3-6 Skills Practice

## Ratios and Proportions

**Use cross products to determine whether each pair of ratios forms a proportion. Write *yes* or *no*.**

1. $\frac{4}{5}, \frac{20}{25}$ yes
2. $\frac{5}{9}, \frac{7}{11}$ no
3. $\frac{6}{7}, \frac{24}{28}$ yes
4. $\frac{8}{9}, \frac{72}{81}$ yes
5. $\frac{7}{16}, \frac{42}{90}$ no
6. $\frac{13}{19}, \frac{26}{38}$ yes
7. $\frac{3}{14}, \frac{21}{98}$ yes
8. $\frac{12}{17}, \frac{50}{85}$ no

**Solve each proportion. If necessary, round to the nearest hundredth.**

9. $\frac{1}{a} = \frac{2}{14}$ 7
10. $\frac{5}{b} = \frac{3}{9}$ 15
11. $\frac{9}{g} = \frac{15}{10}$ 6
12. $\frac{3}{a} = \frac{1}{6}$ 18
13. $\frac{6}{z} = \frac{3}{5}$ 10
14. $\frac{5}{e} = \frac{35}{21}$ 3
15. $\frac{12}{7} = \frac{36}{s}$ 21
16. $\frac{6}{23} = \frac{y}{69}$ 18
17. $\frac{42}{56} = \frac{6}{f}$ 8
18. $\frac{7}{b} = \frac{1}{9}$ 63
19. $\frac{10}{14} = \frac{30}{m}$ 42
20. $\frac{11}{15} = \frac{n}{60}$ 44
21. $\frac{9}{c} = \frac{27}{39}$ 13
22. $\frac{5}{12} = \frac{20}{g}$ 48
23. $\frac{4}{21} = \frac{s}{84}$ 16
24. $\frac{22}{x} = \frac{11}{30}$ 60

25. **BOATING** Hue's boat used 5 gallons of gasoline in 4 hours. At this rate, how many gallons of gasoline will the boat use in 10 hours? 12.5 gal





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# 3-6 Practice (Average)

## Ratios and Proportions

**Use cross products to determine whether each pair of ratios forms a proportion. Write *yes* or *no*.**

1. $\frac{7}{6}, \frac{52}{48}$ no
2. $\frac{3}{11}, \frac{15}{66}$ no
3. $\frac{18}{24}, \frac{36}{48}$ yes
4. $\frac{12}{11}, \frac{108}{99}$ yes
5. $\frac{8}{9}, \frac{72}{81}$ yes
6. $\frac{1.5}{9}, \frac{1}{6}$ yes
7. $\frac{3.4}{5.2}, \frac{7.14}{10.92}$ yes
8. $\frac{1.7}{1.2}, \frac{2.9}{2.4}$ no
9. $\frac{7.6}{1.8}, \frac{3.9}{0.9}$ no

**Solve each proportion. If necessary, round to the nearest hundredth.**

10. $\frac{5}{a} = \frac{30}{54}$ 9
11. $\frac{v}{46} = \frac{34}{23}$ 68
12. $\frac{40}{56} = \frac{k}{7}$ 5
13. $\frac{28}{49} = \frac{4}{w}$ 7
14. $\frac{3}{u} = \frac{27}{162}$ 18
15. $\frac{y}{3} = \frac{48}{9}$ 16
16. $\frac{2}{y} = \frac{10}{60}$ 12
17. $\frac{5}{11} = \frac{35}{x}$ 77
18. $\frac{3}{51} = \frac{z}{17}$ 1
19. $\frac{6}{61} = \frac{12}{h}$ 122
20. $\frac{g}{16} = \frac{6}{4}$ 24
21. $\frac{14}{49} = \frac{2}{a}$ 7
22. $\frac{7}{9} = \frac{8}{c}$ $10\frac{2}{7}$
23. $\frac{3}{q} = \frac{5}{6}$ $3\frac{3}{5}$
24. $\frac{m}{6} = \frac{5}{8}$ $3\frac{3}{4}$
25. $\frac{v}{0.23} = \frac{7}{1.61}$ 1
26. $\frac{3}{0.72} = \frac{12}{b}$ 2.88
27. $\frac{6}{n} = \frac{3}{0.51}$ 1.02
28. $\frac{7}{a-4} = \frac{14}{6}$ 7
29. $\frac{3}{12} = \frac{2}{y+6}$ 2
30. $\frac{m-1}{8} = \frac{2}{4}$ 5
31. $\frac{5}{12} = \frac{x+1}{4}$ $\frac{2}{3}$
32. $\frac{r+2}{7} = \frac{5}{7}$ 3
33. $\frac{3}{7} = \frac{x-2}{6}$ $4\frac{4}{7}$

34. **PAINTING** Ysidra paints a room that has 400 square feet of wall space in $2\frac{1}{2}$ hours. At this rate, how long will it take her to paint a room that has 720 square feet of wall space? $4\frac{1}{2}$ h

35. **VACATION PLANS** Walker is planning a summer vacation. He wants to visit Petrified National Forest and Meteor Crater, Arizona, the 50,000-year-old impact site of a large meteor. On a map with a scale where 2 inches equals 75 miles, the two areas are about $1\frac{1}{2}$ inches apart. What is the distance between Petrified National Forest and Meteor Crater? about 56.25 mi

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3-6

# Reading to Learn Mathematics

## *Ratios and Proportions*

**Pre-Activity** **How are ratios used in recipes?**

Read the introduction to Lesson 3-6 at the top of page 155 in your textbook.

- How many servings of honey frozen yogurt are made by this recipe?
  **4 servings**
- How many recipes would be needed to make enough honey frozen yogurt for all the students in your class? **See students' work.**

### Reading the Lesson

**1.** Complete the following sentence.

A ratio is a comparison of two numbers by **division**.

**2.** Describe two ways to decide whether the sentence $\frac{2}{5} = \frac{8}{20}$ is a proportion.

**Express the ratios in simplest form to see if they are equal. Check to see whether the cross products are equal.**

**3.** For each proportion, tell what the extremes are and what the means are.

**a.** $\frac{14}{35} = \frac{6}{15}$ Extremes: **14 and 15** Means: **35 and 6**

**b.** $\frac{6}{8} = \frac{12}{16}$ Extremes: **6 and 16** Means: **8 and 12**

**4.** A jet flying at a steady speed traveled 825 miles in 2 hours. If you solved the proportion $\frac{825}{2} = \frac{x}{1.5}$, what would the answer tell you about the jet?

**how far the jet traveled in 1.5 h**

### Helping You Remember

**5.** Write how you would explain solving a proportion to a friend who missed Lesson 3-6.

**Use cross products. Write an equation with the product of the extremes on the left side and the product of the means on the right side. Then solve this second equation.**





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3-6

# Enrichment

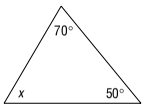
## *Angles of a Triangle*

In geometry, many statements about physical space are proven to be true. Such statements are called **theorems**. Here are two examples of geometric theorems.

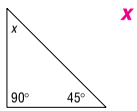
**a.** The sum of the measures of the angles of a triangle is 180°.

**b.** If two sides of a triangle have equal measure, then the two angles opposite those sides also have equal measure.

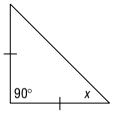
**For each of the triangles, write an equation and then solve for $x$. (A tick mark on two or more sides of a triangle indicates that the sides have equal measure.)**

**1.** 

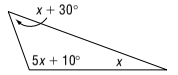
$x = 60°$

**2.** 

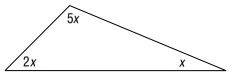
$x = 45°$

**3.** 

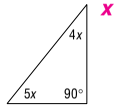
$x = 45°$

**4.** 

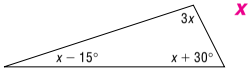
$x = 20°$

**5.** 

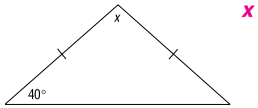
$x = 22.5°$

**6.** 

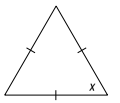
$x = 10°$

**7.** 

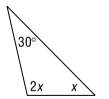
$x = 33°$

**8.** 

$x = 100°$

**9.** 

$x = 60°$

**10.** 

$x = 50°$

**11.** Two angles of a triangle have the same measure. The sum of the measures of these angles is one-half the measure of the third angle. Find the measures of the angles of the triangle.
**30°, 30°, 120°**

**12.** The measure of one angle of a triangle is twice the measure of a second angle. The measure of the third angle is 12 less than the sum of the other two. Find the measures of the angles of the triangle.
**64°, 32°, 84°**





**Answers**

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3-7

# Study Guide and Intervention

## Percent of Change

**Percent of Change** When an increase or decrease in an amount is expressed as a percent, the percent is called the **percent of change**. If the new number is greater than the original number, the percent of change is a **percent of increase**. If the new number is less than the original number, the percent of change is the **percent of decrease**.

**Example 1**

**Find the percent of increase.**
**original: 48**
**new: 60**

First, subtract to find the amount of increase. The amount of increase is $60 - 48 = 12$.

Then find the percent of increase by using the original number, 48, as the base.

$\frac{12}{48} = \frac{r}{100}$ Percent proportion

$12(100) = 48(r)$ Cross products

$1200 = 48r$ Simplify.

$\frac{1200}{48} = \frac{48r}{48}$ Divide each side by 48.

$25 = r$ Simplify.

The percent of increase is 25%.

**Example 2**

**Find the percent of decrease.**
**original: 30**
**new: 22**

First, subtract to find the amount of decrease. The amount of decrease is $30 - 22 = 8$.

Then find the percent of decrease by using the original number, 30, as the base.

$\frac{8}{30} = \frac{r}{100}$ Percent proportion

$8(100) = 30(r)$ Cross products

$800 = 30r$ Simplify.

$\frac{800}{30} = \frac{30r}{30}$ Divide each side by 30.

$26\frac{2}{3} = r$ Simplify.

The percent of decrease is $26\frac{2}{3}\%$, or about 27%.

**Exercises**

**State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.**

**1.** original: 50
new: 80
**increase; 60%**

**2.** original: 90
new: 100
**increase: 11%**

**3.** original: 45
new: 20
**decrease; 56%**

**4.** original: 77.5
new: 62
**decrease; 20%**

**5.** original: 140
new: 150
**increase: 7%**

**6.** original: 135
new: 90
**decrease; 33%**

**7.** original: 120
new: 180
**increase; 50%**

**8.** original: 90
new: 270
**increase: 200%**

**9.** original: 27.5
new: 25
**decrease; 9%**

**10.** original: 84
new: 98
**increase; 17%**

**11.** original: 12.5
new: 10
**decrease: 20%**

**12.** original: 250
new: 500
**increase; 100%**





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3-7

# Study Guide and Intervention *(continued)*

## Percent of Change

**Solve Problems** Discounted prices and prices including tax are applications of percent of change. Discount is the amount by which the regular price of an item is reduced. Thus, the discounted price is an example of percent of decrease. Sales tax is amount that is added to the cost of an item, so the price including tax is an example of percent of increase.

**Example** **A coat is on sale for 25% off the original price. If the original price of the coat is $75, what is the discounted price?**

The discount is 25% of the original price.

25% of \$75 $= 0.25 \times 75$ 25% = 0.25
$= 18.75$ Use a calculator.

Subtract \$18.75 from the original price.
\$75 − \$18.75 = \$56.25

The discounted price of the coat is \$56.25.

**Exercises**

**Find the final price of each item. When a discount and a sales tax are listed, compute the discount price before computing the tax.**

**1.** Compact disc: \$16
Discount: 15%
**\$13.60**

**2.** Two concert tickets: \$28
Student discount: 28%
**\$20.16**

**3.** Airline ticket: \$248.00
Superair discount: 33%
**\$166.16**

**4.** Shirt: \$24.00
Sales tax: 4%
**\$24.96**

**5.** CD player: \$142.00
Sales tax: 5.5%
**\$149.81**

**6.** Celebrity calendar: \$10.95
Sales tax: 7.5%
**\$11.77**

**7.** Class ring: \$89.00
Group discount: 17%
Sales tax: 5%
**\$77.56**

**8.** Software: \$44.00
Discount: 21%
Sales tax: 6%
**\$36.85**

**9.** Video recorder: \$110.95
Discount: 20%
Sales tax: 5%
**\$93.20**

**10. VIDEOS** The original selling price of a new sports video was \$65.00. Due to the demand the price was increased to \$87.75. What was the percent of increase over the original price? **35%**

**11. SCHOOL** A high school paper increased its sales by 75% when it ran an issue featuring a contest to win a class party. Before the contest issue, 10% of the school's 800 students bought the paper. How many students bought the contest issue? **140 students**

**12. BASEBALL** Baseball tickets cost \$15 for general admission or \$20 for box seats. The sales tax on each ticket is 8%, and the municipal tax on each ticket is an additional 10% of the base price. What is the final cost of each type of ticket? **\$17.70; \$23.60**

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3-7

# Skills Practice

## *Percent of Change*

**State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.**

1. original: 25
   new: 10
   **decrease; 60%**
2. original: 50
   new: 75
   **increase; 50%**
3. original: 55
   new: 50
   **decrease; 9%**
4. original: 25
   new: 28
   **increase; 12%**
5. original: 50
   new: 30
   **decrease; 40%**
6. original: 90
   new: 95
   **increase; 6%**
7. original: 48
   new: 60
   **increase; 25%**
8. original: 60
   new: 45
   **decrease; 25%**

**Find the total price of each item.**

9. dress: $69.00
   tax: 5%
   **$72.45**
10. binder: $14.50
    tax: 7%
    **$15.52**
11. hardcover book: $28.95
    tax: 6%
    **$30.69**
12. groceries: $47.52
    tax: 3%
    **$48.95**
13. filler paper: $6.00
    tax: 6.5%
    **$6.39**
14. shoes: $65.00
    tax: 4%
    **$67.60**
15. basketball: $17.00
    tax: 6%
    **$18.02**
16. concert tickets: $48.00
    tax: 7.5%
    **$51.60**

**Find the discounted price of each item.**

17. backpack: $56.25
    discount: 20%
    **$45.00**
18. monitor: $150.00
    discount: 50%
    **$75.00**
19. CD: $15.99
    discount: 20%
    **$12.79**
20. shirt: $25.50
    discount: 40%
    **$15.30**
21. sleeping bag: $125
    discount: 25%
    **$93.75**
22. coffee maker: $102.00
    discount: 45%
    **$56.10**





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3-7

# Practice (Average)

## *Percent of Change*

**State whether each percent of change is a percent of increase or a percent of decrease. Then find each percent of change. Round to the nearest whole percent.**

1. original: 18
   new: 10
   **decrease; 44%**
2. original: 140
   new: 160
   **increase; 14%**
3. original: 200
   new: 320
   **increase; 60%**
4. original: 10
   new: 25
   **increase; 150%**
5. original: 76
   new: 60
   **decrease; 21%**
6. original: 128
   new: 120
   **decrease; 6%**
7. original: 15
   new: 35.5
   **increase; 137%**
8. original: 98.6
   new: 64
   **decrease; 35%**
9. original: 58.8
   new: 65.7
   **increase; 12%**

**Find the total price of each item.**

10. concrete blocks: $95.00
    tax: 6%
    **$100.70**
11. crib: $240.00
    tax: 6.5%
    **$255.60**
12. jacket: $125.00
    tax: 5.5%
    **$131.88**
13. class ring: $325.00
    tax: 6%
    **$344.50**
14. blanket: $24.99
    tax: 7%
    **$26.74**
15. kite: $18.90
    tax: 5%
    **$19.85**

**Find the discounted price of each item.**

16. dry cleaning: $25.00
    discount: 15%
    **$21.25**
17. computer game: $49.99
    discount: 25%
    **$37.49**
18. luggage: $185.00
    discount: 30%
    **$129.50**
19. stationery: $12.95
    discount: 10%
    **$11.66**
20. prescription glasses: $149
    discount: 20%
    **$119.20**
21. pair of shorts: $24.99
    discount: 45%
    **$13.74**

**Find the final price of each item.**

22. television: $375.00
    discount: 25%
    tax: 6%
    **$298.13**
23. DVD player: $269.00
    discount: 20%
    tax: 7%
    **$230.26**
24. printer: $255.00
    discount: 30%
    tax: 5.5%
    **$188.32**

25. **INVESTMENTS** The price per share of an internet-related stock decreased from $90 per share to $36 per share early in 2001. By what percent did the price of the stock decrease? **60%**

26. **HEATING COSTS** Customers of a utility company received notices in their monthly bills that heating costs for the average customer had increased 125% over last year because of an unusually severe winter. In January of last year, the Garcia's paid $120 for heating. What should they expect to pay this January if their bill increased by 125%? **$270**







**Answers**

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3-7

# Reading to Learn Mathematics

## *Percent of Change*

**Pre-Activity** **How can percents describe growth over time?**

Read the introduction to Lesson 3-7 at the top of page 160 in your textbook.

- How many area codes were in use in 1947? **84 area codes**
- How many *more* area codes were in use in 1999? **201 area codes**

### Reading the Lesson

1. If you use (original amount) — (new amount) to find the change for a percent of change problem, then the problem involves a percent of **decrease** (increase/decrease).

2. If you use (new amount) — (original amount) to find the change for a percent of change problem, then the problem involves a percent of **increase** (increase/decrease).

**Complete the chart.**

| | Original Amount | New Amount | Percent Proportion | Percent Increase or Percent Decrease? |
|---|---|---|---|---|
| 3. | 10 | 13 | change → 3 / → = r | increase |
| 4. | 10 | 7 | change → 3 / → = r | decrease |
| 5. | 50 | 42 | change → 8 / → = r | decrease |
| 6. | 50 | 58 | change → 8 / → = r | increase |

7. When you find a discount price, do you add to or subtract from the original price? **subtract**

### Helping You Remember

8. If you remember only two things about the ratio used for finding percent of change, what should they be? **Subtract the prices, then divide by the original number.**





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3-7

# Enrichment

## *Using Percent*

**Use what you have learned about percent to solve each problem.**

A TV movie had a "rating" of 15 and a 25 "share." The rating is the percentage of the nation's total TV households that were tuned in to this show. The share is the percentage of homes with TVs turned on that were tuned to the movie. How many TV households had their TVs turned off at this time?

To find out, let $T$ = the number of TV households
and $x$ = the number of TV households with the TV off.
Then $T - x$ = the number of TV households with the TV on.

Since $0.15T$ and $0.25(T - x)$ both represent the number of households tuned to the movie,

$$0.15T = 0.25(T - x)$$
$$0.15T = 0.25T - 0.25x.$$

Solve for $x$. $0.25x = 0.10T$

$$x = \frac{0.10T}{0.25} = 0.40T$$

Forty percent of the TV households had their TVs off when the movie was aired.

**Answer each question.**

1. During that same week, a sports broadcast had a rating of 22.1 and a 43 share. Show that the percent of TV households with their TVs off was about 48.6%.
**$0.221T = 0.43T - 0.43x$**
**$x = \frac{0.221T - 0.43T}{\quad}$**
**$= 0.486T$**

2. Find the percent of TV households with their TVs turned off during a show with a rating of 18.9 and a 29 share. **34.8%**

3. Show that if T is the number of TV households, r is the rating, and s is the share, then the number of TV households with the TV off is $\frac{(s-r)T}{s}$.
**Solve $rT = s(T - x)$ for $x$.**

4. If the fraction of TV households with no TV on is $\frac{s-r}{s}$ then show that the fraction of TV households with TVs on is $\frac{r}{s}$. **$1 - \frac{s-r}{\quad} = \frac{r}{\quad}$**

5. Find the percent of TV households with TVs on during the most watched serial program in history: the last episode of M*A*S*H, which had a 60.3 rating and a 77 share. **$\frac{60.3}{\quad}$ = 78.3%**

6. A local station now has a 2 share. Each share is worth $50,000 in advertising revenue per month. The station is thinking of going commercial free for the three months of summer to gain more listeners. What would its new share have to be for the last 4 months of the year to make more money for the year than it would have made had it not gone commercial free? **greater than 3.5**

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# 3-8 Study Guide and Intervention

## Solving Equations and Formulas

**Solve for Variables** Sometimes you may want to solve an equation such as $V = \ell wh$ for one of its variables. For example, if you know the values of $V$, $w$, and $h$, then the equation $\ell = \frac{V}{wh}$ is more useful for finding the value of $\ell$. If an equation that contains more than one variable is to be solved for a specific variable, use the properties of equality to isolate the specified variable on one side of the equation.

**Example 1** **Solve $2x - 4y = 8$ for $y$.**

$$\begin{aligned} 2x - 4y &= 8 \\ 2x - 4y - 2x &= 8 - 2x \\ -4y &= 8 - 2x \\ \frac{-4y}{-4} &= \frac{8 - 2x}{-4} \\ y &= \frac{8 - 2x}{-4} \text{ or } \frac{2x - 8}{4} \end{aligned}$$

The value of $y$ is $\frac{2x - 8}{4}$.

**Example 2** **Solve $3m - n = km - 8$ for $m$.**

$$\begin{aligned} 3m - n &= km - 8 \\ 3m - n - km &= km - 8 - km \\ 3m - n - km &= -8 \\ 3m - n - km + n &= -8 + n \\ 3m - km &= -8 + n \\ m(3 - k) &= -8 + n \\ \frac{m(3 - k)}{3 - k} &= \frac{-8 + n}{3 - k} \\ m &= \frac{-8 + n}{3 - k}, \text{ or } \frac{n - 8}{3 - k} \end{aligned}$$

The value of $m$ is $\frac{n - 8}{3 - k}$. Since division by 0 is undefined, $3 - k \neq 0$, or $k \neq 3$.

**Exercises**

**Solve each equation or formula for the variable specified.**

1. $ax - b = c$ for $x$ — $x = \frac{c + b}{a}, a \neq 0$
2. $15x + 1 = y$ for $x$ — $x = \frac{y - 1}{15}$
3. $(x + f) + 2 = j$ for $x$ — $x = j - 2 - f$
4. $xy + z = 9$ for $y$ — $y = \frac{9 - z}{x}, x \neq 0$
5. $x(4 - k) = p$ for $k$ — $k = 4 - \frac{p}{x}, x \neq 0$
6. $7x + 3y = m$ for $y$ — $y = \frac{m - 7x}{3}$
7. $4(c + 3) = t$ for $c$ — $c = \frac{t}{4} - 3$
8. $2x + b = c$ for $x$ — $x = \frac{c - b}{2}$
9. $x(1 + y) = z$ for $x$ — $x = \frac{z}{1 + y}, y \neq -1$
10. $16z + 4x = y$ for $x$ — $x = \frac{y - 16z}{4}$
11. $d = rt$ for $r$ — $r = \frac{d}{t}, t \neq 0$
12. $A = \frac{h(a + b)}{2}$ for $h$ — $h = \frac{2A}{a + b}, a \neq -b$
13. $C = \frac{5}{9}(F - 32)$ for $F$ — $F = \frac{9}{5}C + 32$
14. $P = 2\ell + 2w$ for $w$ — $w = \frac{P - 2\ell}{2}$
15. $A = \ell w$ for $\ell$ — $\ell = \frac{A}{w}, w \neq 0$





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# 3-8 Study Guide and Intervention (continued)

## Solving Equations and Formulas

**Use Formulas** Many real-world problems require the use of formulas. Sometimes solving a formula for a specified variable will help solve the problem.

**Example** **The formula $C = \pi d$ represents the circumference of a circle, or the distance around the circle, where $d$ is the diameter. If an airplane could fly around Earth at the equator without stopping, it would have traveled about 24,900 miles. Find the diameter of Earth.**

| | |
|---|---|
| $C = \pi d$ | Given formula |
| $d = \frac{C}{\pi}$ | Solve for $d$. |
| $d = \frac{24{,}900}{3.14}$ | Use $\pi = 3.14$. |
| $d \approx 7930$ | Simplify. |

The diameter of Earth is about 7930 miles.

**Exercises**

1. **GEOMETRY** The volume of a cylinder $V$ is given by the formula $V = \pi r^2 h$, where $r$ is the radius and $h$ is the height.
   a. Solve the formula for $h$. $h = \frac{V}{\pi r^2}$
   b. Find the height of a cylinder with volume $2500\pi$ feet and radius 10 feet. 25 ft
2. **WATER PRESSURE** The water pressure on a submerged object is given by $P = 64d$, where $P$ is the pressure in pounds per square foot, and $d$ is the depth of the object in feet.
   a. Solve the formula for $d$. $d = \frac{P}{64}$
   b. Find the depth of a submerged object if the pressure is 672 pounds per square foot. 10.5 ft
3. **GRAPHS** The equation of a line containing the points $(a, 0)$ and $(0, b)$ is given by the formula $\frac{x}{a} + \frac{y}{b} = 1$.
   a. Solve the equation for $y$. $y = b\left(1 - \frac{x}{a}\right)$
   b. Suppose the line contains the points (4, 0), and (0, −2). If $x = 3$, find $y$. $-\frac{1}{2}$
4. **GEOMETRY** The surface area of a rectangular solid is given by the formula $S = 2\ell w + 2\ell h + 2wh$, where $\ell$ = length, $w$ = width, and $h$ = height.
   a. Solve the formula for $h$. $h = \frac{S - 2\ell w}{2\ell + 2wh}$
   b. The surface area of a rectangular solid with length 6 centimeters and width 3 centimeters is 72 square centimeters. Find the height. 2 cm







Answers

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3-8

# Skills Practice

## Solving Equations and Formulas

**Solve each equation or formula for the variable specified.**

1. $7t = x$, for $t$ $t = \frac{x}{7}$
2. $e = wp$, for $p$ $p = \frac{e}{w}$
3. $q - r = r$, for $r$ $r = \frac{q}{2}$
4. $4m - n = m$, for $m$ $m = \frac{n}{3}$
5. $7a - b = 15a$, for $a$ $a = -\frac{b}{8}$
6. $-5c + d = 2c$, for $c$ $c = \frac{d}{7}$
7. $x - 2y = 1$, for $y$ $y = \frac{x - 1}{2}$
8. $m + 3n = 1$, for $n$ $n = \frac{1 - m}{3}$
9. $7f + g = 5$, for $f$ $f = \frac{5 - g}{7}$
10. $ax - c = b$, for $x$ $x = \frac{b + c}{a}$
11. $rt - 2n = y$, for $t$ $t = \frac{2n + y}{r}$
12. $bc + 3g = 2k$, for $c$ $c = \frac{2k - 3g}{b}$
13. $kn + 4f = 9v$, for $n$ $n = \frac{9v - 4f}{k}$
14. $8c + 6j = 5p$, for $c$ $c = \frac{5p - 6j}{8}$
15. $\frac{x - c}{2} = d$, for $x$ $x = c + 2d$
16. $\frac{x - c}{2} = d$, for $c$ $c = x - 2d$
17. $\frac{p + 9}{5} = q$, for $p$ $p = 5q - 9$
18. $\frac{b - 4z}{7} = a$, for $b$ $b = 7a + 4z$

**Write an equation and solve for the variable specified.**

19. Five more than a number $g$ is six less than twice a number $h$. Solve for $g$.
$g + 5 = 2h - 6$; $g = 2h - 11$

20. One fourth of a number $q$ is three more than three times a number $w$. Solve for $q$.
$\frac{1}{4}q = 3w + 3$; $q = 12w + 12$

21. Eight less than a number $s$ is three more than four times a number $t$. Solve for $s$.
$s - 8 = 4t + 3$; $s = 4t + 11$





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3-8

# Practice (Average)

## Solving Equations and Formulas

**Solve each equation or formula for the variable specified.**

1. $d = rt$, for $r$ $r = \frac{d}{t}$
2. $6w - y = 2z$, for $w$ $w = \frac{2z + y}{6}$
3. $mx + 4y = 3c$, for $x$ $x = \frac{3c - 4y}{m}$
4. $9s - 5g = -4u$, for $s$ $s = \frac{-4u + 5g}{9}$
5. $ab + 3c = 2d$, for $b$ $b = \frac{2d - 3c}{a}$
6. $2p = kx - q$, for $x$ $x = \frac{2p + q}{k}$
7. $\frac{2}{3}m + a = a + c$, for $m$ $m = \frac{3}{2}c$
8. $\frac{2}{5}h + g = d$, for $h$ $h = \frac{5}{2}(d - g)$
9. $\frac{2}{3}y + v = s$, for $y$ $y = \frac{3}{2}(s - v)$
10. $\frac{3}{4}a - q = k$, for $a$ $a = \frac{4}{3}(k + q)$
11. $\frac{rx + 9}{5} = h$, for $x$ $x = \frac{5h - 9}{r}$
12. $\frac{3b - 4}{2} = c$, for $b$ $b = \frac{2c + 4}{3}$
13. $2w - y = 7w - 2$, for $w$ $w = \frac{2 - y}{5}$
14. $3\ell + y = 5 + 5\ell$, for $\ell$ $\ell = \frac{y - 5}{2}$

**Write an equation and solve for the variable specified.**

15. Three times a number $s$ plus 4 times a number $y$ is 1 more than 6 times the number $s$. Solve for $s$.
$3s + 4y = 6s + 1$; $s = \frac{4y - 1}{3}$

16. Five times a number $k$ minus 9 is two thirds of a number $j$. Solve for $j$.
$5k - 9 = \frac{2}{3}j$; $j = \frac{3}{2}(5k - 9)$

**ELECTRICITY For Exercises 17 and 18, use the following information.**

The formula for Ohm's Law is $E = IR$, where $E$ represents voltage measured in volts, $I$ represents current measured in amperes, and $R$ represents resistance measured in ohms.

17. Solve the formula for $R$. $R = \frac{E}{I}$

18. Suppose a current of 0.25 ampere flows through a resistor connected to a 12-volt battery. What is the resistance in the circuit? 48 ohms

**MOTION For Exercises 19 and 20, use the following information.**

In *uniform circular motion*, the speed $v$ of a point on the edge of a spinning disk is $v = \frac{2\pi}{T}r$, where $r$ is the radius of the disk and $T$ is the time it takes the point to travel once around the circle.

19. Solve the formula for $r$. $r = \frac{Tv}{2\pi}$

20. Suppose a merry-go-round is spinning once every 3 seconds. If a point on the outside edge has a speed of 12.56 feet per second, what is the radius of the merry-go-round? (Use 3.14 for $\pi$.) 6 ft

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3-8

# Reading to Learn Mathematics

## *Solving Equations and Formulas*

**Pre-Activity** **How are equations used to design roller coasters?**

Read the introduction to Lesson 3-8 at the top of page 166 in your textbook.

The equation $g(195 - h) = \frac{1}{2}v^2$ contains several variables. What number values do you know for these variables in this situation?

**32 for *g* and 49 for *v***

### Reading the Lesson

1. Suppose you have an equation with several variables. You want to solve for a particular variable. How does the procedure compare with that for solving an equation with just one variable? How does the solution compare with the solution for an equation with one variable?

   **Sample answer: The procedure is basically the same. You use properties of operations and equality to isolate the variable in which you are interested. The solution will probably contain variables instead of just a number.**

2. Describe what dimensional analysis involves.

   **Sample answer: You use the units along with number values as you do calculations. You treat the units pretty much the same way you would variables. For example, you can divide them and use exponents with them.**

3. What do you have to be careful about when you use variables in denominators of fractions?

   **You have to be sure that you do not use values that would make the denominator 0.**

### Helping You Remember

4. When you give the dimensions of a rectangle, you have to tell how many units long it is and how many units wide it is. How can this help you remember what dimensional analysis involves.

   **Sample answer: Keep the words *dimension* and *unit* in mind. In dimensional analysis, you include units for dimensions in calculations.**





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3-8

# Enrichment

## *Dr. Bernardo Houssay*

Even though researchers have been studying the disease *diabetes mellitus* for hundreds of years, scientists have only recently discovered the cause of the disease and developed methods for reducing its severity. Dr. Bernardo Houssay, an Argentine physiologist, was one of the pioneers of this more modern research. He studied the relationship between diabetes and the pituitary gland, and in 1947 became the first Latin American to win the Nobel Prize in Medicine and Physiology.

Though there is no cure for diabetes, specific diets and exercise can help people control the disease. The American Diabetes Association (ADA) has helped establish flexible dietary guidelines for consumers to follow. These guidelines include some of the following general nutrition rules.

- Fat intake should be equal to or less than 30% of daily calories.
- Saturated fat intake should be equal to or less than 10% of daily calories.
- Protein should be limited to 10% to 20% of daily calories. Persons showing the initial signs of diabetes-induced kidney disease should limit protein to 10% of daily calories.
- Cholesterol intake should be 300 milligrams or less daily.

**Refer to the information above for Exercises 1–4.**

1. Robert consumed 2100 calories on Tuesday. His fat intake totaled 70 grams, and of that 70 grams, 14 were saturated.

   **a.** What percentage of his calorie consumption was fat, and what percentage of that fat was saturated? (To find the percentage of calories from fat, multiply the number of fat grams by 9 before dividing by the number of calories.) **30%; 20%**

   **b.** Did Robert stay within the recommended allowance of fats? **yes**

2. Anna's cholesterol intake was 330 milligrams on Sunday. By what percentage does she need to reduce her cholesterol consumption to remain within the guidelines? **10%**

3. What number of fat grams is 30% of 240 calories? **8**

4. Sharon follows a diet that provides about 50 grams of protein each day. Sharon's doctor has just told her to reduce her daily protein intake by 30%. About how much protein will be in her reduced protein diet? **35 grams**







**Answers**

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3-9

# Study Guide and Intervention

## Weighted Averages

### Mixture Problems

| Weighted Average | The weighted average $M$ of a set of data is the sum of the product of each number in the set and its weight divided by the sum of all the weights. |
|---|---|

**Mixture Problems** are problems where two or more parts are combined into a whole. They involve weighted averages. In a mixture problem, the weight is usually a price or a percent of something.

**Example** **Delectable Cookie Company sells chocolate chip cookies for $6.95 per pound and white chocolate cookies for $5.95 per pound. How many pounds of chocolate chip cookies should be mixed with 4 pounds of white chocolate cookies to obtain a mixture that sells for $6.75 per pound.**

Let $w$ = the number of pounds of chocolate chip cookies

| | Number of Pounds | Price per Pound | Total Price |
|---|---|---|---|
| Chocolate Chip | $w$ | 6.95 | $6.95w$ |
| White Chocolate | 4 | 5.95 | $4(5.95)$ |
| Mixture | $w + 4$ | 6.75 | $6.75(w + 4)$ |

Equation: $6.95w + 4(5.95) = 6.75(w + 4)$

Solve the equation.

| | |
|---|---|
| $6.95w + 4(5.95) = 6.75(w + 4)$ | Original equation |
| $6.95w + 23.80 = 6.75w + 27$ | Simplify. |
| $6.95w + 23.80 - 6.75w = 6.75w + 27 - 6.75w$ | Subtract $6.75w$ from each side. |
| $0.2w + 23.80 = 27$ | Simplify. |
| $0.2w + 23.80 - 23.80 = 27 - 23.80$ | Subtract 23.80 from each side. |
| $0.2w = 3.2$ | Simplify. |
| $w = 16$ | Simplify. |

16 pounds of chocolate chip cookies should be mixed with 4 pounds of white chocolate cookies.

**Exercises**

1. **SOLUTIONS** How many grams of sugar must be added to 60 grams of a solution that is 32% sugar to obtain a solution that is 50% sugar? **21.6 g**

2. **NUTS** The Quik Mart has two kinds of nuts. Pecans sell for $1.55 per pound and walnuts sell for $1.95 per pound. How many pounds of walnuts must be added to 15 pounds of pecans to make a mixture that sells for $1.75 per pound? **15 lb**

3. **INVESTMENTS** Alice Gleason invested a portion of $32,000 at 9% interest and the balance at 11% interest. How much did she invest at each rate if her total income from both investments was $3,200. **$16,000 at 9% and $16,000 at 11%**

4. **MILK** Whole milk is 4% butterfat. How much skim milk with 0% butterfat should be added to 32 ounces of whole milk to obtain a mixture that is 2.5% butterfat? **19.2 oz**





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3-9

# Study Guide and Intervention *(continued)*

## Weighted Averages

### Uniform Motion Problems

Motion problems are another application of weighted averages. **Uniform motion problems** are problems where an object moves at a certain speed, or rate. Use the formula $d = rt$ to solve these problems, where $d$ is the distance, $r$ is the rate, and $t$ is the time.

**Example** **Bill Gutierrez drove at a speed of 65 miles per hour on an expressway for 2 hours. He then drove for 1.5 hours at a speed of 45 miles per hour on a state highway. What was his average speed?**

$M = \frac{65 \cdot 2 + 45 \cdot 1.5}{2 + 1.5}$ Definition of weighted average

$\approx 56.4$ Simplify.

Bill drove at an average speed of about 56.4 miles per hour.

**Exercises**

1. **TRAVEL** Mr. Anders and Ms. Rich each drove home from a business meeting. Mr. Anders traveled east at 100 kilometers per hour and Ms. Rich traveled west at 80 kilometers per hours. In how many hours were they 100 kilometers apart. **$\frac{5}{9}$ h**

2. **AIRPLANES** An airplane flies 750 miles due west in $1\frac{1}{2}$ hours and 750 miles due south in 2 hours. What is the average speed of the airplane? **about 429 mph**

3. **TRACK** Sprinter A runs 100 meters in 15 seconds, while sprinter B starts 1.5 seconds later and runs 100 meters in 14 seconds. If each of them runs at a constant rate, who is further in 10 seconds after the start of the race? Explain.

**Sprinter A; since sprinter A runs 100 m in 15 s, this sprinter runs at a rate of $\frac{100}{15}$ m/s. In 10 seconds, sprinter A will have run $\frac{100}{15}(10) = 66.7$ m. Sprinter B's rate is $\frac{100}{14}$. In 10 seconds, with the delayed start, sprinter B has run $\frac{100}{14}(10 - 1.5) = 60.7$ m.**

4. **TRAINS** An express train travels 90 kilometers per hour from Smallville to Megatown. A local train takes 2.5 hours longer to travel the same distance at 50 kilometers per hour. How far apart are Smallville and Megatown? **281.25 km**

5. **CYCLING** Two cyclists begin traveling in the same direction on the same bike path. One travels at 15 miles per hour, and the other travels at 12 miles per hour. When will the cyclists be 10 miles apart? **$3\frac{1}{3}$ h**

6. **TRAINS** Two trains leave Chicago, one traveling east at 30 miles per hour and one traveling west at 40 miles per hour. When will the trains be 210 miles apart? **3 h**

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3-9

# Skills Practice

## *Weighted Averages*

**SEASONING For Exercises 1–4, use the following information.**

A health food store sells seasoning blends in bulk. One blend contains 20% basil. Sheila wants to add pure basil to some 20% blend to make 16 ounces of her own 30% blend. Let $b$ represent the amount of basil Sheila should add to the 20% blend.

1. Complete the table representing the problem.

| | Ounces | Amount of Basil |
|---|---|---|
| 20% Basil Blend | $16 - b$ | $0.20(16 - b)$ |
| 100% Basil | $b$ | $1.00b$ |
| 30% Basil Blend | 16 | 0.30(16) |

2. Write an equation to represent the problem. $0.20(16 - b) + 1.00b = 0.30(16)$

3. How many ounces of basil should Sheila use to make the 30% blend? 2 oz

4. How many ounces of the 20% blend should she use? 14 oz

**HIKING For Exercises 5–7, use the following information.**

At 7:00 A.M., two groups of hikers begin 21 miles apart and head toward each other. The first group, hiking at an average rate of 1.5 miles per hour, carries tents, sleeping bags, and cooking equipment. The second group, hiking at an average rate of 2 miles per hour, carries food and water. Let $t$ represent the hiking time.

5. Copy and complete the table representing the problem.

| | $r$ | $t$ | $d = rt$ |
|---|---|---|---|
| First group of hikers | 1.5 | $t$ | $1.5t$ |
| Second group of hikers | 2 | $t$ | $2t$ |

6. Write an equation using $t$ that describes the distances traveled. $1.5t + 2t = 21$

7. How long will it be until the two groups of hikers meet? 6 h

**SALES For Exercises 8 and 9, use the following information.**

Sergio sells a mixture of Virginia peanuts and Spanish peanuts for $3.40 per pound. To make the mixture, he uses Virginia peanuts that cost $3.50 per pound and Spanish peanuts that cost $3.00 per pound. He mixes 10 pounds at a time.

8. How many pounds of Virginia peanuts does Sergio use? 8 lb

9. How many pounds of Spanish peanuts does Sergio use? 2 lb





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3-9

# Practice (Average)

## *Weighted Averages*

**GRASS SEED For Exercises 1–4, use the following information.**

A nursery sells Kentucky Blue Grass seed for $5.75 per pound and Tall Fescue seed for $4.50 per pound. The nursery sells a mixture of the two kinds of seed for $5.25 per pound. Let $k$ represent the amount of Kentucky Blue Grass seed the nursery uses in 5 pounds of the mixture.

1. Complete the table representing the problem.

| | Number of Pounds | Price per Pound | Cost |
|---|---|---|---|
| Kentucky Blue Grass | $k$ | \$5.75 | $5.75k$ |
| Tall Fescue | $5 - k$ | \$4.50 | $4.50(5 - k)$ |
| Mixture | 5 | \$5.25 | 5.25(5) |

2. Write an equation to represent the problem. $5.75k + 4.50(5 - k) = 5.25(5)$

3. How much Kentucky Blue Grass does the nursery use in 5 pounds of the mixture? 3 lb

4. How much Tall Fescue does the nursery use in 5 pounds of the mixture? 2 lb

**TRAVEL For Exercises 5–7, use the following information.**

Two commuter trains carry passengers between two cities, one traveling east, and the other west, on different tracks. Their respective stations are 150 miles apart. Both trains leave at the same time, one traveling at an average speed of 55 miles per hour and the other at an average speed of 65 miles per hour. Let $t$ represent the time until the trains pass each other.

5. Copy and complete the table representing the problem.

| | $r$ | $t$ | $d = rt$ |
|---|---|---|---|
| First Train | 55 | $t$ | $55t$ |
| Second Train | 65 | $t$ | $65t$ |

6. Write an equation using $t$ that describes the distances traveled. $55t + 65t = 150$

7. How long after departing will the trains pass each other? 1.25 h

8. **TRAVEL** Two trains leave Raleigh at the same time, one traveling north, and the other south. The first train travels at 50 miles per hour and the second at 60 miles per hour. In how many hours will the trains be 275 miles apart? 2.5 h

9. **JUICE** A pineapple drink contains 15% pineapple juice. How much pure pineapple juice should be added to 8 quarts of the drink to obtain a mixture containing 50% pineapple juice? 5.6 qt







Answers

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NAME _____ DATE _____ PERIOD ____

3-9

# Reading to Learn Mathematics

## *Weighted Averages*

**Pre-Activity** **How are scores calculated in a figure skating competition?**

Read the introduction to Lesson 3-9 at the top of page 171 in your textbook.

Why is the sum of Ilia Kulik's scores divided by 3?

**Her first score is counted once and her second score is counted twice.**

### Reading the Lesson

1. Read the definition of *weighted average* on page 171 of your textbook. What is meant by the weight of a number in a set of data?

   **the number of times the number occurs in the set of data**

2. Linda's quiz scores in science are 90, 85, 85, 75, 85, and 90. What is the weight of the score 85? **3**

3. Suppose Clint drives at 50 miles per hour for 2 hours. Then he drives at 60 miles per hour for 3 hours.

   a. Write his speed for each hour of the trip.

| Speed | 50 | 50 | 60 | 60 | 60 |
|---|---|---|---|---|---|
| Hour | 1 | 2 | 3 | 4 | 5 |

   b. What is the weight of each of the two speeds? **50 mph: 2; 60 mph: 3**

### Helping You Remember

4. Making a table can be helpful in solving mixture problems. In your own words, explain how you use a table to solve mixture problems.

   **Complete each row to write an expression in the last column for each part of the problem and for the combination, then write an equation using those expressions from the last column.**





NAME _____ DATE _____ PERIOD ____

3-9

# Enrichment

## *Diophantine Equations*

The first great algebraist, Diophantus of Alexandria (about A.D. 300), devoted much of his work to the solving of indeterminate equations. An indeterminate equation has more than one variable and an unlimited number of solutions. An example is $x + 2y = 4$.

When the coefficients of an indeterminate equation are integers and you are asked to find solutions that must be integers, the equation is called *diophantine*. Such equations can be quite difficult to solve, often involving trial and error—and some luck!

**Solve each diophantine equation by finding at least one pair of positive integers that makes the equation true. Some hints are given to help you.**

1. $2x + 5y = 32$

   a. First solve the equation for $x$. $x = 16 - \frac{5y}{2}$

   b. Why must $y$ be an even number? **If $y$ is odd, then $x$ won't be an integer.**

   c. Find at least one solution. **Any of these: (11, 2), (6, 4), (1, 6)**

2. $5x + 2y = 42$

   a. First solve the equation for $x$. $x = \frac{42 - 2y}{5}$

   b. Rewrite your answer in the form $x = 8 +$ some expression. $x = 8 + \frac{2 - 2y}{5}$

   c. Why must $(2 - 2y)$ be a multiple of 5? **Otherwise, $x$ won't be an integer.**

   d. Find at least one solution. **Any of these: (8, 1), (6, 6), (4, 11), (2, 16)**

3. $2x + 7y = 29$

   **(11, 1) or (4, 3)**

4. $7x + 5y = 118$

   **Any of these: (14, 4), (9, 11), (4, 18)**

5. $8x - 13y = 100$

   **(19, 4), (32, 12) or any pair when $y = 4n$ and $n$ is a positive odd number**

6. $3x + 4y = 22$

   **(6, 1) or (2, 4)**

7. $5x - 14y = 11$

   **(5, 1), (19, 6) or any pair when $y = 5m - 4$ and $m$ is a positive number**

8. $7x + 3y = 40$

   **(4, 4) or (1, 11)**

# Chapter 3 Assessment Answer Key

## Form 1

### Page 191

1. D
2. D
3. B
4. D
5. C
6. A
7. B
8. B
9. A
10. D

### Page 192

11. B
12. C
13. A
14. D
15. C
16. C
17. B
18. D
19. B
20. A

B: 45

## Form 2A

### Page 193

1. B
2. A
3. C
4. B
5. D
6. A
7. C
8. D
9. C
10. B

*(continued on the next page)*

# Chapter 3 Assessment Answer Key

**Form 2A** *(continued)*
**Page 194**

11. B

12. A

13. C

14. B

15. C

16. B

17. D

18. A

19. B

20. C

B: 3.6 L

**Form 2B**
**Page 195**

1. A

2. C

3. C

4. B

5. A

6. D

7. B

8. C

9. A

10. B

**Page 196**

11. B

12. D

13. C

14. A

15. B

16. D

17. B

18. A

19. A

20. C

B: 21

# Chapter 3 Assessment Answer Key

**Form 2C**

**Page 197**

1. $-9$
2. $\frac{3}{5}$
3. $-5$
4. $5$
5. $-186$
6. $14\frac{2}{5}$
7. $45$
8. $6$
9. $36 - x = 3(4 + x)$
10. Three times the sum of $x$ and $y$ equals two times $y$ minus $x$.
11. $n - 3.5 = 12.7$; $16.2$
12. $5n + 12 = -3$; $-3$
13. $134.40$
14. yes

**Page 198**

15. $1\frac{1}{3}$
16. $22.5$
17. $-1$
18. all numbers
19. $13$
20. $x = \frac{bc}{a}$
21. decrease; 20%
22. $12.84$
23. 3 L
24. 2.5 h
25. $h = \frac{V}{\pi r^2}$; 10.5 in.

**B:** $8$

Answers

# Chapter 3 Assessment Answer Key

**Form 2D**

**Page 199**

1. 4
2. $\frac{2}{3}$
3. 7
4. 7
5. −70
6. $7\frac{5}{7}$
7. 50
8. 7
9. $18 + n = 7(n - 3)$
10. Three divided by $y$ minus five equals $x$ times the sum of $y$ and 7.
11. $n - 8.1 = 4.9$; 13
12. $6n + 15 = 9$; −1
13. $176.80
14. no

**Page 200**

15. $1\frac{4}{5}$
16. 20
17. 3
18. no solution
19. 11
20. $r = s(4v - t)$
21. increase; 25%
22. $13.50
23. 7.5 lb of nuts, 2.5 lb of dried fruit
24. 4 h
25. $h = \frac{V}{\pi r^2}$; 18.67 in.

B: $9.60

# Chapter 3 Assessment Answer Key

**Form 3**

**Page 201**

1. $-27$
2. $-13$
3. $-2\frac{2}{3}$
4. 52
5. $-1\frac{2}{13}$
6. 126
7. 8
8. $\frac{x - 45}{12} + 20 = 5(32 - x)$
9. $\frac{3}{5}x = 1; \frac{5}{3}$
10. $(x + 2)10 = 8x + 36$; 8
11. Five times the sum of two times $x$ and three times $y$ equals the square of $y$ minus two times the cube of $x$.
12. \$4000
13. yes
14. $-6$
15. 10 ft

**Page 202**

16. $-\frac{7}{9}$
17. all numbers
18. 2
19. $x = \frac{r + n}{a}$
20. $x = \frac{rs - t}{4}$
21. increase; 12%
22. \$63.60
23. \$7000
24. 510 mph, 540 mph
25. 3 ft/s

B: 12 mi

Answers

# Chapter 3 Assessment Answer Key

## Page 203, Open-Ended Assessment
## Scoring Rubric

| Score | General Description | Specific Criteria |
|---|---|---|
| 4 | **Superior**<br>A correct solution that is supported by well-developed, accurate explanations | • Shows thorough understanding of the concepts of *translating between verbal sentences and equations, solving equations, percents of increase and decrease, uniform motion problems,* and *proportions.*<br>• Uses appropriate strategies to solve problems.<br>• Computations are correct.<br>• Written explanations are exemplary.<br>• Goes beyond requirements of some or all problems. |
| 3 | **Satisfactory**<br>A generally correct solution, but may contain minor flaws in reasoning or computation | • Shows an understanding of the concepts of *translating between verbal sentences and equations, solving equations, percents of increase and decrease, uniform motion problems,* and *proportions.*<br>• Uses appropriate strategies to solve problems.<br>• Computations are mostly correct.<br>• Written explanations are effective.<br>• Satisfies all requirements of problems. |
| 2 | **Nearly Satisfactory**<br>A partially correct interpretation and/or solution to the problem | • Shows an understanding of most of the concepts of *translating between verbal sentences and equations, solving equations, percents of increase and decrease, uniform motion problems,* and *proportions.*<br>• May not use appropriate strategies to solve problems.<br>• Computations are mostly correct.<br>• Written explanations are satisfactory.<br>• Satisfies the requirements of most of the problems. |
| 1 | **Nearly Unsatisfactory**<br>A correct solution with no supporting evidence or explanation | • Final computation is correct.<br>• No written explanations or work is shown to substantiate the final computation.<br>• Satisfies minimal requirements of some of the problems. |
| 0 | **Unsatisfactory**<br>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 *translating between verbal sentences and equations, solving equations, percents of increase and decrease, uniform motion problems,* and *proportions.*<br>• Does not use appropriate strategies to solve problems.<br>• Computations are incorrect.<br>• Written explanations are unsatisfactory.<br>• Does not satisfy requirements of problems.<br>• No answer may be given. |

# Chapter 3 Assessment Answer Key

## Page 203, Open-Ended Assessment
## Sample Answers

***In addition to the scoring rubric found on page A34, the following sample answers may be used as guidance in evaluating open-ended assessment items.***

**1a.** The student should explain that the first phrase is a product of $x$ and $y$ and then the addition of $z$, while the second phrase is a product of $x$ and the quantity $y + z$.

**1b.** Check that the student's values for $x$, $y$, and $z$ satisfy both $xy + z$ and $x(y + z)$. One example is $x = 1$, $y = 2$, and $z = 3$. Another example is $x = 2$, $y = 3$, and $z = 0$.

**2a.** $\frac{ry + s}{m} - t = x$

(Original equation)

$\frac{ry + s}{m} - t + t = x + t$

(Add $t$ to each side.)

$\frac{ry + s}{m} = x + t$

(Simplify.)

$m\left(\frac{ry + s}{m}\right) = m(x + t)$

(Multiply each side by $m$.)

$ry + s = mx + mt$

(Simplify.)

$ry + s - s = mx + mt - s$

(Subtract $s$ from each side.)

$ry = mx + mt - s$

(Simplify.)

$\frac{ry}{r} = \frac{mx + mt - s}{r}$

(Divide each side by $r$.)

$y = \frac{mx + mt - s}{r}$

(Simplify.)

The value of $y$ is $\frac{mx + mt - s}{r}$.

**2b.** Division by 0 is undefined, so in the original equation $m \neq 0$, and in the final equation $r \neq 0$.

**3a.** The student should conclude that a 10% decrease followed by a 10% increase results in a net decrease of 1%. Thus, the final cost would be 99% of the original price.

**3b.** Since multiplication is commutative, multiplying by 1.1 and then 0.9 would yield the same result as multiplying by 0.9 and then 1.1. The student should conclude that a 10% increase followed by a 10% decrease yields the same result as a 10% decrease followed by a 10% increase.

**4a.** Since the two people walked for the same amount of time and time can be calculated as distance divided by rate, the proportion

$\frac{\text{Tony's distance}}{\text{Tony's rate}} = \frac{\text{Ivia's distance}}{\text{Ivia's rate}}$

can be used to solve this problem.

**4b.** The length of Tony's walk can be calculated directly from his rate of 3 miles per hour and his distance of 6 miles. Ivia walked 1 mile per hour faster, so her rate is 4 miles per hour. The length of Ivia's walk can be calculated directly from her rate of 4 miles per hour and distance of 6 miles. Thus, a proportion would not be used to solve this problem.

**5a.** Sample answer: $x + 2 = 10$, $x - 2 = 6$, $2x = 16$, $\frac{x}{2} = 4$

**5b.** Sample answer: $2x + 1 = x + 9$

**5c.** These two equations are equivalent. The solution to both equations is 5. The student should recognize that the solution to all equations in parts **a** and **b** is 8. Therefore neither of these two equations could be equivalent to any of the equations created for parts **a** and **b**.

Answers

# Chapter 3 Assessment Answer Key

## Vocabulary Test/Review
**Page 204**

1. false; added to
2. true
3. true
4. false; more
5. false; true
6. false; division
7. true
8. true
9. false; percent of decrease
10. false; percent of increase
11. an equation stating that two ratios are equal
12. an equation that states a rule for the relationship between certain quantities

## Quiz (Lessons 3-1 through 3-3)
**Page 205**

1. $2n = 3(n + 9)$
2. $y^2 - 12 = 5x$
3. Two times $b$ minus 10 equals 4.
4. The sum of $y$ and the product of three and the square of $x$ is five times $x$.
5. 14
6. −49
7. −9
8. −9
9. 40
10. −40

## Quiz (Lessons 3-4 and 3-5)
**Page 205**

1. 7
2. 84
3. $-5\frac{3}{5}$
4. −5
5. no solution
6. 0
7. 7
8. C
9. 2
10. 135

## Quiz (Lessons 3-6 and 3-7)
**Page 206**

1. yes
2. no
3. no
4. 15
5. 27
6. 99
7. decrease; 28%
8. increase; 25%
9. $19.08
10. $75.60

## Quiz (Lessons 3-8 and 3-9)
**Page 206**

1. $x = \frac{p + m}{n}$
2. $b = x - ac$
3. 4 g
4. 2.4 mph
5. $\ell = \frac{P - 2w}{2}$; 14 m

# Chapter 3 Assessment Answer Key

## Mid-Chapter Test
**Page 207**

**Part I**

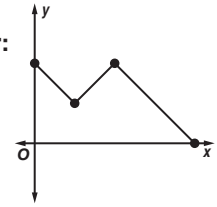
1. B
2. D
3. A
4. C
5. B
6. C

**Part II**

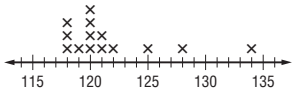
7. 0
8. all numbers
9. −2
10. $116.15
11. Four times $n$ equals $m$ times the difference of five and $n$.
12. Three times the sum of $y$ and 5 equals the product of $y$ and 7.

## Cumulative Review
**Page 208**

1. 22
2. $5u + 9v$
3. Sample answer:




4. 16.9
5. −384
6. −13
7. −1.3
8.




9. 1:3
10. $85 - 9y = 7(4 + y)$
11. 31
12. 7
13. −3
14. 3
15. $m = n(q - p)$
16. 7 L

Answers

# Chapter 3 Assessment Answer Key

## Standardized Test Practice

### Page 209

**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.** **A** B C D

**7.** A B C **D**

**8.** E F **G** H

**9.** A **B** C D

### Page 210

**10.**

| 3 | / | 2 | |
|---|---|---|---|
| . | . | . | . |
| | 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.**

| 1 | / | 1 | 2 |
|---|---|---|---|
| . | . | . | . |
| | 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.**

| 1 | / | 4 | |
|---|---|---|---|
| . | . | . | . |
| | 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.**

| 2 | 5 | | |
|---|---|---|---|
| . | . | . | . |
| | 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 |

**14.** A **B** C D

**15.** A **B** C D

**16.** A B **C** D

# Chapter 3 Assessment Answer Key

## Unit 1 Test

### Page 211

1. $5 - n^3$

2. 71

3. {4}

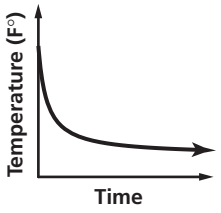
4. Multiplicative Inverse Property; $\frac{1}{6}$

5. $7t^2 + 3t$

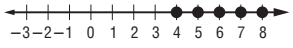
6. $7r + 9t$

7. $23a + 6b$

8. H: a figure is a triangle; C: it is a polygon; If a figure is a triangle, then it is a polygon.

9. 


10. 40 people

11. 


12. −47

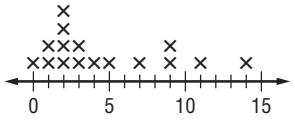
13. $-\frac{2}{3}$

14. −4.7

15. $\frac{1}{4}$ or 25%

16. 5 : 1

### Page 212

17. 


18. Median; most of the data clusters near the median.

19. irrational, real

20. $-3.\overline{65}, -\frac{18}{5}, \frac{75}{21}, \sqrt{13}$

21. −18

22. −12

23. 42

24. 56

25. −2

26. all real numbers

27. $3\frac{2}{7}$

28. $3.91

29. $v = t - sr$

30. 8 lb

Answers