EXERCISES

For more practice, see *Extra Practice*.

Practice and Problem Solving

A Practice by Example

Solve each inequality. Check your solution.

Example 1 (page 153)

1. $4d + 7 \leq 23$ **2.** $5m - 3 > -18$ **3.** $-4x - 2 < 8$

4. $5 - 3n \geq -4$ **5.** $8 \leq -12 + 5q$ **6.** $5 \leq 11 + 3h$

7. $-7 \leq 5 - 4a$ **8.** $10 > 29 - 3b$ **9.** $5 - 9c > -13$

Example 2 (page 154)

Write and solve an inequality.

10. On a trip from Virginia to Florida, the Sampson family wants to travel at least 420 miles in 8 hours of driving. What must be their average rate of speed?

11. Geometry The perimeter of an isosceles triangle is at most 27 cm. One side is 8 cm long. Find the possible lengths of the two congruent sides.

Example 3 (page 154)

12. You want to solve an inequality containing the expression $-3(2x - 3)$. The next line in your solution would rewrite this expression as _?_.

Solve each inequality.

13. $2(j - 4) \geq -6$ **14.** $-(6b - 2) > 0$ **15.** $-2(h + 2) < -14$

16. $-3 \leq 3(5x - 16)$ **17.** $25 > -(4y + 7)$ **18.** $4(w - 2) \leq 10$

19. $-3(c + 4) - 2 > 7$ **20.** $-2(r - 3) + 7 \geq 8$ **21.** $16 \leq 4 - 3(n - 13)$

Example 4 (page 155)

22. $3w + 2 < 2w + 5$ **23.** $3t + 7 \geq 5t + 9$ **24.** $4d + 7 \geq 1 + 5d$

25. $5 - 2n \leq 3 - n$ **26.** $2k - 3 \leq 5k + 9$ **27.** $3s + 16 > 6 + 4s$

28. $6p - 1 > 3p + 8$ **29.** $3x + 2 > -4x + 16$ **30.** $2 - 3m < 4 + 5m$

31. $4d + 5 < -4d - 3$ **32.** $4 - 5y \geq 8 - y$ **33.** $2k + 6 \leq 4 + 5k$

Example 5 (page 155)

34. $-3(v - 3) \geq 5 - 4v$ **35.** $3q + 6 \leq -5(q + 2)$ **36.** $3(2 + r) \geq 15 - 2r$

37. $9 + x < 7 - 2(x - 3)$ **38.** $2(m - 8) < -8 + 3m$ **39.** $2v - 4 \leq 2(3v - 6)$

B Apply Your Skills

Tell what you must do to the first inequality in order to get the second.

40. $8 - 4s > 16; -4s > 8$ **41.** $\frac{2}{3}g + 7 \geq 9; \frac{2}{3}g \geq 2$

42. $2y - 5 > 9 + y; y > 14$ **43.** $-8 > \frac{z}{-5} - 2; 30 < z$

44. $4j + 5 \geq 23 + 3j; j \geq 18$ **45.** $2(q - 3) < 9 - 3q; q < 3$

46. a. Solve $5t + 4 \leq 8t - 5$ by gathering the variable terms on the left side and the constant terms on the right side of the inequality.

b. Solve $5t + 4 \leq 8t - 5$ by gathering the constant terms on the left side and the variable terms on the right side of the inequality.

c. Compare the results of parts (a) and (b).

Write and solve an inequality for each of the following statements.

Sample Four times the sum of x and 10 is less than 20.

$4(x + 10) < 20$

$x + 10 < 5$ **Divide each side by 4.**

$x < -5$ **Subtract 10 from each side.**

47. Six minus the sum of r and 3 is less than 15.

48. One half the difference of t and six is less than or equal to four.

49. Three times the quantity z plus 2 is greater than 12.

50. Writing Suppose a friend is having difficulty solving $2.5(p - 4) > 3(p + 2)$. Explain how to solve the inequality, showing all necessary steps and identifying the properties you would use.

Need Help?
Inequalities or equations that are always true are called *identities*. (See p. 98)

51. a. Mental Math Like equations, some inequalities are true for all values of the variable, and some inequalities are not true for any values of the variable. Determine whether each inequality is *always* true or *never* true.
i. $4s + 6 \geq 6 + 4s$ **ii.** $3r + 5 > 3r - 2$ **iii.** $4(n + 1) < 4n - 3$
b. Critical Thinking How can you tell whether an inequality is always true or never true without solving?

52. Expenses The sophomore class is planning a picnic. The cost of a permit to use a city park is \$250. To pay for the permit, there is a fee of \$.75 for each sophomore and \$1.25 for each guest who is not a sophomore. Two hundred sophomores plan to attend. Write and solve an inequality to find how many guests must attend for the sophomores to pay for the permit.

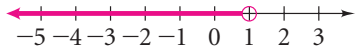
Real-World Connection
Normal blood pressure for teens is about 110/70.

53. Health Care Systolic blood pressure is the higher number in a blood pressure reading. It is measured as your heart muscle contracts. The formula $P \leq \frac{1}{2}a + 110$ gives the normal systolic blood pressure P based on age a.
a. At age 20, does 120 represent a maximum or a minimum normal systolic pressure?
b. Find the normal systolic blood pressure for a 50-year-old person.

Match each inequality with its graph below.

54. $-2x - 2 > 4$ **55.** $2 - 2x > 4$ **56.** $2x + 2 > 4$

57. $2x + 2 > 4x$ **58.** $2x - 2 > 4$ **59.** $-2(x - 2) > 4$

A.


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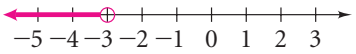

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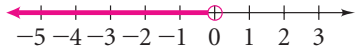

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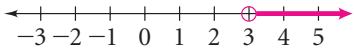

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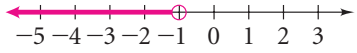

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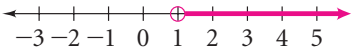


60. Open-Ended Write two different inequalities that you can solve by adding 5 and multiplying by -3. Solve each inequality.

Solve each inequality.

61. $\frac{4}{3}r - 3 < r + \frac{2}{3} - \frac{1}{3}r$

62. $4 - 2m \leq 5 - m + 1$

63. $-2(0.5 - 4s) \geq -3(4 - 3.5s)$

64. $\frac{1}{2}n - \frac{1}{8} \geq \frac{3}{4} + \frac{5}{6}n$

65. $-(8 - s) < 0$

66. $3.8 - k \leq 5.2 - 2k$

67. $10 > 3(2n - 1) - 5(4n + 3)$

68. $3(3r + 1) - (r + 4) \leq 13$

69. $2(3x + 7) > 4(7 - 2x)$

70. $4(a - 2) - 6a \leq -9$

71. $4(3m - 1) \geq 2(m + 3)$

72. $17 - (4k - 2) \geq 2(k + 3)$

73. $2n - 3(n + 3) \leq 14$

74. $5x - \frac{1}{2}(3x + 8) \leq -4 + 3x$

75. $5a - 2(a - 15) < 10$

76. $5c + 4(c - 1) \geq 2 + 5(2 + c)$

77. Business Mandela is starting a part-time word-processing business out of his home. He plans to charge $15 per hour. The table at the right shows his expected monthly business expenses. Write and solve an inequality to find the number of hours he must work in a month to make a profit of at least $600.

78. Commission Joleen is a sales associate in a clothing store. Each week she earns $250 plus a commission equal to 3% of her sales. This week her goal is to earn no less than $460. Write and solve an inequality to find the dollar amount of the sales she must have to reach her goal.

Error Analysis **Find and correct the mistake in each of the following.**

79.

$$3x + 3 \leq -2x + 5$$
$$3x \leq -2x + 2$$
$$x \leq 2$$

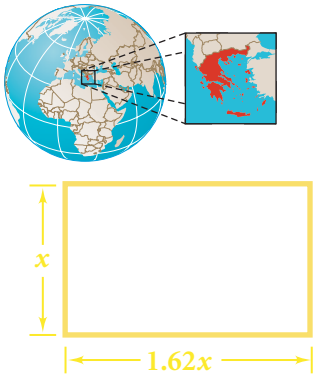
80.

$$4(n + 2) > 3n + 1$$
$$4n + 2 > 3n + 1$$
$$4n > 3n - 1$$
$$n > -1$$

C Challenge

81. a. Solve $ax + b > c$ for x, where a is positive.
b. Reasoning Solve $ax + b > c$ for x, where a is negative.

82. Geometry The base of a triangle is 10 in. Its height is $(x + 4)$ in. Its area is no more than 56 in.^{2}. What are the possible integer values of x?

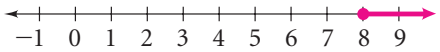


Real-World Connection

The Parthenon, an ancient Greek temple, has dimensions that form a golden rectangle.

83. Architecture The rectangle shown on the drawing at the left is a golden rectangle. Artists often use the golden rectangle because they consider it to be pleasing to the eye. The ratio of two sides of a golden rectangle is approximately 1 : 1.62. Suppose you are making a picture frame in the shape of a golden rectangle. You have a 46-in. length of wood to use for a frame. What are the dimensions of the largest frame you can make? Round to the nearest tenth of an inch.

84. Critical Thinking Find a value of a such that the number line below shows all the solutions of $ax + 4 \leq -12$.



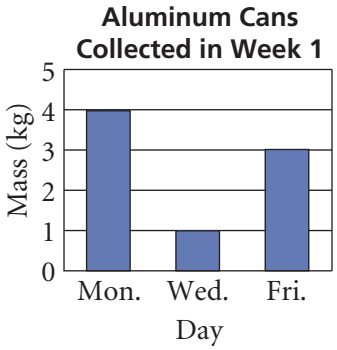
85. Earning You can earn money by handing out flyers in the afternoon for $6.50 an hour and by typing a newsletter in the evening for $8 an hour. You have 20 hours available to work. What are the greatest number of hours you can spend handing out flyers and still make at least $145?

86. Freight Handling The freight elevator of a building can safely carry a load of at most 4000 lb. A worker needs to move supplies in 50-lb boxes from the loading dock to the fourth floor of the building. The worker weighs 160 lb. The cart she uses weighs 95 lb.
a. What is the greatest number of boxes she can move in one trip?
b. The worker must deliver 310 boxes to the fourth floor. How many trips must she make?

Standardized Test Prep

Multiple Choice

87. The Science Club hopes to collect at least 200 kg of aluminum cans for recycling this semester (21 weeks). The graph at the right shows the first week's results.



Let x represent the average mass of cans required per week for the remainder of the semester. Which inequality would you use to find x?

A. $x \geq \frac{200}{21}$ **B.** $x \geq \frac{(200 - 8)}{21}$

C. $x \geq \frac{(200-8)}{20}$ **D.** $x > \left(\frac{200}{20}\right) - 8$

88. Solve $2x - 8 > 4x + 2$.

F. $x < -5$ **G.** $x > -5$ **H.** $x < 5$ **I.** $x > 5$

89. Solve $-5n + 16 \leq -7n$.

A. $n \leq -8$ **B.** $n \geq -8$ **C.** $n \leq 8$ **D.** $n \geq 8$

90. Great Gifts pays its supplier \$65 for each box of 12 bells. The owner wants to determine the least amount x he can charge his customers per bell in order to make at least a 50% profit per box. Which inequality should he use?

F. $12x \geq 1.50(65)$ **G.** $65x \leq 1.50(12)$

H. $0.50(12x) \geq 65$ **I.** $0.50(12x) \leq 65$

Short Response

91. Maxwell orders at least 30 bottles of flea shampoo per month for his pet-grooming business. His supplier charges \$3 per quart bottle plus a \$25 handling fee per order. A competing supplier offers a similar product for \$4 per quart bottle plus a \$5 handling fee per order. The salesman for the competitor shows Maxwell that 10 bottles from his company would cost only \$45 compared to \$55 from Maxwell's current supplier.

Which supplier would you advise Maxwell to use? Explain or show work to support your advice to Maxwell.

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Mixed Review

Lesson 3-3 **Solve each inequality.**

92. $-9m \geq 36$ **93.** $-24 \leq 3y$ **94.** $\frac{x}{3} > -4$ **95.** $-\frac{t}{3} \leq 1$

96. $\frac{2}{3}b < 18$ **97.** $42 > -\frac{3}{7}w$ **98.** $56 < 42p$ **99.** $0.5d \geq 3.5$

Lesson 2-5

100. Your family leaves your town traveling at an average rate of 45 mi/h. Two hours later, your neighbor leaves your town along the same road at an average rate of 60 mi/h. How many hours will it take your neighbor to overtake you?

Lesson 1-6 **Simplify each expression.**

101. -4^2 **102.** $(-4)^2$ **103.** $(-2)^3(-3)$ **104.** -2^4

Algebra at Work

Marketing Director

Marketing directors rely on equations and inequalities to predict the actions their companies must take to stay competitive. For example, the marketing director of a manufacturing company determines how much the cost of raw materials can increase before the company must raise the price of its finished goods or services. The director also predicts the effect of price changes on the quantity of goods and services sold by his company.

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