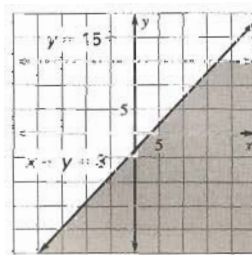
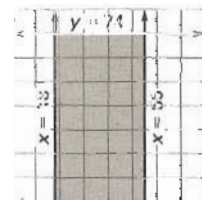
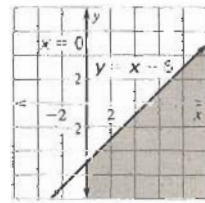
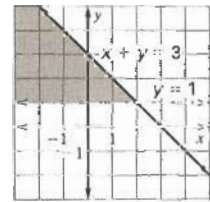
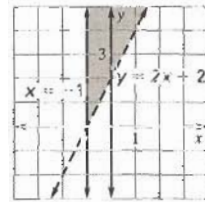
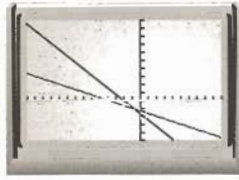
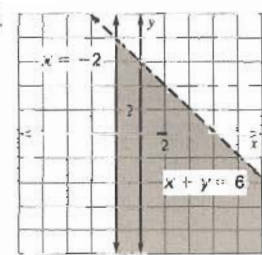
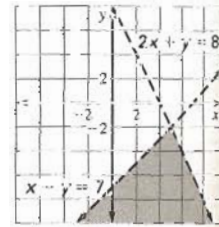
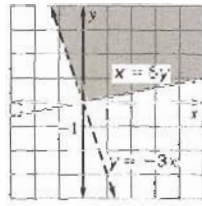
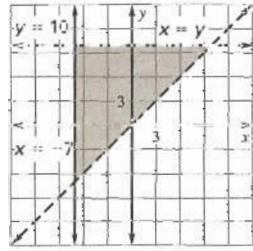
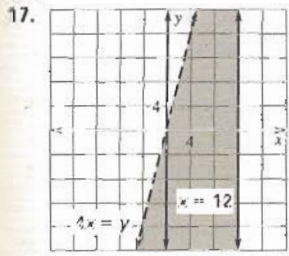


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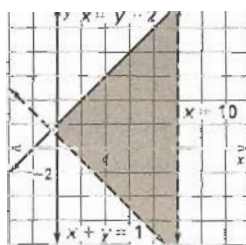
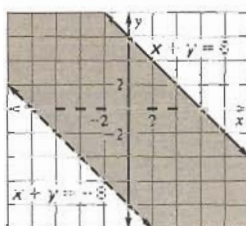
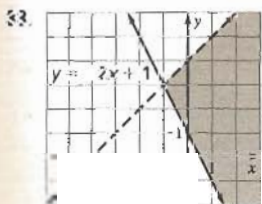
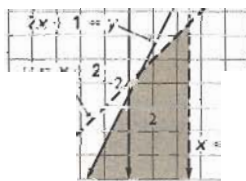
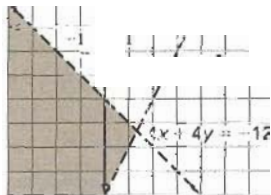
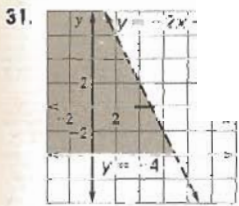
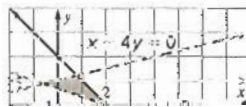
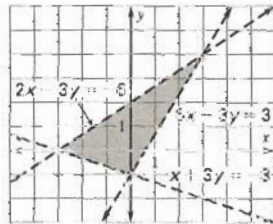
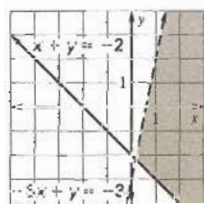
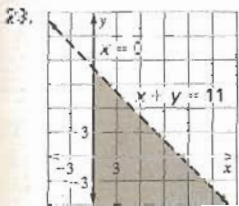
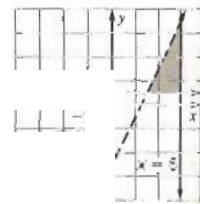
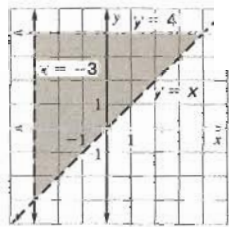
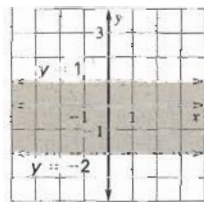
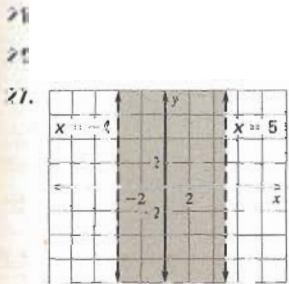
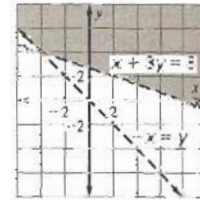
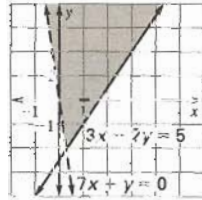
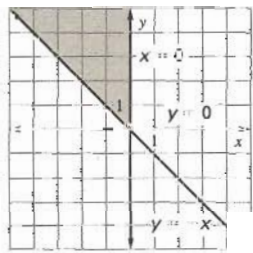
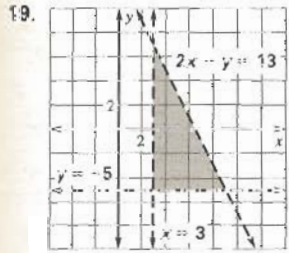


16.

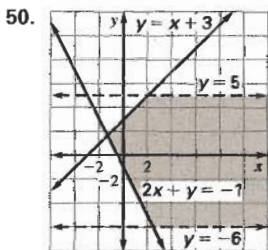
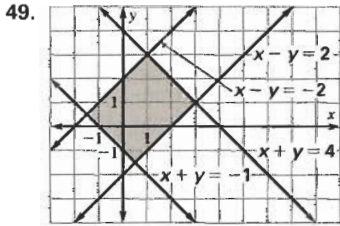
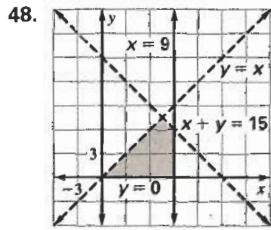
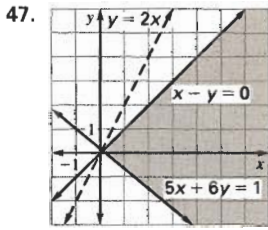




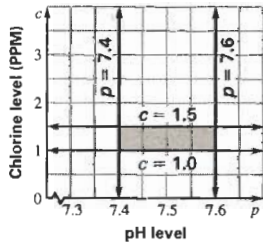
Sample answer: $(-2, -1)$



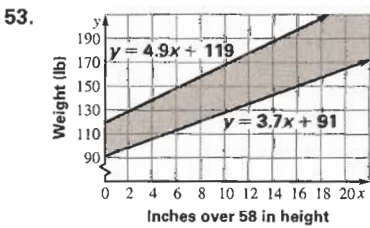
Chapter 3 continued



51. $7.4 \leq p \leq 7.6$
 $1.0 \leq c \leq 1.5$

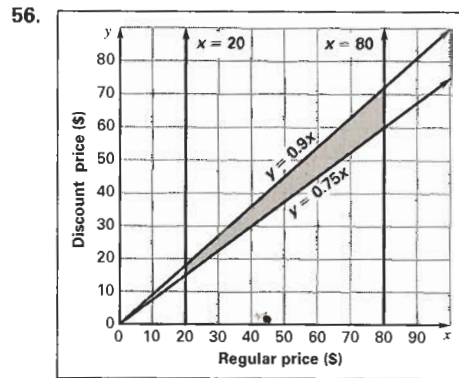


52. $y \geq 3.7x + 91$
 $y \leq 4.9x + 119$

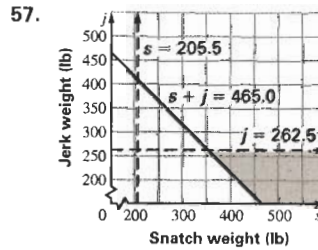


54. $y \geq 3.7(14) + 91$ $y \leq 4.9(14) + 119$
 $y \geq 142.8 \text{ lbs.}$ $y \leq 187.6 \text{ lbs.}$

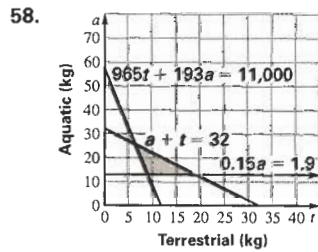
55. $20 \leq x \leq 80; y \leq 0.9x \text{ or } 0.75x \leq y$



\$48.75 to \$58.50



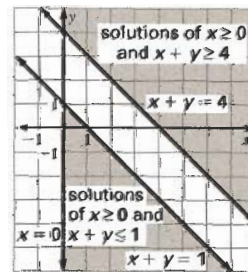
$s > 205.5; j \leq 262.5;$
 $s + j > 465.0$



$0.15a \geq 1.9;$
 $965t + 193a \geq 11,000;$
 $a + t \leq 32$

59. Sample answer:

$x + y \leq 1$
 $x + y \geq 4$
 $x \geq 0$

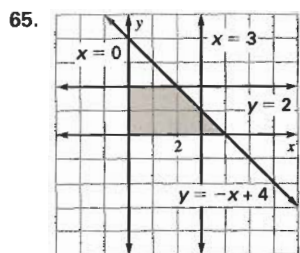


60. A

61. C

62. $x \geq 1; x \leq 8$ 63. $y \leq x + 3;$ 64. $y \leq 4x + 27;$
 $y \geq -5; y \leq 3$ $y \leq 3$ $y \leq -x + 12$
 $y \geq x - 6;$
 $y \geq -1$ $y \geq \frac{2}{3}x + 7$

Chapter 3 continued



$$\begin{aligned}
 65. \quad & x \geq 0 & x \leq 3 \\
 & y \geq 0 & y \leq -x + 4 \\
 & & y \leq 2
 \end{aligned}$$

3.3 Mixed Review (p. 162)

66. $2(5) + 7(-3) = 10 - 21 = -11$
 67. $-4(-6) - 3(-1) = 24 + 3 = 27$
 68. $10(-4) - 3(2) = -40 - 6 = -46$
 69. $-(-3) + 8(-2) = 3 - 16 = -13$
 70. positive correlation 71. relatively no correlation

72. negative correlation

73. $13(10 + 4y) + 5y = 2$

$$130 + 52y + 5y = 2$$

$$57y = -128$$

$$y = -\frac{128}{57}$$

$$x = \frac{570}{57} + 4\left(-\frac{128}{57}\right)$$

$$x = \frac{58}{57}$$

$$\left(\frac{58}{57}, -\frac{128}{57}\right)$$

74. $-2(3y - 3) + 7y = 10$

$$-6y + 6 + 7y = 10$$

$$y = 4$$

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

$$x = 9$$

$$(9, 4)$$

75. $-10x - 12y = 24$

$$10x + 12y = 24$$

$$0 \neq 48$$

no solution

76. $-14x + 10y = 0$

$$14x - 8y = 2$$

$$2y = 2$$

$$y = 1$$

$$14x - 8(1) = 2$$

$$14x = 10$$

$$x = \frac{5}{7}$$

$$\left(\frac{5}{7}, 1\right)$$

77. $-4(2 - 5y) - 10y = 12$

$$-8 + 20y - 10y = 12$$

$$10y = 20$$

$$y = 2$$

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

$$x = -8$$

$$(-8, 2)$$

78. $6x - 8y = -18$

$$-6x + 8y = 18$$

$$0 = 0$$

infinitely many solutions

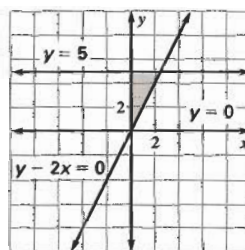
Lesson 3.4

Activity (p. 163)

- at $O, C = 0$;
at $P, C = 20$;
at $R, C = 30$;
at $S, C = 18$;
at $T, C = 8$;
at $U, C = 18$;
at $V, C = 12$;
- $R; O$
- $30; 0$; can't be done

3.4 Guided Practice (p. 166)

- Linear programming is the process of optimizing a linear objective function subject to a set of linear inequalities known as constraints.
- The value of the objective function is tested at various points of the feasible region to determine where it is a maximum and/or minimum; the system of constraints define the feasible region.
- If the feasible region is bounded, the maximum and minimum values of the objective function must occur at a vertex, so the value of the objective function is checked at each vertex.
- $(0, 0), (0, 3), (2, 4), (4, 0)$
- minimum $C = 5(0) + 7(0) = 0$
maximum $C = 5(2) + 7(4) = 38$



At $(0, 0): C = 0 + 0 = 0$ ← minimum

At $(0, 5): C = 0 + 5 = 5$

At $\left(\frac{5}{2}, 5\right): C = \frac{5}{2} + 5 = \frac{15}{2}$ ← maximum

Chapter 3 continued

Lesson 3.5

3.5 Guided Practice (p. 173)

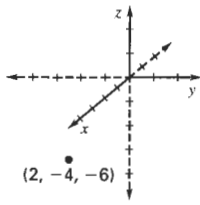
1. $ax + by + cz = d$; the solution of such an equation is a plane in three-dimensional space; to graph it, find the three intercepts and shade the triangular region lying in one octant.

2. false

3. *Sample answer:* Octants and quadrants are both distinct regions bounded by the axes, and defined by the signs of the x -, y - and z -coordinates.

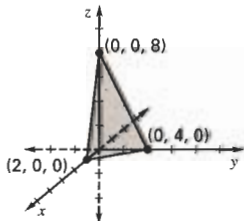
4. To graph a linear equation in three variables, find the three intercepts and shade the triangular region lying in one octant.

5.



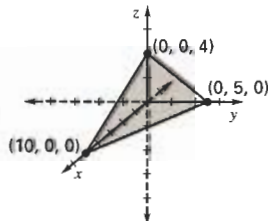
6. $A = (2, 0, 4)$
 $B = (2, 3, 0)$
 $C = (0, 3, 4)$
 $D = (0, 0, 4)$

7.



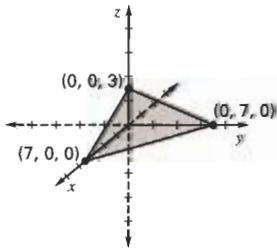
$$8x + 4y + 2z = 16$$

8.



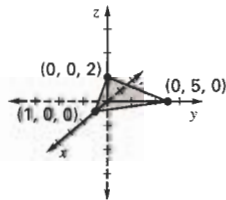
$$2x + 4y + 5z = 20$$

9.



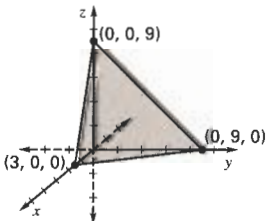
$$3x + 3y + 7z = 21$$

10.



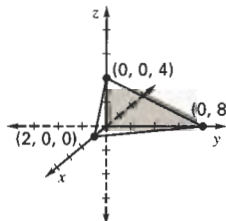
$$10x + 2y + 5z = 10$$

11.



$$9x + 3y + 3z = 27$$

12.



$$4x + y + 2z = 8$$

13. $3z = 9 - 6x - 6y$

$$z = 3 - 2x - 2y$$

$$f(x, y) = 3 - 2x - 2y$$

$$f(1, 2) = 3 - 2(1) - 2(2)$$

$$f(1, 2) = -3$$

14. $z = 7 + 2x + y$

$$f(x, y) = 7 + 2x + y$$

$$f(-3, 2) = 7 + 2(-3) + 2$$

$$f(-3, 2) = 3$$

15. $4z = -16 - 8x - 2y$

$$z = -4 - 2x - \frac{1}{2}y$$

$$f(x, y) = -4 - 2x - \frac{1}{2}y$$

$$f(5, 6) = -4 - 2(5) - \frac{1}{2}(6)$$

$$f(5, 6) = -4 - 10 - 3$$

$$f(5, 6) = -17$$

16. $-5z = 15 - 5x + 10y$

$$z = -3 + x - 2y$$

$$f(x, y) = -3 + x - 2y$$

$$f(2, 2) = -3 + 2 - 2(2)$$

$$f(2, 2) = -3 + 2 - 4$$

$$f(2, 2) = -5$$

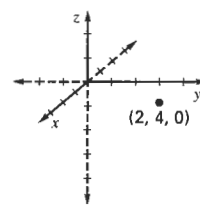
17. $C = 2.25r + 2.95p + 2.65$

$$C = 2.25(5) + 2.95(8) + 2.65$$

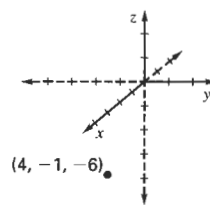
$$C = 11.25 + 23.60 + 2.65$$

$$C = \$37.50$$

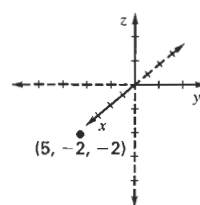
18.



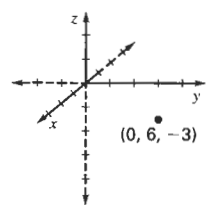
19.



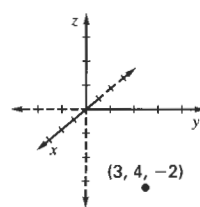
20.



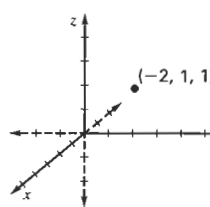
21.



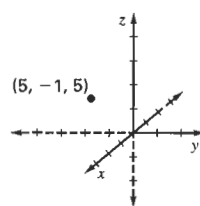
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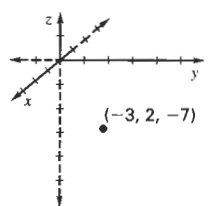
23.



24.

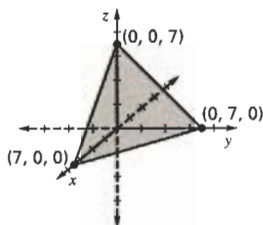


25.



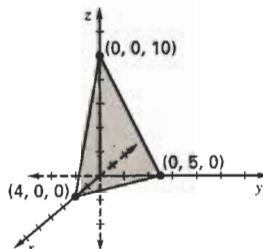
Chapter 3 continued

26.



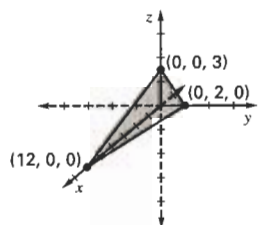
$$x + y + z = 7$$

27.



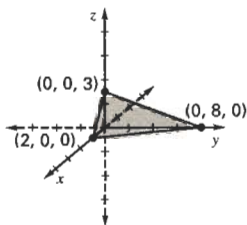
$$5x + 4y + 2z = 20$$

28.



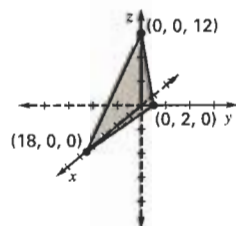
$$x + 6y + 4z = 12$$

29.



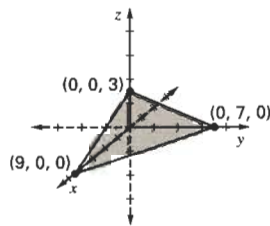
$$12x + 3y + 8z = 24$$

30.



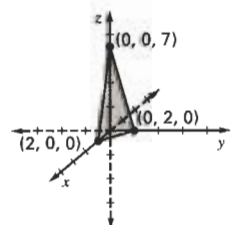
$$2x + 18y + 3z = 36$$

31.



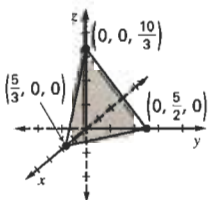
$$7x + 9y + 21z = 63$$

32.



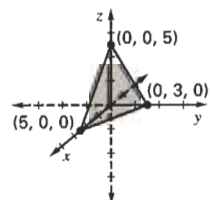
$$7x + 7y + 2z = 14$$

33.



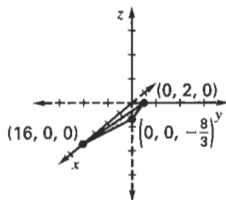
$$6x + 4y + 3z = 10$$

34.



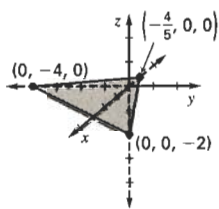
$$3x + 5y + 3z = 15$$

35.



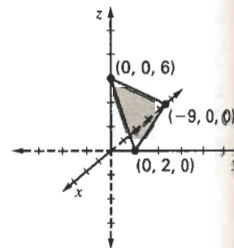
$$\frac{1}{2}x + 4y - 3z = 8$$

36.



$$5x + y + 2z = -4$$

37.



$$-2x + 9y + 3z = 18$$

38. $3z = 18 - 6x - 2y$

$$z = 6 - 2x - \frac{2}{3}y$$

$$f(x, y) = 6 - 2x - \frac{2}{3}y$$

$$f(2, 1) = 6 - 2(2) - \frac{2}{3}(1)$$

$$f(2, 1) = \frac{4}{3}$$

39. $5z = 15 + 2x + 5y$

$$z = 3 + \frac{2}{5}x + y$$

$$f(x, y) = 3 + \frac{2}{5}x + y$$

$$f\left(\frac{3}{2}, -2\right) = 3 + \left(\frac{2}{5}\right)\left(\frac{3}{2}\right) + (-2)$$

$$f\left(\frac{3}{2}, -2\right) = 1 + \frac{3}{5}$$

$$f\left(\frac{3}{2}, -2\right) = \frac{8}{5}$$

40. $z = 10 - x - 6y$

$$f(x, y) = 10 - x - 6y$$

$$f(-4, -1) = 10 - (-4) - 6(-1)$$

$$f(-4, -1) = 10 + 4 + 6$$

$$f(-4, -1) = 20$$

41. $\frac{5}{2}z = 9 - 3x + \frac{3}{4}y$

$$z = \frac{18}{5} - \frac{6}{5}x + \frac{3}{10}y$$

$$f(x, y) = \frac{18}{5} - \frac{6}{5}x + \frac{3}{10}y$$

$$f(-3, 16) = \frac{18}{5} - \frac{18}{5} + \frac{48}{10}$$

$$f(-3, 16) = 12$$

42. $-7z = 14 + x + 2y$

$$z = -2 - \frac{1}{7}x - \frac{2}{7}y$$

$$f(x, y) = -2 - \frac{1}{7}x - \frac{2}{7}y$$

$$f(-5, -10) = -2 + \frac{5}{7} + \frac{20}{7}$$

$$f(-5, -10) = \frac{11}{7}$$

43. $60z = 12 - 10x - 15y$

$$z = \frac{1}{5} - \frac{1}{6}x - \frac{1}{4}y$$

$$f(x, y) = \frac{1}{5} - \frac{1}{6}x - \frac{1}{4}y$$

$$f\left(-3, \frac{4}{5}\right) = \frac{1}{5} + \frac{1}{2} - \frac{1}{5}$$

$$f\left(-3, \frac{4}{5}\right) = \frac{1}{2}$$

44. $z = x - 5y - 14$

$$f(x, y) = x - 5y - 14$$

$$f(3, 6) = 3 - 5(6) - 14$$

$$f(3, 6) = -41$$

Chapter 3 continued

45. $9z = -x + 6y - 12$

$$z = -\frac{1}{9}x + \frac{2}{3}y - \frac{4}{3}$$

$$f(x, y) = -\frac{1}{9}x + \frac{2}{3}y - \frac{4}{3}$$

$$f\left(-\frac{1}{2}, 12\right) = \frac{1}{18} + 8 - \frac{4}{3}$$

$$f\left(-\frac{1}{2}, 12\right) = 6\frac{13}{18}$$

46. $V = (\ell)(w)(h)$

$$V = (7)(4)(2)$$

$$V = 56 \text{ cubic units}$$

48. $C = 0.4g + 4a + 65$

Sample answers:

a	g	C
1	10	\$73
2	20	\$81

50. $C = 0.7t + 0.3c + 12$

Sample answers:

t	c	C
6	6	\$18
12	12	\$24

52. $S = 8l + 6b + 10$

Sample answers:

l	b	S
3	6	\$70
6	3	\$76

53. a. $C = 100x + 350y + 500$

b. Sample answers:

x	y	C
2	4	\$2100
4	2	\$1600

c. Sample answer: 8 of each kind of spot costs \$4100, so you don't have enough money. I would spend \$3950 on 10 off-peak spots and 7 peak ones. This way your commercial gets 17 airings rather than 16 and you are \$50 under budget.

54. $x - 2y + z = 4$

55. $8x + y + 2z = 12$

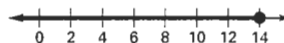
56. $27x - 18y - 12z = 108$

Sample explanation: I found the least common multiple of the given intercepts and divided each one into the LCM to find the coefficients of the variables.

3.5 Mixed Review (p. 175)

57. $3 + x \leq 17$

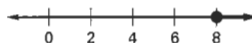
$$x \leq 14$$



58. $2x + 5 \geq 21$

$$2x \geq 16$$

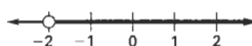
$$x \geq 8$$



59. $-x + 3 < 3x + 11$

$$-4x < 8$$

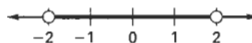
$$x > -2$$



60. $-13 < 6x - 1 < 11$

$$-12 < 6x < 12$$

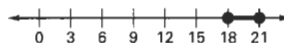
$$-2 < x < 2$$



61. $24 \leq 2x - 12 \leq 30$

$$36 \leq 2x \leq 42$$

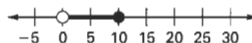
$$18 \leq x \leq 21$$



62. $-3 < 2x - 3 \leq 17$

$$0 < 2x \leq 20$$

$$0 < x \leq 10$$



63. $m_1 = \frac{7+5}{1+3} = \frac{12}{4} = 3$

$$m_2 = \frac{20-2}{-6+0} = \frac{18}{-6} = -3$$

neither

64. $m_1 = \frac{1+4}{-16-4} = \frac{5}{-20} = -\frac{1}{4}$

$$m_2 = \frac{21-5}{5-1} = \frac{16}{4} = 4$$

perpendicular

65. $m_1 = \frac{1-3}{-2-0} = \frac{-2}{-2} = 1$

$$m_2 = \frac{1+1}{2-0} = \frac{2}{2} = 1$$

parallel

66. $m_1 = \frac{6+2}{0-5} = \frac{8}{-5} = -\frac{8}{5}$

$$m_2 = \frac{-1-4}{-1-7} = \frac{-5}{-8} = \frac{5}{8}$$

perpendicular

Chapter 3 continued

67. $3.95r + 3.1p = 48.5$

$r + p = 14$

buy 6 red oak boards and 8 poplar boards

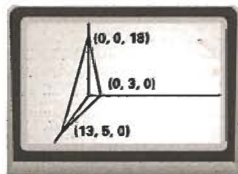
Activity 3.5 (p. 176)

1. $3z = 54 - 4x - 18y$

$z = 18 - \frac{4}{3}x - 6y$

$f(x, y) = 18 - \frac{4}{3}x - 6y$

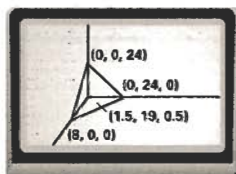
$f(6, 4) = -14$



2. $z = 24 - 3x - y$

$f(x, y) = 24 - 3x - y$

$f(1.5, 19) = 0.5$

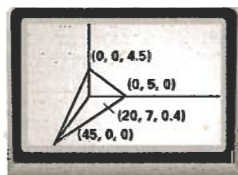


3. $10z = 45 - x - 3y$

$z = 4.5 - 0.1x - 0.3y$

$f(x, y) = 4.5 - 0.1x - 0.3y$

$f(20, 7) = 0.4$

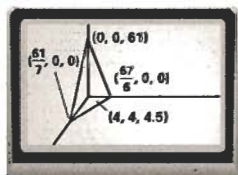


4. $2z = 61 - 7x - 6y$

$z = 30.5 - 3.5x - 3y$

$f(x, y) = 30.5 - 3.5x - 3y$

$f(4, 4) = 4.5$

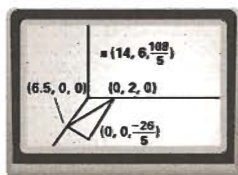


5. $-5z = 26 - 4x - 13y$

$z = -\frac{26}{5} + \frac{4}{5}x + \frac{13}{5}y$

$f(x, y) = -\frac{26}{5} + \frac{4}{5}x + \frac{13}{5}y$

$f(14, 6) = 21.6$

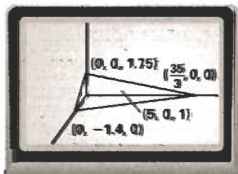


6. $20z = 35 - 3x + 25y$

$z = 1.75 - 0.15x + 1.25y$

$f(x, y) = 1.75 - 0.15x + 1.25y$

$f(5, 0) = 1$



Lesson 3.6

3.6 Guided Practice (p. 181)

1. Sample answers:

$x + y + z = 3$

$4x + 2y - \frac{1}{2}z = 7$

$3x + 11y - 4z = 20$

2. When you come up with an impossible solution such as $0 = 3$, that tells you that the original system of equations is inconsistent. If there are many solutions, you would obtain an identity, such as $0 = 0$.

3. Two or more of the planes could coincide.

4. Solve one of the equations for one variable in terms of the other two, and then substitute this expression into each of the other two equations, obtaining a system of two equations in two variables.

5. $-2(1) - (4) + 5(2) \neq 12$

$3(1) + 2(4) - 2 \neq -7$

$-5(1) + 4(4) + 2(2) \neq -17$

no

6. $-4(7) + 6(-1) - 0 = -34$

$-2(7) - 5(-1) + 0 = -9$

$5(7) + 2(-1) + 0 = 33$

yes

7. $5(-2) - 2(3) + 3 = -13$

$-2 + 4(3) + 3(3) = 19$

$-3(-2) + 3 + 6(3) \neq 15$

no

8. $2x + 10y - 2z = 32$

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

$5x + 7y = 44$ Equation 1

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

$-4x - 8y - 2z = -40$

$-x - 11y = -28$ Equation 2

$5x + 7y = 44$

$-5x - 55y = -140$

$-48y = -96$

$y = 2$

$5x + 7(2) = 44$

$5x = 30$

$x = 6$

$6 + 5(2) - z = 16$

$16 - z = 16$

$-z = 0$

$z = 0$

$(6, 2, 0)$

Chapter 3 continued

$$\begin{aligned}
 9. \quad & -2(4 - 2y - z) + y + 3z = -8 \\
 & 3(4 - 2y - z) + 4y - 2z = 9 \\
 & -8 + 4y + 2z + y + 3z = -8 \\
 & 12 - 6y - 3z + 4y - 2z = 9 \\
 & 5y + 5z = 0 \qquad 5(-1) + 5(z) = 0 \\
 & -2y - 5z = -3 \qquad 5z = 5 \\
 & \qquad \qquad \qquad z = 1 \\
 & 5y + (-2y + 3) = 0 \\
 & \quad 5y - 2y = -3 \qquad x = 4 - 2(-1) - (1) \\
 & \quad 3y = -3 \qquad x = 4 + 2 - 1 \\
 & \quad y = -1 \qquad x = 5
 \end{aligned}$$

$$(5, -1, 1)$$

$$\begin{aligned}
 10. \quad & x = 2 + y - 2z \\
 & 9(2 + y - 2z) + 5y - z = -11 \\
 & 18 + 9y - 18z + 5y - z = -11 \\
 & \quad 14y - 19z = -29 \\
 & 6(2 + y - 2z) + 4y + 2z = 2 \\
 & 12 + 6y - 12z + 4y + 2z = 2 \\
 & \quad 10y - 10z = -10 \\
 & \quad y - z = -1 \\
 & \quad y = z - 1 \\
 & 14(z - 1) - 19z = -29 \qquad y = 3 - 1 \\
 & 14z - 14 - 19z = -29 \qquad y = 2 \\
 & \quad -5z = -15 \qquad x = 2 + y - 2z \\
 & \quad z = 3 \qquad x = 2 + 2 - 2(3) \\
 & \qquad \qquad \qquad x = -2 \\
 & (-2, 2, 3)
 \end{aligned}$$

$$\begin{aligned}
 11. \quad & 0.02s + 0.05c + 0.06b = 1000 \\
 & s + c + b = 20,000 \\
 & c = 2b \\
 & s + 2b + b = 20,000 \\
 & \quad 0.02s + 0.1b + 0.06b = 1000 \\
 & \quad 0.02s + 0.16b = 1000 \\
 & 0.02(20,000 - 3b) + 0.16b = 1000 \\
 & \quad 400 - 0.06b + 0.16b = 1000 \\
 & \quad 0.10b = 600 \\
 & \quad b = \$6,000 \\
 & c = \$12,000 \\
 & s + 12,000 + 6000 = 20,000 \\
 & s = 2000
 \end{aligned}$$

She should invest \$2,000 in savings, \$6,000 in bonds, and \$12,000 in CDs.

3.6 Practice and Applications (pp. 181-183)

$$\begin{aligned}
 12. \quad & 3x + 2y - z = 8 \\
 & \underline{-3x + 4y + 5z = -14} \\
 & \quad 6y + 4z = -6 \\
 & -3x + 4y + 5z = -14 \\
 & \underline{3x - 9y + 12z = -42} \\
 & \quad -5y + 17z = -56 \\
 & \quad 30y + 20z = -30 \\
 & \underline{-30y + 102z = -336} \\
 & \quad 122z = -366 \\
 & \quad z = -3 \\
 & 6y + 4(-3) = -6 \\
 & \quad 6y = 6 \\
 & \quad y = 1 \\
 & x = -14 + 3(1) - 4(-3) \\
 & x = -14 + 3 + 12 \\
 & x = 1 \\
 & (1, 1, -3) \\
 13. \quad & x + 2y + 5z = -1 \\
 & \underline{4x - 2y + 2z = 4} \\
 & \quad 5x + 7z = 3 \\
 & 8x - 4y + 4z = 8 \\
 & \underline{3x + 4y - 4z = 14} \\
 & \quad 11x = 22 \\
 & x = 2 \\
 & 5(2) + 7 = 3 \\
 & \quad 7z = -7 \\
 & \quad z = -1 \\
 & 2(2) - y - 1 = 2 \\
 & \quad -y = -1 \\
 & \quad y = 1 \\
 & (2, 1, -1) \\
 14. \quad & 3x + 2y - 3z = -2 \\
 & \underline{7x - 2y + 5z = -14} \\
 & \quad 10x + 2z = -16 \\
 & 14x - 4y + 10z = -28 \\
 & \underline{2x + 4y + z = 6} \\
 & \quad 16x + 11z = -22 \\
 & -110x - 22z = 176 \\
 & \underline{32x + 22z = -44} \\
 & \quad -78x = 132 \\
 & x = -\frac{22}{13} \\
 & 16\left(-\frac{22}{13}\right) + 11z = -22 \\
 & \quad 11z = \frac{66}{13} \\
 & \quad z = \frac{6}{13} \\
 & 3\left(-\frac{22}{13}\right) + 2y - 3\left(\frac{6}{13}\right) = -2 \\
 & \quad 2y = \frac{58}{13} \\
 & \quad y = \frac{29}{13} \\
 & \left(-\frac{22}{13}, \frac{29}{13}, \frac{6}{13}\right) \\
 15. \quad & 5x - 4y + 4z = 18 \\
 & \underline{-2x + 6y - 4z = 0} \\
 & \quad 3x + 2y = 18 \\
 & -7x + 21y - 14z = 0 \\
 & \underline{8x - 4y + 14z = 6} \\
 & \quad x + 17y = 6 \\
 & 3x + 2y = 18 \\
 & \underline{-3x - 51y = -18} \\
 & \quad -49y = 0 \\
 & \quad y = 0 \\
 & x = 6 \\
 & -6 + 3(0) - 2z = 0 \\
 & \quad -2z = 6 \\
 & \quad z = -3 \\
 & (6, 0, -3)
 \end{aligned}$$

Chapter 3 continued

16. $x + y - 2z = 5$
 $-x - 2y - z = -8$
 $-y - 3z = -3$
 $-2x - 2y + 4z = -10$
 $2x + 3y - z = 13$
 $y + 3z = 3$
 $-y - 3z = -3$
 $y + 3z = 3$
 $0 = 0$
 $y = 3 - 3z$
 $-3x - 3y + 6z = -15$
 $2x + 3y - z = 13$
 $-x + 5z = -2$
 $x = 5z + 2$
 infinitely many solutions
 $(5z + 2, -3z + 3, z)$

17. $-10x + 6y + 2z = -30$
 $10x + 2y + 8z = 18$
 $8y + 10z = -12$
 $-15x + 9y + 3z = -45$
 $15x + 5y + 7z = 9$
 $14y + 10z = -36$
 $6y = -24$
 $y = -4$
 $14(-4) + 10z = -36$
 $10z = 20$
 $z = 2$
 $-5x + 3(-4) + 2 = -15$
 $-5x - 12 + 2 = -15$
 $-5x = -5$
 $x = 1$

$$(1, -4, 2)$$

18. $3x + 2(1 - 6z + 2x) + 5z = 16$
 $3x + 2 - 12z + 4x + 5z = 16$
 $7x - 7z = 14$
 $x - z = 2$
 $7x + 3(1 - 6z + 2x) - 4z = 11$
 $7x + 3 - 18z + 6x - 4z = 11$
 $13x - 22z = 8$
 $13(2 + z) - 22z = 8$
 $26 + 13z - 22z = 8$
 $-9z = -18$
 $z = 2$

$$x - 2 = 2$$

$$x = 4$$

$$-2(4) + y + 6(2) = 1$$

$$y = 1 - 12 + 8$$

$$y = -3$$

$$(4, -3, 2)$$

19. $-(-8 + 6y + 2z) + 5y + 3z = 2$
 $8 - 6y - 2z + 5y + 3z = 2$
 $-y + z = -6$
 $3(-8 + 6y + 2z) - 2y - 4z = 18$
 $-24 + 18y + 6z - 2y - 4z = 18$
 $16y + 2z = 42$
 $8y + z = 21$
 $8y + y - 6 = 21$
 $9y = 27$
 $y = 3$
 $-3 + z = -6$
 $z = -3$
 $x = -8 + 6(3) + 2(-3)$
 $x = -8 + 18 - 6$
 $x = 4$
 $(4, 3, -3)$

20. $5(4 - y - z) + 5y - 5z = 12$
 $20 - 5y - 5z + 5y + 5z = 12$
 $0 = -8$
 no solution

21. $3(21 + 3y - 6z) + 2y - 5z = -30$
 $63 + 9y - 18z + 2y - 5z = -30$
 $11y - 23z = -93$
 $2(21 + 3y - 6z) - 5y + 2z = -6$
 $42 + 6y - 12z - 5y + 2z = -6$
 $y - 10z = -48$
 $11(-48 + 10z) - 23z = -93$
 $-528 + 110z - 23z = -93$
 $87z = 435$
 $z = 5$

$$y = -48 + 10(5)$$

$$y = 2$$

$$x = 21 + 3(2) - 6(5)$$

$$x = -3$$

$$(-3, 2, 5)$$

22. $5 - y + 2z + 2y + z = 8$
 $y + 3z = 3$

$$2(5 - y + 2z) + 3y - z = 1$$

$$10 - 2y + 4z + 3y - z = 1$$

$$y + 3z = -9$$

$$3 - 3z + 3z = -9$$

$$3 \neq -9$$

no solution

Chapter 3 continued

23. $y + 2(5) = 13$

$$y = 3$$

$$2x - 3(3) + 5 = 10$$

$$2x = 14$$

$$x = 7$$

$$(7, 3, 5)$$

24. $2x - 2y + 5y + 31 = 3$

$$2x + 3y = -28$$

$$x + 3y + 2(5y + 31) = -21$$

$$x + 3y + 10y = -83$$

$$x + 13y = -83$$

$$2(-83 - 13y) + 3y = -28$$

$$-166 - 26y + 3y = -28$$

$$-23y = 138$$

$$y = -6$$

$$x + 13(-6) = -83$$

$$x = -5$$

$$2(-5) - 2(-6) + z = 3$$

$$-10 + 12 + z = 3$$

$$z = 1$$

$$(-5, -6, 1)$$

25. $17x - (8 + 4z - x) + 2z = -9$

$$17x + x - 4z + 2z = -1$$

$$18x - 2z = -1$$

$$3x - 2(8 + 4z - x) - 12z = 24$$

$$3x - 16 - 8z + 2x - 12z = 24$$

$$5x - 20z = 40$$

$$x - 4z = 8$$

$$18(8 + 4z) - 2z = -1$$

$$144 + 72z - 2z = -1$$

$$70z = -145$$

$$z = -\frac{29}{14}$$

$$x - 4\left(-\frac{29}{14}\right) = 8$$

$$x = 8 - \frac{58}{7}$$

$$x = -\frac{2}{7}$$

$$y = 8 + 4\left(-\frac{29}{14}\right) + \frac{2}{7}$$

$$y = 0$$

$$\left(-\frac{2}{7}, 0, -\frac{29}{14}\right)$$

26. $5x + 3y + 3z = 71$

$$4x - 2y - 3z = 1$$

$$9x + y = 72$$

$$4x - 2y - 3z = 1$$

$$-6x + 3y + 3z = -6$$

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

$$-9x - y = -72$$

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

$$-11x = -77$$

$$x = 7$$

$$-14 + y = -5$$

$$y = 9$$

$$5(7) + 3(9) + 3(z) = 71$$

$$3z = 9$$

$$z = 3$$

$$(7, 9, 3)$$

27. $x - 9y + 4z = 1$

$$2x + y - 4z = -3$$

$$3x - 8y = -2$$

$$2x - 18y + 8z = 2$$

$$-4x + 18y - 8z = -6$$

$$-2x = -4$$

$$x = 2$$

$$6 - 8y = -2$$

$$-8y = -8$$

$$y = 1$$

$$2 - 9(1) + 4z = 1$$

$$4z = 8$$

$$z = 2$$

$$(2, 1, 2)$$

Chapter 3 continued

28. $2x + y + 2z = 7$

$$\underline{2x - y + 2z = 1}$$

$$4x + 4z = 8$$

$$x + z = 2$$

$$2x - y + 2z = 1$$

$$\underline{5x + y + 5z = 13}$$

$$7x + 7z = 14$$

$$2x + y + 2z = 7$$

$$\underline{-2x + y - 2z = -1}$$

$$2y = 6$$

$$y = 3$$

infinitely many solutions

$$(2 - z, 3, z)$$

29. $42x - 18y + 24z = -84$

$$\underline{8x + 2y - 24z = 18}$$

$$50x - 16y = -66$$

$$25x - 8y = -33$$

$$8x + 2y - 24z = 18$$

$$\underline{18x - 30y + 24z = -72}$$

$$26x - 28y = -54$$

$$13x - 14y = -27$$

$$175x - 56y = -231$$

$$\underline{-52x + 56y = 108}$$

$$123x = -123$$

$$x = -1$$

$$13(-1) - 14y = -27$$

$$-14y = -14$$

$$y = 1$$

$$7(-1) - 3(1) + 4z = -14$$

$$4z = -4$$

$$z = -1$$

$$(-1, 1, -1)$$

30. $12(-10 - y) + 6y + 7z = -35$

$$-120 - 12y + 6y + 7z = -35$$

$$-6y + 7z = 85$$

$$7(-10 - y) - 5y - 6z = 200$$

$$-70 - 7y - 5y - 6z = 200$$

$$-12y - 6z = 270$$

$$y = \frac{270 + 6z}{-12}$$

$$-6\left(\frac{270 + 6z}{-12}\right) + 7z = 85$$

$$135 + 3z + 7z = 85$$

$$10z = -50$$

$$z = -5$$

$$y = \frac{270 + 6(-5)}{-12}$$

$$y = -20$$

$$x = -10 + 20$$

$$x = 10$$

$$(10, -20, -5)$$

31. $7x - 10y + 8z = -50$

$$\underline{-6x - 8y - 8z = -52}$$

$$x - 18y = -102$$

$$-2x - 5y + 12z = -90$$

$$\underline{-9x - 12y - 12z = -78}$$

$$-11x - 17y = -168$$

$$-11(-102 + 18y) - 17y = -168$$

$$1122 - 198y - 17y = -168$$

$$-215y = -1290$$

$$y = 6$$

$$x = (-102 + 108) \quad 3(6) + 4(6) + 4z = 26$$

$$x = 6$$

$$4z = -16$$

$$z = -4$$

$$(6, 6, -4)$$

Chapter 3 continued

$$32. x = \frac{-26 + 3y + 6z}{-2}$$

$$5\left(13 - \frac{3}{2}y - 3z\right) + 5y + 4z = 24$$

$$65 - \frac{15}{2}y - 15z + 5y + 4z = 24$$

$$-\frac{5}{2}y - 11z = -41$$

$$-5y - 22z = -82$$

$$3\left(13 - \frac{3}{2}y - 3z\right) + 4y - 5z = -40$$

$$39 - \frac{9}{2}y - 9z + 4y - 5z = -40$$

$$-\frac{1}{2}y - 14z = -79$$

$$y = 158 - 28z$$

$$-5(158 - 28z) - 22z = -82$$

$$-790 + 140z - 22z = -82$$

$$118z = 708$$

$$z = 6$$

$$y = 158 - 28(6)$$

$$y = -10$$

$$-2x = -26 + 3(-10) + 6(6)$$

$$x = 10$$

$$(10, -10, 6)$$

$$33. 6x + 6y + 2z = 60$$

$$\underline{-6x + 7y + 3z = -49}$$

$$13y + 5z = 11$$

$$30x + 30y + 10z = 300$$

$$\underline{-30x + 9y + 21z = -51}$$

$$39y + 31z = 249$$

$$39y + 31z = 249$$

$$\underline{-39y - 15z = -33}$$

$$16z = 216$$

$$z = \frac{27}{2}$$

$$39y = 249 - 31\left(\frac{27}{2}\right)$$

$$y = -\frac{113}{26}$$

$$3x = 30 - 3\left(-\frac{113}{26}\right) - \frac{27}{2}$$

$$3x = \frac{384}{13}$$

$$x = \frac{128}{13}$$

$$\left(\frac{128}{13}, -\frac{113}{26}, \frac{27}{2}\right)$$

$$34. n + \frac{1}{2}g + \frac{1}{2}d = 5.97$$

$$\frac{4}{3}n + \frac{1}{4}g + \frac{3}{2}d = 9.22$$

$$\frac{1}{3}n + \frac{3}{2}g + 2d = 10.96$$

$$-\frac{1}{3}n - \frac{1}{6}g - \frac{1}{6}d = -1.99$$

$$\underline{\frac{1}{3}n + \frac{9}{6}g + \frac{12}{6}d = 10.96}$$

$$\frac{4}{3}g + \frac{11}{6}d = 8.97$$

$$\frac{4}{3}n + \frac{1}{4}g + \frac{3}{2}d = 9.22$$

$$\underline{-\frac{4}{3}n - \frac{24}{4}g - \frac{16}{2}d = -43.84}$$

$$-\frac{23}{4}g - \frac{13}{2}d = -34.62$$

$$\frac{26}{3}g + \frac{143}{12}d = 58.305$$

$$\underline{-\frac{253}{24}g - \frac{143}{12}d = -63.47}$$

$$-\frac{15}{8}g = -5.165$$

$$g = \$2.75$$

$$\frac{4}{3}(2.75) + \frac{11}{6}d = 8.97$$

$$\frac{11}{6}d = 5.30$$

$$d = 2.89$$

$$n + 1.38 + 1.44 = 5.97$$

$$n = \$3.15$$

A pound of mixed nuts costs \$3.15, a pound of granola costs \$2.75, and dried fruit costs \$2.89 a pound.

$$35. f + s + t = 20$$

$$5f + 3s + t = 68$$

$$s = f + t$$

$$f + f + t + t = 20$$

$$2f + 2t = 20$$

$$f + t = 10$$

$$s = 10$$

$$5f + 3(10) + t = 68$$

$$5f + t = 38$$

$$5f + 10 - f = 38$$

$$4f = 28$$

$$f = 7$$

$$10 = 7 + t$$

$$3 = t$$

There were 7 first place finishers, 10 second place finishers, and 3 third place finishers.

Chapter 3 continued

36. $2f + c = 5$

$$1f + c + b = 5.25$$

$$2c + b = 5.75$$

$$f + c + 5.75 - 2c = 5.25$$

$$f - c = -0.50$$

$$2(-0.50 + c) + c = 5$$

$$-1 + 2c + c = 5$$

$$3c = 6$$

$$c = 2$$

Chicken chow mein is \$2 per portion.

37. $s + l = 1300$

$$s + 2c = 1400$$

$$s + l + c = 1600$$

38. $1300 + c = 1600$

$$c = \$300$$

$$s + 2(300) = 1400$$

$$s = \$800$$

$$800 + l = 1300$$

$$l = \$500$$

sofa: \$800

love seat: \$500

chair: \$300

39. $0.2D + 0.15R + 0.2O = 18$

$$0.3D + 0.35R + 0.25O = 31.5$$

$$D + R + O = 100$$

$$-0.05R = -2$$

$$0.05R - 0.05O = 1.5$$

$$-0.05O = -0.5$$

$$O = 10$$

$$0.05R = 1.5 + 0.5$$

$$R = 40$$

$$D = 50$$

Democrat: 50 million

Republican: 40 million

Other parties: 10 million

40. $-1 + 2(2) - 3(-3) = 12 = a$

$$1 - 2 + (-3) = -4 = b$$

$$2(-1) + 3(2) - 2(-3) = 10 = c$$

41. a. *Sample answer:*

$$x + y + z = 3$$

$$2x - 2y + 5z = 23$$

$$4x - 3z = 1$$

b. *Sample answer:*

$$x + y + z = 3$$

$$2x - 2y + 5z = 23$$

$$4x - 4y + 10z = 11$$

c. *Sample answer:*

$$x + y + z = 3$$

$$2x - 2y + 5z = 23$$

$$3x - y + 6z = 26$$

42. a. $e + r + g = 21$

$$1.4e + 1.1r + 1.3g = 25$$

$$r = 2(e + g)$$

b. $e + 2e + 2g + g = 21$

$$3e + 3g = 21$$

$$e + g = 7$$

$$1.4e + 2.2e + 2.2g + 1.3g = 25$$

$$3.6e + 3.5g = 25$$

$$3.6(7 - g) + 3.5g = 25$$

$$25.2 - 3.6g + 3.5g = 25$$

$$-0.1g = -0.2$$

$$g = 2$$

$$e = 5$$

$$r = 14$$

5 lb empire apples; 2 lb golden delicious;

14 lb red delicious

c. *Sample answer:* You need 4 pounds of berries to make berry tarts for a party. Strawberries cost \$1.50 per pound, raspberries cost \$4.00 per pound and blueberries cost \$2.00 per pound. You have \$8 to spend, and plan to use as many pounds of strawberries as of blueberries and raspberries combined.

$$s + r + b = 4$$

$$s = r + b$$

$$1.5s + 4r + 2b = 8$$

Buy 2 lb of strawberries, $\frac{1}{2}$ lb of raspberries and 1 $\frac{1}{2}$ lb of blueberries.

43. $w = -\frac{2}{19}$

$$x = \frac{123}{38}$$

$$y = \frac{65}{38}$$

$$z = \frac{22}{19}$$

44. $w = 2$

$$x = -12$$

$$y = -4$$

$$z = 1$$

3.6 Mixed Review (p. 184)

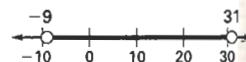
45. 11 46. 16 47. 84 48. 18 49. -16 50. 48

51. $\frac{3}{10}$ 52. $\frac{2}{21}$ 53. $-\frac{9}{4}$

54. $-20 < 11 - x < 20$

$$-31 < -x < 9$$

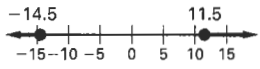
$$-9 < x < 31$$



Chapter 3 continued

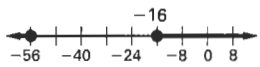
55. $2x + 3 \geq 26$ or $2x + 3 \leq -26$

$$\begin{aligned} 2x &\geq 23 & 2x &\leq -29 \\ x &\geq \frac{23}{2} & x &\leq -\frac{29}{2} \end{aligned}$$



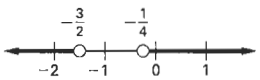
56. $18 + \frac{x}{2} \geq 10$ or $18 + \frac{x}{2} \leq -10$

$$\begin{aligned} \frac{x}{2} &\geq -8 & \frac{x}{2} &\leq -28 \\ x &\geq -16 & x &\leq -56 \end{aligned}$$



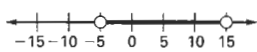
57. $7 + 8x < -5$ or $7 + 8x > 5$

$$\begin{aligned} 8x &< -12 & 8x &> -2 \\ x &< -\frac{3}{2} & x &> -\frac{1}{4} \end{aligned}$$



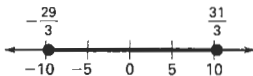
58. $-10 < 5 - x < 10$

$$\begin{aligned} -15 &< -x < 5 \\ -5 &< x < 15 \end{aligned}$$



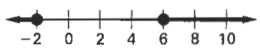
59. $-30 \leq 3x - 1 \leq 30$

$$\begin{aligned} -29 &\leq 3x \leq 31 \\ -\frac{29}{3} &\leq x \leq \frac{31}{3} \end{aligned}$$



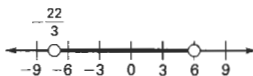
60. $-12 \geq -3x + 6$ or $-3x + 6 \geq 12$

$$\begin{aligned} -18 &\geq -3x & -3x &\geq 6 \\ 6 &\leq x & x &\leq -2 \end{aligned}$$



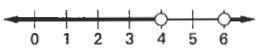
61. $-40 < 6x + 4 < 40$

$$\begin{aligned} -44 &< 6x < 36 \\ -\frac{22}{3} &< x < 6 \end{aligned}$$

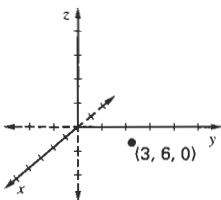


62. $15 - 3x < -3$ or $15 - 3x > 3$

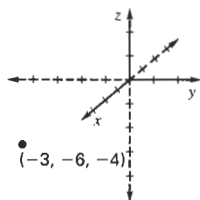
$$\begin{aligned} -3x &< -18 & -3x &> -12 \\ x &> 6 & x &< 4 \end{aligned}$$



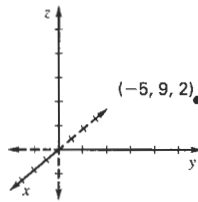
63.



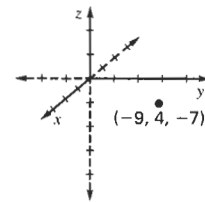
64.



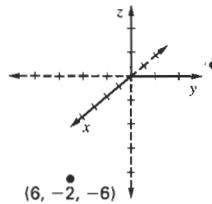
65.



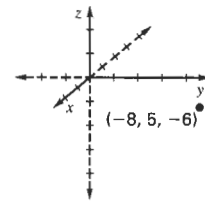
66.



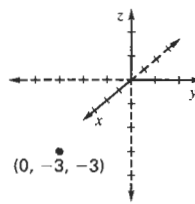
67.



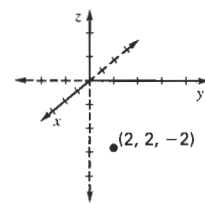
68.



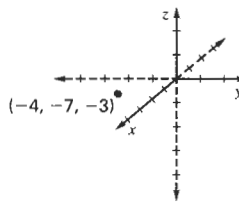
69.



70.

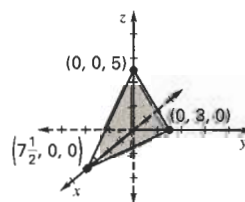


71.

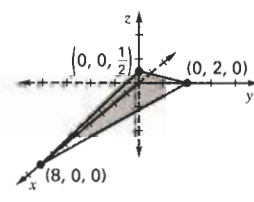


Quiz 3 (p. 184)

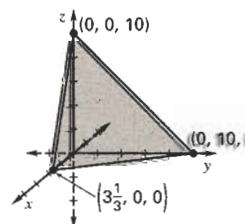
1.



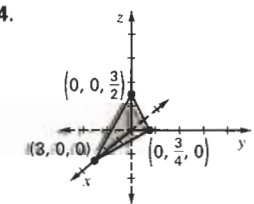
2.



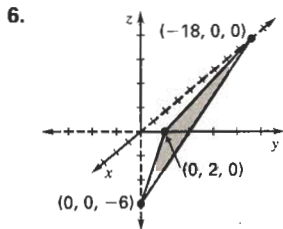
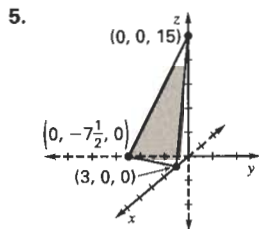
3.



4.



Chapter 3 continued



7. $3z = 18 + x - \frac{1}{2}y$

$$z = 6 + \frac{x}{3} - \frac{1}{6}y$$

$$f(2, 0) = 6 + \frac{2}{3}$$

$$f(2, 0) = \frac{20}{3}$$

9. $z = 20x - 3y - 15$

$$f(x, y) = 20x - 3y - 15$$

$$f(3, -7) = 60 + 21 - 15$$

$$f(3, -7) = 66$$

8. $-8z = -16 - 8y - 4x$

$$z = 2 + y + \frac{x}{2}$$

$$f(-4, 4) = 2 + 4 - 2$$

$$f(-4, 4) = 4$$

10. $6z = 24 + 2x - y$

$$z = 4 + \frac{x}{3} - \frac{y}{6}$$

$$f(12, 7) = 4 + 4 - \frac{7}{6}$$

$$f(12, 7) = \frac{41}{6}$$

11. $6x - 2y + 12z = 30$

$$5x + 2y - z = 25$$

$$11x + 11z = 55$$

$$x + z = 5$$

$$2x + 4y + 3z = 10$$

$$-10x - 4y + 2z = -50$$

$$-8x + 5z = -40$$

$$-8(5 - z) + 5z = -40$$

$$-40 + 8z + 5z = -40$$

$$13z = 0$$

$$z = 0$$

$$x = 5$$

$$2(5) + 4y + 0 = 10$$

$$4y = 0$$

$$y = 0$$

$$(5, 0, 0)$$

12. $8x + z = 15$

$$7x - 4z = 18$$

$$7x - 4(15 - 8x) = 18$$

$$7x - 60 + 32x = 18$$

$$39x = 78$$

$$x = 2$$

$$16 + z = 15$$

$$z = -1$$

$$-2 + y - 1 = -7$$

$$y = -4$$

$$(2, -4, -1)$$

13. $3x - 6y + 9z = -27$ 14. $w = 2(s + p)$

$$-3x + 6y - 9z = -12$$

$$0 \neq -39$$

no solution

$$w + s + p = 15$$

$$s = 3$$

$$15 - s - p = 2s + 2p$$

$$15 = 3s + 3p$$

$$5 = s + p$$

$$5 = 3 + p$$

$$2 = p$$

$$w = 2(3 + 2)$$

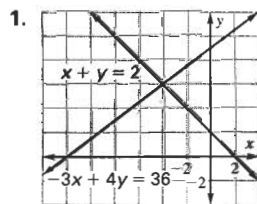
$$w = 10$$

3 string players,

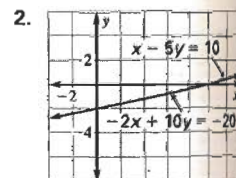
10 winds, and

2 percussionists

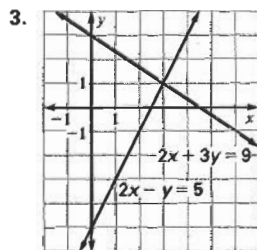
Chapter 3 Review (pp. 186-188)



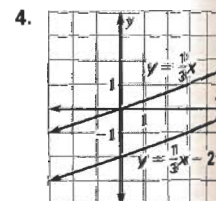
one solution; $(-4, 6)$



infinitely many solutions



one solution; $(3, 1)$



no solution

5. $9(12 - 2y) - 5y = -30$

$$108 - 23y = -30$$

$$-23y = -138$$

$$y = 6$$

$$x = 12 - 12$$

$$x = 0$$

$$(0, 6)$$

7. $4x + 6y = -14$

$$-4x - 5y = 13$$

$$y = -1$$

$$2x - 3 = -7$$

$$2x = -4$$

$$x = -2$$

$$(-2, -1)$$

6. $2 - y + 3y = -2$

$$2y = -4$$

$$y = -2$$

$$x = 2 + 2$$

$$x = 4$$

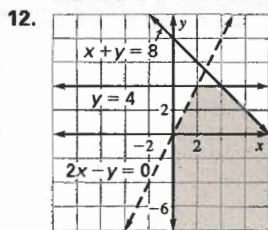
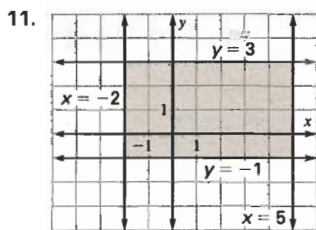
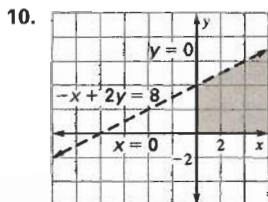
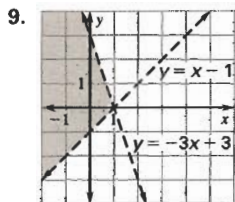
$$(4, -2)$$

Chapter 3 continued

$$\begin{aligned}
 8. \quad & -6x - 6y = 0 \\
 & -2x - 6y = -24 \\
 & \underline{-8x = -24} \\
 & x = 3
 \end{aligned}$$

$$\begin{aligned}
 3(3) + 3(y) &= 0 \\
 3y &= -9 \\
 y &= -3
 \end{aligned}$$

(3, -3)

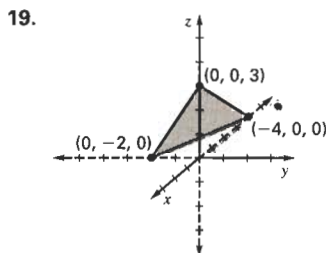
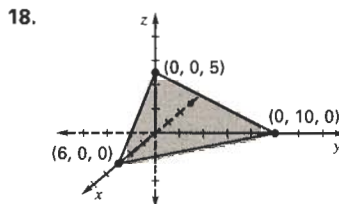
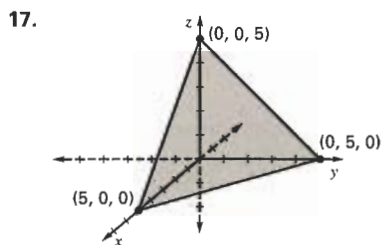


13. (0, 10): $C = 5(0) + 2(10) = 20$
 (10, 0): $C = 5(10) + 2(0) = 50$ max
 (0, 0): $C = 5(0) + 2(0) = 0$ min

14. (0, 4): $C = 5(0) + 2(4) = 8$
 (5, 0): $C = 5(5) + 2(0) = 25$ max
 (0, 0): $C = 5(0) + 2(0) = 0$ min

15. (1, 0): $C = 5(1) + 2(0) = 5$ min
 (1, 9): $C = 5(1) + 2(9) = 23$
 (4, 0): $C = 5(4) + 2(0) = 20$
 (4, 9): $C = 5(4) + 2(9) = 38$ max

16. (0, 0): $C = 5(0) + 2(0) = 0$ min
 (0, 6): $C = 5(0) + 2(6) = 12$
 (4, 6): $C = 5(4) + 2(6) = 32$
 (5, 5): $C = 5(5) + 2(5) = 35$ max



20.
$$\begin{aligned}
 x + 2y - z &= 3 \\
 -x + y + 3z &= -5 \\
 \hline
 3y + 2z &= -2 \\
 -3x + 3y + 9z &= -15 \\
 \hline
 3x + y + 2z &= 4 \\
 4y + 11z &= -11 \\
 -12y - 8z &= 8 \\
 \hline
 12y + 33z &= -33
 \end{aligned}$$

$$\begin{aligned}
 25z &= -25 \\
 z &= -1
 \end{aligned}$$

$$\begin{aligned}
 4y - 11 &= -11 & x &= 3 - 1 - 2(0) \\
 4y &= 0 & x &= 2 \\
 y &= 0
 \end{aligned}$$

(2, 0, -1)

21.
$$\begin{aligned}
 2x - 4y + 3z &= 1 \\
 -2x + 5y - 2z &= 2 \\
 \hline
 y + z &= 3 \\
 6x + 2y + 10z &= 19 \\
 -6x + 15y - 6z &= 6 \\
 \hline
 17y + 4z &= 25 \\
 -17y - 17z &= -51 \\
 \hline
 17y + 4z &= 25 \\
 -13z &= -26 \\
 z &= 2
 \end{aligned}$$

22.
$$\begin{aligned}
 x + y + z &= 3 \\
 x + y - z &= 3 \\
 \hline
 2x + 2y &= 6 \\
 x + y - z &= 3 \\
 2x + 2y + z &= 6 \\
 \hline
 3x + 3y &= 9 \\
 2y &= 6 - 2x \\
 y &= 3 - x \\
 x + 3 - x + z &= 3 \\
 z &= 0 \\
 (x, 3 - x, 0)
 \end{aligned}$$

$$\begin{aligned}
 y + 2 &= 3 \\
 y &= 1
 \end{aligned}$$

$$\begin{aligned}
 2x &= 1 + 4 - 6 \\
 2x &= -1 \\
 x &= -\frac{1}{2}
 \end{aligned}$$

$(-\frac{1}{2}, 1, 2)$