

EXAMPLE 6 Write a model using standard form

ONLINE MUSIC You have \$30 to spend on downloading songs for your digital music player. Company A charges \$.79 per song, and company B charges \$.99 per song. Write an equation that models this situation.

Solution

Write a verbal model. Then write an equation.

| | | | | | | | | |
|-------------------------------------------|---|------------------------------------|---|-------------------------------------------|---|------------------------------------|---|-----------------------------|
| Company A song price (dollars/song) | • | Songs from company A (songs) | + | Company B song price (dollars/song) | • | Songs from company B (songs) | = | Your budget (dollars) |
| ↓ | | ↓ | | ↓ | | ↓ | | ↓ |
| 0.79 | • | x | + | 0.99 | • | y | = | 30 |

▶ An equation for this situation is $0.79x + 0.99y = 30$.

✓ **GUIDED PRACTICE** for Example 6

10. **WHAT IF?** In Example 6, suppose that company A charges \$.69 per song and company B charges \$.89 per song. Write an equation that models this situation.

2.4 EXERCISES

HOMEWORK KEY

- = **WORKED-OUT SOLUTIONS**
on p. WS3 for Exs. 15, 35, and 53
- ★ = **STANDARDIZED TEST PRACTICE**
Exs. 2, 26, 39, 47, and 53
- ◆ = **MULTIPLE REPRESENTATIONS**
Ex. 57

SKILL PRACTICE

1. **VOCABULARY** Copy and complete: The linear equation $6x + 8y = 72$ is written in ? form.
2. ★ **WRITING** Given two points on a line, explain how you can use point-slope form to write an equation of the line.

EXAMPLE 1

on p. 98
for Exs. 3–8

SLOPE-INTERCEPT FORM Write an equation of the line that has the given slope and y-intercept.

- | | | |
|-----------------------------|------------------------------|---------------------|
| 3. $m = 0, b = 2$ | 4. $m = 3, b = -4$ | 5. $m = 6, b = 0$ |
| 6. $m = \frac{2}{3}, b = 4$ | 7. $m = -\frac{5}{4}, b = 7$ | 8. $m = -5, b = -1$ |

EXAMPLE 2

on p. 99
for Exs. 9–19

POINT-SLOPE FORM Write an equation of the line that passes through the given point and has the given slope.

- | | | |
|---------------------------------|--------------------------------|---------------------------------|
| 9. $(0, -2), m = 4$ | 10. $(3, -1), m = -3$ | 11. $(-4, 3), m = 2$ |
| 12. $(-5, -6), m = 0$ | 13. $(8, 13), m = -9$ | 14. $(12, 0), m = \frac{3}{4}$ |
| 15. $(7, -3), m = -\frac{4}{7}$ | 16. $(-4, 2), m = \frac{3}{2}$ | 17. $(9, -5), m = -\frac{1}{3}$ |

ERROR ANALYSIS Describe and correct the error in writing an equation of the line that passes through the given point and has the given slope.

18. $(-4, 2), m = 3$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = 3(x - 4)$$

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

$$y = 3x - 10$$



19. $(5, 1), m = -2$

$$y - y_1 = m(x - x_1)$$

$$y - 5 = -2(x - 1)$$

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

$$y = -2x + 7$$



EXAMPLE 3

on p. 99
for Exs. 20–26

PARALLEL AND PERPENDICULAR LINES Write an equation of the line that passes through the given point and satisfies the given condition.

20. $(-3, -5)$; parallel to $y = -4x + 1$

21. $(7, 1)$; parallel to $y = -x + 3$

22. $(2, 8)$; parallel to $y = 3x - 2$

23. $(4, 1)$; perpendicular to $y = \frac{1}{3}x + 3$

24. $(-6, 2)$; perpendicular to $y = -2$

25. $(3, -1)$; perpendicular to $y = 4x + 1$

26. **★ MULTIPLE CHOICE** What is an equation of the line that passes through $(1, 4)$ and is perpendicular to the line $y = 2x - 3$?

(A) $y = 2x + 2$

(B) $y = \frac{1}{2}x + \frac{7}{2}$

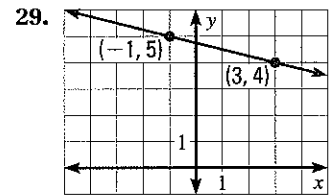
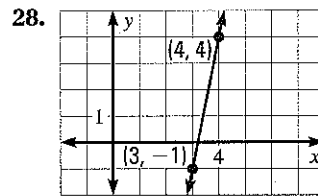
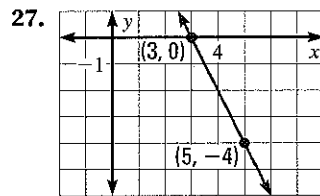
(C) $y = -\frac{1}{2}x + \frac{9}{2}$

(D) $y = -\frac{1}{2}x + 4$

EXAMPLE 4

on p. 100
for Exs. 27–38

VISUAL THINKING Write an equation of the line.



WRITING EQUATIONS Write an equation of the line that passes through the given points.

30. $(-1, 3), (2, 9)$

31. $(4, -1), (6, -7)$

32. $(-2, -3), (2, -1)$

33. $(0, 7), (3, 5)$

34. $(-1, 2), (3, -4)$

35. $(-5, -2), (-3, 8)$

36. $(15, 20), (-12, 29)$

37. $(3.5, 7), (-1, 20.5)$

38. $(0.6, 0.9), (3.4, -2.6)$

39. **★ MULTIPLE CHOICE** Which point lies on the line that passes through the point $(9, -5)$ and has a slope of -6 ?

(A) $(6, 10)$

(B) $(6, 6)$

(C) $(7, 7)$

(D) $(6, -4)$

STANDARD FORM Write an equation in standard form $Ax + By = C$ of the line that satisfies the given conditions. Use integer values for $A, B,$ and C .

40. $m = -3, b = 5$

41. $m = 4, b = -3$

42. $m = -\frac{3}{2}$, passes through $(4, -7)$

43. $m = \frac{4}{5}$, passes through $(2, 3)$

44. passes through $(-1, 3)$ and $(-6, -7)$

45. passes through $(2, 8)$ and $(-4, 16)$


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46. **REASONING** Write an equation of the line that passes through (3, 4) and satisfies the given condition.
- Parallel to $y = -2$
 - Perpendicular to $y = -2$
 - Parallel to $x = -2$
 - Perpendicular to $x = -2$
47. ★ **OPEN-ENDED MATH** Write an equation of a line ℓ such that ℓ and the lines $y = -3x + 5$ and $y = 2x + 1$ form a right triangle.
48. **REASONING** Consider two distinct nonvertical lines $A_1x + B_1y = C_1$ and $A_2x + B_2y = C_2$. Show that the following statements are true.
- If the lines are parallel, then $A_1B_2 = A_2B_1$.
 - If the lines are perpendicular, then $A_1A_2 + B_1B_2 = 0$.
49. **CHALLENGE** Show that an equation of the line with x -intercept a and y -intercept b is $\frac{x}{a} + \frac{y}{b} = 1$. This is the *intercept form* of a linear equation.


PROBLEM SOLVING

EXAMPLE 5
on p. 100
for Exs. 50–51

50. **CAR EXPENSES** You buy a used car for \$6500. The monthly cost of owning the car (including insurance, fuel, maintenance, and taxes) averages \$350. Write an equation that models the total cost of buying and owning the car.

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51. **HOUSING** Since its founding, a volunteer group has restored 50 houses. It plans to restore 15 houses per year in the future. Write an equation that models the total number n of restored houses t years from now.

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EXAMPLE 6
on p. 101
for Exs. 52–54

52. **GARDENING** You have a rectangular plot measuring 16 feet by 25 feet in a community garden. You want to grow tomato plants that each need 8 square feet of space and pepper plants that each need 5 square feet. Write an equation that models how many tomato plants and how many pepper plants you can grow. How many pepper plants can you grow if you grow 15 tomato plants?



53. ★ **SHORT RESPONSE** Concert tickets cost \$15 for general admission, but only \$9 with a student ID. Ticket sales total \$4500. Write and graph an equation that models this situation. *Explain* how to use your graph to find how many student tickets were sold if 200 general admission tickets were sold.
54. **MULTI-STEP PROBLEM** A company will lease office space in two buildings. The annual cost is \$21.75 per square foot in the first building and \$17 per square foot in the second. The company has \$86,000 budgeted for rent.
- Write an equation that models the possible amounts of space rented in the buildings.
 - How many square feet of space can be rented in the first building if 2500 square feet are rented in the second?
 - If the company wants to rent equal amounts of space in the buildings, what is the total number of square feet that can be rented?

55. **CABLE TELEVISION** In 1994, the average monthly cost for expanded basic cable television service was \$21.62. In 2004, this cost had increased to \$38.23. Write a linear equation that models the monthly cost as a function of the number of years since 1994. Predict the average monthly cost of expanded basic cable television service in 2010.

56. **TIRE PRESSURE** Automobile tire pressure increases about 1 psi (pound per square inch) for each 10°F increase in air temperature. At an air temperature of 55°F, a tire's pressure is 30 psi. Write an equation that models the tire's pressure as a function of air temperature.

57. **MULTIPLE REPRESENTATIONS** Your class wants to make a rectangular spirit display, and has 24 feet of decorative border to enclose the display



a. **Writing an Equation** Write an equation in standard form relating the possible lengths l and widths w of the display.

b. **Drawing a Graph** Graph the equation from part (a).

c. **Making a Table** Make a table of at least five possible pairs of dimensions for the display.

58. **CHALLENGE** You are participating in a dance-a-thon to raise money for a class trip. Donors can pledge an amount of money for each hour you dance, a fixed amount of money that does not depend on how long you dance, or both. The table shows the amounts pledged by four donors. Write an equation that models the total amount y of money you will raise from the donors if you dance for x hours.

| Donor | Hourly amount | Fixed amount |
|--------|---------------|--------------|
| Clare | \$4 | \$15 |
| Emilia | \$8 | None |
| Julio | None | \$35 |
| Max | \$3 | \$20 |

MIXED REVIEW

PREVIEW

Prepare for
Lesson 2.5
in Exs. 59–64.

Solve the equation. Check your solution. (p. 18)

59. $9x = 27$

60. $5x = 20$

61. $-3x = 21$

62. $8x = 6$

63. $4x = -14$

64. $10x = 8$

Solve the inequality. Then graph the solution. (p. 41)

65. $3x + 5 < 17$

66. $2x - 4 > -10$

67. $6x + 4 \geq 22$

68. $5x + 3 \leq 2x - 12$

69. $4x + 5 \geq 2x + 3$

70. $-3 \leq 2x - 7 \leq 13$

71. $14 < 5 - x < 9$

72. $3x - 5 \geq 7$ or $-x - 4 > 3$

73. $2x < 6$ or $5x - 9 \geq 16$

Graph the equation. (p. 72)

74. $y = x - 8$

75. $y = -2x + 1$

76. $y = 3x - 2$

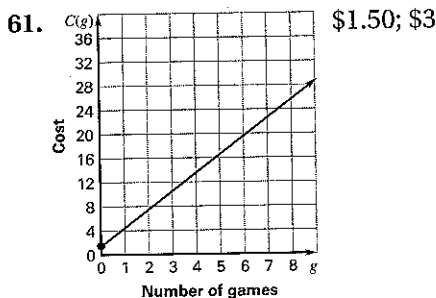
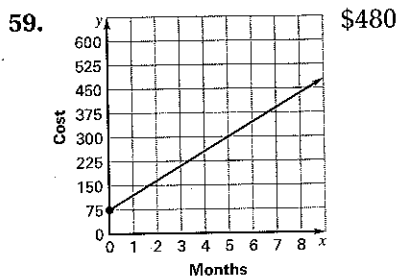
77. $y = 4x + 2$

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

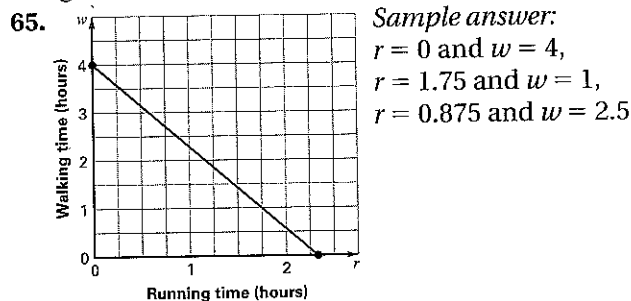
79. $y = \frac{5}{2}x - 6$

80. **RESERVOIRS** The surface elevation of a reservoir is 940 feet above sea level. Water is released over a period of 15 days, lowering the surface elevation to 934 feet above sea level. What is the average rate of change in the reservoir's surface elevation over the period? (p. 82)

2.3 Problem Solving (pp. 94-96)

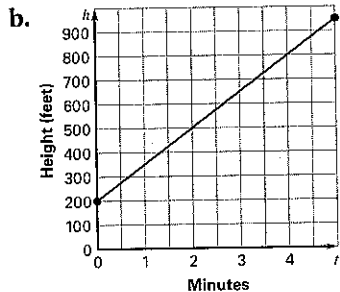


63. 30; fall; the value of the card will decrease after you buy each smoothie, so the line will fall from left to right.



67. a.

| t (minutes) | h (feet) |
|------------------|---------------|
| 0 | 200 |
| 1 | 350 |
| 2 | 500 |
| 3 | 650 |
| 4 | 800 |
| 5 | 950 |

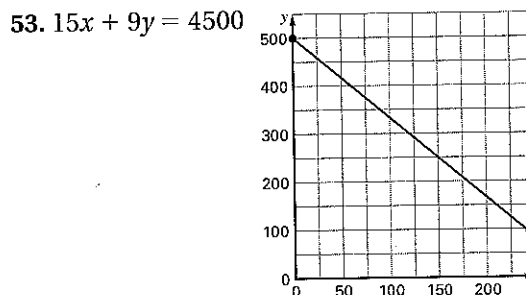


c. $h(t) = 150t + 200$

- 2.4 Skill Practice (pp. 101-103)** 1. standard 3. $y = 2$
 5. $y = 6x$ 7. $y = -\frac{5}{4}x + 7$ 9. $y = 4x - 2$ 11. $y = 2x + 11$
 13. $y = -9x + 85$ 15. $y = -\frac{4}{7}x + 1$ 17. $y = -\frac{1}{3}x - 2$
 19. The x - and y -coordinates were transposed;
 $y - 1 = -2(x - 5)$, $y - 1 = -2x + 10$, $y = -2x + 11$.
 21. $y = -x + 8$ 23. $y = -3x + 13$ 25. $y = -\frac{1}{4}x - \frac{1}{4}$

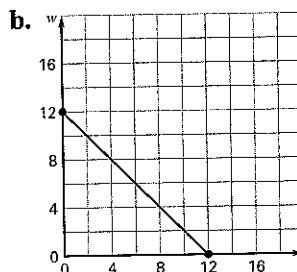
27. $y = -2x + 6$ 29. $y = -\frac{1}{4}x + \frac{19}{4}$ 31. $y = -3x + 11$
 33. $y = -\frac{2}{3}x + 7$ 35. $y = 5x + 23$ 37. $y = -3x + 17.5$
 41. $-4x + y = -3$ 43. $4x - 5y = -7$ 45. $4x + 3y = 32$
 47. *Sample answer:* $y = -\frac{1}{2}x + 8$

2.4 Problem Solving (pp. 103-104) 51. $n = 15t + 50$



Find the point on the line where x is 200 then the corresponding y -coordinate is how many student tickets were sold. 55. $y = 1.66x + 21.62$; \$48.18

57. a. $2l + 2w = 24$



c. *Sample answer:*

| l | w |
|-----|-----|
| 6 | 6 |
| 7 | 5 |
| 8 | 4 |
| 9 | 3 |
| 10 | 2 |

2.4 Problem Solving Workshop (p. 105) 1. $y = 4x + 7$

3. $y = -\frac{1}{2}x + 16$ 5. $y = 32.14x + 1764.36$

2.5 Skill Practice (pp. 109-110) 1. *Sample answer:*
 If $y = ax$, then a is the constant of variation. a is a constant ratio of y to x for all ordered pairs (x, y) .

