

DIAGNOSING READINESS

page 338

1. $3(2 - 2x) = -6(x - 1)$
 $6 - 6x = -6x + 6$

identity

2. $3m + 1 = -m + 5$
 $4m + 1 = 5$
 $4m = 4$
 $m = 1$

3. $4x - 1 = 3(x + 1) + x$
 $4x - 1 = 3x + 3 + x$
 $-1 = 3$

no solution

4. $\frac{1}{2}(6x - 4) = 4 + x$
 $6x - 4 = 8 + 2x$
 $4x - 4 = 8$
 $4x = 12$
 $x = 3$

5. $5x = 2 - (x - 7)$
 $5x = 2 - x + 7$
 $6x = 9$
 $x = \frac{3}{2}$

6. $x + 5 = x - 5$
 $5 = -5$

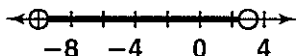
no solution

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

8. $10 = x + 5y$
 $-5y + 10 = x$
 $-5y = x - 10$
 $y = -\frac{1}{5}x + 2$

9. $2y = -2x - 8$
 $y = -x - 4$

10. $-10 < x < 3$



11. $x < 12$ or $x > 60$

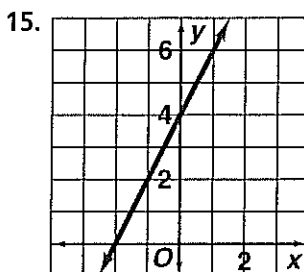
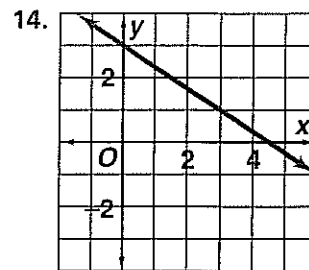
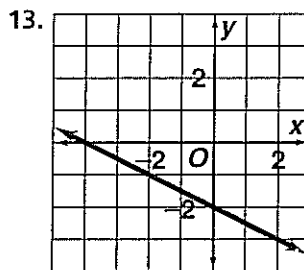


12a. $C(t) = (35 + 4.50)t = 39.50t$

12b. $C(3) = 39.50 \cdot 3 = 118.50$; cost is \$118.50.

12c. $237 = 39.50t$
 $\frac{237}{39.50} = t$
 $6 = t$

6 tickets were purchased.

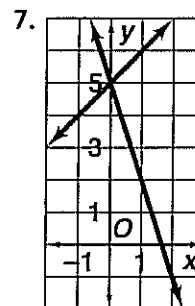
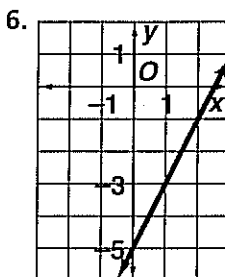
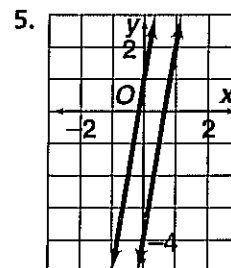
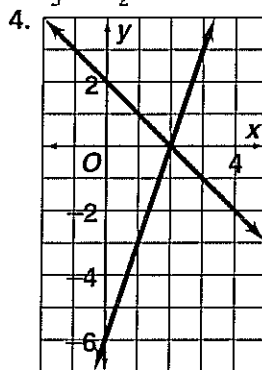


7-1 Solving Systems by Graphing

pages 340–345

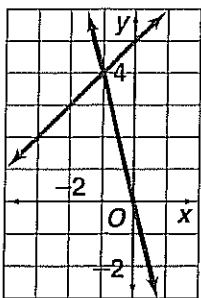
Check Skills You'll Need For complete solutions see *Daily Skills Check* and *Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. $1\frac{2}{3}$ 2. $3\frac{1}{2}$ 3. 7



Check Understanding

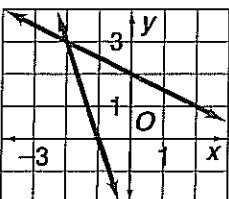
1a.



Solution is $(-1, 4)$.

$$\begin{aligned}\text{Check: } y &= x + 5 \\ 4 &\stackrel{?}{=} -1 + 5 \\ 4 &= 4 \\ y &= -4x \\ 4 &\stackrel{?}{=} -4(-1) \\ 4 &= 4\end{aligned}$$

1b.

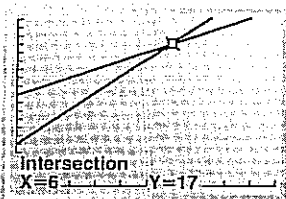


Solution is $(-2, 3)$.

$$\begin{aligned}\text{Check: } 3 &\stackrel{?}{=} -\frac{1}{2}(-2) + 2 \\ 3 &\stackrel{?}{=} -3(-2) - 3 \\ 3 &= 6 - 3\end{aligned}$$

2. Plant C: $H(d) = 5 + 2d$

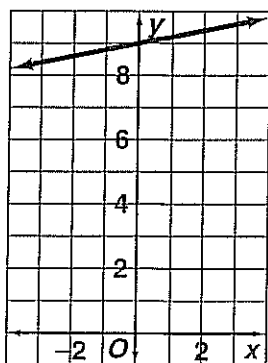
Plant D: $H(d) = 11 + d$



The lines intersect at $(6, 17)$. After 6 days, their height will be 17 cm. 3. If the slopes are the same, but the y-intercepts are different, the system will have no solution, because the graphs will be

parallel and never intersect.

4. Multiplying the first equation through by 5, we see that the two equations are identical and will have the same graphs (they overlap).



The solutions are all the ordered pairs (x, y) that satisfy the equation $5y = x + 45$.

Exercises 1.

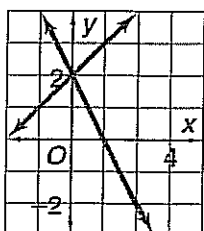
$$\begin{aligned}x + y &= 4 \\ -1 + 5 &\stackrel{?}{=} 4 \\ 4 &= 4 \\ x &= -1 \\ -1 &\stackrel{?}{=} -1 \text{ YES}\end{aligned}$$

2. $5 \stackrel{?}{=} -(-1) + 5$ no; $\stackrel{?}{=} -\frac{1}{3}(-1)$ yes; NO

3. $5 \stackrel{?}{=} 5$ yes; $-1 \stackrel{?}{=} 5 - 6$ yes; YES

4. $5 \stackrel{?}{=} 2(-1) + 7$ yes; $5 = -1 + 6$ yes; YES

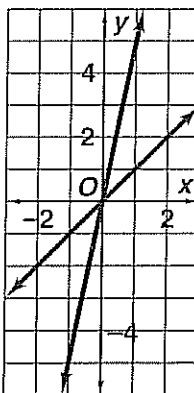
5.



Lines intersect at $(0, 2)$ Check:

$$\begin{aligned}y &= x + 2 \\ 2 &\stackrel{?}{=} 0 + 2 \\ 2 &= 2 \\ y &= -2x + 2 \\ 2 &\stackrel{?}{=} -2 \cdot 0 + 2 \\ 2 &= 2\end{aligned}$$

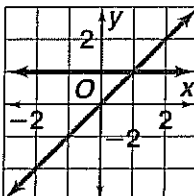
6.



Solution is $(0, 0)$.

$$\text{Check: } 0 \stackrel{?}{=} 0; 0 \stackrel{?}{=} 5 \cdot 0$$

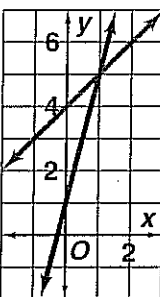
7.



Solution is $(1, 1)$.

$$\text{Check: } 1 \stackrel{?}{=} 1; 1 \stackrel{?}{=} 1$$

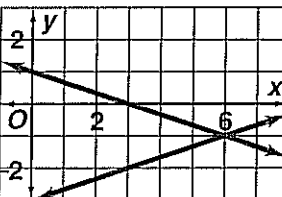
8.



Solution is $(1, 5)$.

$$\text{Check: } 5 \stackrel{?}{=} 1 + 4; 5 \stackrel{?}{=} 4 \cdot 1 + 1$$

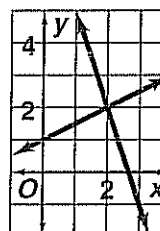
9.



Solution is $(6, -1)$.

$$\begin{aligned}\text{Check: } -1 &\stackrel{?}{=} -\frac{1}{3} \cdot 6 + 1 \\ -1 &\stackrel{?}{=} -2 + 1; \\ -1 &\stackrel{?}{=} \frac{1}{3} \cdot 6 - 3 \\ -1 &\stackrel{?}{=} 2 - 3\end{aligned}$$

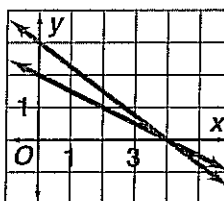
10.



Solution is $(2, 2)$.

$$\begin{aligned}\text{Check: } 2 &\stackrel{?}{=} \frac{1}{2} \cdot 2 + 1; \\ 2 &\stackrel{?}{=} -3 \cdot 2 + 8\end{aligned}$$

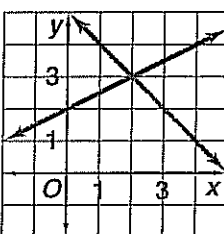
11.



Solution is $(4, 0)$.

$$\text{Check: } 3 \cdot 4 + 4 \cdot 0 = 12$$

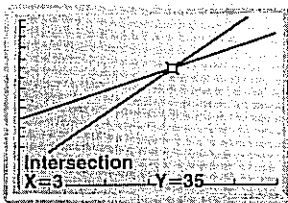
12.



Solution is $(2, 3)$.

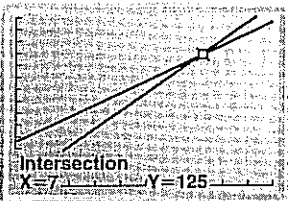
$$\begin{aligned}\text{Check: } 3 &\stackrel{?}{=} \frac{1}{2} \cdot 2 + 2; \\ 3 &\stackrel{?}{=} -2 + 5\end{aligned}$$

- 13a. You: $y = 20 + 5x$
 Friend: $y = 5 + 10x$



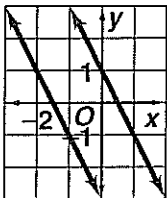
The lines intersect at (3, 35).
 The accounts will have the same amounts after 3 weeks.
 13b. You will each have \$35.

14. You: $y = 55 + 10x$
 Friend: $y = 20 + 15x$

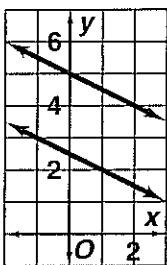


The lines intersect at (7, 125).
 The accounts will have the same amounts after 7 weeks.

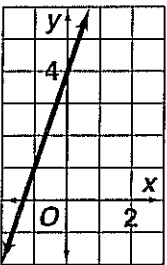
15. The graphs look parallel, but to be sure we must calculate the slopes from the equations: both slopes = -2 ; the y -intercepts are different; the lines will never meet; there is no solution.



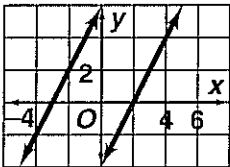
16. Graphs look parallel; slopes = $-\frac{1}{2}$; y -intercepts different; no solution.



17. Graphs coincide; slopes = 3; y -intercepts = 4; infinitely many solutions.

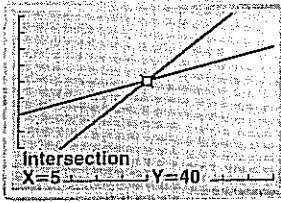


18. Graphs look parallel; slopes = 2; y -intercepts different; no solution.
 19. same slopes; different intercepts; no solution
 20. same slopes; same

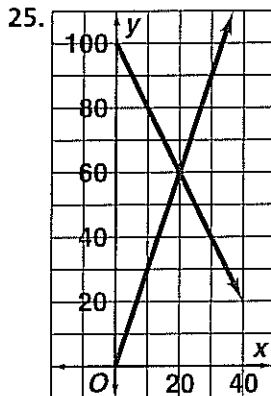


intercepts; infinitely many solutions 21. Different slopes; lines will intersect; one solution. 22. same slopes; same intercepts; infinitely many solutions 23. One slope is negative and the other is positive; system B shows both slopes positive so it can't be B. Intercepts of equations check with system A.

24. Card A: $y = 30 + 2x$
 Card B: $y = 10 + 6x$



The lines intersect at (5, 40).
 A 5-min call costs the same.

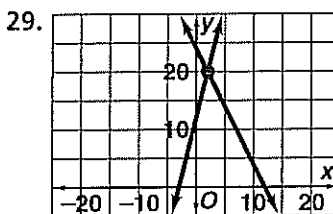


Lines intersect at (20, 60); ball is at (20 m, 60 m).

26. Answers may vary. Sample: $y = -1$; $x = 2$

27. Answers may vary. Sample: $y = 2x + 5$; $y = 2x - 1$

28. Answers may vary. Sample: $x + y = 3$; $3x + 3y = 9$



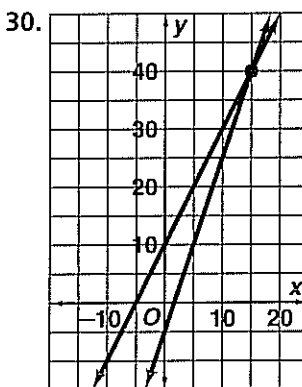
Solution is (2, 20).

Check: $y = 4x + 12$

$$20 \stackrel{?}{=} 4 \cdot 2 + 12$$

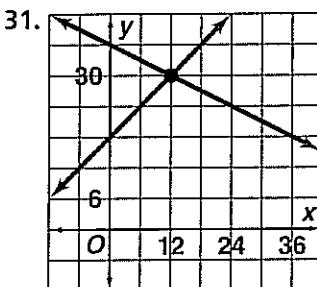
$$y = -2x + 24$$

$$20 \stackrel{?}{=} -2 \cdot 2 + 24$$



Solution is (15, 40).

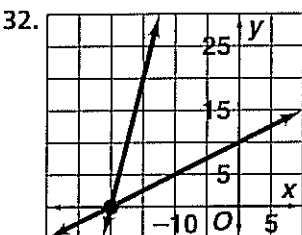
Check: $40 \stackrel{?}{=} 3 \cdot 15 - 5$;
 $40 = 2 \cdot 15 + 10$



Solution is (12, 30).

Check: $30 \stackrel{?}{=} 12 + 18$;

$$30 \stackrel{?}{=} -\frac{1}{2} \cdot 12 + 36$$



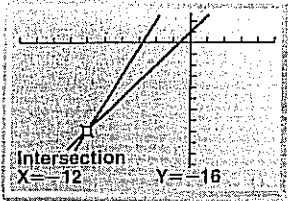
Solution is (-20, 0).

Check: $0 \stackrel{?}{=} 4(-20) + 80$;

$$0 = \frac{1}{2}(-20) + 10$$

33a. vertical: distance;
 horizontal: time

33b. tortoise: red (slow steady progress at constant speed); hare: blue (fast at first, then stationary while napping, then fast) 33c. There are two points of intersection. The first shows the contestants together at the starting line. The second shows the tortoise passing the sleeping hare.

34.  $(-12, -16)$

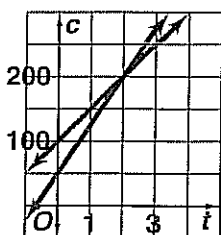
35.  $(-2, 10)$

36.  $(-30, -2.5)$

37.  $(-0.9, 1.6)$

38. The values of y are equal at $(2, 3)$.

39a. Studio A: $c = 100 + 50t$ Studio B: $c = 50 + 75t$



Solution is $(2, 200)$; both rents = \$200 for 3 hours.

39b. Studio A is cheaper for 1 or 2 hours; studio B is cheaper for 3 hours or more. "What is the solution?" means "for what number of hours are the costs equal?"

40a. One sees that $w = y + 5x = v$;

w and v must be equal for solution to exist; for any particular values of $w = v$ the graphs of the two equations will overlap; one solution is not possible; no values of w and v provide unique solution. 40b. If $w \neq v$ there is no solution. 40c. We have already seen that there are infinitely many solutions if $w = v$. 41a. For no solution, we require: that y -intercepts be different (they are); that the slopes be the same; that $g = h$; answer is "sometimes." 41b. For infinitely many solutions we require same y -intercepts; answer is "never." 42. First line has equation $y = \frac{2}{9}x$. Second line has equation

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

$$y = x + 7$$

Point P is solution to this system, so solve by graphing.

$$\frac{2}{9}x = x + 7$$

$$2x = 9x + 63$$

$$-7x = 63$$

$$x = -9$$

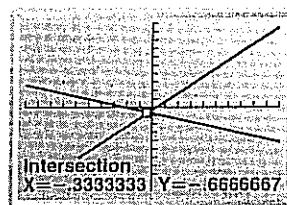
$$y = -9 + 7 = -2$$

Point P has coordinates $(-9, -2)$. These check.

43. Solve the equations for y :

$$y = x - \frac{1}{3}$$

$$y = -\frac{1}{3}x - \frac{7}{9}$$



The lines intersect at $(-\frac{1}{3}, -\frac{2}{3})$.

The answer is D.

44. $2(2) + 3 = 2.5(2) + b$
 $7 = 5 + b$
 $2 = b$

Check: $2 \cdot 2 + 3 = 2.5 \cdot 2 + 2 = 7$

The answer is F.

45. [2] a. Answers may vary.

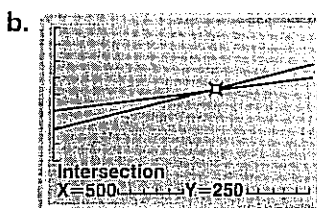
Sample:

$$x - 2y = 6$$

b. Since the lines do not intersect, the lines are parallel. Parallel lines have the same slope but different intercepts.

[1] incorrect equation OR incorrect explanation

46. [4] a. $y = 0.2x + 150$
 $y = 0.1x + 200$



Earnings are equal for \$500 in sales.

c. The first because commissions are greater.

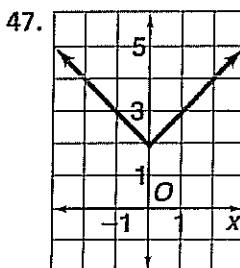
$$0.2(600) + 150 = 120 + 150 = 270; \text{ greater than}$$

$$0.1(600) + 200 = 60 + 200 = 260$$

[3] appropriate methods but one computational error

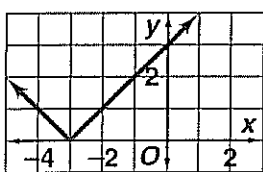
[2] incorrect system solved correctly OR correct system solved incorrectly

[1] no work shown

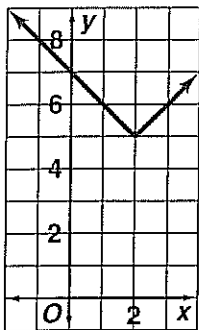


translated up 2 units

48. translated 3 units to the left



49. translated 2 units right and 5 units up



50. percent of change = $\frac{\text{amount of change}}{\text{original amount}} = \frac{5 - 4}{4} = \frac{1}{4} = 0.25 = 25\%$

51. $\frac{12 - 8}{12} = 0.333 = 33\frac{1}{3}\%$

52. $\frac{24 - 20}{20} = 0.20 = 20\%$

53. $\frac{25 - 10}{10} = 1.50 = 150\%$

54. $\frac{9 - 6}{9} = 0.333 = 33\frac{1}{3}\%$

55. $\frac{15 - 12}{12} = 0.25 = 25\%$

56. $\frac{55 - 50}{50} = 0.10 = 10\%$

57. $\frac{48 - 42}{48} = 0.125 = 12.5\%$

INVESTIGATION

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1. $y = x + 1$
 $2x + y = 10$
 $2x + x + 1 = 10$
 $3x + 1 = 10$
 $3x = 9$
 $x = 3$
 $y = 3 + 1 = 4$

Solution is (3, 4).

2. $x + 4y = 1$
 $y - 4 + 4y = 1$
 $5y - 4 = 1$
 $5y = 5$
 $y = 1$
 $x = 1 - 4 = -3$

Solution is (-3, 1).

3. $y = y$
 $2x - 1 = x + 5$
 $x - 1 = 5$
 $x = 6$
 $y = 2 \cdot 6 - 1 = 11$

Solution is (6, 11).

4. $2x = y + 9$
 $2(3y + 2) = y + 9$
 $6y + 4 = y + 9$
 $5y + 4 = 9$
 $5y = 5$
 $y = 1$
 $x = 3 \cdot 1 + 2 = 5$

Solution is (5, 1).

5. $x - 4y = 2$
 $y + 1 - 4y = 2$
 $-3y + 1 = 2$
 $-3y = 1$
 $y = -\frac{1}{3}$
 $x = -\frac{1}{3} + 1 = \frac{2}{3}$

Solution is $(\frac{2}{3}, -\frac{1}{3})$.

6. $x + 3 = 2x + 6$
 $3 = x + 6$
 $-3 = x$
 $y = -3 + 3 = 0$

Solution is (-3, 0).

7. Second cannot have a graph parallel to that of the first. Any equation of the form $ay = bx + c$ where $a \neq b$ (slopes must be different).

7-2 Solving Systems Using Substitution

pages 347-352

Check Skills You'll Need For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. $-4\frac{2}{3}$ 2. $1\frac{1}{2}$ 3. 15 4. no 5. no

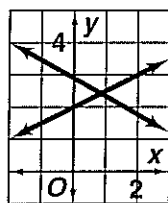
Investigation 1. Solution is approximately (-2.5, 3.5).

2. Check: $3.5 \stackrel{?}{=} -2.5 + 6.1$
 $3.5 \stackrel{?}{=} 3.6$ no
 $3.5 \stackrel{?}{=} -2(-2.5) - 1.4$
 $3.5 \stackrel{?}{=} 3.6$ no

[Check would work for (-2.5, 3.6).]

3. No; it is too difficult to read exact values when they are not integers.

4. $y = 2x - 4$
 $x = 2.5$
 $y = 2(2.5) - 4 = 1$, approximately.



Check Understanding

1. $y = 2x$
 $7x - y = 15$
 $7x - (2x) = 15$
 $5x = 15$
 $x = 3$
 $y = 2(3) = 6$

Check: $6 \stackrel{?}{=} 2 \cdot 3$
 $7 \cdot 3 - 6 \stackrel{?}{=} 15$

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

$$6y + 8x = 28$$

$$6(-3 + 2x) + 8x = 28$$

$$-18 + 12x + 8x = 28$$

$$-18 + 20x = 28$$

$$20x = 46$$

$$x = 2.3$$

$$y = -3 + 2(2.3) = 1.6$$

$$\text{Check: } 6(1.6) + 8(2.3) = 9.6 + 18.4 = 28$$

$$2(2.3) - 1.6 = 4.6 - 1.6 = 3$$

$$3. \quad \ell = 4w$$

$$P = 2\ell + 2w = 30$$

$$2(4w) + 2w = 30$$

$$10w = 30$$

$$w = 3$$

$$\ell = 4 \cdot 3 = 12$$

Rectangle is 3 cm by 12 cm.

$$\text{Check: } 12/3 = 4; 2 \cdot 3 + 2 \cdot 12 = 6 + 24 = 30$$

Exercises 1. y is 1 greater than x only for D. 2. Second equation is satisfied only by C. 3. x and y are equal only for B. 4. x is 1 greater than y only for A.

$$5. \quad y = 4x - 8$$

$$y = 2x + 10$$

$$4x - 8 = 2x + 10$$

$$2x - 8 = 10$$

$$2x = 18$$

$$x = 9$$

$$y = 4 \cdot 9 - 8 = 28$$

$$\text{Check: } y = 4 \cdot 9 - 8 = 36 - 8 = 28$$

$$y = 2 \cdot 9 + 10 = 18 + 10 = 28$$

$$6. \quad -3n - 6 = n - 4$$

$$-4n - 6 = -4$$

$$-4n = 2$$

$$n = -\frac{1}{2}$$

$$C(n) = -3\left(-\frac{1}{2}\right) - 6 = -4\frac{1}{2}$$

$$\text{Check: } C(n) = -3\left(-\frac{1}{2}\right) - 6 = -4\frac{1}{2}$$

$$C(n) = -\frac{1}{2} - 4 = -4\frac{1}{2}$$

$$7. \quad 5p + 8 = -10p + 3$$

$$15p + 8 = 3$$

$$15p = -5$$

$$p = -\frac{1}{3}$$

$$m = 5\left(-\frac{1}{3}\right) + 8 = 6\frac{1}{3}$$

$$\text{Check: } m = 5\left(-\frac{1}{3}\right) + 8 = 6\frac{1}{3}$$

$$m = -10\left(-\frac{1}{3}\right) + 3 = 3\frac{1}{3} + 3 = 6\frac{1}{3}$$

$$8. \quad -4x + 12\frac{1}{2} = \frac{1}{4}x + 4$$

$$-16x + 50 = x + 16$$

$$-17x + 50 = 16$$

$$-17x = -34$$

$$x = 2$$

$$y = -4 \cdot 2 + 12\frac{1}{2} = 4\frac{1}{2}$$

$$\text{Check: } y = -4 \cdot 2 + 12\frac{1}{2} = 4\frac{1}{2}$$

$$y = \frac{1}{4} \cdot 2 + 4 = 4\frac{1}{2}$$

$$9. \quad 6g - 4 = -2g + 28$$

$$8g - 4 = 28$$

$$8g = 32$$

$$g = 4$$

$$h = 6 \cdot 4 - 4 = 20$$

$$\text{Check: } h = 6 \cdot 4 - 4 = 20$$

$$h = -2 \cdot 4 + 28 = 20$$

$$10. \quad \frac{2}{3}b - 3 = 2b - 18$$

$$2b - 15 = 10b - 90$$

$$-8b - 15 = -90$$

$$-8b = -75$$

$$b = \frac{-75}{-8} = 9\frac{3}{8}$$

$$a = 2\left(\frac{75}{8}\right) - 3 = 3\frac{3}{4} - 3 = \frac{3}{4}$$

$$\text{Check: } a = 2\left(\frac{75}{8}\right) - 3 = 3\frac{3}{4} - 3 = \frac{3}{4}$$

$$a = 2\left(\frac{75}{8}\right) - 18 = 18\frac{3}{4} - 18 = \frac{3}{4}$$

$$11. \quad y = x - 2$$

$$2x + 2y = 4$$

$$2x + 2(x - 2) = 4$$

$$2x + 2x - 4 = 4$$

$$4x - 4 = 4$$

$$4x = 8$$

$$x = 2$$

$$y = 2 - 2 = 0$$

$$\text{Check: } y = 2 - 2 = 0$$

$$2 \cdot 2 + 2 \cdot 0 = 4$$

$$12. \quad c = 3d - 27$$

$$4d + 10c = 120$$

$$4d + 10(3d - 27) = 120$$

$$4d + 30d - 270 = 120$$

$$34d - 270 = 120$$

$$34d = 390$$

$$17d = 195$$

$$d = \frac{195}{17} = 11\frac{8}{17}$$

$$c = 3\left(\frac{195}{17}\right) - 27 = \frac{585}{17} - \frac{459}{17} = \frac{126}{17} = 7\frac{7}{17}$$

$$\text{Check: } c = 3\left(\frac{195}{17}\right) - 27 = \frac{585}{17} - \frac{459}{17} = \frac{126}{17} = 7\frac{7}{17}$$

$$4\left(\frac{195}{17}\right) + 10\left(\frac{126}{17}\right) = \frac{780}{17} + \frac{1260}{17} = \frac{2040}{17} = 120$$

$$13. \quad 3x - 6y = 30$$

$$3x - 6(-6x + 34) = 30$$

$$3x + 36x - 204 = 30$$

$$39x - 204 = 30$$

$$39x = 234$$

$$x = 6$$

$$y = -6(6) + 34 = -36 + 34 = -2$$

$$\text{Check: } y = -6(6) + 34 = -36 + 34 = -2$$

$$3 \cdot 6 - 6(-2) = 18 + 12 = 30$$

$$14. \quad -6n + 8m = 36$$

$$-6n + 8(4n + 11) = 36$$

$$-6n + 32n + 88 = 36$$

$$26n + 88 = 36$$

$$26n = -52$$

$$n = -2$$

$$m = 4(-2) + 11 = -8 + 11 = 3$$

$$\text{Check: } m = 4(-2) + 11 = -8 + 11 = 3$$

$$-6(-2) + 8 \cdot 3 = 12 + 24 = 36$$

$$15. \quad 7x - 8y = 112$$

$$7x - 8(-2x + 9) = 112$$

$$7x + 16x - 72 = 112$$

$$23x - 72 = 112$$

$$23x = 184$$

$$x = 8$$

$$y = -2 \cdot 8 + 9 = -16 + 9 = -7$$

$$\text{Check: } y = -2 \cdot 8 + 9 = -16 + 9 = -7$$

$$7 \cdot 8 - 8(-7) = 56 + 56 = 112$$

$$16. \quad 4s + 5t = 35$$

$$4s + 5(0.2s + 10) = 35$$

$$4s + s + 50 = 35$$

$$5s + 50 = 35$$

$$5s = -15$$

$$s = -3$$

$$t = 0.2(-3) + 10 = -0.6 + 10 = 9.4$$

$$\text{Check: } t = 0.2(-3) + 10 = -0.6 + 10 = 9.4$$

$$4(-3) + 5 \cdot 9.4 = -12 + 47 = 35$$

$$17. \quad \ell = 2w + 5$$

$$P = 2\ell + 2w = 34$$

$$2(2w + 5) + 2w = 34$$

$$4w + 10 + 2w = 34$$

$$6w + 10 = 34$$

$$6w = 24$$

$$w = 4$$

$$\ell = 2 \cdot 4 + 5 = 13$$

$$\text{Check: } 2 \cdot 13 + 2 \cdot 4 = 26 + 8 = 34$$

Rectangle is 4 cm by 13 cm.

$$18. \quad 28 + 18.25x = 161 - 15x$$

$$33.25x + 28 = 161$$

$$33.25x = 133$$

$$x = 4$$

The accounts will be equal after 4 weeks.

$$19. \quad a - 1.2b = -3$$

$$a = 1.2b - 3$$

$$0.2b + 0.6a = 12$$

$$0.2b + 0.6(1.2b - 3) = 12$$

$$0.2b + 0.72b - 1.8 = 12$$

$$0.92b - 1.8 = 12$$

$$0.92b = 13.8$$

$$b = 15$$

$$a = 1.2 \cdot 15 - 3 = 18 - 3 = 15$$

$$\text{Check: } 15 - 1.2 \cdot 15 = 15 - 18 = -3$$

$$0.2 \cdot 15 + 0.6 \cdot 15 = 3 + 9 = 12$$

$$20. \quad y + 18 = 16x$$

$$y = 16x - 18$$

$$0.5x + 0.25y = 36$$

$$0.5x + 0.25(16x - 18) = 36$$

$$0.5x + 4x - 4.5 = 36$$

$$4.5x = 40.5$$

$$x = 9$$

$$y = 16 \cdot 9 - 18 = 144 - 18 = 126$$

$$\text{Check: } 0.5 \cdot 9 + 0.25 \cdot 126 = 4.5 + 31.5 = 36$$

$$126 + 18 = 144 = 16 \cdot 9$$

$$21. \quad 20x + 32y = 48$$

$$20x + 32(0.8x + 7.2) = 48$$

$$20x + 25.6x + 230.4 = 48$$

$$45.6x + 230.4 = 48$$

$$45.6x = -182.4$$

$$x = -4$$

$$y = 0.8(-4) + 7.2 = -3.2 + 7.2 = 4$$

$$\text{Check: } y = 0.8(-4) + 7.2 = -3.2 + 7.2 = 4$$

$$20(-4) + 32 \cdot 4 = -80 + 128 = 48$$

22, 24. In these problems one equation will suffice.

22. Let x = number of videos rented.

$$9.99 + 2.49x = 20.49 + 1.79x$$

$$0.70x + 9.99 = 20.49$$

$$0.7x = 10.50$$

$$x = 15$$

For 15 video rentals the total costs are the same.

23. Let s = acres of sunflowers and f = acres of flax.

$$s = f + 80$$

$$s + f = 240$$

$$f + 80 + f = 240$$

$$2f = 160$$

$$f = 80$$

$$s = 80 + 80 = 160$$

The farmer should plant 80 acres of flax and 160 acres of sunflowers.

24. Let x = years of ownership. $A = B$ or

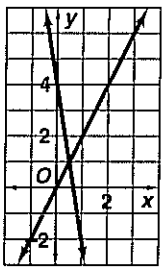
$$17,655 + 1230x = 15,900 + 1425x$$

$$17,655 = 195x + 15,900$$

$$1755 = 195x$$

$$9 = x$$

Costs will be equal after 9 years of ownership.

25.  Estimate $(\frac{1}{2}, 1)$. Exact solution:

$$y = y \text{ or}$$

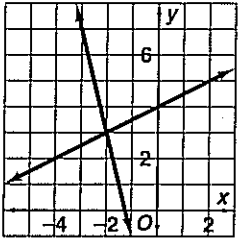
$$2x = -6x + 4$$

$$8x = 4$$

$$x = \frac{1}{2}$$

$$y = 2\left(\frac{1}{2}\right) = 1$$

Exact solution is $(\frac{1}{2}, 1)$.

26.  Estimate $(-2, 3)$.

$$\frac{1}{2}x + 4 = -4x - 5$$

$$x + 8 = -8x - 10$$

$$9x + 8 = -10$$

$$9x = -18$$

$$x = -2$$

$$y = -4(-2) - 5 = 3$$

Exact solution is $(-2, 3)$.

27.  Estimate $(-1, 1)$.

$$x + y = 0$$

$$y = -x$$

$$5x + 2y = -3$$

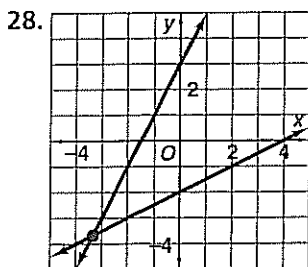
$$5x + 2(-x) = -3$$

$$3x = -3$$

$$x = -1$$

$$y = -(-1) = 1$$

Exact solution is $(-1, 1)$.



Estimate $(-3.3, -3.7)$.

$$2x + 3 = 0.5x - 2$$

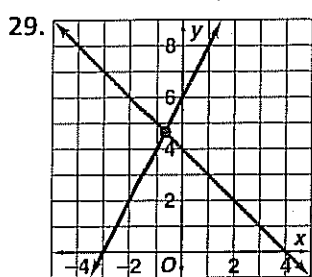
$$1.5x + 3 = -2$$

$$1.5x = -5$$

$$x = -\frac{10}{3} = -3\frac{1}{3} = -3.33$$

$$y = 2\left(-\frac{10}{3}\right) + 3 = -\frac{11}{3} = -3\frac{2}{3} = -3.67$$

Exact solution is $\left(-3\frac{1}{3}, -3\frac{2}{3}\right)$.



Estimate $\left(-\frac{2}{3}, 4\frac{2}{3}\right)$.

$$-x + 4 = 2x + 6$$

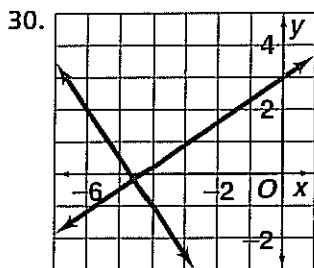
$$-3x + 4 = 6$$

$$-3x = 2$$

$$x = -\frac{2}{3}$$

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

Exact solution is $\left(-\frac{2}{3}, 4\frac{2}{3}\right)$.



Estimate $(-4.6, -0.2)$.

$$0.7x + 3 = -1.5x - 7$$

$$2.2x + 3 = -7$$

$$2.2x = -10$$

$$11x = -50$$

$$x = -\frac{50}{11} = -4.55$$

$$y = -1.5\left(-\frac{50}{11}\right) - 7 = \frac{75 - 77}{11} = -\frac{2}{11} = -0.18$$

Exact solution is $\left(-\frac{50}{11}, -\frac{2}{11}\right)$.

31a. Let n = number of nickels and
 d = number of dimes.

$$n + d = 28$$

$$5n + 10d = 205$$

31b. Solve the first equation for either variable.
Substitute this expression into the second equation.
Solve the second equation for the other variable. Then
substitute its value into the first equation and solve for
the first variable.

31c. $n = -d + 28$

$$5(-d + 28) + 10d = 205$$

$$-5d + 140 + 10d = 205$$

$$5d + 140 = 205$$

$$5d = 65$$

$$d = 13$$

$$n = -13 + 28 = 15$$

You have 15 nickels and 13 dimes.

32. Answers may vary. Sample:

$$y = x$$

$$y = -3x + 2$$

$$x = -3x + 2$$

$$4x = 2$$

$$x = \frac{1}{2}$$

$$y = \frac{1}{2}$$

33a.

$$y = 0.5x + 4$$

$$-x + 2y = 8$$

$$-x + 2(0.5x + 4) = 8$$

$$-x + x + 8 = 8$$

$$8 = 8$$

Substitution does not yield any solution. A better
approach would be to manipulate the second equation:

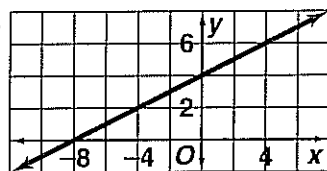
$$-x + 2y = 8$$

$$2y = x + 8$$

$$y = 0.5x + 4$$

The two equations are the same. Solution
is $(x, 0.5x + 4)$.

33b.



Solutions are all
points on the line
shown.

33c. Graphing: each
equation forms the
same line; the lines

intersect everywhere along their length. Substitution
results in an identically true equation which gives no
information about the variables.

34a.

$$y = 3x + 1$$

$$6x - 2y = 10$$

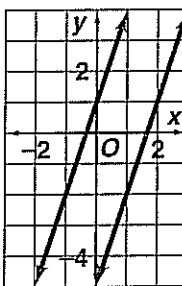
$$6x - 2(3x + 1) = 10$$

$$6x - 6x - 2 = 10$$

$$-2 = 10$$

no solution

34b.



Eqns. are $y = 3x + 1$

and $y = 3x - 5$

They are parallel and do
not intersect.

34c. Graphing shows two
parallel lines. Substitution
results in a false equation
with no variables.

35.

$$y = 2x$$

$$6x - y = 8$$

$$6x - (2x) = 8$$

$$4x = 8$$

$$x = 2$$

$$y = 2 \cdot 2 = 4$$

36.

$$x = 3y + 1$$

$$x = 3(3x + 1) + 1$$

$$x = 9x + 3 + 1$$

$$-8x = 4$$

$$x = -\frac{1}{2}$$

$$y = 3\left(-\frac{1}{2}\right) + 1 = -\frac{1}{2}$$

37.

$$x - 2 = 0$$

$$x = 2$$

$$x - 3y = 14$$

$$2 - 3y = 14$$

$$-3y = 12$$

$$y = -4$$

38.

$$2x + 2y = 5$$

$$2x + 2\left(\frac{1}{4}x\right) = 5$$

$$4x + x = 10$$

$$5x = 10$$

$$x = 2$$

$$y = \frac{1}{4}(2) = \frac{1}{2}$$

39.

$$4x + y = -2$$

$$y = -4x - 2$$

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

$$-2x - 3(-4x - 2) = 1$$

$$-2x + 12x + 6 = 1$$

$$10x + 6 = 1$$

$$10x = -5$$

$$x = -\frac{1}{2}$$

$$y = -4\left(-\frac{1}{2}\right) - 2 = 2 - 2 = 0$$

40.

$$x + 4y = -4$$

$$x = -4y - 4$$

$$3x + 5y = 2$$

$$3(-4y - 4) + 5y = 2$$

$$-12y - 12 + 5y = 2$$

$$-7y - 12 = 2$$

$$-7y = 14$$

$$y = -2$$

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

41. If the final result has no x and is a true equation, such as $2 = 2$, the equations are equivalent, and there are infinitely many solutions of the form $(x, ax + b)$.

42. If the final result has no x and is a false equation, such as $10 = 1$, then the graphs have different y -intercepts, are parallel, and there is no solution.

43. If the final result contains x , in a form such as $x = 4$, then the equations have different slopes, and the system has one solution.

44a.

$$\frac{g}{b} = \frac{23}{22}$$

$$g = \frac{23}{22}b$$

44b.

$$g + b = 1170$$

$$b = -g + 1170$$

$$g = \frac{23}{22}b$$

$$b = -\left(\frac{23}{22}b\right) + 1170$$

$$22b = -23b + 25,740$$

$$45b = 25,740$$

$$b = 572$$

$$g = \frac{23}{22}(572) = 598$$

$$44c. g - b = 598 - 572 = 26$$

45a.

$$8.8t = 9t - 1.8$$

$$-0.2t = -1.8$$

$$t = 9$$

$$d = 8.8 \cdot 9 = 79.2$$

45b. Yes; since $79 \text{ m} < 100 \text{ m}$, Gail will overtake Joetta 9 sec after Joetta's start, 79.2 m from the starting line.

46.

$$r = t + 3$$

$$t + r + s = 20$$

$$t + (t + 3) + s = 20$$

$$2t + 3 + s = 20$$

$$s = -2t + 17$$

$$t + 5r + 10s = 129$$

$$t + 5(t + 3) + 10(-2t + 17) = 129$$

$$-14t + 15 + 170 = 129$$

$$-14t = -56$$

$$t = 4$$

$$r = 4 + 3 = 7$$

$$s = -2 \cdot 4 + 17 = 9$$

47.

$$x = 5y - 143$$

$$5x + 5y = 179$$

$$5(5y - 143) + 5y = 179$$

$$25y - 715 + 5y = 179$$

$$30y - 715 = 179$$

$$30y = 894$$

$$y = \frac{894}{30} = 29.8$$

48.

$$9x + 3480 = 81x - 7104$$

$$-72x + 3480 = -7104$$

$$-72x = -10,584$$

$$x = 147$$

$$y = 9 \cdot 147 + 3480 = 4803$$

49.

$$220 + 25x = 100 + 35x$$

$$220 - 10x = 100$$

$$-10x = -120$$

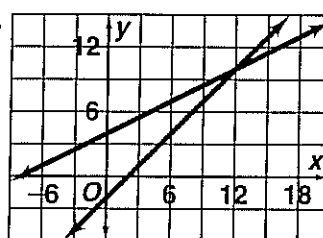
$$x = 12 \text{ [one year]}$$

$$220 + 25 \cdot 12 = 220 + 300 = 100 + 35 \cdot 12 =$$

$100 + 420 = 520$; both have \$520 at the beginning of the next July.

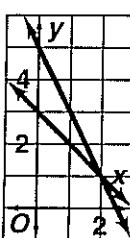
50. [2] $7(-7) - 4(-2) = -49 + 8 = -41 \neq 29$; no; $(-2, -7)$ must satisfy both equations to be a solution of the system. [1] no explanation given

51.



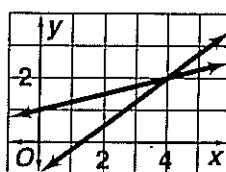
(12, 10)

52.

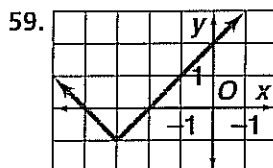
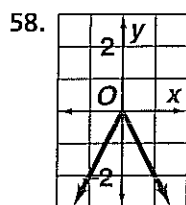
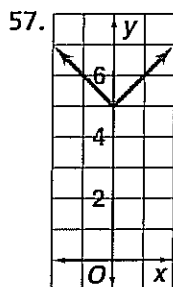
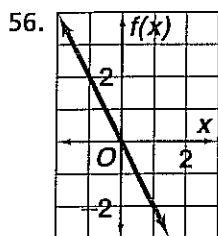
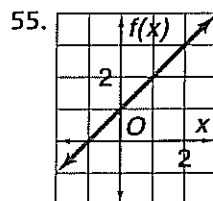
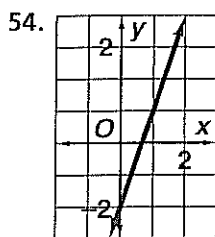


(2, 1)

53.

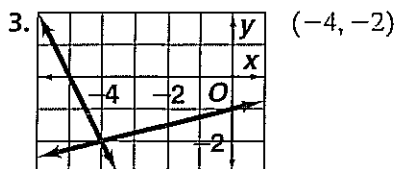
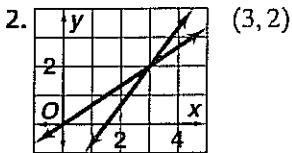
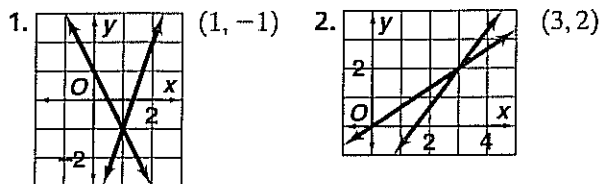


(4, 2)



CHECKPOINT QUIZ 1

page 352



4.
$$\begin{aligned} y &= y \\ 3x - 14 &= x - 10 \\ 2x - 14 &= -10 \\ 2x &= 4 \\ x &= 2 \\ y &= 3 \cdot 2 - 14 = -8 \end{aligned}$$

5.
$$\begin{aligned} 2x + 5 &= 6x + 1 \\ -4x + 5 &= 1 \\ -4x &= -4 \\ x &= 1 \\ y &= 2 \cdot 1 + 5 = 7 \end{aligned}$$

6.
$$\begin{aligned} x &= y + 7 \\ x &= (8 + 2x) + 7 \\ -x &= 15 \\ x &= -15 \\ y &= 8 + 2(-15) = 8 - 30 = -22 \end{aligned}$$

7.
$$\begin{aligned} 3x + 4y &= 12 \\ 3x + 4(-2x + 10) &= 12 \\ 3x - 8x + 40 &= 12 \end{aligned}$$

$$-5x + 40 = 12$$

$$-5x = -28$$

$$x = \frac{28}{5} = 5\frac{3}{5}$$

$$y = -2\left(\frac{28}{5}\right) + 10 = \frac{-56 + 50}{5} = -\frac{6}{5}$$

8.
$$4x + 9y = 24$$

$$4x + 9\left(-\frac{1}{3}x + 2\right) = 24$$

$$4x - 3x + 18 = 24$$

$$x + 18 = 24$$

$$x = 6$$

$$y = -\frac{1}{3}(6) + 2 = -2 + 2 = 0$$

9.
$$\ell = 3w$$

$$P = 2\ell + 2w = 44$$

$$2(3w) + 2w = 44$$

$$8w = 44$$

$$w = \frac{44}{8} = \frac{11}{2} = 5.5$$

$$\ell = 3(5.5) = 16.5$$

Rectangle measures 5.5 cm by 16.5 cm.

10.
$$c = p + 250$$

$$p + c = 420$$

$$p + (p + 250) = 420$$

$$2p + 250 = 420$$

$$2p = 170$$

$$p = 85$$

$$c = 85 + 250 = 335$$

85 acres of pumpkins and 335 acres of corn

7.3 Solving Systems Using Elimination

pages 353-359

Check Skills You'll Need For complete solutions see *Daily Skills Check* and *Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. (8, 29) 2. (2, -6) 3. (3, -4)

Check Understanding

1.
$$\begin{aligned} 6x - 3y &= 3 \\ -6x + 5y &= 3 \\ \hline 2y &= 6 \\ y &= 3 \\ 6x - 3(3) &= 3 \\ 6x - 9 &= 3 \\ 6x &= 12 \\ x &= 2 \end{aligned}$$

2.
$$\begin{aligned} s + 2.50a &= 109 \\ s + a &= 64 \\ \hline 1.50a &= 45 \\ a &= 30 \\ s + 30 &= 64 \\ s &= 34 \end{aligned}$$

30 adult; 34 student

$$\begin{array}{r}
 3. \quad 3[7x - 5y = 17] \\
 21x - 15y = 51 \\
 -2x + 15y = -32 \\
 \hline
 19x = 19 \\
 x = 1 \\
 7 \cdot 1 - 5y = 17 \\
 -5y = 10 \\
 y = -2
 \end{array}$$

$$\begin{array}{r}
 4. \quad -2[w + c = 220] \\
 -2w - 2c = -440 \\
 2w + 5c = 695 \\
 \hline
 3c = 255 \\
 c = 85 \\
 w + 85 = 220 \\
 w = 135
 \end{array}$$

85 packages of cards and 135 packages of gift wrap

$$\begin{array}{r}
 5. \quad 3[10x + 7y = -4] \\
 2[15x + 3y = 9] \\
 30x + 21y = -12 \\
 30x + 6y = 18 \\
 \hline
 15y = -30 \\
 y = -2 \\
 15x + 3(-2) = 9 \\
 15x - 6 = 9 \\
 15x = 15 \\
 x = 1
 \end{array}$$

Exercises

$$\begin{array}{r}
 1. \quad 2x + 5y = 17 \\
 6x - 5y = -9 \\
 \hline
 8x = 8 \\
 x = 1 \\
 2 \cdot 1 + 5y = 17 \\
 5y = 15 \\
 y = 3
 \end{array}$$

$$\begin{array}{r}
 2. \quad 7x + 2y = 10 \\
 -7x + y = -16 \\
 \hline
 3y = -6 \\
 y = -2 \\
 7x + 2(-2) = 10 \\
 7x = 14 \\
 x = 2
 \end{array}$$

$$\begin{array}{r}
 3. \quad 2x - 3y = 61 \\
 2x + y = -7 \\
 \hline
 -4y = 68 \\
 y = -17 \\
 2x + (-17) = -7 \\
 2x = 10 \\
 x = 5
 \end{array}$$

$$\begin{array}{r}
 4. \quad 8x + 11y = 20 \\
 5x - 11y = -59 \\
 \hline
 13x = -39 \\
 x = -3 \\
 8(-3) + 11y = 20 \\
 11y = 44 \\
 y = 4
 \end{array}$$

$$\begin{array}{r}
 5. \quad 4x + 18y = -27 \\
 2x + 18y = -9 \\
 \hline
 2x = -18
 \end{array}$$

$$\begin{array}{r}
 x = -9 \\
 2(-9) + 18y = -9 \\
 18y = 9 \\
 y = \frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 6. \quad 20x + 3y = 20 \\
 -20x + 5y = 60 \\
 \hline
 8y = 80 \\
 y = 10 \\
 20x + 3 \cdot 10 = 20 \\
 20x = -10 \\
 x = -\frac{1}{2}
 \end{array}$$

$$\begin{array}{r}
 7a. \quad x + y = 20 \\
 x - y = 4 \\
 \hline
 2x = 24
 \end{array}$$

$$\begin{array}{r}
 7b. \quad 2x = 24 \\
 x = 12 \\
 12 + y = 20 \\
 y = 8
 \end{array}$$

$$\begin{array}{r}
 8a. \quad 3.5a + s = 1131 \\
 a + s = 456 \\
 \hline
 2.5a = 675
 \end{array}$$

$$\begin{array}{r}
 8b. \quad 2.5a = 675 \\
 a = 270 \\
 270 + s = 456 \\
 s = 186
 \end{array}$$

270 adult, 186 student

$$\begin{array}{r}
 9. \quad 4[3x - 10y = -25] \\
 12x - 40y = -100 \\
 4x + 40y = 20 \\
 \hline
 16x = -80 \\
 x = -5 \\
 3 \cdot -5 - 10y = -25 \\
 -10y = -10 \\
 y = 1
 \end{array}$$

$$\begin{array}{r}
 10. \quad 5[x - 3y = 20] \\
 5x - 15y = 100 \\
 7x + 15y = 32 \\
 \hline
 12x = 132 \\
 x = 11 \\
 11 - 3y = 20 \\
 -3y = 9 \\
 y = -3
 \end{array}$$

$$\begin{array}{r}
 11. \quad 2[x - 8y = 18] \\
 2x - 16y = 36 \\
 -16x + 16y = -8 \\
 \hline
 -14x = 28 \\
 x = -2 \\
 -2 - 8y = 18 \\
 -8y = 20 \\
 y = -\frac{5}{2}
 \end{array}$$

$$\begin{array}{r}
 12. \quad 3[24x + 2y = 52] \\
 2[6x - 3y = -36] \\
 72x + 6y = 156 \\
 12x - 6y = -72 \\
 \hline
 84x = 84 \\
 x = 1 \\
 6 \cdot 1 - 3y = -36 \\
 -3y = -42 \\
 y = 14
 \end{array}$$

$$\begin{array}{l}
 13. \quad \begin{array}{r}
 3[88x - 5y = 39] \\
 5[-8x + 3y = -1] \\
 264x - 15y = 117 \\
 -40x + 15y = -5 \\
 \hline
 224x = 112 \\
 x = \frac{1}{2} \\
 -8\left(\frac{1}{2}\right) + 3y = -1 \\
 -4 + 3y = -1 \\
 3y = 3 \\
 y = 1
 \end{array} \\
 14. \quad \begin{array}{r}
 4[5x + y = -7] \\
 20x + 4y = -28 \\
 2x + 4y = 8 \\
 \hline
 18x = -36 \\
 x = -2 \\
 5(-2) + y = -7 \\
 -10 + y = -7 \\
 y = 3
 \end{array} \\
 15a. \quad \begin{array}{r}
 30w + \ell = 17.65 \\
 20w + 3\ell = 25.65
 \end{array} \\
 15b. \quad \begin{array}{r}
 90w + 3\ell = 52.95 \\
 \hline
 70w = 27.30 \\
 w = 0.39 \\
 30(0.39) + \ell = 17.65 \\
 11.70 + \ell = 17.65 \\
 \ell = 5.95
 \end{array}
 \end{array}$$

\$0.39 for a wallet size and \$5.95 for an 8 × 10

$$\begin{array}{l}
 16a. \quad \begin{array}{r}
 3b + 4t = 11.33 \\
 9b + 5t = 23.56
 \end{array} \\
 16b. \quad \begin{array}{r}
 15b + 20t = 56.65 \\
 36b + 20t = 94.24 \\
 \hline
 21b = 37.59 \\
 b = 1.79 \\
 3(1.79) + 4t = 11.33 \\
 5.37 + 4t = 11.33 \\
 4t = 5.96 \\
 t = 1.49
 \end{array}
 \end{array}$$

burrito: \$1.79; taco: \$1.49

$$\begin{array}{l}
 17. \quad \begin{array}{r}
 5[3x + 2y = -9] \\
 -2[-10x + 5y = -5] \\
 15x + 10y = -45 \\
 20x - 10y = 10 \\
 \hline
 35x = -35 \\
 x = -1 \\
 3(-1) + 2y = -9 \\
 2y = -6 \\
 y = -3
 \end{array} \\
 18. \quad \begin{array}{r}
 4[4x + 5y = 15] \\
 5[6x - 4y = 11] \\
 16x + 20y = 60 \\
 30x - 20y = 55 \\
 \hline
 46x = 115 \\
 x = 2.5 \\
 4(2.5) + 5y = 15 \\
 5y = 5 \\
 y = 1
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 19. \quad \begin{array}{r}
 3[3x - 2y = 10] \\
 2[2x + 3y = -2] \\
 9x - 6y = 30 \\
 4x + 6y = -4 \\
 \hline
 13x = 26 \\
 x = 2 \\
 3 \cdot 2 - 2y = 10 \\
 -2y = 4 \\
 y = -2
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 20. \quad \begin{array}{r}
 3[-2x + 5y = 20] \\
 2[3x - 7y = -26] \\
 -6x + 15y = 60 \\
 6x - 14y = -52 \\
 \hline
 y = 8 \\
 -2x + 5 \cdot 8 = 20 \\
 -2x = -20 \\
 x = 10
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 21. \quad \begin{array}{r}
 6[10x + 8y = 2] \\
 -8[8x + 6y = 1] \\
 60x + 48y = 12 \\
 -64x - 48y = -8 \\
 \hline
 -4x = 4 \\
 x = -1 \\
 10(-1) + 8y = 2 \\
 8y = 12 \\
 y = \frac{3}{2}
 \end{array}
 \end{array}$$

$$\begin{array}{l}
 22. \quad \begin{array}{r}
 2[9x + 5y = 34] \\
 5[8x - 2y = -2] \\
 18x + 10y = 68 \\
 40x - 10y = -10 \\
 \hline
 58x = 58 \\
 x = 1 \\
 8 \cdot 1 - 2y = -2 \\
 -2y = -10 \\
 y = 5
 \end{array}
 \end{array}$$

23–28. Avoid graphing because it can be tedious and does not always give an accurate answer. Choose substitution when one of the variables has a coefficient of 1.

$$\begin{array}{l}
 23. \quad \begin{array}{r}
 y = y \\
 2x = x - 1 \\
 x = -1 \\
 y = 2(-1) = -2
 \end{array}
 \end{array}$$

Elimination would have taken more steps.

$$\begin{array}{l}
 24. \quad \begin{array}{r}
 10[7x + 8y = 25] \\
 8[9x + 10y = 35] \\
 70x + 80y = 250 \\
 72x + 80y = 280 \\
 \hline
 2x = 30 \\
 x = 15 \\
 7(15) + 8y = 25 \\
 105 + 8y = 25 \\
 8y = -80 \\
 y = -10
 \end{array}
 \end{array}$$

Substitution would have involved messy equations with lots of fractions.

$$\begin{aligned}
 25. \quad & x = 12y - 14 \\
 & 3y + 2x = 26 \\
 & 3y + 2(12y - 14) = 26 \\
 & 3y + 24y - 28 = 26 \\
 & 27y - 28 = 26 \\
 & 27y = 54 \\
 & y = 2 \\
 & x = 12 \cdot 2 - 14 = 10
 \end{aligned}$$

Substitution was used, since an equation was solved for x .

$$\begin{aligned}
 26. \quad & -5[-20x + 7y = 137] \\
 & 7[4x + 5y = 43] \\
 & 100x - 35y = -685 \\
 & \underline{28x + 35y = 301} \\
 & 128x = -384 \\
 & x = -3 \\
 & 4(-3) + 5y = 43 \\
 & 5y = 55 \\
 & y = 11
 \end{aligned}$$

Substitution would be very messy, with greater chance for error.

$$\begin{aligned}
 27. \quad & 5y = x \\
 & 2x - 3y = 7 \\
 & 2(5y) - 3y = 7 \\
 & 7y = 7 \\
 & y = 1 \\
 & x = 5 \cdot 1 = 5
 \end{aligned}$$

Substitution was used, since an equation was solved for x .

$$\begin{aligned}
 28. \quad & x + 2 = -2x + 3 \\
 & 3x + 2 = 3 \\
 & 3x = 1 \\
 & x = \frac{1}{3} \\
 & y = \frac{1}{3} + 2 = 2\frac{1}{3}
 \end{aligned}$$

Substitution was used, since both equations were solved for y .

$$\begin{aligned}
 29. \quad & -7[2n + 4m = 195] \\
 & 2[7n + 10m = 650] \\
 & -14n - 28m = -1365 \\
 & \underline{14n + 20m = 1300} \\
 & -8m = -65 \\
 & m = 8.125 \\
 & 2n + 4(8.125) = 195 \\
 & 2n + 32.5 = 195 \\
 & 2n = 162.5 \\
 & n = 81.25
 \end{aligned}$$

One night costs \$81.25; one meal costs about \$8.13.

$$\begin{aligned}
 30a. \quad & 2.5[7b + 4s = 54] \\
 & 17.5b + 10s = 135 \\
 & \underline{3b + 10s = 48} \\
 & 14.5b = 87 \\
 & b = 6 \\
 & 3 \cdot 6 + 10s = 48 \\
 & 10s = 30 \\
 & s = 3
 \end{aligned}$$

brass: \$6; steel: \$3

30b. $10b + 13s = 10 \cdot 6 + 13 \cdot 3 = 60 + 39 = 99$; cost is \$99. 31. No; she neglected to multiply -8 by 6.

32. Answers may vary. Sample:

$$\begin{aligned}
 2x - 3y &= 6 \\
 x + 3y &= 9 \\
 2x + 6y &= 18 \\
 9y &= 12 \\
 y &= \frac{4}{3}
 \end{aligned}$$

$$\begin{aligned}
 x + 3\left(\frac{4}{3}\right) &= 9 \\
 x + 4 &= 9 \\
 x &= 5
 \end{aligned}$$

$$\begin{aligned}
 33. \quad & 2[16x - \frac{1}{2}y = 163] \\
 & 32x - y = 326 \\
 & \underline{\frac{1}{2}x + y = -1} \\
 & 32.5x = 325 \\
 & x = 10 \\
 & 0.5 \cdot 10 + y = -1 \\
 & y = -6
 \end{aligned}$$

$$\begin{aligned}
 34. \quad & -80[\frac{1}{4}x - 6y = -70] \\
 & 4[5x + \frac{3}{4}y = 49] \\
 & -20x + 480y = 5600 \\
 & \underline{20x + 3y = 196} \\
 & 483y = 5796 \\
 & y = 12 \\
 & 5x + \frac{3}{4}(12) = 49 \\
 & 5x + 9 = 49 \\
 & 5x = 40 \\
 & x = 8
 \end{aligned}$$

$$\begin{aligned}
 35. \quad & 5[-0.2x + 4y = -1] \\
 & -x + 20y = -5 \\
 & \underline{x + 0.5y = -15.5} \\
 & 20.5y = -20.5 \\
 & y = -1 \\
 & x + 0.5(-1) = -15.5 \\
 & x = -15
 \end{aligned}$$

$$\begin{aligned}
 36. \quad & y = 0.5x + 2 \\
 & \underline{1.5x + y = 42} \\
 & 1.5x = -0.5x + 40 \\
 & 2x = 40 \\
 & x = 20 \\
 & y = 0.5 \cdot 20 + 2 = 12
 \end{aligned}$$

$$\begin{aligned}
 37. \quad & \frac{1}{4}x + \frac{33}{2} = y \\
 & \underline{y - 12 = -2x} \\
 & \frac{1}{4}x + y + \frac{33}{2} - 12 = y - 2x \\
 & x + 66 - 48 = -8x \\
 & 9x + 18 = 0 \\
 & 9x = -18 \\
 & x = -2 \\
 & y - 12 = -2(-2) \\
 & y = 16
 \end{aligned}$$

38.

$$\begin{array}{r}
 3\left[\frac{2}{3}x - y = 70\right] \\
 -6\left[\frac{1}{3}x - \frac{2}{3}y = 43\right] \\
 \hline
 2x - 3y = 210 \\
 -2x + 4y = -258 \\
 \hline
 y = -48 \\
 2x - 3(-48) = 210 \\
 2x + 144 = 210 \\
 2x = 66 \\
 x = 33
 \end{array}$$

39.

$$\begin{array}{r}
 5x - 10y = 50 \\
 nx + 10y = 6 \\
 \hline
 (n+5)x = 56 \\
 (n+5)4 = 56 \\
 4n + 20 = 56 \\
 4n = 36 \\
 n = 9
 \end{array}$$

40. Answers may vary. Sample: Elimination involves adding or subtracting two equations (perhaps multiplying by factors first) in order to eliminate one variable, yielding a single equation which can be solved for the second variable. Examples:

$$\begin{array}{r}
 3x + 2y = 6 \\
 -x - 2y = 4
 \end{array}$$

Addition eliminates y ; solve for x ; then substitute result for x in one equation and solve for y .

$$\begin{array}{r}
 5x + 3y = 15 \\
 5x - 2y = 10
 \end{array}$$

Subtracting one equation from the other eliminates x .

$$\begin{array}{r}
 4x + 5y = 20 \\
 2x - y = 10
 \end{array}$$

Multiplying second equation by 2 and subtracting eliminates x .

41.

add:

$$\begin{array}{r}
 B_1 + B_2 = 4.5 \\
 B_1 - B_2 = 1.5 \\
 \hline
 2B_1 = 6 \\
 B_1 = 3 \\
 3 + B_2 = 4.5 \\
 B_2 = 1.5
 \end{array}$$

Voltages are 3 volts and 1.5 volts.

42.

$$\begin{array}{r}
 2\left[\frac{3}{x} + \frac{8}{y} = 3\right] \\
 \frac{6}{x} + \frac{16}{y} = 6 \\
 \frac{6}{x} - \frac{4}{y} = -4 \\
 \hline
 \frac{20}{y} = 10 \\
 20 = 10y \\
 y = 2 \\
 \frac{3}{x} + \frac{8}{2} = 3 \\
 \frac{3}{x} + 4 = 3 \\
 \frac{3}{x} = -1 \\
 3 = -x \\
 x = -3
 \end{array}$$

43.

$$\begin{array}{r}
 ax + by = c \\
 ax + y = c \\
 \hline
 (b-1)y = 0 \\
 y = 0
 \end{array}$$

$$ax + 0 = c$$

$$ax = c$$

$$x = \frac{c}{a}$$

This solution assumes $b \neq 1, a \neq 0$.

44.

$$\begin{array}{r}
 x + y + z = 41 \\
 x - y + z = 15 \\
 \hline
 2x + 2z = 56 \\
 x + z = 28 \\
 3x - z = 4 \\
 \hline
 4x = 32 \\
 x = 8 \\
 8 + z = 28 \\
 z = 20 \\
 8 + y + 20 = 41 \\
 y = 13
 \end{array}$$

45.

$$\begin{array}{r}
 300c + 400t + 100 + 240 = 2080 \\
 -0.15[300c + 400t = 1740] \\
 500c + 600t + 100 + 240 = 3120 \\
 0.1[500c + 600t = 2780] \\
 -45c - 60t = -261 \\
 \hline
 50c + 60t = 278 \\
 5c = 17 \\
 c = 3.4 \\
 50(3.4) + 60t = 278 \\
 170 + 60t = 278 \\
 60t = 108 \\
 t = 1.8
 \end{array}$$

CDs cost \$3.40 each and cassette tapes cost \$1.80 each.

46a.

$$\begin{array}{r}
 9[a + c = 8.4] \\
 9a + 9c = 75.6 \\
 19.3a + 9c = 104.44 \\
 \hline
 10.3a = 28.84 \\
 a = 2.8
 \end{array}$$

mass of gold = 2.8 g

46b. percent mass of gold = $\frac{2.8}{104.44} \approx 0.0268 \approx 2.7\%$

47. (1)

$$7x - 4y = 5$$

(2)

$$6x + 7y = -11$$

A. same as 7(1), 4(2) B. same as 6(1), 7(2) C. same as $-2(1), 2(2)$ D. first equation not a linear multiple of (1), but second equation is same as $-4(2)$. The answer is D.

48.

$$\begin{array}{r}
 -2[4x - 2y = 11] \\
 -8x + 4y = -22 \\
 3x - 4y = -6 \\
 \hline
 -5x = -28 \\
 x = 5.6 \\
 4(5.6) - 2y = 11 \\
 22.4 - 2y = 11 \\
 -2y = -11.4 \\
 y = 5.7
 \end{array}$$

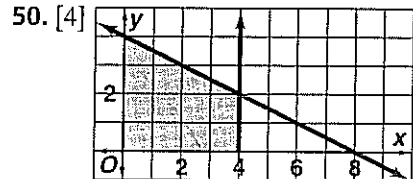
$x - y = 5.6 - 5.7 = -0.1$. The answer is H.

49. [2]

$$\begin{array}{r}
 y - x = 13 \\
 7y + x = 11 \\
 \hline
 8y = 24 \\
 y = 3
 \end{array}$$

$$\begin{array}{r}
 3 - x = 13 \\
 -x = 10 \\
 x = -10
 \end{array}$$

[1] no work shown



(3, 2)
 $A = \frac{1}{2}h(b_1 + b_2) =$
 $\frac{1}{2}(4)(4 + 2) = 12.$
 The area is 12 square units. [3] correct

graph and formula, one mathematical error [2] correct graph, error in formula [1] graph only

51.

$$\begin{aligned} 4x + 2 &= 6x - 10 \\ -2x + 2 &= -10 \\ -2x &= -12 \\ x &= 6 \\ y &= 4 \cdot 6 + 2 = 26 \end{aligned}$$

52.

$$\begin{aligned} p &= q - 5 \\ 3p + q &= 1 \\ 4p + q &= q - 4 \\ 4p &= -4 \\ p &= -1 \\ -1 &= q - 5 \\ 4 &= q \end{aligned}$$

53.

$$\begin{aligned} w + a &= 4 \\ w + 2a &= 13 \\ a &= 9 \\ w + 9 &= 4 \\ w &= -5 \end{aligned}$$

54. There are 10 marbles for the first draw and 9 for the second. $P = \frac{2}{10} \cdot \frac{5}{9} = \frac{1}{9}$ 55. $P = \frac{5}{10} \cdot \frac{4}{9} = \frac{2}{9}$

56. $P = \frac{3}{10} \cdot \frac{2}{9} = \frac{1}{15}$

57.

$$\begin{aligned} c - 4 &= 67 \\ c - 4 + 4 &= 67 + 4 \\ c &= 71 \end{aligned}$$

Check: $71 - 4 = 67$

58.

$$\begin{aligned} t + 27 &= 9 \\ t &= -18 \end{aligned}$$

Check: $-18 + 27 = 9$

59.

$$\begin{aligned} n - 12 &= -56 \\ n &= -44 \end{aligned}$$

Check: $-44 - 12 = -56$

60.

$$\begin{aligned} -9 + k &= 13 \\ k &= 22 \end{aligned}$$

Check: $-9 + 22 = 13$

61.

$$\begin{aligned} x - 82 &= 1 \\ x &= 83 \end{aligned}$$

Check: $83 - 82 = 1$

62.

$$\begin{aligned} 17 + b &= 11 \\ b &= -6 \end{aligned}$$

Check: $17 + (-6) = 11$

TECHNOLOGY

page 361

1.

$$\begin{bmatrix} 4 & 2 & 9 \end{bmatrix} \cdot \begin{bmatrix} 3 \\ 1 \\ 7 \end{bmatrix} = [4 \cdot 3 + 2 \cdot 1 + 9 \cdot 7] = [12 + 2 + 63] = [77]$$

2. $\begin{bmatrix} 12 & 10 \\ 8 & -11 \end{bmatrix} \cdot \begin{bmatrix} 0 & 4 \\ 9 & -1 \end{bmatrix} =$

$$\begin{bmatrix} 12 \cdot 0 + 10 \cdot 9 & 12 \cdot 4 + 10 \cdot (-1) \\ 8 \cdot 0 + (-11) \cdot 9 & 8 \cdot 4 + (-11) \cdot (-1) \end{bmatrix} =$$

$$\begin{bmatrix} 0 + 90 & 48 - 10 \\ 0 - 99 & 32 + 11 \end{bmatrix} = \begin{bmatrix} 90 & 38 \\ -99 & 43 \end{bmatrix}$$

3. $\begin{bmatrix} 44 & -12 \\ 27 & 35 \\ 25 & -16 \end{bmatrix} \cdot \begin{bmatrix} 21 & -41 \\ 25 & 17 \end{bmatrix} =$

$$\begin{bmatrix} 44 \cdot 21 - 12 \cdot 25 & 44 \cdot (-41) - 12 \cdot 17 \\ 27 \cdot 21 + 35 \cdot 25 & 27 \cdot (-41) + 35 \cdot 17 \\ 25 \cdot 21 - 16 \cdot 25 & 25 \cdot (-41) - 16 \cdot 17 \end{bmatrix} =$$

$$\begin{bmatrix} 924 - 300 & -1804 - 204 \\ 567 + 875 & -1107 + 595 \\ 525 - 400 & -1025 - 272 \end{bmatrix} = \begin{bmatrix} 624 & -2008 \\ 1442 & -512 \\ 125 & -1297 \end{bmatrix}$$

4. Matrix multiplication:

(Number)(Unit cost) = (Total cost)

$$\begin{bmatrix} 212 & 318 & 175 \\ 185 & 292 & 221 \end{bmatrix} \cdot \begin{bmatrix} 0.96 \\ 1.23 \\ 1.51 \end{bmatrix} =$$

$$\begin{bmatrix} 212 \cdot 0.96 + 318 \cdot 1.23 + 175 \cdot 1.51 \\ 185 \cdot 0.96 + 292 \cdot 1.23 + 221 \cdot 1.51 \end{bmatrix} =$$

$$\begin{bmatrix} 203.52 + 391.14 + 264.25 \\ 177.60 + 359.16 + 333.71 \end{bmatrix} = \begin{bmatrix} 858.91 \\ 870.47 \end{bmatrix}$$

Monday: \$858.91

Tuesday: \$870.47

5. Calculator: $[A]^{-1}[B] = \begin{bmatrix} 5.6 \\ 1.3 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}; (x, y) = (5.6, 1.3)$

6. Calculator: $[A]^{-1}[B] = \begin{bmatrix} 39 \\ -17 \end{bmatrix}; (x, y) = (39, -17)$

7. Calculator: $[A]^{-1}[B] = \begin{bmatrix} 9.8 \\ -36.6 \end{bmatrix}; (x, y) = (9.8, -36.6)$

7-4 Applications of Linear Systems

pages 362-369

Check Skills You'll Need For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. 3.25 h 2. 275 mi

Check Understanding 1. Let g = mass of 25% alloy;
 h = mass of 50% alloy.

$$g + h = 40$$

$$g = 40 - h$$

$$0.25g + 0.5h = 0.45(40)$$

$$0.25(40 - h) + 0.5h = 0.45(40)$$

$$10 - 0.25h + 0.5h = 0.45(40)$$

$$10 + 0.25h = 18$$

$$0.25h = 8$$

$$h = 32$$

$$g = 40 - 32$$

$$g = 8$$

8 g of 25% alloy; 32 g of 50% alloy

2. Let x = number of copies sold.

Income: $y = 0.55x$

Expenses: $y = 0.35x + 770$

Break even: $0.55x = 0.35x + 770$

$$0.2x = 770$$

$$x = 3850$$

Break-even point is sales of 3850 copies.

3. Follow Example 3; wind blows from West to East.

$$(A + W)5 = 2400$$

$$(A - W)6 = 2400$$

$$A + W = 480$$

add: $A - W = 400$

$$2A = 880$$

$$A = 440$$

$$440 + W = 480$$

$$W = 40$$

Airspeed is 440 mi/h; wind speed is 40 mi/h.

Exercises 1a. $5[4a + 5b = 6.71]$

1b. $4[5a + 3b = 7.12]$

1c. $20a + 25b = 33.55$

$$20a + 12b = 28.48$$

$$13b = 5.07$$

$$b = 0.39$$

$$4a + 5(0.39) = 6.71$$

$$4a + 1.95 = 6.71$$

$$4a = 4.76$$

$$a = 1.19$$

A pen costs \$1.19 and a pencil costs \$.39.

2. The answer is D. 3a. Combine a kilograms of fruit drink A and b kilograms of fruit drink B to form 24 kilograms of mixed drink:

	Fruit Drink A 4% Sugar	Fruit Drink B 8% Sugar	Mixed Fruit Drink 5% Sugar
Fruit drink (kg)	a	b	24
Sugar (kg)	$0.04a$	$0.08b$	$0.05(24)$

3b. $a + b = 24$

$$a = 24 - b$$

$$0.04a + 0.08b = 0.05(24)$$

3c. $0.04(24 - b) + 0.08b = 0.05(24)$

$$0.04(24) - 0.04b + 0.08b = 0.05(24)$$

$$0.04b = (0.05 - 0.04)(24)$$

$$4b = 24$$

$$b = 6$$

$$a = 24 - 6 = 18$$

You need 18 kg of drink A; 6 kg of drink B.

4a. $22 + 11.50x = 218 - 13x$

$$22 + 24.50x = 218$$

$$24.50x = 196$$

$$x = 8$$

The account balances will be equal after 8 weeks.

4b. Your balance = $22 + 11.50 \cdot 12 = 22 + 138 = 160$;
cousin's balance = $218 - 13 \cdot 12 = 218 - 156 = 62$;
balances are \$160; \$62.

5. $10,410 + 2.65x = 20x$

$$10,410 = 17.35x$$

$$600 = x$$

You will break even for sales of 600 games.

6. $280 + 3.99x = 10.99x$

$$280 = 7x$$

$$40 = x$$

Break even for sales of 40 shirts.

7a. Let s = speed of paddling in still water; c = current speed.

$$s + c = 2.75$$

7b. $s - c = 1.5$

7c. $2s = 4.25$

$$s = 2.125$$

paddling speed = 2.125 mi/h

7d. $2.125 + c = 2.75$

$$c = 0.625$$

current speed = 0.625 mi/h

8a. $(A + W)4.8 = 2100$

$$(A - W)5.6 = 2100$$

8b. $A + W = 437.5$

$$A - W = 375$$

$$2A = 812.5$$

$$A = 406.25$$

$$406.25 + W = 437.5$$

$$W = 31.25$$

Airspeed = 406.25 mi/h

8c. wind speed = 31.25 mi/h.

9–14. Answers may vary. Samples are given. Avoid graphing because it may give inaccurate results.

9. Substitution: one equation is solved for t .

10. Substitution: both equations are solved for y .

11. Elimination: subtraction will eliminate m .

12. Substitution: both equations are solved for y .

13. Elimination: multiply first equation by 3, and add to eliminate y . 14. Substitution: one equation is solved for u .

15a. $t = 99 - 3.5m$

$$t = 0 + 2.5m$$

$$99 - 3.5m = 0 + 2.5m$$

$$99 = 6m$$

$$16.5 = m$$

$$t = 0 + 2.5 \cdot 16.5 = 41.25$$

15b. After 16.5 minutes, the temperature of either piece will be 41.25°C.

16. $2m + 2n = 34$

$$m + n + n + 1 = 30$$

$$m + n = 17$$

$$m + 2n = 29$$

$$n = 12$$

$$m + 12 = 17$$

$$m = 5$$

The sides are $m = 5$ cm and $n = 12$ cm.

17. Answers may vary. Sample: You have 10 coins, all dimes and quarters. The value of the coins is \$1.75. How many dimes do you have? How many quarters do you have?

$$q + d = 10$$

$$0.25q + 0.10d = 1.75$$

You have 5 dimes and 5 quarters.

18. Let s = number of small mowers sold and ℓ = number of large mowers sold.

$$s + \ell = 30$$

$$\ell = 30 - s$$

$$249.99s + 329.99\ell = 8379.70$$

$$249.99s + 329.99(30 - s) = 8379.70$$

$$249.99s + 9899.70 - 329.99s = 8379.70$$

$$-80s + 9899.70 = 8379.70$$

$$-80s = -1520$$

$$s = 19$$

$$\ell = 30 - 19 = 11$$

sold: 19 small mowers; 11 large mowers

19a. $(A + W)\frac{1}{3} = 18$

$$(A - W)\frac{3}{5} = 18$$

$$A + W = 54$$

$$A - W = 30$$

$$2A = 84$$

$$A = 42$$

19b. $42 + W = 54$

$$W = 12$$

airspeed = 42 mi/h; wind speed = 12 mi/h

20a. $\frac{g}{b} = \frac{19}{17}$

$$g = \frac{19}{17}b$$

20b. $g + b = 1908$

$$\frac{19}{17}b + b = 1908$$

$$19b + 17b = 17 \cdot 1908$$

$$36b = 17 \cdot 1908$$

$$b = \frac{17 \cdot 1908}{36} = 17 \cdot 53 = 901$$

$$g + 901 = 1908$$

$$g = 1007$$

901 boys, 1007 girls

21a. $60x = 400 + 35x$

$$25x = 400$$

$$x = 16$$

The break-even point is 16 days.

21b. Renting would be cheaper for 1, 2, or 3 years.

Buying would be cheaper after 4 years.

22. $x + 2\left(\frac{5}{4}y\right) = 12$

$$3\left[x + 2.5y = 12\right]$$

$$3x + 7.5y = 36$$

$$3x + 2y = 14$$

$$5.5y = 22$$

$$y = 4$$

$$x + 2.5 \cdot 4 = 12$$

$$x + 10 = 12$$

$$x = 2$$

23.

$$b = 2a + 1$$

$$10a + b = 5b + 2$$

$$-2a + b = 1$$

$$10a - 4b = 2$$

$$\frac{-8a + 4b = 4}{2a = 6}$$

$$a = 3$$

$$b = 2 \cdot 3 + 1 = 7$$

Number is 37.

24a. Let s = number of small cards sold and ℓ = number of large cards sold.

$$\frac{\ell}{s} = \frac{5}{2}$$

$$\ell = 2.5s$$

$$2.50s + 4.00\ell = 10,000$$

$$2.5s + 4(2.5s) = 10,000$$

$$12.5s = 10,000$$

$$s = 800$$

$$\ell = 2.5 \cdot 800 = 2000$$

800 small, 2000 large

24b. Artist makes 5 cards per hour. Time is $\frac{800 + 2000}{5} =$

$$560 [560 \text{ h}]. \quad 24c. \frac{\$10,000}{560 \text{ h}} \approx \$17.86/\text{h}$$

25. Only choices C and D show a sum and a difference.

D shows the difference is 20. Answer is C. 26. Let f = amount of federal tax and s = amount of state tax.

$$f = 8s$$

$$f + s = 2700$$

$$8s + s = 2700$$

$$9s = 2700$$

$$s = 300$$

Answer is H.

27. Only choice B shows a correct equation for four more nickels than dimes. Answer is B.

28. [2]

$$3v + c = 22$$

$$2v + 4c = 28$$

$$\frac{-12v - 4c = -88}{-10v = -60}$$

$$v = 6$$

Each van can carry 6 students.

[1] no work shown

29.

$$2x + 5y = 13$$

$$\frac{3x - 5y = 7}{5x = 20}$$

$$x = 4$$

$$2 \cdot 4 + 5y = 13$$

$$5y = 5$$

$$y = 1$$

30.

$$2[-2x + 3y = 33]$$

$$-4x + 6y = 66$$

$$\frac{4x + 2y = -10}{8y = 56}$$

$$y = 7$$

$$4x + 2 \cdot 7 = -10$$

$$4x = -24$$

$$x = -6$$

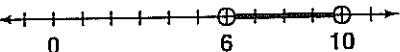
$$\begin{aligned}
 31. \quad & 4[7x + 6y = 30] \\
 & 3[9x - 8y = 15] \\
 & 28x + 24y = 120 \\
 & 27x - 24y = 45 \\
 & \hline
 & 55x = 165 \\
 & x = 3 \\
 & 7 \cdot 3 + 6y = 30 \\
 & 6y = 9 \\
 & y = \frac{3}{2}
 \end{aligned}$$

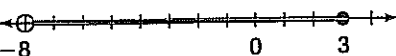
32. Points are (x_1, y_1) and (x_2, y_2) . Slope = $\frac{y_2 - y_1}{x_2 - x_1} = \frac{10 - 4}{6 - 2} = \frac{3}{2}$ 33. slope = $\frac{14 - 1}{10 - (-3)} = 1$

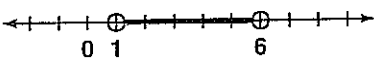
34. $\frac{-12 - (-11)}{5 - 8} = \frac{1}{3}$ 35. $\frac{0.2 - 7}{4.6 - 1.2} = -2$

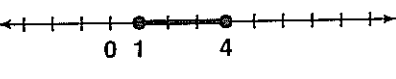
36. $\frac{3.5 - (-0.5)}{-6 - 5} = -\frac{4}{11}$

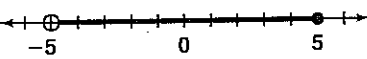
37. $\frac{5 - 0}{8 - 8} = \frac{5}{0}$; undefined (infinite)

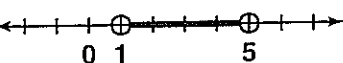
38. $6 < y < 10$ 

39. $-8 < n \leq 3$ 

40. $2 < k + 1 < 7$ 
 $1 < k < 6$

41. $4 \leq 4p \leq 16$ 
 $1 \leq p \leq 4$

42. $-13 < 3c + 2 \leq 17$ 
 $-15 < 3c \leq 15$
 $-5 < c \leq 5$

43. $21 > 5w - 4 > 1$ 
 $25 > 5w > 5$
 $5 > w > 1$

READING MATH

page 369

Let s = number of small trees sold during the year and
 ℓ = number of large trees sold.

Total number of trees sold during year:

$$s + \ell = 73$$

$$\ell = 73 - s$$

Total dollar sales for year:

$$19.99s + 35.99\ell = 1907.27$$

$$19.99s + 35.99(73 - s) = 1907.27$$

$$19.99s + 2627.27 - 35.99s = 1907.27$$

$$-16s + 2627.27 = 1907.27$$

$$-16s = -720$$

$$s = 45$$

$$\ell = 73 - 45 = 28$$

45 small trees and 28 large trees were sold.

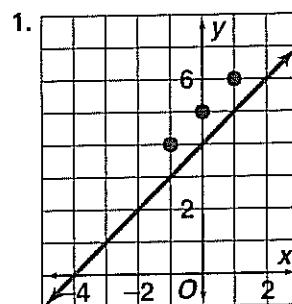
7-5 Linear Inequalities

pages 370-375

Check Skills You'll Need For complete solutions see *Daily Skills Check and Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

1. never 2. always 3. sometimes 4. $y = \frac{2}{3}x - 3$
 5. $y = -3x + 6$ 6. $y = \frac{3}{4}x + \frac{1}{4}$

Investigation



2-3. Answers may vary.

Samples are given.

2. $(0, 5)$: $5 > 0 + 4$; $(1, 6)$:

$6 > 1 + 4$; $(-1, 4)$:

$4 > -1 + 4$; all statements

are true, and points are plotted in graph to the left.

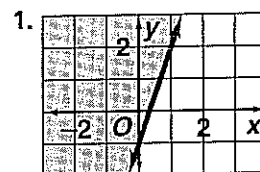
3. $(0, 1)$: $1 \not> 0 + 4$; $(1, 2)$:

$2 \not> 1 + 4$; $(2, 4)$: $4 \not> 2 + 4$; all

statements are false, and

points are not plotted. 4. above 5. below

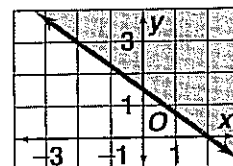
Check Understanding



2. $6x + 8y \geq 12$

$$8y \geq -6x + 12$$

$$y \geq -\frac{3}{4}x + \frac{3}{2}$$



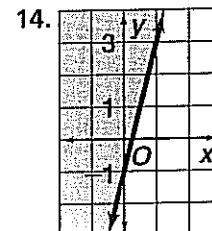
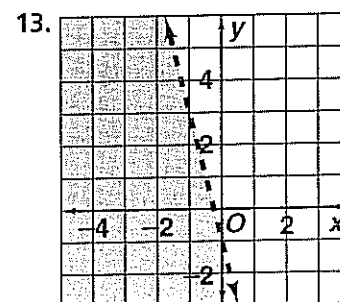
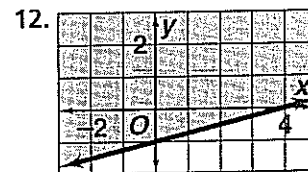
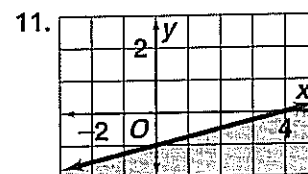
3. $3h + 2.4c \leq 24$ Sample

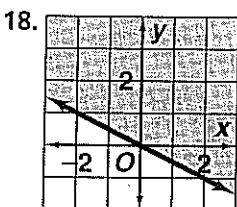
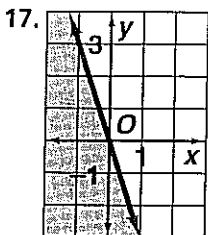
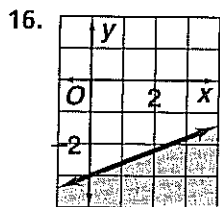
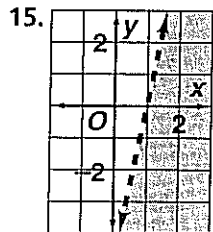
solutions: 6 lb hamburger, 2 lb chicken; 3 lb hamburger, 6 lb chicken; 5 lb hamburger and 3 lb chicken

Exercises 1. $2 \leq -2(2) + 1$; no 2. $0 \leq 2$; yes

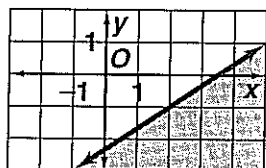
3. $0 \geq 3(0) - 2$; yes 4. $1 \geq 0 - 1$; yes 5. $0 \geq -\frac{2}{5}(0) + 4$;

no 6. $1 \geq \frac{5}{3}(0) - 4$; yes 7. A 8. B 9. B 10. A





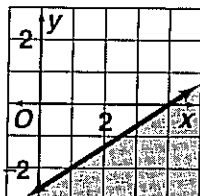
19. $2x - 3y \geq 7$
 $-3y \geq -2x + 7$
 $y \leq \frac{2}{3}x - \frac{7}{3}$



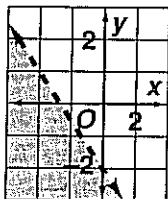
20. $5x - 3y \leq 6$
 $-3y \leq -5x + 6$
 $y \geq \frac{5}{3}x - 2$



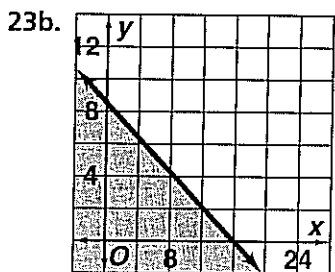
21. $4x - 6y \geq 16$
 $-6y \geq -4x + 16$
 $y \leq \frac{2}{3}x - \frac{8}{3}$



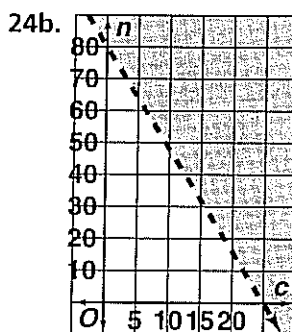
22. $-4y - 6x > 8$
 $-4y > 6x + 8$
 $y < -\frac{3}{2}x - 2$



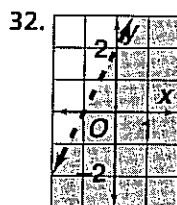
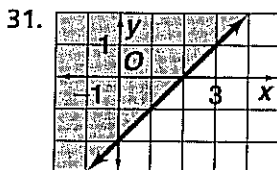
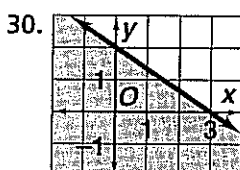
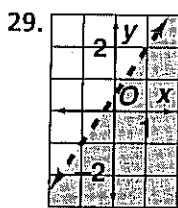
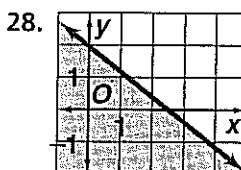
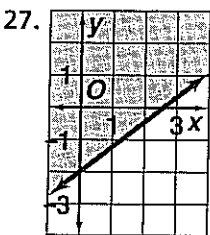
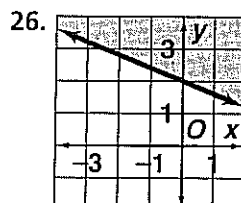
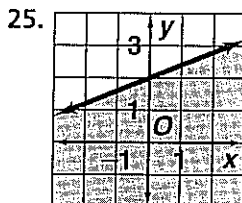
23a. $3x + 5y \leq 48$



23c. Sample solutions: 8 blue, 4 gold; 2 blue, 8 gold; 12 blue, 2 gold 23d. No; you cannot buy -2 rolls of paper. 24a. Let n = number of nylon backpacks sold and c = number of canvas backpacks sold.
 $3n + 10c > 250$



24c. Sample solutions: 30 canvas, 10 nylon; 26 canvas, 20 nylon; 35 canvas, 10 nylon 24d. Domain and range values must be positive integers, because you cannot buy portions of packs or a negative number of packs.

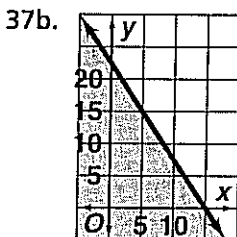


33. For an inequality written in the form $y <$ or $y \leq$, shade below the boundary line. For an inequality written in the form $y >$ or $y \geq$, shade above the boundary line. If there is no y : for $x <$ or $x \leq$, shade to the left; for $x >$ or $x \geq$, shade to the right of the boundary line.

34. Slope = 2; y -intercept = -1; $y > 2x - 1$ 35. $x \leq -3$

36. Slope = $\frac{1}{3}$; y -intercept = -2; $y \leq \frac{1}{3}x - 2$

37a. $12x + 8y \leq 180$

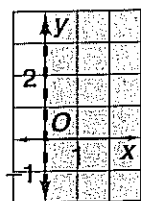


37c. $12 \cdot 8 + 8 \cdot 9 = 96 + 72 = 168 < 180$; yes. Buying 8 CDs and 9 tapes is within your \$180 budget.

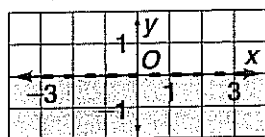
37d. $x = 0$: $8y \leq 180$
 $y \leq 22.5$

The station can buy 22 tapes and get 21 CDs free, acquiring 43 recordings.

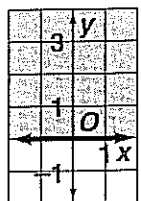
38. $x > 0$



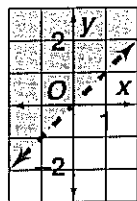
39. $y < 0$



40. $y \geq 0$

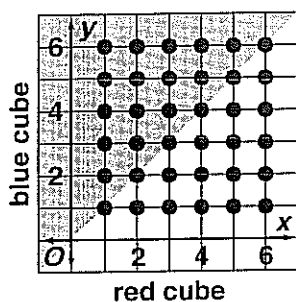


41. $x < y$ or $y > x$



42. The border line is correct. But the graph should be shaded above the line (not below) because $y > -\frac{2}{3}x + 2$ (not $y <$); the line should be dashed (not solid) because $y >$ (not $y \geq$). 43. $y < x + 2$

44a.



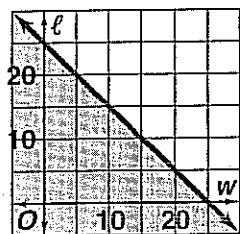
Shade above the dashed line $y = x$.

44b. Shaded region should be $y > x$.

44c. There are 15 points in shaded region, 36 points total.

$$P = \frac{15}{36} = \frac{5}{12}$$

45a. $2w + 2\ell \leq 50$; $w + \ell \leq 25$



45b. Sample: 10 ft by 10 ft, 5 ft by 5 ft 45c. $(w, \ell) = (12, 15)$ does not satisfy the inequality.

$$2 \cdot 12 + 2 \cdot 15 = 24 + 30 = 54 \not\leq 50$$

46. Boundary line has

$$\text{slope} = \frac{5 - (-3)}{8 - 0} = 1 \text{ and}$$

y-intercept -3 ; line is $y = x - 3$.

Point $(1, 1)$: $1 > 1 - 3$;

inequality is $y < x - 3$.

47. Slope $= \frac{-8 - 12}{-3 - 7} = 2$; boundary line has equation

$$y - 12 = 2(x - 7)$$

$$y - 12 = 2x - 14$$

$$y = 2x - 2;$$

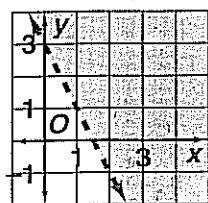
$$1 \geq 2 \cdot 1 - 2;$$

$(1, 1)$:

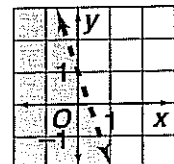
The inequality is $y \geq 2x - 2$.

48. Answers may vary. Samples are given.

48a. $2x + y > 3$



48b. $3x + y < 1$



48c.

$$Ax + By > C$$

$(B > 0)$

$$y > -\frac{A}{B}x + \frac{C}{B}$$

$$Ax + By < C$$

$(B > 0)$

$$y < -\frac{A}{B}x + \frac{C}{B}$$

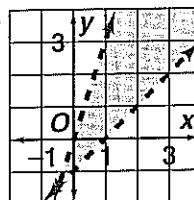
Similarly for \geq and \leq .

For $>$ or \geq in standard form, shade above the line; for $<$ or \leq in standard form, shade below the line (if $B > 0$).

48d. If $B < 0$, then inequalities in slope-intercept forms above would be reversed, and conclusions about shading would be reversed. 49a. $5 \stackrel{?}{>} 4 - 1$; yes

49b. $5 \stackrel{?}{<} 3 \cdot 4$; yes 49c. Answers may vary.

Sample: $(2, 3)$ 49d.

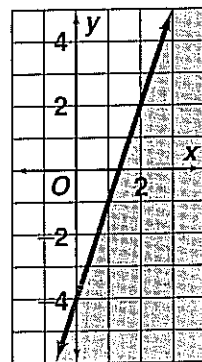


50. For \geq , the shading is above a solid boundary line.

The answer is A. 51. The graph shows shading below a solid boundary line. The answer is H. 52. D has an inequality that becomes $y > x - 9$. The answer is D.

53. Only F indicates "less than." The answer is F.

54. [2] First graph $y = 3x - 4$. Slope $= 3$; points are $(0, -4)$; $(1, -1)$; $(2, 2)$. Draw line solid because we have \leq and not $<$. Shade below because we have \leq and not \geq .



[1] correct graph, no explanation.

55. Let x = number of games made and sold.

$$12,000 + 2.50x = 18x$$

$$12,000 = 15.5x$$

$$774.2 \approx x$$

You must make and sell about 775 games.

56. Let c = average speed of current and p = average speed of paddling in still water.

$$p - c = 2.5$$

$$p + c = 4$$

$$2p = 6.5$$

$$p = 3.25$$

$$3.25 + c = 4$$

$$c = 0.75$$

paddling: 3.25 mi/h; current: 0.75 mi/h

$$57. -3 - (-8) = 5 \quad 58. 11 - 4 = 7 \quad 59. 24 - 13 = 11$$

$$60. 5 - 11 = -6 \quad 61. A(2) = 3 + (2 - 1)5 = 8; A(4) = 3 + (4 - 1)5 = 18$$

$$62. -9 + (2 - 1)(2.3) = -9 + 2.3 = -6.7; -9 + (4 - 1)(2.3) = -9 + 6.9 = -2.1$$

$$63. \frac{3}{4} = \frac{m}{16}$$

$$16\left(\frac{3}{4}\right) = 16\left(\frac{m}{16}\right)$$

$$12 = m$$

$$64. \frac{6}{7} = \frac{24}{g}$$

$$6g = 7 \cdot 24$$

$$g = \frac{7 \cdot 24}{6} = 28$$

$$65. \frac{4}{w} = \frac{8}{22}$$

$$\frac{1}{w} = \frac{1}{11}$$

$$11 = w$$

$$66. \frac{9}{10} = \frac{15}{a}$$

$$9a = 10 \cdot 15$$

$$a = \frac{10 \cdot 15}{9} = \frac{50}{3} = 16\frac{2}{3}$$

$$67. \frac{x+1}{3} = \frac{2}{9}$$

$$3(x+1) = 2$$

$$3x+3 = 2$$

$$3x = -1$$

$$x = -\frac{1}{3}$$

$$68. \frac{n-2}{5} = \frac{6}{15}$$

$$3(n-2) = 6$$

$$3n-6 = 6$$

$$3n = 12$$

$$n = 4$$

$$69. \frac{8}{r+1} = \frac{4}{7}$$

$$7 \cdot 8 = 4(r+1)$$

$$56 = 4r + 4$$

$$52 = 4r$$

$$13 = r$$

$$70. \frac{9}{x+3} = \frac{18}{19}$$

$$9 \cdot 19 = 18(x+3)$$

$$19 = 2(x+3)$$

$$19 = 2x + 6$$

$$13 = 2x$$

$$6.5 = x$$

CHECKPOINT QUIZ 2

page 376

$$1. \quad 2x + 5y = 2$$

$$\underline{3x - 5y = 53}$$

$$5x = 55$$

$$x = 11$$

$$2 \cdot 11 + 5y = 2$$

$$5y = -20$$

$$y = -4$$

$$2. \quad -8x - 3y = 69$$

$$\underline{8x + 7y = -65}$$

$$4y = 4$$

$$y = 1$$

$$-8x - 3 \cdot 1 = 69$$

$$-8x = 72$$

$$x = -9$$

$$3. \quad 2[4x + 2y = 34]$$

$$8x + 4y = 68$$

$$\underline{10x - 4y = -5}$$

$$18x = 63$$

$$x = 3.5$$

$$4(3.5) + 2y = 34$$

$$14 + 2y = 34$$

$$2y = 20$$

$$y = 10$$

4. Add equations: get $0 = 196$; no solution.

$$5. \quad 4[3x + 6y = 42]$$

$$-3[-7x + 8y = -109]$$

$$12x + 24y = 168$$

$$\underline{21x - 24y = 327}$$

$$33x = 495$$

$$x = 15$$

$$3 \cdot 15 + 6y = 42$$

$$6y = -3$$

$$y = -\frac{1}{2}$$

$$6. \quad n + d = 21$$

$$n = 21 - d$$

$$5n + 10d = 170$$

$$5(21 - d) + 10d = 170$$

$$105 - 5d + 10d = 170$$

$$5d + 105 = 170$$

$$5d = 65$$

$$d = 13$$

$$n = 21 - 13 = 8$$

8 nickels, 13 dimes

7. Only one equation is needed. Break-even point is expenditures = revenue

$$200 + 0.35x = 1.20x$$

$$200 = 0.85x$$

$$235.3 \approx x$$

You must sell 236 ice cream cones to break even.

8. Let x = paddling speed, y = current speed.

$$(x - y)4 = 12$$

$$(x + y)3 = 12$$

$$x - y = 3$$

$$\underline{x + y = 4}$$

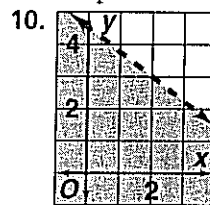
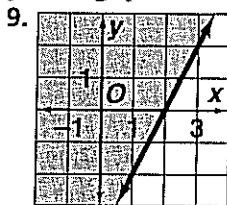
$$2x = 7$$

$$x = 3.5$$

$$3.5 + y = 4$$

$$y = 0.5$$

paddling speed = 3.5 mi/h; current speed = 0.5 mi/h

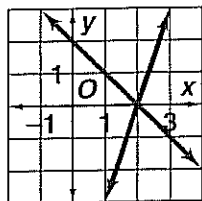


7-6 Systems of Linear Inequalities

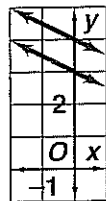
pages 377–386

Check Skills You'll Need For complete solutions see *Daily Skills Check* and *Lesson Quiz Transparencies* or *Presentation Pro CD-ROM*.

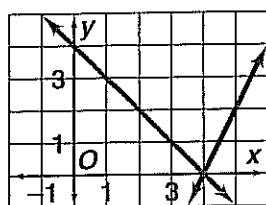
1. (2, 0)



2. no solution

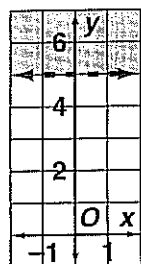


3.

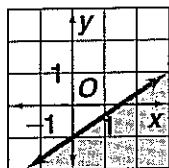


(4, 0)

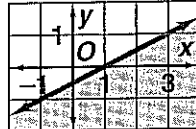
4.



5.



6.



Check Understanding 1.

2a. $y \geq \frac{1}{2}x - 1$ (red) and $y < 2$ (blue)

2b. $y \leq -\frac{2}{3}x$ (blue) and $x > -3$ (red)

3. Let x = width of garden and y = length of garden.

$$2x + 2y \leq 140$$

$$x + y \leq 70$$

$$y \geq 50$$

4a. Look for points in the lavender region with integer coordinates. Sample: two 20¢ stamps and six 34¢ stamps; three 20¢ stamps and six 34¢ stamps

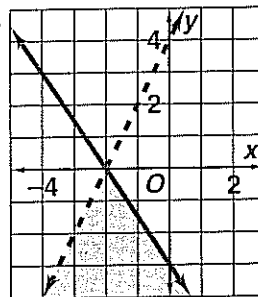
4b. No; both give more than \$2.40. 4c. You cannot have a negative or fractional number of stamps.

Exercises 1. $19 \stackrel{?}{\leq} 7 \cdot 1 - 13$: no; $19 \stackrel{?}{\geq} 3 \cdot 1 + 6$: yes; NO

2. $9 \cdot 4 - 10 \stackrel{?}{\geq} 23$: yes; $5 \cdot 4 + 0.2 \cdot 10 \stackrel{?}{\geq} 20$: yes; YES

3. $40 \stackrel{?}{\geq} -13(-2) + 29$: no; $40 \stackrel{?}{\leq} 9(-2) + 11$: no; NO

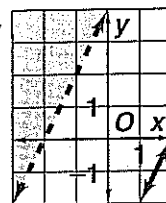
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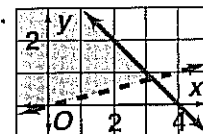
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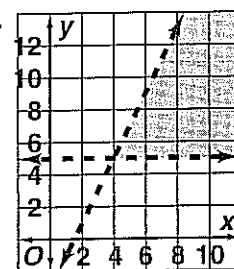
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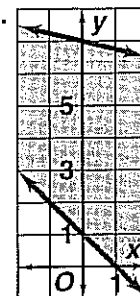
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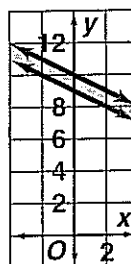
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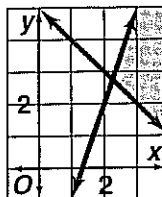
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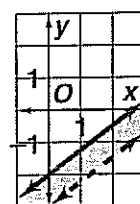
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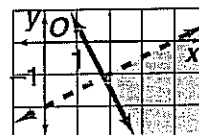
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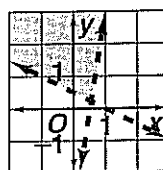
12.



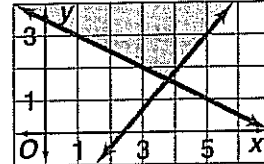
13.



14.



15.



16. $y \geq -x + 3$ and $x > 5$ 17. $y \leq \frac{1}{2}x + 2$ and

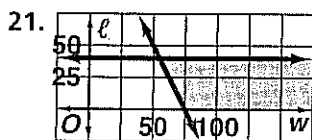
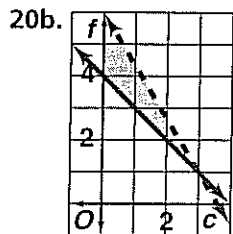
$y \geq -\frac{1}{2}x - 2$ 18. $y \geq -\frac{1}{3}x + 1$ and $y \geq -\frac{3}{4}x + 3$

19. $y \leq -\frac{2}{3}x - 4$ and $y \geq \frac{1}{5}x - 3$

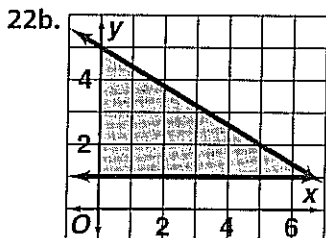
20a. Let f = weight of flour and c = weight of corn purchased.

$$f + c \geq 4$$

$$1.5f + 2.5c < 9.5$$

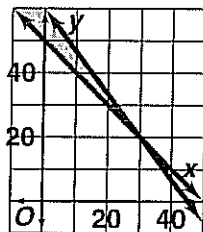


22a. $x \geq 0$
 $y \geq 1$
 $5.99x + 9.99y = 50$



22c. No; 6 CDs would cost \$59.94, and you have only \$50. 22d. Study the graph for an intersection point closest to the upper solid line. It is at $(x, y) = (5, 2)$; $5.99 \cdot 5 + 9.99 \cdot 2 = 29.95 + 19.98 = 49.93$. The cost is \$49.93.

23. Let p = pounds of perch bought and s = pounds of salmon.



$p + s \geq 30$
 $1.25p + 3.00s = 60$

24a. Let x = hours per week at ice cream shop and y = hours babysitting.

$x + y \leq 12$

$6x + 4y \geq 60$

24b. Answers may vary.

Samples: $(8, 4)$, $(9, 2)$, $(10, 1)$

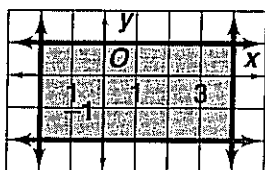
25. $-3 \leq x \leq 3$; $-3 \leq y \leq 3$

26. $x < 5$, $y \geq 2$, $y \leq x$

27. $y \geq \frac{2}{3}x - 2$, $y < \frac{2}{3}x + 2$

28. $y \geq -x - 3$, $y \leq -x + 3$, $y \leq x + 3$, $y \geq x - 3$

29. Answers may vary. Sample, graphed below: $x \geq -2$, $x \leq 4$, $y \leq 1$, $y \geq -2$



30a. The right angle is formed by the x - and y -axes. To be isosceles, the two sides on these axes must have equal lengths. The hypotenuse is given by $y = mx + 4$, which must have equal

x - and y -intercepts, so its slope is $m = -1$.

30b. Area = $\frac{1}{2}bh = \frac{1}{2}(4 \cdot 4) = 8$

31a. triangle 31b. $(2, 2)$, $(-4, -1)$, $(-4, 2)$

31c. Area = $\frac{1}{2}bh = \frac{1}{2}(6 \cdot 3) = 9$

32a. square 32b. $(1, -1)$, $(5, -1)$, $(5, 3)$, $(1, 3)$

32c. Area = $a^2 = 4^2 = 16$

33a. trapezoid 33b. $(0, -4)$, $(0, 2)$, $(2, 0)$, $(2, -4)$

33c. Area = $a \cdot \frac{b_1 + b_2}{2} = 2 \cdot \frac{4 + 6}{2} = 10$

34a. right isosceles triangle 34b. $(2, -3)$, $(2, 2)$, $(7, -3)$

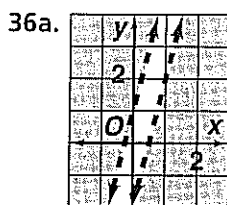
34c. Area = $\frac{1}{2}bh = \frac{1}{2}(5 \cdot 5) = 12.5$

35a. Let x = number of pairs of pants bought and y = number of shirts.

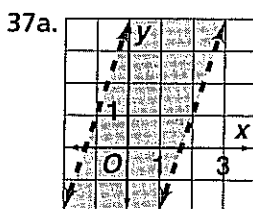
$x \geq 1$

$10.99x + 4.99y \leq 45$

35b. $(3, 0)$, $(3, 1)$, $(3, 2)$, $(4, 0)$



36b. No; they have the same slope and have different y -intercepts, so they are parallel. 36c. no 36d. no



37b. No; they have the same slope and different y -intercepts, so they are parallel. 37c. It is the shaded strip having the parallel lines as borders.

38–42. Answers may vary. Samples are given.

38. $x \leq 1$ and $y \leq 2$ 39. $x < 0$ and $y > 0$ 40. $y > 5$ and $y < 3$ 41. $x < 2$ and $y < 5$ 42. $x > 0$ and $y < 0$

43a. $s + d > 10$

$s + d < 20$

$d \geq 3$

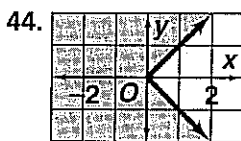
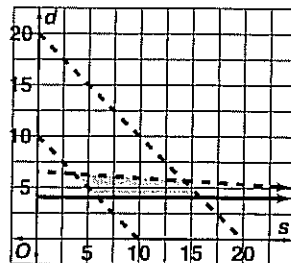
$0.15s + 10d < 60$

43b. Answers may vary.

Sample: $(s, d) = (8, 4.5)$;

12.5 g; silver: \$1.20;

gold: \$45.00.



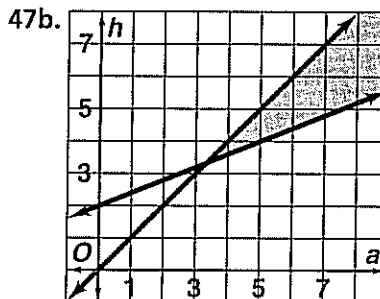
45–46. Answers may vary.

Samples are given.

45. $y > \frac{1}{2}x$, $y < 2x$

46. $y > x + 1$, $y < -x + 1$

47a. $\frac{120 + h}{305 + a} \geq 0.400$
 $120 + h \geq 0.4(305 + a)$
 $120 + h \geq 122 + 0.4a$
 $h \geq 2 + 0.400a$



47c. For any number of at-bats, the solution shows how many hits are needed to bring up the average to 0.400. For example, in 3 at-bats this is impossible; in 7 at-bats 5, 6, or 7 hits would suffice.

48a. Let x = number of 14-in. drums built and y = number of 18-in. drums.

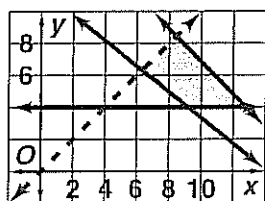
$$180x + 240y \geq 2700$$

or $3x + 4y \geq 45$

$$x + y \leq 17$$

$$x > y$$

$$y \geq 4$$



48b. Answers may vary.

Sample: ten 14-in. drums and four 18-in. drums.

49. I. $2 > 1$: yes; $2 < 3 \cdot 1 - 4$: no; II. $4 > 3$: yes; $4 < 3 \cdot 3 - 4$: yes; III. $9 > 3$: yes; $9 < 3 \cdot 3 - 4$: no; the answer is D. 50. *At most* and *at least* imply \leq and \geq . The answer is G. 51. [2] all points on the line $3x + 4y = 12$; [1] incorrect description 52. [4] a. Let x = number of toppings, and y = cost of one large pizza.

Maria's: $y = 0.50x + 8$

Tony's: $y = 0.75x + 7$

b. $0.50x + 8 = 0.75x + 7$

$$8 = 0.25x + 7$$

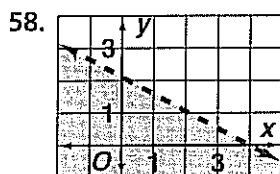
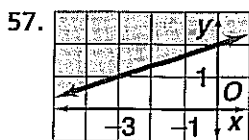
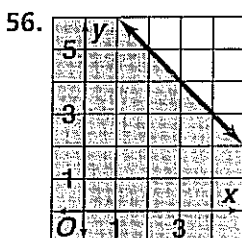
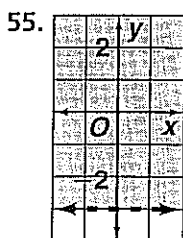
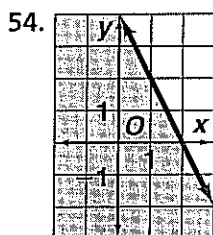
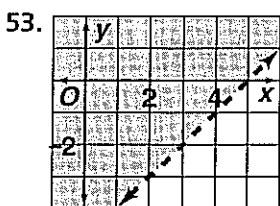
$$1 = 0.25x$$

$$4 = x$$

$$y = 0.50 \cdot 4 + 8 = 10$$

With 4 toppings, the cost is \$10 at either Tony's or Maria's. c. For 3 toppings or less, a pizza is cheaper at Tony's; for 5 toppings or more, Maria's is cheaper.

[3] (a) and (b) done correctly [2] computational error in (b) [1] incorrect system solved correctly



59. $5x - 2y = 8$
 $-2y = -5x + 8$
 $y = \frac{5}{2}x - 4$

slope = $\frac{5}{2}$

60. $y = -3x + 17$; slope = -3

61. $0.5y - 10 + 4x = 0$
 $0.5y = -4x + 10$
 $y = -8x + 20$

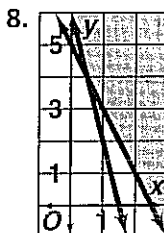
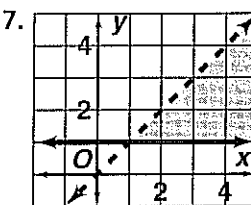
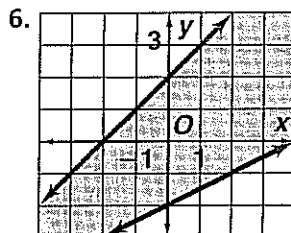
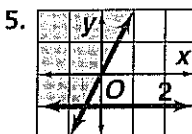
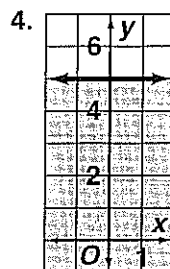
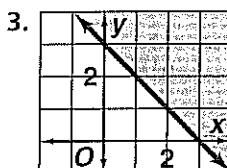
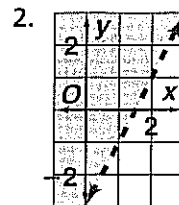
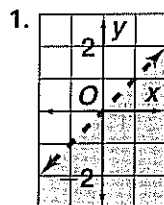
slope = -8

62. $-\frac{1}{4}$ 63. $-\frac{1}{5}$ 64. $-\frac{8}{3}$ 65. $\frac{10}{9}$ 66. original slope = $-\frac{13}{6}$; slope of perpendicular line = $\frac{6}{13}$ 67. original slope = $-\frac{4}{15}$; slope of perpendicular line = $\frac{15}{4}$

68. $f(x) = 7x$ 69. $f(x) = x + 6$ 70. $f(x) = x^2$

TECHNOLOGY

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TEST-TAKING STRATEGIES

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1. Answers may vary. Sample: $(0, \frac{3}{4})$. I. $\frac{3}{4} \geq 0$: yes; $\frac{3}{4} \leq 0$: yes; $\frac{3}{4} \leq 1$: yes II. $0 + \frac{3}{4} \geq 0$: yes; $0 - \frac{3}{4} \geq 0$: yes; $\frac{3}{4} \leq 1$: yes III. $\frac{3}{4} \geq |0|$: yes; $\frac{3}{4} \leq 1$: yes. All three systems are valid for the point $(0, \frac{3}{4})$. 2. All of the systems are true for the point $(0, 0)$, which is not a good choice because it is on the border of the region.

3. Break-even point is

$$\text{expenses} = \text{income}$$

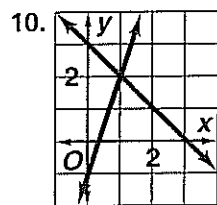
$$8.40 + 0.05x = 0.25x$$

$$8.4 = 0.2x$$

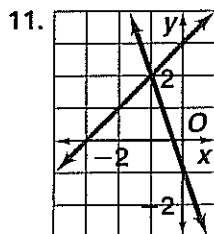
$$42 = x$$

20 cups: income = $0.25 \cdot 20 = 5$; expenses = $8.40 + 0.05 \cdot 20 = 9.40$, I is true; II and III are false. The answer is C.

1. Elimination 2. solution of the system 3. system of linear inequalities 4. solution of the inequality 5. Substitution 6. A 7. $5 \leq 2 \cdot 2 + 1$; yes; $2 \cdot 2 - 5 \leq 8$; no; NO for the system 8. Multiply first equation by 6: $6y = -3x + 12$; this is identical to the second equation; there are infinitely many solutions. 9. Answers may vary. Sample: systems having noninteger solutions; solutions that are difficult to read from graph.

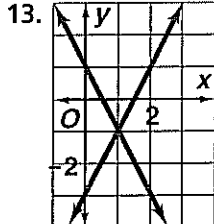
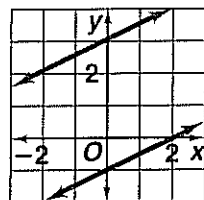


(1, 2)



(-1, 2)

12. no solution



(1, -1)

14. $3x + 11 = -2x + 1$
 $5x + 11 = 1$
 $5x = -10$
 $x = -2$
 $y = -2(-2) + 1 = 5$

15. $4x - y = -12$
 $y = 4x + 12$
 $-6x + 5y = -3$
 $-6x + 5(4x + 12) = -3$
 $-6x + 20x + 60 = -3$
 $14x = -63$
 $x = -\frac{9}{2} = -4\frac{1}{2}$
 $y = 4(-\frac{9}{2}) + 12 = -18 + 12 = -6$

16. $2x = 4y$
 $x = 2y$
 $8x = -2y - 10$
 $8(2y) = -2y - 10$
 $16y = -2y - 10$
 $18y = -10$
 $y = -\frac{5}{9}$
 $x = 2(-\frac{5}{9}) = -1\frac{1}{9}$

17. $5(5x - 8) = 2x + 6$
 $25x - 40 = 2x + 6$
 $23x - 40 = 6$
 $23x = 46$
 $x = 2$
 $y = 5 \cdot 2 - 8 = 2$

18. Answers may vary. Sample: After substitution, if the second variable disappears, and you get a false equation such as $0 = 2$, then there is no solution; if you get a true equation such as $5 = 5$, then there are infinitely many

solutions. 19a. Let x = number of 4-point questions in the test and y = number of 5-point questions.

$$4x + 5y = 100$$

$$x + y = 24$$

19b. $x = 24 - y$
 $4(24 - y) + 5y = 100$
 $96 - 4y + 5y = 100$
 $y = 4$
 $x = 24 - 4 = 20$

There are 20 4-point questions and 4 5-point questions.

20. $y = -3x + 5$
 $y = -4x - 1$
 $0 = x + 6$
 $-6 = x$
 $y = -3(-6) + 5 = 23$
 Check: $23 \stackrel{?}{=} -3(-6) + 5 \checkmark$
 $23 \stackrel{?}{=} -4(-6) - 1 \checkmark$

21. $-2[x + 2y = -1]$
 $-2x - 4y = 2$
 $2x - 3y = 5$
 $-7y = 7$
 $y = -1$
 $x + 2(-1) = -1$
 $x = 1$

Check: $2 \cdot 1 - 3(-1) \stackrel{?}{=} 5 \checkmark$
 $1 + 2(-1) \stackrel{?}{=} -1 \checkmark$

22. $x + y = 10$
 $x - y = 2$
 $2x = 12$
 $x = 6$
 $6 + y = 10$
 $y = 4$
 Check: $6 + 4 \stackrel{?}{=} 10 \checkmark$
 $6 - 4 \stackrel{?}{=} 2 \checkmark$

23. $-2[x + 4y = 12]$
 $-2x - 8y = -24$
 $2x - 3y = 6$
 $-11y = -18$
 $y = \frac{18}{11} = 1\frac{7}{11}$
 $x + 4(\frac{18}{11}) = 12$
 $x = 12 - \frac{72}{11} = \frac{132}{11} - \frac{72}{11} = \frac{60}{11} = 5\frac{5}{11}$

Check: $\frac{60}{11} + 4(\frac{18}{11}) \stackrel{?}{=} 12$
 $\frac{132}{11} = 12 \checkmark$

$2(\frac{60}{11}) - 3(\frac{18}{11}) \stackrel{?}{=} 6$
 $\frac{120}{11} - \frac{54}{11} = \frac{66}{11} = 6 \checkmark$

24. Let x = number of chickens and y = number of cows.

$-2[x + y = 34]$
 $-2x - 2y = -68$
 $2x + 4y = 110$
 $2y = 42$
 $y = 21$
 $x + 21 = 34$
 $x = 13$

13 chickens and 21 cows

25. Let t = ounces of turpentine and ℓ = ounces of linseed oil.

$$t = 2\ell$$

$$\ell = \frac{1}{2}t$$

$$t + \ell = 16$$

$$t + \frac{1}{2}t = 16$$

$$\frac{3}{2}t = 16$$

$$t = \frac{2}{3}(16) = \frac{32}{3} = 10\frac{2}{3}$$

$10\frac{2}{3}$ fl oz of turpentine are needed.

26. Let x and y be the two angles.

$$x + y = 90$$

$$x - y = 36$$

$$\frac{2x}{2} = \frac{126}{2}$$

$$x = 63$$

$$63 + y = 90$$

$$y = 27$$

Angles measure 63° and 27° .

27. Let ℓ = length and w = width.

$$\ell = 2w + 3$$

$$2\ell + 2w = 114$$

$$2(2w + 3) + 2w = 114$$

$$4w + 6 + 2w = 114$$

$$6w + 6 = 114$$

$$6w = 108$$

$$w = 18$$

$$\ell = 2 \cdot 18 + 3 = 39$$

18 ft by 39 ft

28. Let b = price of a package of balloons and f = price of a package of favors.

$$5[3b + 4f = 14.63]$$

$$-4[2b + 5f = 16.03]$$

$$15b + 20f = 73.15$$

$$-8b - 20f = -64.12$$

$$\frac{7b}{7} = \frac{9.03}{7}$$

$$b = 1.29$$

A package of balloons costs \$1.29.

29. Let A = airspeed and W = wind speed.

$$(A + 22)6 = (A - 22)8$$

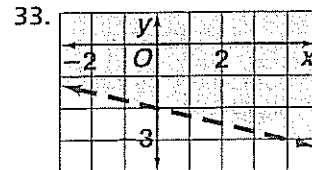
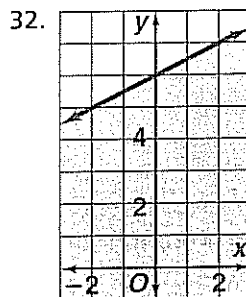
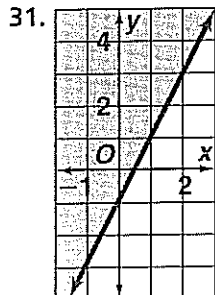
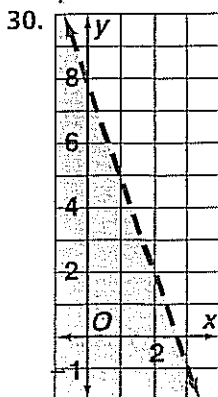
$$6A + 132 = 8A - 176$$

$$132 = 2A - 176$$

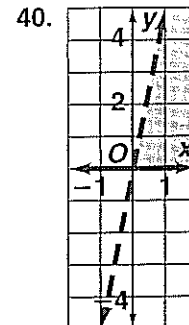
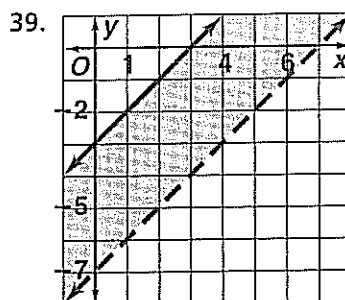
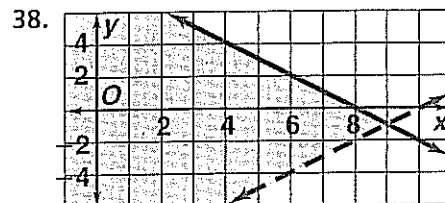
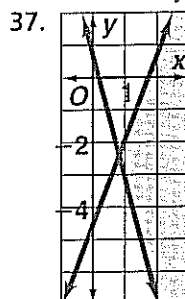
$$308 = 2A$$

$$154 = A$$

Airspeed = 154 km/h



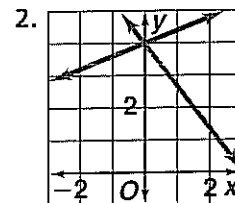
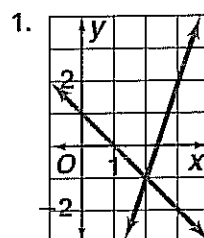
34. $x \geq 4$ 35. $y \leq 3x + 3$ 36. $2x + 3y \geq -6$



41. $y \leq 3, y > x$ 42. $y > -2x + 2, y > \frac{4}{5}x - 4$
 43. $x > -1, y \leq x + 5$ 44. $y < -\frac{3}{2}x + 3, y \geq -\frac{1}{2}x - 1$
 45. Answers may vary. Sample: $x \geq -1, y \leq 5, x + y \leq 7, x \leq 5, y \geq -1$

CHAPTER TEST

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3. one solution 4. one solution 5. no solution 6. one solution 7. one solution 8. infinitely many solutions

9. $4x - 7 = 2x + 9$
 $2x - 7 = 9$
 $2x = 16$
 $x = 8$
 $y = 2 \cdot 8 + 9 = 25$

10. $-2x - 1 = 3x - 16$
 $-5x - 1 = -16$
 $-5x = -15$
 $x = 3$
 $y = -2 \cdot 3 - 1 = -7$

$$\begin{aligned}
 11. \quad & y = -5x + 1 \\
 & 8x + 2y = -2 \\
 & 8x + 2(-5x + 1) = -2 \\
 & 8x - 10x + 2 = -2 \\
 & -2x + 2 = -2 \\
 & -2x = -4 \\
 & x = 2 \\
 & y = -5 \cdot 2 + 1 = -9
 \end{aligned}$$

$$\begin{aligned}
 12. \quad & y = 2x - 6 \\
 & 4x - 10y = 4 \\
 & 4x - 10(2x - 6) = 4 \\
 & 4x - 20x + 60 = 4 \\
 & -16x + 60 = 4 \\
 & -16x = -56 \\
 & x = 3.5 \\
 & y = 2(3.5) - 6 = 1
 \end{aligned}$$

$$\begin{aligned}
 13. \quad & 4x + y = 8 \\
 & -3x - y = 0 \\
 \hline
 & x = 8 \\
 & 4 \cdot 8 + y = 8 \\
 & y = -24
 \end{aligned}$$

$$\begin{aligned}
 14. \quad & 3[2x + 5y = 20] \\
 & -2[3x - 10y = 37] \\
 \hline
 & 6x + 15y = 60 \\
 & -6x + 20y = -74 \\
 \hline
 & 35y = -14 \\
 & y = -\frac{2}{5}
 \end{aligned}$$

$$\begin{aligned}
 & 2x + 5\left(-\frac{2}{5}\right) = 20 \\
 & 2x - 2 = 20 \\
 & 2x = 22 \\
 & x = 11
 \end{aligned}$$

$$\begin{aligned}
 15. \quad & x + y = 10 \\
 & -x - 2y = -14 \\
 \hline
 & -y = -4 \\
 & y = 4 \\
 & x + 4 = 10 \\
 & x = 6
 \end{aligned}$$

$$\begin{aligned}
 16. \quad & -3[x - 12y = 19] \\
 & -3x + 36y = -57 \\
 & 3x + 2y = -19 \\
 \hline
 & 38y = -76 \\
 & y = -2 \\
 & x - 12(-2) = 19 \\
 & x + 24 = 19 \\
 & x = -5
 \end{aligned}$$

17. Let b = monthly cost of basic service and m = monthly cost per movie channel.

$$\begin{aligned}
 & b + m = 35 \\
 & b + 2m = 45 \\
 \hline
 & m = 10 \\
 & b + 10 = 35 \\
 & b = 25
 \end{aligned}$$

Basic costs \$25/mo; one movie channel costs \$10/mo.

18. Let n = number of novelists and p = number of poets.

$$\frac{n}{p} = \frac{5}{3}$$

$$\begin{aligned}
 & 3n = 5p \\
 & n + p = 24 \\
 & 3n + 3p = 72 \\
 & 5p + 3p = 72 \\
 & 8p = 72 \\
 & p = 9 \\
 & n + 9 = 24 \\
 & n = 15
 \end{aligned}$$

There are 15 novelists and 9 poets.

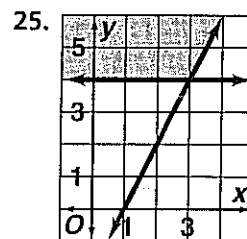
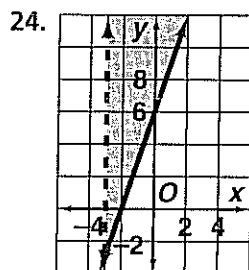
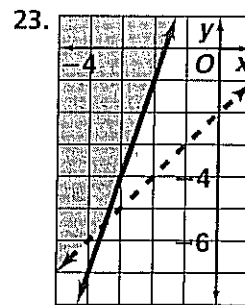
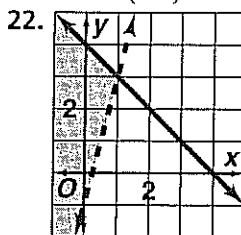
$$\begin{aligned}
 19. \quad & q + n = 15 \\
 & n = 15 - q \\
 & 25q + 5n = 2.75 \\
 & 25q + 5(15 - q) = 2.75 \\
 & 25q + 75 - 5q = 2.75 \\
 & 20q + 75 = 2.75 \\
 & 20q = 2.00 \\
 & q = 0.10 \\
 & n = 15 - 0.10 = 14.90
 \end{aligned}$$

10 quarters, 5 nickels

20. Answers may vary. Sample: The solution of a system of linear equations involves finding a single point where all their graphs intersect. The solution of a system of linear inequalities involves finding a region that satisfies all the inequalities. 21. A. $-4 \stackrel{?}{\leq} 3 \cdot 2 - 1$: yes

B. $7 \stackrel{?}{\leq} 3 \cdot 5 - 1$: yes C. $-1 \stackrel{?}{\leq} 3 \cdot 0 - 1$: no

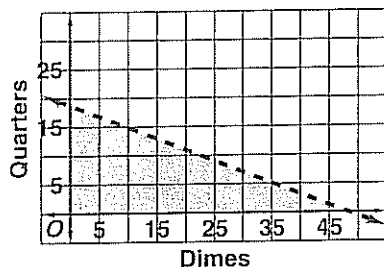
D. $-9 \stackrel{?}{\leq} 3(-4) - 1$: no; the answer is C.



26. Answers may vary. Sample:

$$\begin{aligned}
 & y = x + 1 \\
 & y = 3x - 5 \\
 & x + 1 = 3x - 5 \\
 & -2x = -6 \\
 & x = 3 \\
 & y = 3 + 1 = 4
 \end{aligned}$$

27a. $10d + 25q < 500$



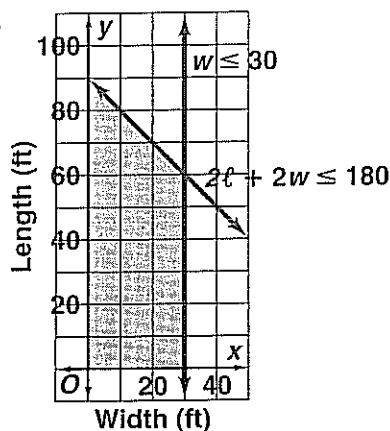
27b. If $q = 0$, $10d < 500$ or $d < 50$; 49 items.

27c. If $d = 0$, $25q < 500$ or $q < 20$; 19 items.

28a. $w \leq 30$

$2\ell + 2w \leq 180$

28b.



29a.

	30% insecticide	50% insecticide	42% insecticide
Liters of solution	x	y	200
Liters of insecticide	$0.30x$	$0.50y$	$0.42(200)$

29b.

$x + y = 200$

$0.30x + 0.50y = 0.42(200) = 84$

$x = 200 - y$

$0.3(200 - y) + 0.5y = 84$

$60 - 0.3y + 0.5y = 84$

$60 + 0.2y = 84$

$0.2y = 24$

$y = 120$

$x = 200 - 120 = 80$

80 liters of 30% solution and 120 liters of 50% solution

STANDARDIZED TEST PREP

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1. $22.6 + 339.1 + 167.0 = 528.7$; the answer is B.
2. The answer is H. 3. Percent of change is the amount of change divided by the original amount. The answer is D. 4. Slope = $\frac{2.9 \text{ million} - 167.0 \text{ million}}{1999 - 1985} = \frac{-164.1 \text{ million}}{14 \text{ years}} = -11.7 \text{ million/year}$; the answer is F. 5. The answer is B.
6. Percent of change = $\frac{339.1 - 123.6}{339.1} = \frac{215.5}{339.1} = 0.6355 \approx 64\%$; the number of cassettes decreased by about 64%.
7. $\frac{938.9 - 22.6}{22.6} = \frac{916.3}{22.6} \approx 40.54 = 4054\%$. Yes, the increase is about 4054%.
8. Let x = years after 1985 and y = millions of CDs shipped. Slope = $\frac{938.9 - 22.6}{1999 - 1985} = \frac{916.3}{14} = 65.45$ [millions per year].

$y = 65.45x + 22.6$

Check for 1999: $y = 65.45(14) + 22.6 = 938.9$ ✓

2010: $y = 65.45(25) + 22.6 = 1658.85$

Predict 1659 million CDs shipped in 2010. 9. [2] Yes, in 1999 more CDs were sold than cassettes and albums.

[1] correct conclusion but no explanation