5. MyMathLab—MyMathLab provides exercises correlated to the text. In addition, online tools such as video lectures, animations, and a multimedia textbook are available to help you understand the material.

6. MathXL®—MathXL is a powerful online homework, tutorial, and assessment system correlated specifically to this text. You can take chapter tests in MathXL and receive a personalized study plan based on your test results. The study plan links directly to tutorial exercises for the objectives you need to study or retest.

7. Pearson Tutor Center—Once the program has been initiated by your instructor, you can get individual tutoring by phone, fax, or email.

It is important that you keep trying! Remember, the more you practice, the better you will become at solving application problems.

EXERCISE SET 2.3

MathXL®   MyMathLab

Warm-Up Exercises

Fill in the blanks with the appropriate word, phrase, or symbol(s) from the following list.

less than	greater than	is	$x + 3$	$x - 3$	$x - 7$	$7 - x$

1. The phrase "a number increased by 3" can be represented by the algebraic expression _____.

2. The phrase "a number decreased by 3" can be represented by the algebraic expression _____.

3. A seven-foot rope is cut into two pieces. If we let $x =$ the length of the first piece, then _____ = the length of the second piece.

4. The word "_____" in a word problem often means "is equal to."

5. The phrase "6 _____ a number" can be represented by the algebraic expression $x - 6$.

6. The phrase "5 _____ a number" can be represented by the algebraic expression $x + 5$.

Practice the Skills

In Exercises 7–10, express each phrase as an algebraic expression.

7. the cost of buying y books at $19.95 each

8. 17 more than 4 times a number, m

9. 11 times a number n, decreased by 7.5

10. 7 times a number, p, increased by 8

In Exercises 11–20, select one variable to represent one quantity and express the second quantity in terms of the first.

11. A 12-foot piece of wood is cut into 2 pieces.

12. One angle of a triangle is 7° more than another angle.

13. The length of a rectangle is 29 meters longer than the width.

14. A 17-hour task is shared between Robin and Tom.

15. $165 is shared between Max and Lora.

16. George can paint a house twice as fast as Jason.

17. Nora can jog 1.3 miles per hour faster than Betty.

18. The speed limit on an expressway is 30 miles per hour faster than the speed limit on a local road.

19. The cost of electricity has increased by 22%.

20. The price of a refrigerator has increased by 6%.

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See Exercise 16.

Problem Solving

In Exercises 21–72, write an equation that can be used to solve the problem. Find the solution to the problem.

21. **Complementary Angles** Angles A and B are complementary angles. Determine the measures of angles A and B if angle A is four times the size of angle B. See Example 9.

22. **Complementary Angles** Angles C and D are complementary angles. Determine the measures of angles C and D if angle D is 15° less than twice angle C.

23. **Supplementary Angles** Angles A and B are supplementary angles. Find the measures of angles A and B if angle B is 4 times the size of angle A. See Example 10.

24. **Supplementary Angles** Angle A and angle B are supplementary angles. Find the measure of each angle if angle A is 30° greater than angle B.

25. Angles in a Triangle The sum of the measures of the angles of a triangle is 180°. Find the three angles of a triangle if one angle is 20° greater than the smallest angle and the third angle is twice the smallest angle.

26. Angles in a Triangle Find the measures of the three angles of a triangle if one angle is twice the smallest angle and the third angle is 60° greater than the smallest angle.

27. History Honor Society One benefit of membership in a national honor society is a 25% discount on all history magazine subscriptions. Thomas used this discount to order an annual subscription to *American Heritage* magazine and paid $24. What was the cost of a regular subscription?

28. A New Suit Matthew Stringer is shopping for a new suit. At K & G Menswear, he finds that the sale price of a suit that was reduced by 25% is $187.50. Find the regular price of the suit.

29. Bus Pass Kate Spence buys a monthly bus pass, which entitles her to unlimited bus travel, for $45 per month. Without the pass each bus ride costs $1.80. How many rides per month would Kate have to take so that the cost of the rides without the bus pass is equal to the total cost of the rides with the bus pass?

30. Laundry Costs It costs Bill Winschief $12.50 a week to wash and dry his clothes at the corner laundry. If a washer and dryer cost a total of $940, how many weeks will it take for the laundry cost to equal the cost of a washer and dryer? (Disregard energy cost.)

31. Truck Rental The cost of renting a truck is $35 a day plus 20¢ per mile. How far can Tanya Richardson drive in 1 day if she has only $80?

32. Waitress Pay Candice Colton is a banquet waitress. She is paid $3.25 per hour plus 15% of the total cost of the food and beverages she serves during the banquet. If, during a 5-hour shift, Candice earns $331.25, what was the total cost of the food and beverages she served?

33. Playing Golf Albert Sanchez has two options for membership in a golf club. A social membership costs $1775 in annual dues. In addition, he would pay a $50 green fee and a $25 golf cart fee every time he played. A golf membership costs $2425 in annual dues. With this membership, Albert would only pay a $25 golf cart fee when he played. How many times per year would Albert need to golf for the two options to cost the same?

34. George Washington Bridge Tolls Travelers going into New York (during off-peak hours) using the George Washington Bridge must pay a toll by paying either $8 cash or $6 using the EZ Pass system. The EZ Pass system is a prepaid plan that also requires a one-time $10 activation fee. How many trips to New York would a person need to make so that the total amount spent using the EZ Pass system would be equal to the amount spent on tolls if paying with cash?

Source: Port Authority of NY and NJ Web site

35. Toll Bridge Mr. and Mrs. Morgan live in a resort island community attached to the mainland by a toll bridge. The toll is $2.50 per car going to the island, but there is no toll coming from the island. Island residents can purchase a monthly pass for $20, which permits them to cross the toll bridge from the mainland for only 50¢ each time. How many times a month would the Morgans have to go to the island from the mainland for the cost of the monthly pass to equal the regular toll cost?

36. Sales Tax The sales tax rate in North Carolina is 4.25%. What is the maximum price that Don and Betty Lichtenberg can spend on a new computer desk if the total cost of the desk, including sales tax, is $650?

37. Renting an Apartment The DuVall family is renting an apartment in Southern California. For 2010, the rent is $1720 per month. The monthly rent in 2010 is 7.5% higher than the monthly rent in 2009. Determine the monthly rent in 2009.

38. Retirement Funds Eva Chang makes regular contributions of $5000 annually to a retirement plan. She has some of her contribution going to the growth stock fund and some going to the global equities fund. Her contribution to the growth stock fund is $250 less than twice what she contributes to the global equities fund. How much does she contribute to each fund?

39. Girl Scouts To make money for the organization, the Girl Scouts have their annual cookie drive. This year, the total sales from two districts, the southeast district and the northwest district, totaled $4.6 million. If the sales from the southeast district were $0.31 million more than the sales from the northwest district, find the sales from each district.
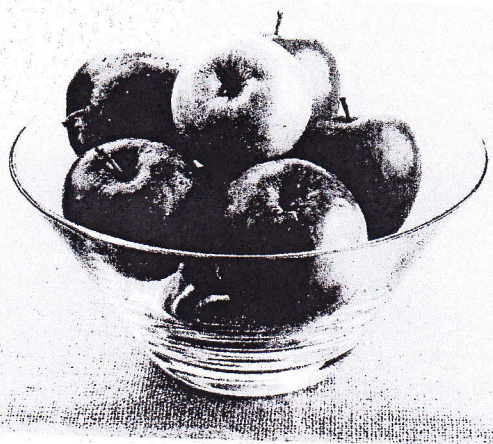
40. NFL Franchise Values As of July 13, 2008, the Dallas Cowboys and the Washington Redskins had the highest franchise values among all professional sports teams. The total value of the two franchises was $2.967 billion. The value of the Cowboys was about 2.25% higher than the value of the Redskins. Determine the value of the two teams.

Source: ESPN Magazine

41. Fiber Comparison One serving of canned blackberries contains 4.4 grams of fiber. This is 10% more fiber than in a medium-sized apple. How many grams of fiber are in a medium-sized apple?
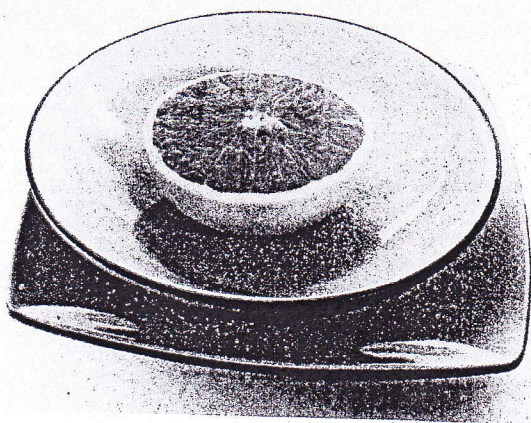
Source: Continuum Health Partners

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42. Lycopene Comparison One pink grapefruit contains 3 milligrams (mg) of lycopene. This is 50% more lycopene than in a tablespoon of ketchup. How many milligrams of lycopene are in a tablespoon of ketchup?

Source: Advance Physician Formulas

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43. Minimum Wage Increase From 2008 to 2009, the federal minimum hourly wage increased about 10.69% to $7.25. What was the minimum hourly wage in 2008?

Source: U.S. Department of Labor

44. Bones and Steel According to *Health* magazine, the stress a bone can withstand in pounds per square inch is 6000 pounds more than 3 times the amount that steel can withstand. If the difference between the amount of stress a bone and steel can withstand is 18,000 pounds per square inch, find the stress that both steel and a bone can withstand.

45. Pollen There are 57 major sources of pollen in the Un States. These pollen sources are categorized as gra weeds, and trees. If the number of weeds is 5 less than t the number of grasses, and the number of trees is 2 n than twice the number of grasses, find the number of gra weeds, and trees that are major pollen sources.

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46. Car Antitheft System By purchasing and installing a LoJa antitheft system, Janet Samuels can save 15% of the price her auto insurance. The LoJack system costs $743.65 to p chase and install. If Janet's annual insurance before install the LoJack system is $849.44, in how many years would t LoJack system pay for itself?

47. Ordering Lunch After Valerie Fandl is seated in a resta rant, she realizes that she only has $20.00. If she must pay 7 sales tax and wishes to leave a 15% tip on the total bill (me plus tax), what is the maximum price of the lunch she c order?

48. Hotel Tax Rate While on vacation in Milwaukee, t Ahmeds were quoted a hotel room price of $85 per nig plus tax. They stayed one night and watched a movie th cost $9.25. Their total bill came to $106.66. What was the t rate?

49. Comparing Mortgages The Chos are purchasing a ne home and are considering a 30-year $70,000 mortgage wi two different banks. Madison Savings is charging 9.0' with 0 points and First National is charging 8.5% with points. First National is also charging a $200 applicatic fee, whereas Madison is charging none. The monthly mor gage payments with Madison would be $563.50 and th monthly mortgage payments with First National would t $538.30.

a) After how many months would the total payments fc the two banks be the same?

b) If the Chos plan to keep their house for 30 years, whic mortgage would have the lower total cost? (Se Example 8.)

50. Payment Plan The Midtown Tennis Club offers two pay ment plans for its members. Plan 1 is a monthly fee of $2 plus $10 per hour of court rental time. Plan 2 has no monthl fee, but court time costs $18.50 per hour. How many hour would Mrs. Levin have to play per month so that plan 1 be comes advantageous?
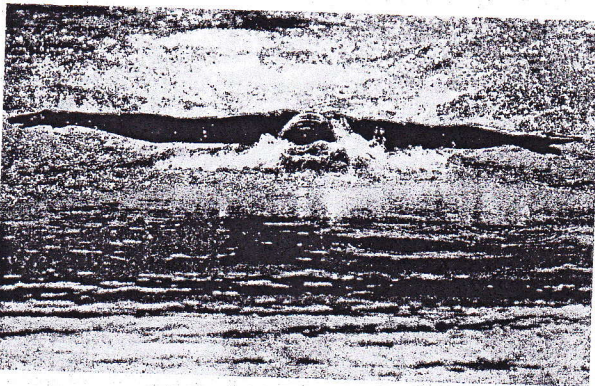
51. Refinancing a Mortgage Dung Nguyen is considering refinancing his house at a lower interest rate. He has an 11.875% mortgage, is presently making monthly principal and interest payments of $510, and has 20 years left on his mortgage. Because interest rates have dropped, Countrywide Mortgage Corporation is offering him a rate of 9.5%, which would result in principal and interest payments of $420.50 for 20 years. However, to get this mortgage, his closing cost would be $2500.

a) In how many months after refinancing will he have spent the same amount on his new mortgage plus closing cost as he would have spent on the original mortgage?

b) If he plans to spend the next 20 years in the house, would he save money by refinancing?

52. Dinner Seminars Heather Jockson, a financial planner, is sponsoring dinner seminars. She must pay for the dinners of those attending out of her own pocket. She chooses a restaurant that seats 40 people and charges her $9.50 per person. If she earns 12% commission of sales made, determine how much in sales she must make from these 40 people

a) to break even.

b) to make a profit of $500.

53. 2008 Olympic Swimmers The top four medal winners in swimming for the United States during the 2008 Summer Olympics were Michael Phelps, Natalie Coughlin, Ryan Lochte, and Matt Grevers. The total number of medals won by these swimmers was 21. Lochte won one more medal than Grevers. Coughlin won twice as many medals as Grevers. Phelps won two more than twice as many medals as Grevers. How many medals did each swimmer win?
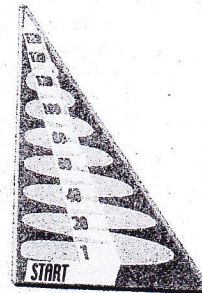

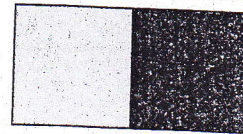© V.J. Matthew/Shutterstock

Source: United States Olympic Committee

54. Test Grades On a recent test in an intermediate algebra class, 34 students received grades of A, B, C, or D. There were twice as many C's as D's. There were 2 more B's than D's. The number of A's was two more than twice the number of D's. Determine the number of A's, B's, C's, and D's from this test.

55. Plants and Animals Approximately 1,500,000 species worldwide have been categorized as either plants, animals, or insects. Insects are often subdivided into beetles and insects that are not beetles. There are about 100,000 more plant than animal species. There are 290,000 more nonbeetle insects than animals. The number of beetles is 140,000 less than twice the number of animals. Find the number of animal, plant, nonbeetle insect, and beetle species.

56. Sides of a Triangle The sum of the lengths of the sides of a triangle is 30 inches. The length of the first side is 3 inches more than twice the shortest side. The length of the second side is 2 inches more than twice the shortest side. Find the lengths of the three sides of the triangle.
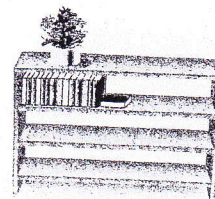
57. Perimeter of a Triangle John is developing a game that contains a triangular game board. The perimeter of the triangular board is 36 inches. Find the length of the three sides if one side is 3 inches greater than the smallest side, and the third side is 3 inches less than twice the length of the smallest side.
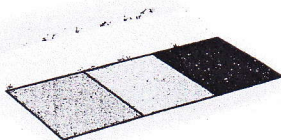

58. Angles of a Triangle A rectangular piece of paper is cut from opposite corners to form a triangle. One angle of the triangle measures 12° greater than the smallest angle. The third angle measures 27° less than three times the smallest angle. If the sum of the interior angles of a triangle measure 180°, determine the measures of the three angles.

59. Triangular Garden The perimeter of a triangular garden is 60 feet. Find the length of the three sides if one side is 4 feet greater than twice the length of the smallest side, and the third side is 4 feet less than 3 times the length of the smallest side.

60. Stairway Railing A stairway railing has a design that contains triangles. In one of the triangles one angle measures 20° less than twice the smallest angle. The third angle measures 25° greater than twice the smallest angle. Determine the measures of the three angles.

61. Fence Dimensions Greg Middleton, a landscape architect, wishes to fence in two equal areas as illustrated in the figure. If both areas are squares and the total length of fencing used is 91 meters, find the dimensions of each square.

62. Sandbox Construction Edie Hall is planning to build a rectangular sandbox for her children. She wants its length to be 3 feet more than its width. Find the length and width of the sandbox if only 22 feet of lumber are available to form the frame. Use $P = 2l + 2w$.

63. Bookcase Dimensions Eric Krassow wishes to build a bookcase with four shelves (including the top) as shown in the figure. The width of the bookcase is to be 3 feet more than the height. If only 30 feet of wood are available to build the bookcase, what will be the dimensions of the bookcase?
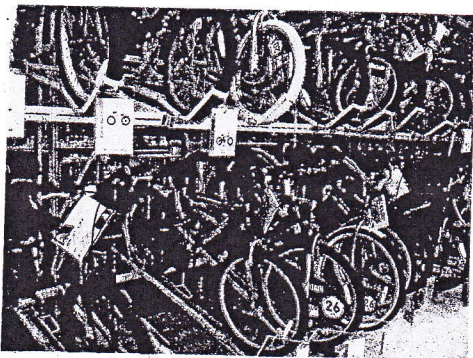
64. Fence Dimensions Collette Siever wishes to fence in three rectangular areas along a river bank as illustrated in the figure. Each rectangle is to have the same dimensions, and the length of each rectangle is to be 1 meter greater than its width (along the river). Find the length and width of each rectangle if the total amount of fencing used is 114 meters.

65. Price Reductions During the first week of a going-out-of-business sale, Sam's General Store reduces all prices by 10%. The second week of the sale, Sam's reduces all items by an additional $5. If Jim Condor bought a calculator for $49 during the second week of the sale, find the original price of the calculator.

66. Farm Divisions Deborah Schmidt's farm is divided into three regions. The area of one region is twice as large as the area of the smallest region, and the area of the third region is 4 acres less than three times the area of the smallest region. If the total acreage of the farm is 512 acres, find the area of each of the three regions.

67. Selling Paintings J. P. Richardson sells each of his paintings for $500. The gallery where he displays his work charges him $1350 a month plus a 10% commission on sales. How many paintings must J. P. sell in a month to break even?

68. Comparing Toy Sales Kristen Hodge is shopping for a certain bicycle for her niece and knows that Toys "R" Us and Wal-Mart sell the bike for the same price. On December 26, Toys "R" Us has the bike on sale for 37% off the original price and Wal-Mart has the bike on sale for $50 off the original price. After visiting both stores, Kristen discovers that the sale prices for the bike at the two stores are also the same.

a) Determine the original price of the bike.
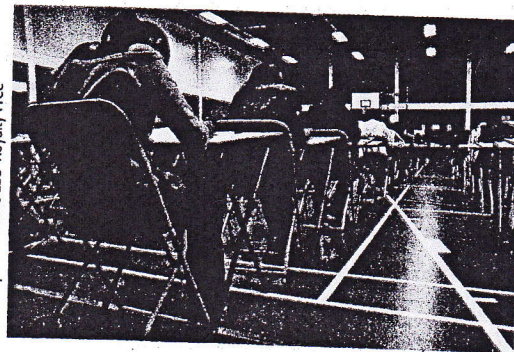
b) Determine the sale price of the bike.

69. Incandescent Bulbs The cost of purchasing incandesce bulbs for use over a 9750-hour period is $9.75. The ener cost of incandescent bulbs over this period is $73. The cost one equivalent fluorescent bulb that lasts about 9750 hours $20. By using a fluorescent bulb instead of incandesce bulbs for 9750 hours, the total savings of purchase price pl energy cost is $46.75. What is the energy cost of using the fl orescent bulb over this period?

70. Dinner Bill The five members of the Newton family a going out to dinner with the three members of the Lee fami Before dinner, they decide that the Newtons will pay $\frac{5}{8}$ of tl bill (before tip) and the Lees will pay $\frac{3}{8}$ plus the entire 15 tip. If the total bill including the 15% tip comes to $184.6 how much will be paid by each family?

71. Earning an A To find the average of a set of test scores, w divide the sum of the test scores by the number of test score On her first four algebra tests, Paula West's scores were 8 92, 97, and 96.

a) Write an equation that can be used to determine th grade Paula needs to obtain on her fifth test to have a 9 average.

b) Explain how you determined your equation.

c) Solve the equation and determine the score.

72. Physics Exam Average Francis Timoney's grades on five physics exams were 70, 83, 97, 84, and 74.

a) If the final exam will count twice as much as each exam, what grade does Francis need on the final exam to have an 80 average?

b) If the highest possible grade on the final exam is 100 points, is it possible for Francis to obtain a 90 average? Explain.

73. a) Make up your own realistic word problem involving percents. Represent this word problem as an equation.

b) Solve the equation and answer the word problem.

74. a) Make up your own realistic word problem involving money. Represent this word problem as an equation.

b) Solve the equation and answer the word problem.

Challenge Problems

75. Truck Rental The Elmers Truck Rental Agency charges $28 per day plus 15¢ a mile. If Martina Estaban rented a small truck for 3 days and the total bill was $121.68, including a 4% sales tax, how many miles did she drive?

76. Money Market On Monday Sophia Murkovic purchased shares in a money market fund. On Tuesday the value of the shares went up 5%, and on Wednesday the value fell 5%. How much did Sophia pay for the sh