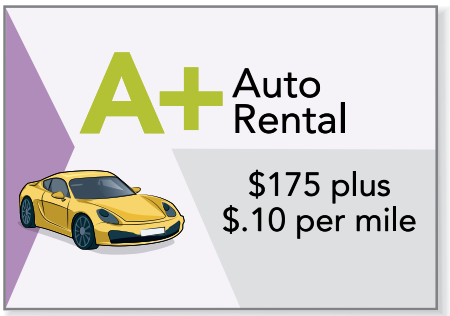
Applications

1. Sam needs to rent a car for a one-week trip in Oregon. He is considering two companies.



a. Write an equation relating the rental cost for each company to the number of miles driven.

b. Graph the equations.

c. Under what circumstances is the rental cost the same for both companies? What is that cost?

d. Under what circumstances is renting from Zippy cheaper than renting from A+?

e. Suppose Sam rents a car from A+ and drives 225 miles. What is his rental cost?

2. Mariana lives 1,250 meters from school. Ming lives 800 meters from school. Both students leave for school at the same time. Mariana walks at an average speed of 70 meters per minute, while Ming walks at an average speed of 40 meters per minute. Mariana's route takes her past Ming's house.

a. Write equations that show Mariana and Ming's distances from school t minutes after they leave their homes.

Answer parts (b)–(d) by writing and solving equations or inequalities.

b. When, if ever, will Mariana catch up with Ming?

c. How long will Mariana remain behind Ming?

d. At what times is the distance between the two students less than 20 meters?

3. Suppose s and t are two numbers and that $s > t$. Determine whether each inequality must be true.

a. $s + 15 > t + 15$

b. $s - (-22) > t - (-22)$

c. $s \times 0 > t \times 0$

d. $\frac{s}{-6} > \frac{t}{-6}$

e. $\frac{s}{6} > \frac{t}{6}$

f. $s(-3) < t(-4)$

For Exercises 4–7, solve the inequality. Then, graph the solution on a number line.

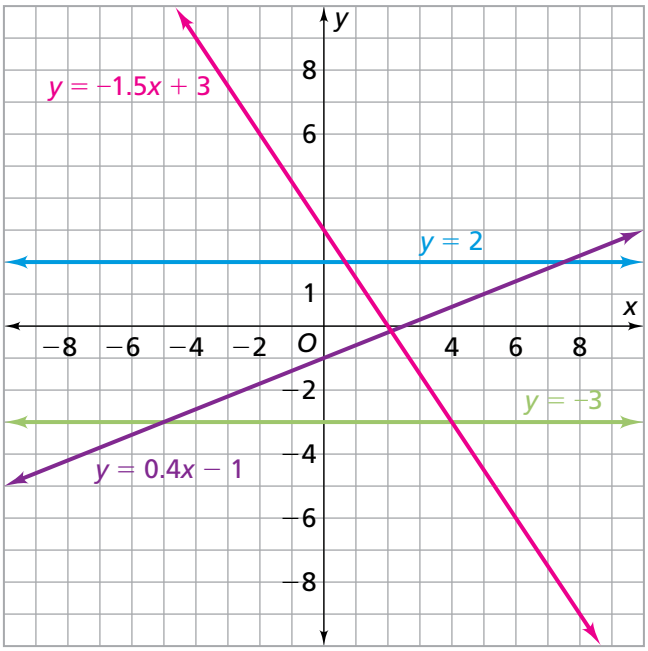
4. $12 < 7x - 2$

5. $2x + 12 > 32$

6. $4x - 17 \leq 31$

7. $-16x - 12 > 14 - 10x$

8. Use the graph below to estimate solutions for the inequalities and equations in parts (a)–(f). Then, use symbolic reasoning to check your estimates.



a. $0.4x - 1 > 2$

b. $0.4x - 1 > -3$

c. $-1.5x + 3 > 2$

d. $-1.5x + 3 < -3$

e. $-1.5x + 3 = 0.4x - 1$

f. $-1.5x + 3 > 0.4x - 1$

9. When a soccer ball is kicked into the air, its height h in feet at any time t seconds later can be estimated by the function $h = -16t^2 + 32t$. For each question, write and solve an equation or inequality.

a. When does the ball return to the ground ($h = 0$ feet)?

b. When is the ball 12 feet above the ground?

c. When is the ball at least 12 feet above the ground?

d. When is the ball at most 12 feet above the ground?

e. When is the ball 16 feet above the ground?

10. Solve each equation or inequality. Sketch the graphs of the functions that are associated with each equation or inequality. Explain how to find the solutions using the graphs.

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

b. $-x^2 + 4x - 4 < -2x + 4$

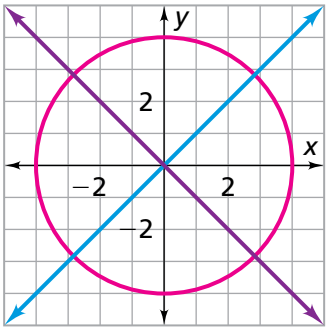
c. $-x^2 + 4x - 4 > -2x + 4$

d. $x^2 - 5x = 6$

e. $x^2 - 5x < 6$

f. $x^2 - 5x > 6$

11. The graph below shows a circle with radius 4 and two lines intersecting the circle.



- Estimate the solution(s) of the systems of equations using the graph.
- Check your estimates by substituting them into the equations.
- Find exact solution(s) of each system.

a. $\begin{cases} x^2 + y^2 = 16 \\ y = x \end{cases}$

b. $\begin{cases} x^2 + y^2 = 16 \\ y = -x \end{cases}$

Connections

Calculate the *y*-value for the given *x*-value.

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

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

14. $y = \frac{1}{2}x - 4$ when $x = 24$

15. $y = -5x - 7$ when $x = \frac{1}{5}$

16. $y = \frac{2}{3}x - 12$ when $x = -18$

17. $y = -\frac{1}{4}x - \frac{3}{4}$ when $x = -6$

Graph the system of equations and estimate the point of intersection. Then, use symbolic reasoning to check whether your estimate is accurate.

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

19. $y = x + 5$ and $y = -3x + 3$

20. $y = 3$ and $y = 6x - 3$

21. $x = 2$ and $y = -\frac{2}{5}x + 4$

Write an equation for the line satisfying the given conditions.

22. slope $= 2$, y-intercept $= -3$

23. slope $= -4$, passes through $(0, 1.5)$

24. passes through $(-2, 1)$ and $(4, -3)$

25. passes through $(4, 0)$ and $(0, 3)$

Identify the slope, *x*-intercept, and *y*-intercept of the line.

26. $y = 7x - 3$

27. $y = -3x + 4$

28. $y = \frac{2}{3}x + 12$

29. $y = -\frac{1}{4}x - 5$

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

31. $y = -\frac{2}{3}(x + 10)$

For Exercises 32–37, copy each pair of expressions. Insert $<$, $>$, or $=$ to make a true statement.

32. $-18 \div (-3) \blacksquare -24 \div (-4)$

33. $1{,}750(-12) \blacksquare 1{,}749(-12)$

34. $5(18 - 24) \blacksquare 90 - (-120)$

35. $-8(-5) \blacksquare -7(-5)$

36. $4[-3 - (-7)] \blacksquare 4(-3) - 4(-7)$

37. $-5(-4)^2 \blacksquare -4(-5)^2$

38. Write an equation or inequality that tells whether each point is inside, outside, or on the circle with a radius of 10 and centered at (0, 0).

a. (6, 8)

b. (7, 7)

c. (−7, −7)

d. (−6, 8)

e. (−7, 8)

f. (−7, −8)

For Exercises 39–44, copy each pair of fractions. Insert $<$, $>$, or $=$ to make a true statement.

39. $\frac{6}{8} \blacksquare \frac{-18}{24}$

40. $\frac{6}{8} \blacksquare \frac{7}{9}$

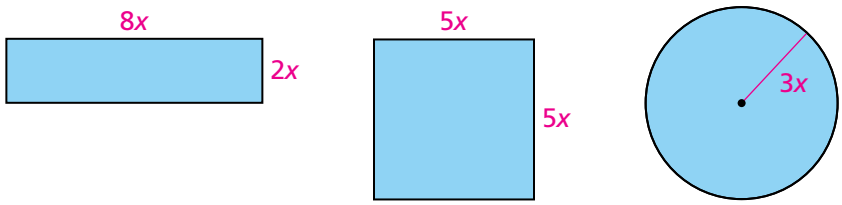
41. $\frac{6}{8} \blacksquare \frac{-7}{9}$

42. $\frac{6}{8} \blacksquare \frac{-18}{-24}$

43. $\frac{6}{8} \blacksquare \frac{-7}{-9}$

44. $\frac{8}{6} \blacksquare \frac{-9}{7}$

45. Use the figures below for parts (a)–(f). Insert $<$, $>$, or $=$ to make true statements.



a. perimeter of square ■ perimeter of rectangle

b. area of square ■ area of rectangle

c. perimeter of square ■ circumference of circle

d. area of square ■ area of circle

e. perimeter of rectangle ■ circumference of circle

f. area of rectangle ■ area of circle

46. The gender of a newborn child is nearly equally likely to be a boy or a girl. Consider the patterns likely to occur in a family with three children.

Note: In the following statements, $P(Q)$ is used to indicate the probability that event Q occurs.

Copy parts (a)–(d). Insert $<$, $=$, or $>$ to make true statements.

a. P(all boys) ■ P(all girls)

b. P(exactly one boy) ■ P(exactly 2 girls)

c. P(BGB) ■ P(BBG)

d. P(two boys and one girl) ■ P(all girls)

47. Multiple Choice If $w = 3x + c$, what is the value of x?

A. 3

B. $\frac{w - c}{3}$

C. $w - c$

D. $\frac{w + c}{3}$

48. Suppose $\frac{a}{b}$ and $\frac{c}{d}$ are two nonzero fractions and $\frac{a}{b} < \frac{c}{d}$.

a. Give an example of values of a, b, c, and d that satisfy $\frac{a}{b} < \frac{c}{d}$ and also $\frac{b}{a} < \frac{d}{c}$.

b. Give an example of values of a, b, c, and d that satisfy $\frac{a}{b} < \frac{c}{d}$ and also $\frac{b}{a} > \frac{d}{c}$.

49. Multiple Choice Which function's graph is perpendicular to the graph of $y = 2.5x + 4$?

A. $y = 2.5x$

B. $y = 0.4x$

C. $y = -0.4x$

D. $y = -2.5x$

50. Use a table or graph of $y = 5(2^x)$ to estimate the solution of the inequality $5(2^x) > 1{,}000$.

For Exercises 51–56, write the expression for x in factored form. Then, find the x- and y-intercepts for the graph of the function.

51. $y = x^2 + 4x$

52. $y = x^2 + 4x + 4$

53. $y = x^2 + 3x - 10$

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

55. $y = x^2 - 4$

56. $y = x^2 + 4x + 3$

57. Multiple Choice Which expression is the factored form of $x + 2x + 6$?

F. $3x + 6$ **G.** $2(x + 3)$ **H.** $3(x + 2)$ **J.** $3(x + 6)$

Extensions

58. In parts (a)–(d), find values of x that satisfy the given conditions. Then, graph the solution on a number line.

a. $x + 7 < 4$ *or* $x + 3 > 9$
(**Hint:** Find the x-values that satisfy one inequality or the other, or both.)

b. $3x + 4 < 13$ *and* $12 < 6x$
(**Hint:** Find the x-values that satisfy both inequalities.)

c. $5x - 6 > 2x + 18$ *or* $-3x + 5 > 8x - 39$

d. $-11x - 7 < -7x + 33$ *and* $9 + 2x > 11x$

59. Suppose m and n are positive whole numbers and $m < n$. Tell whether each statement is always true.

a. $2^m < 2^n$ **b.** $m^2 < n^2$ **c.** $0.5^m < 0.5^n$ **d.** $\frac{1}{m} < \frac{1}{n}$

60. Solve these quadratic inequalities.
(**Hint:** Use a graph or table of $y = 5x^2 + 7$ to estimate the solutions. Then adapt the reasoning used to solve linear inequalities to check the accuracy of your estimates.)

a. $5x^2 + 7 \leq 87$ **b.** $5x^2 + 7 > 87$

61. Solve these exponential inequalities.
(**Hint:** Use a graph or table of $y = 2(3^x) - 8$ to estimate the solutions. Then adapt the reasoning used to solve linear inequalities to check the accuracy of your estimates.)

a. $2(3^x) - 8 < 46$ **b.** $2(3^x) - 8 > 10$