Applications

1. a. $l = 3c + 2p$

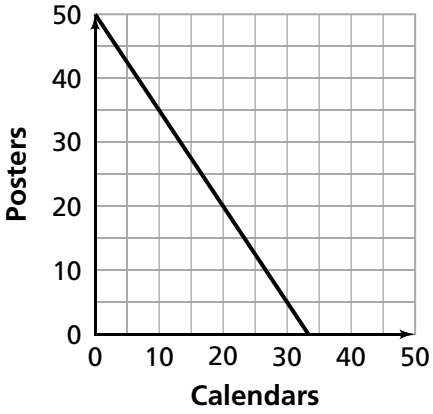
b. $3(25) + 2(18) = 111$

c. $3(12) + 2(15) = 66$

d. $3(20) + 2(12) = 84$

e. Some possible pairs include (0, 50), (10, 35), (20, 20), (30, 5) and others.

f. The graphs may look something like the one below.



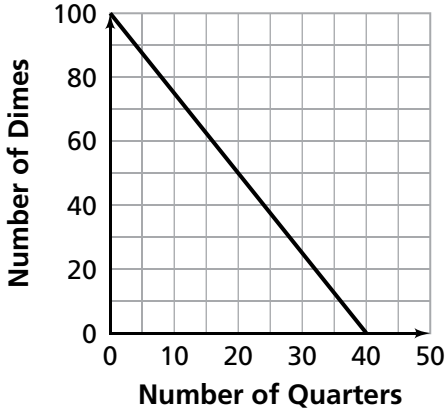
NOTE: The scales can be determined by finding the points where the line intercepts the horizontal and vertical axes. Since there is no dependence relationship between the posters and the calendars, it does not matter which variable is on the horizontal axis and which is on the vertical axis. The intercepts for the graph are (33.3, 0) and (0, 50).

g. Estimates of other pairs might include (4, 44), (16, 26), (26, 11), etc.

2. a. 40 quarters or 100 dimes

b. $0.25x + 0.10y = 10$

c. Graph will look like this:



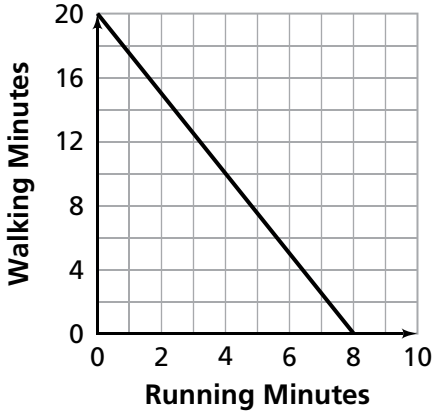
d. Five obvious pairs are (0, 100), (10, 75), (20, 50), (30, 35), and (40, 0).

3. a. $4(200) + 8(80) = 1{,}440$ meters, so he is 160 meters from his goal.

b. $d = 200x + 80y$

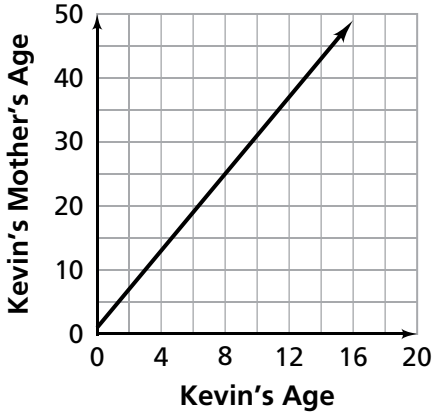
c. Combinations include (0, 20), (8, 0), (4, 10), and so on.

d. There are many other combinations, including (2, 15) and (5, 7), shown in the graph.



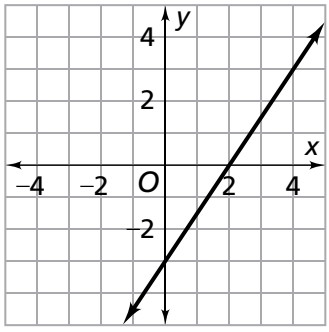
4. a. $y - 3x = 1$ and $3x + 1 = y$

b. Pairs would include (1, 4), (2, 7), (3, 10), etc.

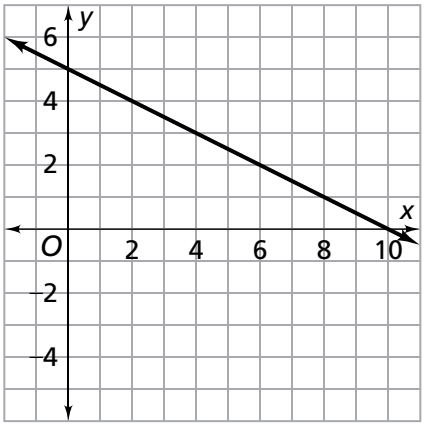


c. Possible pairs include (4, 13), (5, 16), and (10, 31).

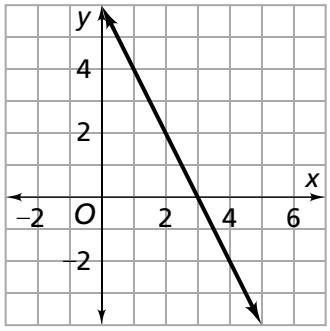
5. Possible pairs include (0, −3), (2, 0), and (1, −1.5).



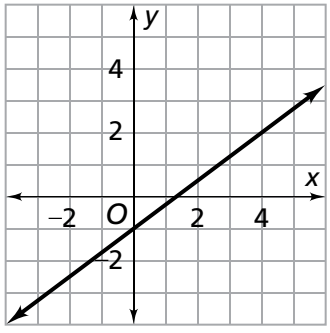
6. Possible pairs include (0, 5), (10, 0), and (4, 3).



7. Possible pairs include (0, 6), (3, 0), and (1, 4).



8. Possible pairs include (0, −1), $\left(\frac{4}{3}, 0\right)$, and (4, 2).



For Exercises 9–14, there are a number of correct equivalent forms. One possible answer is provided.

9. $-4x + y = -2$, x-intercept is (0.5, 0), y-intercept is (0, −2), slope is 4

10. $3x + y = 5$, x-intercept is $\left(\frac{5}{3}, 0\right)$, y-intercept is (0, 5), slope is −3

11. $x - y = -7$ or $-x + y = 7$, x-intercept is (−7, 0), y-intercept is (0, 7), slope is 1

12. $-5x + y = 3$, x-intercept is (−0.6, 0), y-intercept is (0, 3), slope is 5

13. $8x + y = -12$, x-intercept is (−1.5, 0), y-intercept is (0, −12), slope is −8

14. $9x + y = 5$, x-intercept is $\left(\frac{5}{9}, 0\right)$, y-intercept is (0, 5), slope is −9

15. $y = -2x + 5$, x-intercept is (2.5, 0), y-intercept is (0, 5), slope is −2

16. $y = -2x - 3$, x-intercept is (−1.5, 0), y-intercept is (0, −3), slope is −2

17. $y = x - 4$, x-intercept is (4, 0), y-intercept is (0, −4), slope is 1

18. $y = -0.75x + 3$, x-intercept is (4, 0), y-intercept is (0, 3), slope is −0.75

19. $y = \frac{7}{2}x - 8$ or $y = 3.5x - 8$, x-intercept is $\left(\frac{16}{7}, 0\right)$, y-intercept is (0, −8), slope is $\frac{7}{2} = 3.5$

20. $y = 0.2x - 11$, x-intercept is (55, 0), y-intercept is (0, −11), slope is 0.2

21. **a.** x-intercept $= \frac{C}{A}$

b. y-intercept $= \frac{C}{B}$

c. slope $= -\frac{A}{B}$

22. Students may verify their claims by comparing slopes and y-intercepts.

a. $2x + 3y = 9$ is line l because its intercepts are (4.5, 0) and (0, 3), which satisfy the equation.

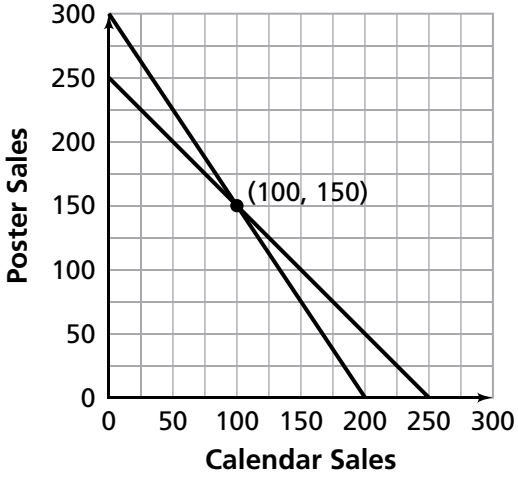
b. $3x - 4y = 12$ is line n because its intercepts are (4, 0) and (0, −3), which satisfy the equation.

c. $x - 3y = 6$ is line m because its intercepts are (6, 0) and (0, −2), which satisfy the equation.

d. $3x + 2y = 6$ is line k because its intercepts are (2, 0) and (0, 3), which satisfy the equation.

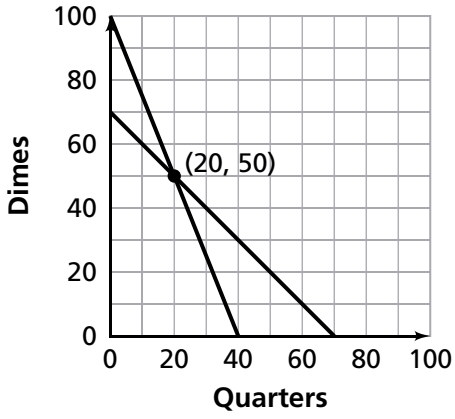
23. **a.** $c + p = 250$

b. The intersection point has coordinates (100, 150) meaning that sale of 100 calendars and 150 posters will give $600 profit exactly.



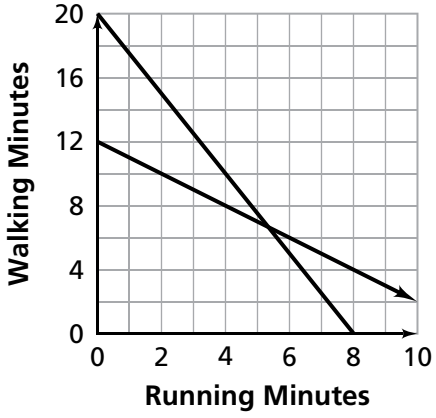
24. **a.** $x + y = 70$

b. The intersection point has coordinates (20, 50) meaning that a collection of 20 quarters and 50 dimes will give a value of $10 for 70 coins in all.



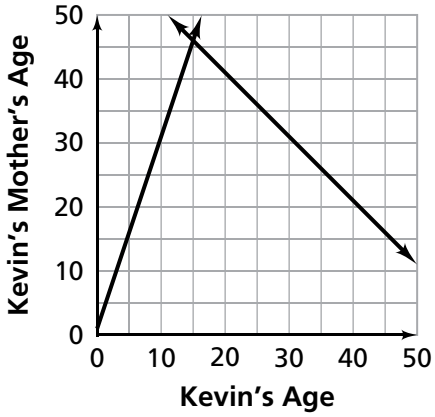
25. **a.** $x + y = 12$

b. The intersection point has coordinates of about (5.5, 7), meaning that he can cover 1,600 meters in 12 minutes if he runs for five and a half minutes and walks for about 7 minutes. The exact solution is $\left(5\frac{1}{3}, 6\frac{2}{3}\right)$.



26. a. $x + y = 61$

b. The intersection point is (15, 46), meaning that Kevin is 15 years old and his mother is 46 years old.



27. a. $x = 1$, $y = 5$

b. $x = -3$, $y = -3$

c. The lines are parallel, so there is no solution to the system.

Connections

28. $x < 2$, x is less than 2 (See Figure 1.)

29. $x > 8$, x is greater than 8 (See Figure 2.)

30. $x \leq -16$, x is less than or equal to -16 (See Figure 3.)

31. $x \geq -5$, x is greater than or equal to -5 (See Figure 4.)

32. $x \leq -4$, x is less than or equal to -4 (See Figure 5.)

33. $x \leq -3$, x is less than or equal to -3 (See Figure 6.)

Figure 1

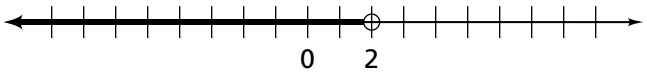


Figure 2

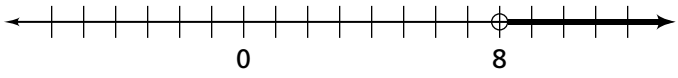


Figure 3

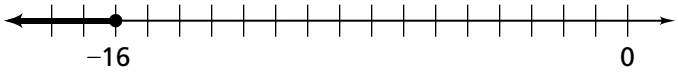


Figure 4

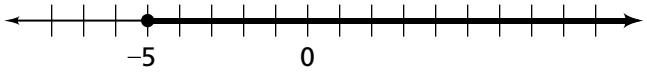


Figure 5

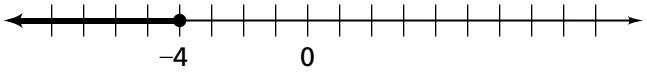
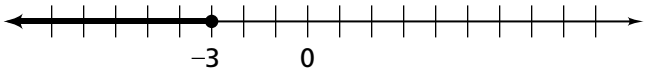


Figure 6



34. a. (12, 96) indicates that it costs \$96 to make 12 T-shirts.

b. (12, 120) indicates that \$120 is greater than the actual cost to make 12 T-shirts.

c. (12, 78) indicates that \$78 is less than the actual cost to make 12 T-shirts.

35. a. Point (2, 5) is on the line, points (2, 1) and (2, 2) are below the line, and point (2, 8) is above the line.

b. Answers may vary. (4, 13) is on the line. (4, 14), (4, 15), and (4, 16) are above the line.

c. Answers may vary. Two points that make the inequality $y < 4x - 3$ true are $(-2, -13)$ and (3, 7). Two points that make the inequality $y > 4x - 3$ true are $(-2, -9)$ and (3, 11).

36. any other line with slope 4

37. any other line with slope 6

38. any other line with slope -1

39. any other line with slope $-\frac{1}{4}$

40. any other line with slope $-\frac{3}{4}$

41. any other line with slope -7

42. any other line with slope $\frac{1}{4}$

43. any other line with slope $\frac{3}{2}$

44. any other line with slope $-\frac{1}{6}$

45. any other line with slope $-\frac{1}{2}$

46. any other line with slope -4

47. any other line with slope $\frac{3}{2}$

48. a. no; $3(-2) - 5(-4) = 14$

b. yes; $3(0) - 5(-3) = 15$

c. no; $3(-10) - 5(9) = -75$

d. yes; $3(-5) - 5(-6) = 15$

e. yes; $3(-10) - 5(-9) = 15$

f. yes; $3(-4) - 5(-5.4) = 15$

49. a. $z = 180 - (x + y)$; $z = 180 - x - y$; or $x + y + z = 180$

b. $40 = 180 - (x + y)$ is satisfied by possible combinations of (x, y) such as (120, 20), (110, 30), (100, 40), (90, 50), and (80, 60).

50. A **51.** J

52. a. Slopes of parallel lines will be $-\frac{A}{B}$, where $B \neq 0$.

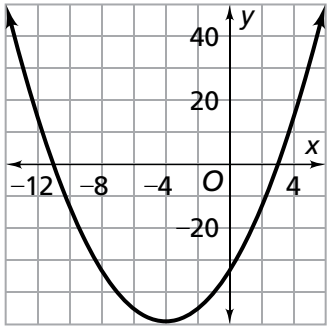
b. Slopes of perpendicular lines will be $\frac{B}{A}$, where $A \neq 0$.

53. a. Answers will vary. Students may be quite inaccurate if they are counting grid squares to get the area.

b. The labels are rectangles. In each case, one dimension of the rectangle must wrap around the can, so this dimension must match the circumference of the circular base. The other dimension of the rectangular label must match the height of the can. If we switch ℓ and w, then the labels are still the same size and shape. **Note:** Students investigated this idea in *Filling and Wrapping* when they used a sheet of 8.5″ × 11″ paper to make two different cylinders, one 8.5″ high and the other 11″ high.

54. C

55. a. $x < -11$ or > 3 **b.** $-11 < x < 3$



56. a. This line does not have a slope of $-\frac{1}{2}$ because $\frac{-1}{-2} = \frac{1}{2}$.

b. This line has a slope of $-\frac{1}{2}$ because $\frac{-1}{2} = -\frac{1}{2}$.

c. This line has a slope of $-\frac{1}{2}$ because $\frac{1}{-2} = -\frac{1}{2}$.

d. This line has a slope of $-\frac{1}{2}$.

57. a. The figure will be a right prism with triangular bases.

b. The surface area is $24 + 2\sqrt{3}$, which is approximately 27.5 grid squares.

c. The volume is $\sqrt{3} \times 4$, which is approximately 6.9 cubic units.

58. Parallel; their slopes are both $-\frac{1}{2}$. The equations in $y = mx + b$ form are $y = -\frac{1}{2}x + 2$ and $y = -\frac{1}{2}x + 10$.

59. Perpendicular; their slopes are negative reciprocals, since the reciprocal of 1 is itself.

60. Parallel; their slopes are both -5. The two equations are equivalent, so the lines are the same.

61. Perpendicular; the slope of the equation $y = -3 + 5x$ is 5 and the slope of $y = -\frac{x}{5} + 3$ is $-\frac{1}{5}$. Since 5 and $-\frac{1}{5}$ are negative reciprocals, the lines are perpendicular.

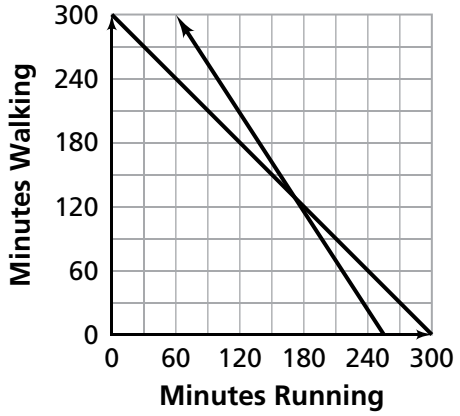
62. Neither; the slope of the line represented by the equation $10x + 5y = 20$ is -2 and the slope for $y = 10x + 20$ is 10.

Extensions

63. a. $x + y = 300$

b. $\frac{x}{10} + \frac{y}{15} = 26.2$

c. Solutions to the equation in part (a) include (0, 300), (300, 0), and (150, 150). Solutions to the equation in part (b) include (0, 393), (262, 0), (100, 243), and (162, 150).



d. The graph suggests a combination of running and walking times in the vicinity of 180 minutes running and 120 minutes walking. The exact solution is (186, 114), so the graph gives a good estimate.

64. a. Possible combinations of times less than 5 hours include (100, 199), (199, 100), and (100, 150).

b. $x + y < 300$

c–d. The coordinates of points in the shaded region satisfy the time constraint. But only those that also reach the distance minimum of 26.2 miles will be feasible solutions. Those points are along the graph of distance, below its intersection point with the time constraint graph.