

2 Review and Applications of Algebra

Exercise 2.1

Basic Problems

1. $(-p) + (-3p) + 4p = -p - 3p + 4p = \underline{0}$
2. $(5s - 2t) - (2s - 4t) = 5s - 2t - 2s + 4t = \underline{3s + 2t}$
3. $4x^2y + (-3x^2y) - (-5x^2y) = 4x^2y - 3x^2y + 5x^2y = \underline{6x^2y}$
4. $1 - (7e^2 - 5 + 3e - e^3) = 1 - 7e^2 + 5 - 3e + e^3 = \underline{e^3 - 7e^2 - 3e + 6}$
5. $(6x^2 - 3xy + 4y^2) - (8y^2 - 10xy - x^2) = 6x^2 - 3xy + 4y^2 - 8y^2 + 10xy + x^2$
 $= \underline{7x^2 - 4y^2 + 7xy}$
6. $6a - 3a - 2(2b - a) = 6a - 3a - 4b + 2a = \underline{5a - 4b}$
7. $\frac{3y}{1.2} + 6.42y - 4y + 7 = 2.5y + 6.42y - 4y + 7 = \underline{4.92y + 7}$
8. $13.2 + 7.4t - 3.6 + \frac{2.8t}{0.4} = 13.2 + 7.4t - 3.6 + 7t = \underline{14.4t + 9.6}$

Intermediate Problems

9. $4a(3ab - 5a + 6b) = \underline{12a^2b - 20a^2 + 24ab}$
10. $9k(4 - 8k + 7k^2) = \underline{36k - 72k^2 + 63k^3}$
11. $-5xy(2x^2 - xy - 3y^2) = \underline{-10x^3y + 5x^2y^2 + 15xy^3}$
12. $(3p^2 - 5p)(-4p + 2) = -12p^3 + 6p^2 + 20p^2 - 10p = \underline{-12p^3 + 26p^2 - 10p}$
13. $3(a - 2)(4a + 1) - 5(2a + 3)(a - 7) = 3(4a^2 + a - 8a - 2) - 5(2a^2 - 14a + 3a - 21)$
 $= 12a^2 - 21a - 6 - 10a^2 + 55a + 105$
 $= \underline{2a^2 + 34a + 99}$
14. $5(2x - y)(y + 3x) - 6x(x - 5y) = 5(2xy + 6x^2 - y^2 - 3xy) - 6x^2 + 30xy$
 $= -5xy + 30x^2 - 5y^2 - 6x^2 + 30xy$
 $= \underline{24x^2 + 25xy - 5y^2}$
15. $\frac{18x^2}{3x} = \underline{6x}$
16. $\frac{6a^2b}{-2ab^2} = \underline{-3\frac{a}{b}}$
17. $\frac{x^2y - xy^2}{xy} = \underline{\frac{x - y}{1}}$
18. $\frac{-4x + 10x^2 - 6x^3}{-0.5x} = \underline{8 - 20x + 12x^2}$

$$19. \quad \frac{12x^3 - 24x^2 + 36x}{48x} = \frac{x^2 - 2x + 3}{4}$$

Exercise 2.1 (continued)

$$20. \quad \frac{120(1+i)^2 + 180(1+i)^3}{360(1+i)} = \frac{2(1+i) + 3(1+i)^2}{6}$$

$$21. \quad 3d^2 - 4d + 15 = 3(2.5)^2 - 4(2.5) + 15 \\ = 18.75 - 10 + 15 \\ = \underline{23.75}$$

$$22. \quad 15g - 9h + 3 = 15(14) - 9(15) + 3 = \underline{78}$$

$$23. \quad 7x(4y - 8) = 7(3.2)(4 \times 1.5 - 8) = 22.4(6 - 8) = \underline{-44.8}$$

$$24. \quad (1+i)^m - 1 = (1 + 0.0225)^4 - 1 = \underline{0.093083}$$

$$25. \quad I \div Pr = \frac{\$13.75}{\$500 \times 0.11} = \underline{0.250}$$

$$26. \quad \frac{N}{1-d} = \frac{\$89.10}{1-0.10} = \underline{\$99.00}$$

$$27. \quad P(1+rt) = \$770 \left(1 + 0.013 \times \frac{223}{365} \right) = \$770(1.0079425) = \underline{\$776.12}$$

$$28. \quad \frac{S}{1+rt} = \frac{\$2500}{1+0.085 \times \frac{123}{365}} = \frac{\$2500}{1.028644} = \underline{\$2430.38}$$

$$29. \quad P(1+i)^n = \$1280(1 + 0.025)^3 = \underline{\$1378.42}$$

$$30. \quad \frac{S}{(1+i)^n} = \frac{\$850}{(1+0.0075)^6} = \frac{\$850}{1.045852} = \underline{\$812.73}$$

Advanced Problems

$$31. \quad \frac{2x+9}{4} - 1.2(x-1) = 0.5x + 2.25 - 1.2x + 1.2 = \underline{-0.7x + 3.45}$$

$$32. \quad \frac{x}{2} - x^2 + \frac{4}{5} - 0.2x^2 - \frac{4}{5}x + \frac{1}{2} = 0.5x - x^2 + 0.8 - 0.2x^2 - 0.8x + 0.5 \\ = \underline{-1.2x^2 - 0.3x + 1.3}$$

$$33. \quad \frac{8x}{0.5} + \frac{5.5x}{11} + 0.5(4.6x - 17) = 16x + 0.5x + 2.3x - 8.5 = \underline{18.8x - 8.5}$$

$$34. \quad \frac{2x}{1.045} - \frac{2.016x}{3} + \frac{x}{2} = 1.9139x - 0.6720x + 0.5x = \underline{1.7419x}$$

$$35. \quad R \left[\frac{(1+i)^n - 1}{i} \right] = \$550 \left(\frac{1.085^3 - 1}{0.085} \right) = \$550 \left(\frac{0.2772891}{0.085} \right) = \underline{\underline{\$1794.22}}$$

Exercise 2.1 (continued)

$$36. \quad R \left[\frac{(1+i)^n - 1}{i} \right] (1+i) = \$910 \left(\frac{1.1038129^4 - 1}{0.1038129} \right) (1.1038129) \\ = \$910 \left(\frac{0.4845057}{0.1038129} \right) (1.1038129) \\ = \underline{\underline{\$4687.97}}$$

$$37. \quad \frac{R}{i} \left[1 - \frac{1}{(1+i)^n} \right] = \frac{\$630}{0.115} \left(1 - \frac{1}{1.115^2} \right) = \underline{\underline{\$1071.77}}$$

Exercise 2.2

Basic Problems

$$1. \quad I = Prt \\ \$6.25 = P(0.05)0.25 \\ \$6.25 = 0.0125P \\ \frac{\$6.25}{0.0125} = \underline{\underline{\$500.00}}$$

$$2. \quad PV = \frac{PMT}{i} \\ \$150,000 = \frac{\$900}{i} \\ \$150,000i = \$900 \\ \frac{\$900}{\$150,000} = \underline{\underline{0.00600}}$$

$$3. \quad S = P(1 + rt) \\ \$3626 = P(1 + 0.004 \times 9) \\ \$3626 = 1.036P \\ \frac{\$3626}{1.036} = \underline{\underline{\$3500.00}}$$

$$4. \quad N = L(1 - d) \\ \$891 = L(1 - 0.10) \\ \$891 = 0.90L \\ \frac{\$891}{0.90} = \underline{\underline{\$990.00}}$$

$$\begin{aligned}
 5. \quad N &= L(1 - d) \\
 \$410.85 &= \$498(1 - d) \\
 \frac{\$410.85}{\$498} &= 1 - d \\
 0.825 &= 1 - d \\
 d &= 1 - 0.825 = \underline{\underline{0.175}}
 \end{aligned}$$

Exercise 2.2 (continued)

$$\begin{aligned}
 6. \quad S &= P(1 + rt) \\
 \$5100 &= \$5000(1 + 0.0025t) \\
 \$5100 &= \$5000 + \$12.5t \\
 \$5100 - \$5000 &= \$12.5t \\
 \frac{\$100}{\$12.5} &= \underline{\underline{8.00}}
 \end{aligned}$$

$$\begin{aligned}
 7. \quad NI &= (CM)X - FC \\
 \$15,000 &= CM(5000) - \$60,000 \\
 \$15,000 + \$60,000 &= 5000CM \\
 \frac{\$75,000}{5000} &= \underline{\underline{\$15.00}}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad NI &= (CM)X - FC \\
 -\$542.50 &= (\$13.50)X - \$18,970 \\
 \$18,970 - \$542.50 &= (\$13.50)X \\
 \frac{\$18,427.50}{\$13.50} &= \underline{\underline{1365}}
 \end{aligned}$$

$$\begin{aligned}
 9. \quad N &= L(1 - d_1)(1 - d_2)(1 - d_3) \\
 \$1468.80 &= L(1 - 0.20)(1 - 0.15)(1 - 0.10) \\
 \$1468.80 &= L(0.80)(0.85)(0.90) \\
 \frac{\$1468.80}{0.6120} &= \underline{\underline{\$2400.00}}
 \end{aligned}$$

$$\begin{aligned}
 10. \quad c &= \frac{V_f - V_i}{V_i} \\
 0.12 &= \frac{V_f - \$6700}{\$6700}
 \end{aligned}$$

$$0.12(\$6700) = V_f - \$6700$$

$$\begin{aligned}
 \$804 + \$6700 &= V_f \\
 V_f &= \underline{\underline{\$7504.00}}
 \end{aligned}$$

$$\begin{aligned}
 11. \quad c &= \frac{V_f - V_i}{V_i}
 \end{aligned}$$

$$0.07 = \frac{\$1850 - V_i}{V_i}$$

$$0.07V_i = \$1850 - V_i$$

$$0.07V_i + V_i = \$1850$$

$$1.07V_i = \$1850$$

$$V_i = \frac{\$1850}{1.07}$$

$$V_i = \underline{\underline{\$1728.97}}$$

Exercise 2.2 (continued)

Intermediate Problems

$$12. a^2 \times a^3 = \underline{\underline{a^5}}$$

$$13. (x^6)(x^4) = \underline{\underline{x^{10}}}$$

$$14. b^{10} \div b^6 = b^{10-6} = \underline{\underline{b^4}}$$

$$15. h^7 \div h^{-4} = h^{7-(-4)} = \underline{\underline{h^{11}}}$$

$$16. (1+i)^4 \times (1+i)^9 = \underline{\underline{(1+i)^{13}}}$$

$$17. (1+i) \times (1+i)^n = \underline{\underline{(1+i)^{n+1}}}$$

$$18. (x^4)^7 = x^{4 \times 7} = \underline{\underline{x^{28}}}$$

$$19. (y^3)^3 = \underline{\underline{y^9}}$$

$$20. (t^6)^{\frac{1}{3}} = \underline{\underline{t^2}}$$

$$21. (n^{0.5})^8 = \underline{\underline{n^4}}$$

$$22. \frac{(x^5)(x^6)}{x^9} = x^{5+6-9} = \underline{\underline{x^2}}$$

$$23. \frac{(x^5)^6}{x^9} = x^{5 \times 6 - 9} = \underline{\underline{x^{21}}}$$

$$24. [2(1+i)]^2 = \underline{\underline{4(1+i)^2}}$$

$$25. \left(\frac{1+i}{3i}\right)^3 = \underline{\underline{\frac{(1+i)^3}{27i^3}}}$$

$$26. 8^{\frac{4}{3}} = \left(8^{\frac{1}{3}}\right)^4 = 2^4 = \underline{\underline{16}}$$

$$27. -27^{\frac{2}{3}} = -\left(27^{\frac{1}{3}}\right)^2 = \underline{\underline{-9}}$$

28. $\left(\frac{2}{5}\right)^3 = 0.4^3 = \underline{\underline{0.064}}$
29. $5^{-3/4} = 5^{-0.75} = \underline{\underline{0.299070}}$
30. $(0.001)^{-2} = \underline{\underline{1,000,000}}$
31. $0.893^{-1/2} = 0.893^{-0.5} = \underline{\underline{1.05822}}$
32. $(1.0085)^5(1.0085)^3 = 1.0085^8 = \underline{\underline{1.07006}}$
33. $(1.005)^3(1.005)^{-6} = 1.005^{-3} = \underline{\underline{0.985149}}$

Exercise 2.2 (continued)

34. $\sqrt[3]{1.03} = 1.03^{0.\bar{3}} = \underline{\underline{1.00990}}$
35. $\sqrt[6]{1.05} = \underline{\underline{1.00816}}$

Advanced Problems

36. $\frac{4r^5t^6}{(2r^2t)^3} = \frac{4r^5t^6}{8r^6t^3} = \frac{r^{5-6}t^{6-3}}{2} = \frac{t^3}{\underline{\underline{2r}}}$
37. $\frac{(-r^3)(2r)^4}{(2r^{-2})^2} = \frac{-r^3(16r^4)}{4r^{-4}} = -4r^{3+4-(-4)} = \underline{\underline{-4r^{11}}}$
38. $\frac{(3x^2y^3)^5}{(xy^2)^3} = \frac{243x^{10}y^{15}}{x^3y^6} = 243x^{10-3}y^{15-6} = \underline{\underline{243x^7y^9}}$
39. $\frac{6(-3xy)^4}{(-3x^{-3})^2} = \frac{6(81x^4y^4)}{9x^{-6}} = \frac{486x^4y^4}{9x^{-6}} = 54x^{4-(-6)}y^4 = \underline{\underline{54x^{10}y^4}}$
40. $(4^4)(3^{-3})\left(-\frac{3}{4}\right)^3 = \frac{4^4}{3^3}\left(-\frac{3^3}{4^3}\right) = \underline{\underline{-4}}$
41. $\left[\left(-\frac{3}{4}\right)^2\right]^{-2} = \left(-\frac{3}{4}\right)^{-4} = \left(-\frac{4}{3}\right)^4 = \frac{256}{81} = \underline{\underline{3.16049}}$
42. $\left(\frac{2}{3}\right)^3\left(-\frac{3}{2}\right)^2\left(-\frac{3}{2}\right)^{-3} = \left(\frac{2}{3}\right)^3\left(\frac{3}{2}\right)^2\left(-\frac{2}{3}\right)^3 = \frac{2}{3}\left(-\frac{2}{3}\right)^3 = -\frac{16}{81} = \underline{\underline{-0.197531}}$

43. $\frac{1.03^{16} - 1}{0.03} = \underline{\underline{20.1569}}$
44. $\frac{1 - 1.0225^{-20}}{0.0225} = \frac{0.3591835}{0.0225} = \underline{\underline{15.9637}}$
45. $(1 + 0.055)^{1/6} - 1 = \underline{\underline{0.00896339}}$

Exercise 2.3

Basic Problems

1. $10a + 10 = 12 + 9a$
 $10a - 9a = 12 - 10$
 $a = \underline{\underline{2}}$

Exercise 2.3 (continued)

2. $29 - 4y = 2y - 7$
 $36 = 6y$
 $y = \underline{\underline{6}}$
3. $0.5(x - 3) = 20$
 $x - 3 = 40$
 $x = \underline{\underline{43}}$
4. $\frac{1}{3}(x - 2) = 4$
 $x - 2 = 12$
 $x = \underline{\underline{14}}$
5. $y = 192 + 0.04y$
 $y - 0.04y = 192$
 $y = \frac{192}{0.96} = \underline{\underline{200}}$
6. $x - 0.025x = 341.25$
 $0.975x = 341.25$
 $x = \frac{341.25}{0.975} = \underline{\underline{350}}$
7. $12x - 4(2x - 1) = 6(x + 1) - 3$
 $12x - 8x + 4 = 6x + 6 - 3$
 $-2x = -1$
 $x = \underline{\underline{0.5}}$
8. $3y - 4 = 3(y + 6) - 2(y + 3)$
 $= 3y + 18 - 2y - 6$
 $2y = 16$
 $y = \underline{\underline{8}}$
9. $8 - 0.5(x + 3) = 0.25(x - 1)$
 $8 - 0.5x - 1.5 = 0.25x - 0.25$

$$-0.75x = -6.75$$

$$x = \underline{\underline{9}}$$

10. $5(2 - c) = 10(2c - 4) - 6(3c + 1)$
 $10 - 5c = 20c - 40 - 18c - 6$
 $-7c = -56$
 $c = 8$

Exercise 2.3 (continued)

Intermediate Problems

11. $x - y = 2$ ①
 $3x + 4y = 20$ ②
① $\times$ 3: $3x - 3y = 6$
Subtract: $7y = 14$
 $y = 2$

Substitute into equation ①:

$$x - 2 = 2$$

$$x = 4$$

$$(x, y) = (4, 2)$$

Check: LHS of ② = $3(4) + 4(2) = 20 =$ RHS of ②

12. $y - 3x = 11$ ①
 $-4y + 5x = -30$ ②
① $\times$ 4: $4y - 12x = 44$
Add: $-7x = 14$
 $x = -2$

Substitute into equation ①:

$$y - 3(-2) = 11$$

$$y = 11 - 6 = 5$$

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

Check: LHS of ② = $-4(5) + 5(-2) = -30 =$ RHS of ②

13. $7p - 3q = 23$ ①
 $-2p - 3q = 5$ ②
Subtract: $9p = 18$
 $p = 2$

Substitute into equation ①:

$$7(2) - 3q = 23$$

$$3q = -23 + 14$$

$$q = -3$$

$$(p, q) = (2, -3)$$

Check: LHS of ② = $-2(2) - 3(-3) = 5 =$ RHS of ②

14. $y = 2x$ ①
 $7x - y = 35$ ②
Add: $7x = 2x + 35$
 $5x = 35$
 $x = 7$

Substitute into ①:

$$y = 2(7) = 14$$

$$(x, y) = (7, 14)$$

Check: LHS of ② = $7(7) - 14 = 49 - 14 = 35 =$ RHS of ②

Exercise 2.3 (continued)

$$\begin{array}{rcl} 15. & -3c + d = -500 & \textcircled{1} \\ & 0.7c + 0.2d = 550 & \textcircled{2} \end{array}$$

To eliminate d,

$$\textcircled{1} \times 0.2: -0.6c + 0.2d = -100$$

$$\textcircled{2}: \quad \underline{0.7c + 0.2d = 550}$$

$$\text{Subtract:} \quad \underline{-1.3c + 0 = -650}$$

$$c = 500$$

$$\text{Substitute into } \textcircled{1}: \quad d = 3(500) - 500 = 1000$$

$$(c, d) = \underline{(500, 1000)}$$

$$\text{Check:} \quad \text{LHS of } \textcircled{2} = 0.7(500) + 0.2(1000) = 550 = \text{RHS of } \textcircled{2}$$

$$\begin{array}{rcl} 16. & 0.03x + 0.05y = 51 & \textcircled{1} \\ & 0.8x - 0.7y = 140 & \textcircled{2} \end{array}$$

To eliminate y,

$$\textcircled{1} \times 0.7: \quad 0.021x + 0.035y = 35.7$$

$$\textcircled{2} \times 0.05: \quad \underline{0.04x - 0.035y = 7}$$

$$\text{Add:} \quad \underline{0.061x + 0 = 42.7}$$

$$x = 700$$

Substitute into $\textcircled{2}$:

$$0.8(700) - 0.7y = 140$$

$$-0.7y = -420$$

$$y = 600$$

$$(x, y) = \underline{(700, 600)}$$

$$\text{Check:} \quad \text{LHS of } \textcircled{1} = 0.03(700) + 0.05(600) = 51 = \text{RHS of } \textcircled{1}$$

$$\begin{array}{rcl} 17. & 2v + 6w = 1 & \textcircled{1} \\ & 10v - 9w = 18 & \textcircled{2} \end{array}$$

To eliminate v,

$$\textcircled{1} \times 10: \quad 20v + 60w = 10$$

$$\textcircled{2} \times 2: \quad \underline{20v - 18w = 36}$$

$$\text{Subtract:} \quad \underline{0 + 78w = -26}$$

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

Substitute into $\textcircled{1}$:

$$2v + 6\left(-\frac{1}{3}\right) = 1$$

$$2v = 1 + 2$$

$$v = \frac{3}{2}$$

$$(v, w) = \left(\frac{3}{2}, -\frac{1}{3}\right)$$

$$\text{Check:} \quad \text{LHS of } \textcircled{2} = 10\left(\frac{3}{2}\right) - 9\left(-\frac{1}{3}\right) = 18 = \text{RHS of } \textcircled{2}$$

Exercise 2.3 (continued)

$$\begin{array}{rcl} 18. & 2.5a + 2b = 11 & \textcircled{1} \\ & 8a + 3.5b = 13 & \textcircled{2} \end{array}$$

To eliminate b,

$$\textcircled{1} \times 3.5: \quad 8.75a + 7b = 38.5$$

$$\textcircled{2} \times 2: \quad \underline{16a + 7b = 26}$$

$$\begin{array}{r} \text{Subtract:} \\ -7.25a + 0 = 12.5 \\ a = -1.724 \end{array}$$

Substitute into $\textcircled{1}$:

$$2.5(-1.724) + 2b = 11$$

$$2b = 11 + 4.31$$

$$b = 7.655$$

$$(a, b) = \underline{(-1.72, 7.66)}$$

$$\text{Check:} \quad \text{LHS of } \textcircled{2} = 8(-1.724) + 3.5(7.655) = 13.00 = \text{RHS of } \textcircled{2}$$

$$\begin{array}{rcl} 19. & 37x - 63y = 235 & \textcircled{1} \\ & 18x + 26y = 468 & \textcircled{2} \end{array}$$

To eliminate x,

$$\textcircled{1} \times 18: \quad 666x - 1134y = 4230$$

$$\textcircled{2} \times 37: \quad \underline{666x + 962y = 17,316}$$

$$\begin{array}{r} \text{Subtract:} \\ 0 - 2096y = -13,086 \\ y = 6.243 \end{array}$$

Substitute into $\textcircled{1}$:

$$37x - 63(6.243) = 235$$

$$37x = 628.3$$

$$x = 16.98$$

$$(x, y) = \underline{(17.0, 6.24)}$$

$$\text{Check:} \quad \text{LHS of } \textcircled{2} = 18(16.98) + 26(6.243) = 468.0 = \text{RHS of } \textcircled{2}$$

$$\begin{array}{rcl} 20. & 68.9n - 38.5m = 57 & \textcircled{1} \\ & 45.1n - 79.4m = -658 & \textcircled{2} \end{array}$$

To eliminate n,

$$\textcircled{1} \times 45.1: \quad 3107n - 1736.4m = 2571$$

$$\textcircled{2} \times 68.9: \quad \underline{3107n - 5470.7m = -45,336}$$

$$\begin{array}{r} \text{Subtract:} \\ 0 + 3734.3m = 47,907 \\ m = 12.83 \end{array}$$

Substitute into $\textcircled{1}$:

$$68.9n - 38.5(12.83) = 57$$

$$68.9n = 551.0$$

$$n = 7.996$$

$$(m, n) = \underline{(12.8, 8.00)}$$

$$\text{Check:} \quad \text{LHS of } \textcircled{2} = 45.1(7.996) - 79.4(12.83) = -658.1 = \text{RHS of } \textcircled{2}$$

Advanced Problems

$$\begin{array}{rcl} 21. & \frac{x}{1.1^2} + 2x(1.1)^3 = \$1000 \\ & 0.8264463x + 2.622x = \$1000 \\ & 3.488446x = \$1000 \\ & x = \underline{\underline{\$286.66}} \end{array}$$

Exercise 2.3 (continued)

$$\begin{aligned} 22. \quad & \frac{3x}{1.025^6} + x(1.025)^8 = \$2641.35 \\ & 2.586891x + 1.218403x = \$2641.35 \\ & x = \underline{\underline{\$694.13}} \end{aligned}$$

$$\begin{aligned} 23. \quad & \frac{2x}{1.03^7} + x + x(1.03^{10}) = \$1000 + \frac{\$2000}{1.03^4} \\ & 1.626183x + x + 1.343916x = \$1000 + \$1776.974 \\ & 3.970099x = \$2776.974 \\ & x = \underline{\underline{\$699.47}} \end{aligned}$$

$$\begin{aligned} 24. \quad & x(1.05)^3 + \$1000 + \frac{x}{1.05^7} = \frac{\$5000}{1.05^2} \\ & 1.157625x + 0.7106813x = \$4535.147 - \$1000 \\ & x = \underline{\underline{\$1892.17}} \end{aligned}$$

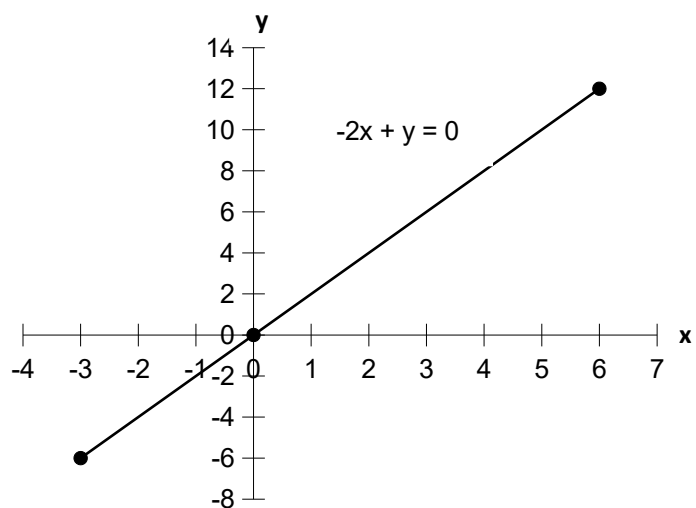
$$\begin{aligned} 25. \quad & x \left(1 + 0.095 \times \frac{84}{365} \right) + \frac{2x}{1 + 0.095 \times \frac{108}{365}} = \$1160.20 \\ & 1.021863x + 1.945318x = \$1160.20 \\ & 2.967181x = \$1160.20 \\ & x = \underline{\underline{\$391.01}} \end{aligned}$$

Exercise 2.4

Basic Problems

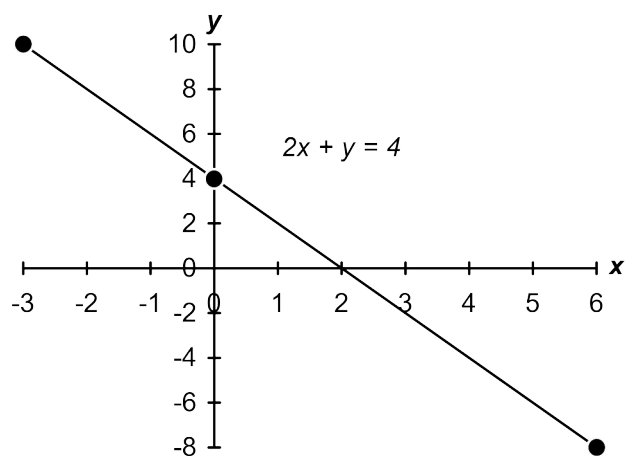
1.

x:	-3	0	6
y:	-6	0	12



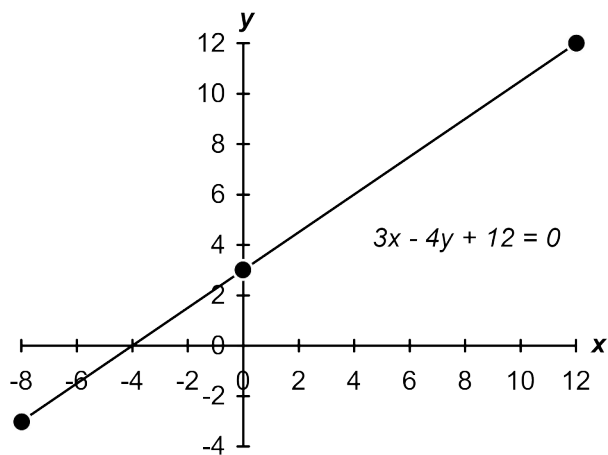
2.

x:	-3	0	6
y:	10	4	-8



3.

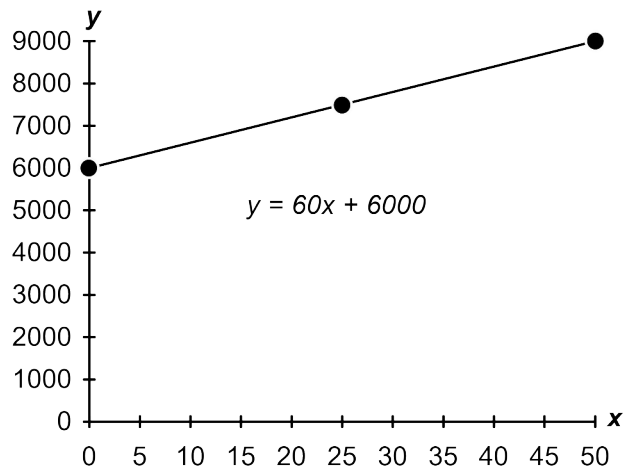
x:	-8	0	12
y:	-3	3	12



Exercise 2.4 (continued)

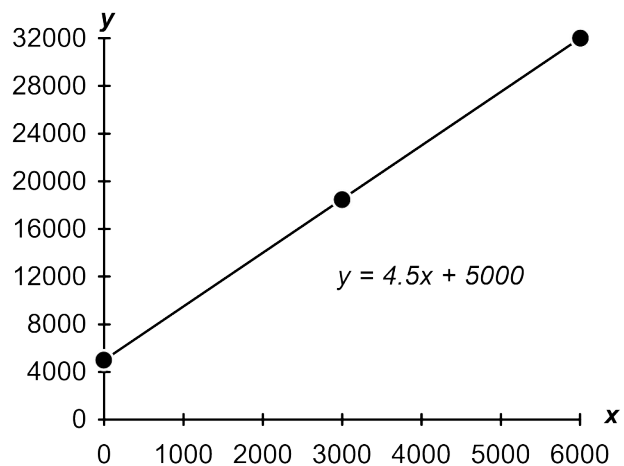
4.

x:	0	25	50
y:	6000	7500	9000



5.

x:	0	3000	6000
y:	5000	18,500	32,000



6. In each part, rearrange the equation to render it in the form $y = mx + b$

a. $2x = 3y + 4$

$$3y = 2x - 4$$

$$y = \frac{2}{3}x - \frac{4}{3}$$

The slope is $m = \frac{2}{3}$ and the y-intercept is $b = -\frac{4}{3}$.

b. $8 - 3x = 2y$

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

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

The slope is $m = -\frac{3}{2}$ and the y-intercept is $b = 4$

(continued)

Exercise 2.4 (continued)

6. c. $8x - 2y - 3 = 0$

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

$$y = 4x - \frac{3}{2}$$

The slope is $m = 4$ and the y-intercept is $b = -\frac{3}{2}$.

d. $6x = 9y$

$$y = \frac{6}{9}x = \frac{2}{3}x$$

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

The slope is $m = \frac{2}{3}$ and the y-intercept is $b = 0$.

Intermediate Problems

7. The plumber charges a \$100 service charge plus $4(\$20) = \80 per hour

Then $C = \$100 + \$80H$

Expressing this equation in the form $y = mx + b$

$$C = \$80H + \$100$$

On a plot of C vs. H , slope = \$80 and C-intercept = \$100.

8. Ehud earns \$1500 per month plus 5% of sales. Then gross earnings

$$E = \$1500 + 0.05R$$

Expressing this equation in the form $y = mx + b$

$$E = 0.05R + \$1500$$

On a plot of E vs. R , slope = 0.05 and E-intercept = \$1500.

9. a. Comparing the equation $F = \frac{9}{5}C + 32$ to $y = mx + b$,
we can conclude that a plot of F vs. C will have

$$\text{slope} = \frac{9}{5} \text{ and } \text{F-intercept} = 32.$$

b.
$$\text{Slope} = \frac{\text{Change in } F}{\text{Change in } C}$$

Therefore, $(\text{Change in } F) = \text{Slope}(\text{Change in } C) = \frac{9}{5}(10 \text{ Celsius}) = \underline{18 \text{ Fahrenheit}}$

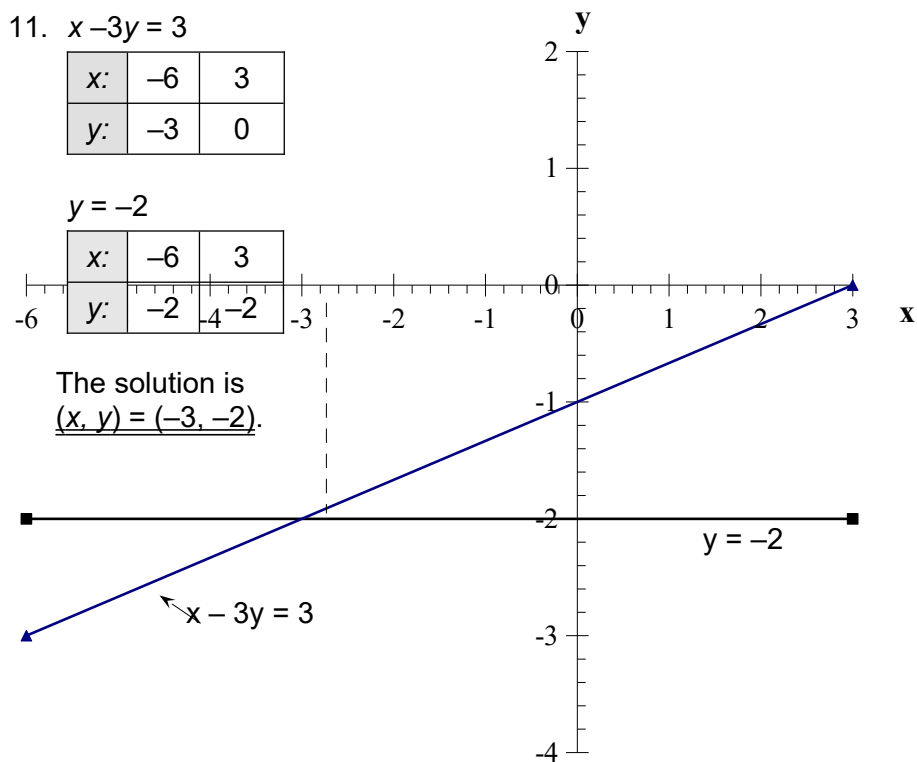
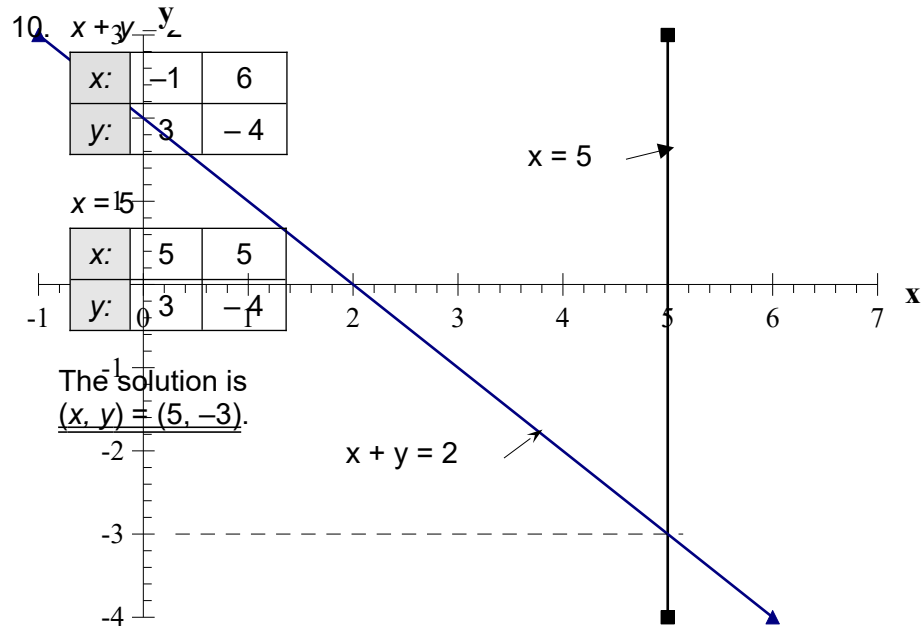
c.
$$F = \frac{9}{5}C + 32$$

$$\frac{9}{5}C = F - 32$$

$$C = \frac{5}{9}F - \frac{5}{9}(32) = \frac{5}{9}F - 17\frac{7}{9}$$

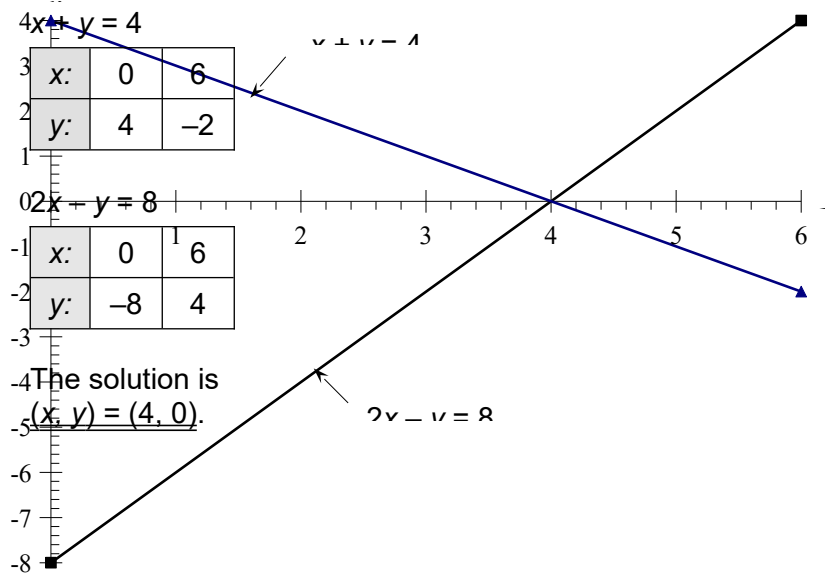
On a plot of C vs. F, slope = $\frac{5}{9}$ and C-intercept = $-17\frac{7}{9}$.

Exercise 2.4 (continued)

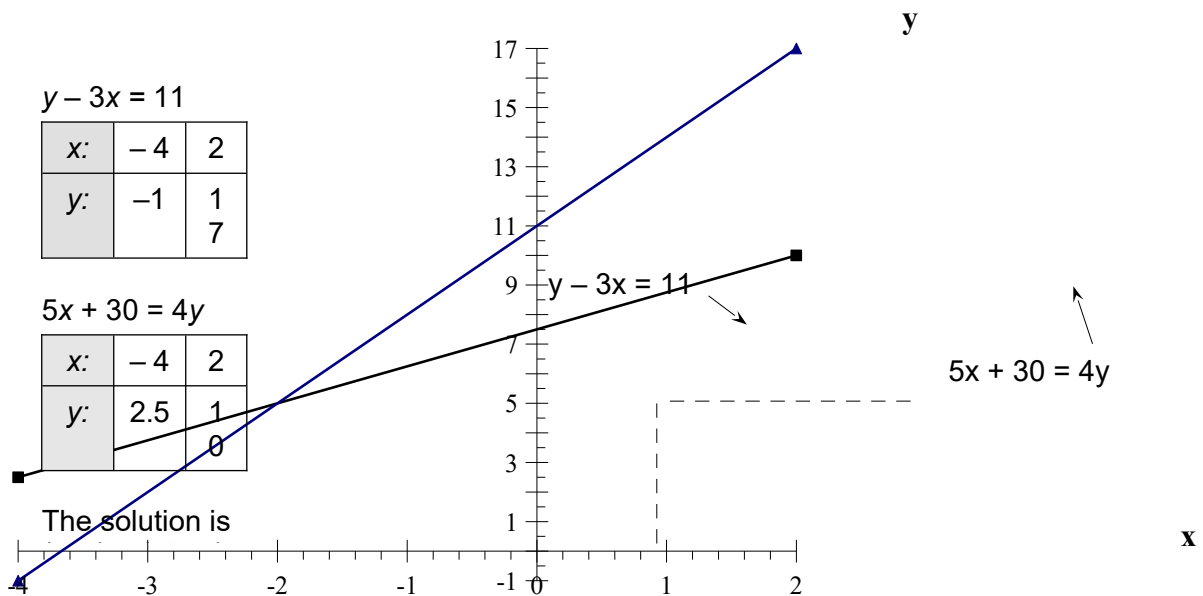


Exercise 2.4 (continued)

12.



13.



Exercise 2.4 (continued)

Advanced Problem

14. a. Given: $TR = \$6X$

On a plot of TR vs. X , slope = \$6 and TR -intercept = \$0.

- b. $TC = \$2X + \$80,000$

On a plot of TC vs. X , slope = \$2 and TC -intercept = \$80,000.

- c. $NI = \$4X - \$80,000$

On a plot of NI vs. X , slope = \$4 and NI -intercept = - \$80,000.

- d. The steepest line is the one with the largest slope.

Therefore, the TR line is steepest.

- e. The increase in NI per pair of sunglasses sold is the “change in NI ” divided by the “change in X ”. This is just the slope of the NI vs. X line. Therefore, NI increases by \$4 for each pair of sunglasses sold.

- f. The coefficient of X in the TR equation is the unit selling price, which is unchanged.

Therefore, the slope remains unchanged.

The coefficient of X in the TC equation is the unit cost.

Therefore, the slope decreases (from \$2 to \$1.75).

The coefficient of X in the NI equation equals

$$(\text{Unit selling price}) - (\text{Unit cost})$$

Therefore, the slope increases (from \$4 to \$4.25).

Exercise 2.5

Basic Problems

1. Step 2: Hits last month = 2655 after the $\frac{2}{7}$ increase.
Let the number of hits 1 year ago be n .

Step 3: Hits last month = Hits 1 year ago + $\frac{2}{7}$ (Hits 1 year ago)

Step 4: $2655 = n + \frac{2}{7}n$

Step 5: $2655 = \frac{9}{7}n$

Multiply both sides by $\frac{7}{9}$.

$$n = 2655 \times \frac{7}{9} = 2065$$

The Web site had 2065 hits in the same month 1 year ago.

2. Step 2: Retail price = \$712; Markup = 60% of wholesale of cost.
Let the wholesale cost be C .

Step 3: Retail price = Cost + 0.60(Cost)

Step 4: $\$712 = C + 0.6C$

Step 5: $\$712 = 1.6C$

$$C = \frac{\$712}{1.6} = \underline{\underline{\$445.00.}}$$

$C =$

The wholesale cost is \$445.00.

Exercise 2.5 (continued)

3. Step 2: Tag price = \$39.95 (including 13% HST). Let the plant's pretax price be P .

Step 3: Tag price = Pretax price + HST

$$\text{Step 4: } \$39.95 = P + 0.13P$$

$$\text{Step 5: } \$39.95 = 1.13P$$

$$P = \frac{\$39.95}{1.13} = \$35.35$$

The amount of HST is $\$39.95 - \$35.35 = \underline{\$4.60}$

4. Step 2: Commission rate = 2.5% on the first \$5000 and 1.5% on the remainder
Commission amount = \$227. Let the transaction amount be x .

$$\text{Step 3: Commission amount} = 0.025(\$5000) + 0.015(\text{Remainder})$$

$$\text{Step 4: } \$227 = \$125.00 + 0.015(x - \$5000)$$

$$\text{Step 5: } \$102 = 0.015x - \$75.00$$

$$\$102 + \$75 = 0.015x$$

$$x = \frac{\$177}{0.015} = \underline{\$11,800.00}$$

The amount of the transaction was \$11,800.00.

5. Step 2: Let the basic price be P . First 20 meals at P .
Next 20 meals at $P - \$2$. Additional meals at $P - \$3$.

$$\text{Step 3: Total price for 73 meals} = \$1686$$

$$\text{Step 4: } 20P + 20(P - \$2) + (73 - 40)(P - \$3) = \$1686$$

$$\text{Step 5: } 20P + 20P - \$40 + 33P - \$99 = \$1686$$

$$73P = \$1686 + \$99 + \$40$$

$$P = \frac{\$1825}{73} = \underline{\$25.00}$$

The basic price per meal is \$25.00.

6. Step 2: Rental Plan 1: \$295 per week + \$0.15 $\times$ (Distance in excess of 1000 km)
Rental Plan 2: \$389 per week
Let d represent the distance at which the costs of both plans are equal.

$$\text{Step 3: Cost of Plan 1} = \text{Cost of Plan 2}$$

$$\text{Step 4: } \$295 + \$0.15(d - 1000) = \$389$$

$$\text{Step 5: } \$295 + \$0.15d - \$150 = \$389$$

$$\$0.15d = \$244$$

$$d = \underline{1627 \text{ km}}$$

To the nearest kilometre, the unlimited driving plan will be cheaper if you drive more than 1627 km in the one-week interval.

Exercise 2.5 (continued)

7. Step 2: Tax rate = 38%; Overtime hourly rate = $1.5(\$23.50) = \35.25

Cost of canoe = \$2750

Let h represent the hours of overtime Alicia must work.

Step 3: Gross overtime earnings – Income tax = Cost of the canoe

Step 4: $\$35.25h - 0.38(\$35.25h) = \$2750$

Step 5: $\$21.855h = \2750

$$h = 125.83 \text{ hours}$$

Alicia must work 125 $\frac{3}{4}$ hours of overtime to earn enough money to buy the canoe.

8. Let x represent the number of units of product X and y represent the number of units of product Y. Then

$$x + y = 93 \quad \textcircled{1}$$

$$0.5x + 0.75y = 60.5 \quad \textcircled{2}$$

$$\textcircled{1} \div 0.5: \quad 0.5x + 0.5y = 46.5$$

$$\text{Subtract:} \quad 0 + 0.25y = 14$$

$$y = 56$$

$$\text{Substitute into } \textcircled{1}: \quad x + 56 = 93$$

$$x = 37$$

Therefore, 37 units of X and 56 units of Y were produced last week.

9. Let the price per litre of milk be m and the price per dozen eggs be e . Then

$$5m + 4e = \$19.51 \quad \textcircled{1}$$

$$9m + 3e = \$22.98 \quad \textcircled{2}$$

To eliminate e ,

$$\textcircled{1} \div 3: \quad 15m + 12e = \$58.53$$

$$\textcircled{2} \div 4: \quad 36m + 12e = \$91.92$$

$$\text{Subtract:} \quad -21m + 0 = -\$33.39$$

$$m = \$1.59$$

$$\text{Substitute into } \textcircled{1}: \quad 5(\$1.59) + 4e = \$19.51$$

$$e = \$2.89$$

Milk costs \$1.59 per litre and eggs cost \$2.89 per dozen.

10. Let M be the number of litres of milk and J be the number of cans of orange juice per week.

$$\$1.50M + \$1.30J = \$57.00 \quad \textcircled{1}$$

$$\$1.60M + \$1.39J = \$60.85 \quad \textcircled{2}$$

To eliminate M ,

$$\textcircled{1} \div 1.60: \quad \$2.40M + \$2.08J = \$91.20$$

$$\textcircled{2} \div 1.50: \quad \$2.40M + \$2.085J = \$91.275$$

$$\text{Subtract:} \quad 0 - 0.005J = -\$0.075$$

$$J = 15$$

Substitution of $J = 15$ into either equation will give $M = 25$. Hence 25 litres of milk and 15 cans of orange juice are purchased each week.

Exercise 2.5 (continued)

Intermediate Problems

11. Step 2: Number of two-bedroom homes = $0.4(\text{Number of three-bedroom homes})$
Number of two-bedroom homes = $2(\text{Number of four-bedroom homes})$
Total number of homes = 96
Let h represent the number of two-bedroom homes

Step 3: # 2-bedroom homes + # 3-bedroom homes + # 4-bedroom homes = 96

$$h + \frac{h}{0.4} + \frac{h}{2} = 96$$

Step 4:

Step 5: $h + 2.5h + 0.5h = 96$

$$4h = 96$$

$$h = 24$$

There should be 24 two-bedroom homes, $2.5(24) =$ 60 three-bedroom homes,
and $0.5(24) =$ 12 four-bedroom homes.

12. Step 2: Cost of radio advertising = $0.5(\text{Cost of internet advertising})$
Cost of TV advertising = $0.6(\text{Cost of radio advertising})$
Total advertising budget = \$160,000
Let r represent the amount allocated to radio advertising

Step 3: Radio advertising + TV advertising + Internet advertising = \$160,000

$$r + 0.6r + \frac{r}{0.5} = \$160,000$$

Step 4:

Step 5: $3.6r = \$160,000$

$$r = \$44,444.44$$

The advertising budget allocations should be:

\$44,444 to radio advertising,

$0.6(\$44,444.44) =$ \$26,667 to TV advertising, and

$2(\$44,444.44) =$ \$88,889 to internet advertising.

13. Step 2: By-laws require: 5 parking spaces per 100 square meters,
4% of spaces for customers with physical disabilities
In remaining 96%, # regular spaces = $1.4(\text{\# small car spaces})$
Total area = 27,500 square meters

Let s represent the number of small car spaces.

Step 3: Total # spaces = # spaces for customers with physical disabilities + # regular spaces + # small spaces

$$\text{Step 4: } \frac{27,500}{100} \times 5 = 0.04 \times \frac{27,500}{100} \times 5 + s + 1.4s$$

Step 5: $1375 = 55 + 2.4s$

$$s = 550$$

The shopping centre must have 55 parking spaces for customers with physical disabilities,
550 small-car spaces, and 770 regular parking spaces.

Exercise 2.5 (continued)

14. Step 2: Overall portfolio's rate of return = 1.1%, equity fund's rate of return = -3.3%, bond fund's rate of return = 7.7%.

Let e represent the fraction of the portfolio initially invested in the equity fund.

Step 3: Overall rate of return = Weighted average rate of return
 $= (\text{Equity fraction})(\text{Equity return}) + (\text{Bond fraction})(\text{Bond return})$

Step 4: $1.1\% = e(-3.3\%) + (1 - e)(7.7\%)$

Step 5: $1.1 = -3.3e + 7.7 - 7.7e$
 $-6.6 = -11.0e$
 $e = 0.600$

Therefore, 60.0% of Erin's original portfolio was invested in the equity fund.

15. Step 2: Pile A steel is 5.25% nickel; pile B steel is 2.84% nickel.
We want a 32.5-tonne mixture from A and B averaging 4.15% nickel.
Let A represent the tonnes of steel required from pile A.

Step 3: Wt. of nickel in 32.5 tonnes of mixture
 $= \text{Wt. of nickel in steel from pile A} + \text{Wt. of nickel in steel from pile B}$
 $= (\% \text{ nickel in pile A})(\text{Amount from A}) + (\% \text{ nickel in pile B})(\text{Amount from B})$

Step 4: $0.0415(32.5) = 0.0525A + 0.0284(32.5 - A)$

Step 5: $1.34875 = 0.0525A + 0.9230 - 0.0284A$
 $0.42575 = 0.0241A$
 $A = 17.67 \text{ tonnes}$

The recycling company should mix 17.67 tonnes from pile A with 14.83 tonnes from pile B.

16. Step 2: Total options = 100,000
of options to an executive = 2000 + # of options to an engineer
of options to an engineer = 1.5(# of options to a technician)
There are 3 executives, 8 engineers, and 14 technicians.
Let t represent the number of options to each technician.

Step 3: Total options = Total options to engineers
+ Total options to technicians + Total options to executives

Step 4: $100,000 = 8(1.5t) + 14t + 3(2000 + 1.5t)$

Step 5: $= 12t + 14t + 6000 + 4.5t$
 $94,000 = 30.5t$
 $t = 3082 \text{ options}$

Each technician will receive 3082 options,
each engineer will receive $1.5(3082) = \underline{4623 \text{ options}}$,
and each executive will receive $2000 + 4623 = \underline{6623 \text{ options}}$.

Exercise 2.5 (continued)

17. Step 2: Plan A: 20 cents/minute for local calls and 40 cents/minute for long distance calls
Plan B: 35 cents/minute any time
Let d represent the fraction of long-distance usage at which costs are equal.

Step 3: Cost of Plan A = Cost of plan B

Step 4: Pick any amount of usage in a month—say 1000 minutes.

$$d(1000)\$0.40 + (1 - d)(1000)\$0.20 = 1000(\$0.35)$$

$$\begin{aligned}\text{Step 5:} \quad 400d + 200 - 200d &= 350 \\ 200d &= 150 \\ d &= 0.75\end{aligned}$$

If long distance usage exceeds 75% of overall usage, plan B will be cheaper.

18. Step 2: Raisins cost \$3.75 per kg; peanuts cost \$2.89 per kg.
Cost per kg of ingredients in 50 kg of “trail mix” is to be \$3.20.
Let p represent the weight of peanuts in the mixture.

Step 3: Cost of 50 kg of trail mix = Cost of p kg peanuts + Cost of $(50 - p)$ kg of raisins

$$\text{Step 4: } 50(\$3.20) = p(\$2.89) + (50 - p)(\$3.75)$$

$$\begin{aligned}\text{Step 5: } \$160.00 &= \$2.89p + \$187.50 - \$3.75p \\ -\$27.50 &= -\$0.86p \\ p &= 31.98 \text{ kg}\end{aligned}$$

32.0 kg of peanuts should be mixed with 18.0 kg of raisins.

19. Step 2: Total bill = \$3310. Total hours = 41.
Hourly rate = \$120 for CGA
= \$50 for clerk.

Let x represent the CGA's hours.

Step 3: Total bill = (CGA hours x CGA rate) + (Clerk hours x Clerk rate)

$$\begin{aligned}\text{Step 4: } \$3310 &= x(\$120) + (41 - x)\$50 & \text{Step 5: } \$3310 &= \$120x + \$2050 - \$50x \\ 1260 &= 70x & x &= 18\end{aligned}$$

The CGA worked 18 hours and the clerk worked $41 - 18 =$ 23 hours.

20. Step 2: Total investment = \$32,760
Sue's investment = 1.2(Joan's investment)
Joan's investment = 1.2(Stella's investment)
Let L represent Stella's investment.

Step 3: Sue's investment + Joan's investment + Stella's investment = Total investment

$$\begin{aligned}\text{Step 4: } \text{Joan's investment} &= 1.2L \\ \text{Sue's investment} &= 1.2(1.2L) = 1.44L \\ 1.44L + 1.2L + L &= \$32,760\end{aligned}$$

$$\begin{aligned}\text{Step 5:} \quad 3.64L &= \$32,760 \\ L &= \frac{\$32,760}{3.64} = \$9000\end{aligned}$$

(continued)

Exercise 2.5 (continued)

Stella will contribute \$9000, Joan will contribute $1.2(\$9000) = \$10,800$, and Sue will contribute $1.2(\$10,800) = \$12,960$

21. Step 2: Sven receives 30% less than George (or 70% of George's share).
Robert receives 25% more than George (or 1.25 times George's share).
Net income = \$88,880
Let G represent George's share.
- Step 3: George's share + Robert's share + Sven's share = Net income
- Step 4: $G + 1.25G + 0.7G = \$88,880$
- Step 5: $2.95G = \$88,880$
 $G = \$30,128.81$
George's share is \$30,128.81, Robert's share is $1.25(\$30,128.81) = \$37,661.02$,
and Sven's share is $0.7(\$30,128.81) = \$21,090.17$.
22. Step 2: Time to make X is 20 minutes.
Time to make Y is 30 minutes.
Total time is 47 hours. Total units = 120. Let Y represent the number of units of Y.
- Step 3: Total time = (Number of X) $\times$ (Time for X) + (Number of Y) $\times$ (Time for Y)
- Step 4: $47 \times 60 = (120 - Y)20 + Y(30)$
- Step 5: $2820 = 2400 - 20Y + 30Y$
 $420 = 10Y$
 $Y = 42$
Forty-two units of product Y were manufactured.
23. Step 2: Price of blue ticket = \$19.00. Price of red ticket = \$25.50.
Total tickets = 4460. Total revenue = \$93,450.
Let the number of tickets in the red section be R.
- Step 3: Total revenue = (Number of red $\times$ Price of red) + (Number of blue $\times$ Price of blue)
- Step 4: $\$93,450 = R(\$25.50) + (4460 - R)\$19.00$
- Step 5: $93,450 = 25.5R + 84,740 - 19R$
 $6.5R = 8710$
 $R = 1340$
1340 seats were sold in the red section and $4460 - 1340 = 3120$ seats were sold in the blue section.
24. Step 2: Regal owns a 58% interest in a mineral claim. Yukon owns the remainder (42%).
Regal sells one fifth of its interest for \$1.2 million.
Let the V represent the implied value of the entire mineral claim.
- Step 3: $\frac{1}{5}$ (or 20%) of a 58% interest is worth \$1.2 million
- Step 4: $0.20(0.58)V = \$1,200,000$
\$1,200,000
- Step 5: $V = 0.20 \times 0.58 = \$10,344,828$
The implied value of Yukon's interest is
 $0.42V = 0.42 \times \$10,344,828 = \$4,344,828$

Exercise 2.5 (continued)

25. Step 2: $\frac{5}{7}$ of entrants complete Level 1. $\frac{2}{9}$ of Level 1 completers fail Level 2.
587 students completed Level 2 last year.

Let the N represent the original number who began Level 1.

Step 3: $\frac{7}{9}$ of $\frac{5}{7}$ of entrants will complete Level 2.

Step 4: $\frac{7}{9} \times \frac{5}{7} N = 587$

Step 5: $N = \frac{9 \times 7}{7 \times 5} \times 587 = 1056.6$
1057 students began Level 1.

26. Step 2: $\frac{4}{7}$ of inventory was sold at cost.

$\frac{3}{7}$ inventory was sold to liquidators at 45% of cost, yielding \$6700.
Let C represent the original cost of the entire inventory.

Step 3: $\frac{3}{7}$ of inventory was sold to liquidators at 45% of cost, yielding \$6700.

Step 4: $\frac{3}{7} (0.45C) = \$6700$
 $\frac{7 \times \$6700}{3 \times 0.45}$

Step 5: $C = \frac{3 \times 0.45}{7} = \$34,740.74$

a. The cost of inventory sold to liquidators was

$$\frac{3}{7} (\$34,740.74) = \underline{\$14,888.89}$$

b. The cost of the remaining inventory sold in the bankruptcy sale was
 $\$34,740.74 - \$14,888.89 = \underline{\$19,851.85}$

27. Let r represent the number of regular members and s the number of student members.

Then $r + s = 583$ ①

Total revenue: $\$2140r + \$856s = \$942,028$ ②

① $\times \$856$: $\underline{\$856r + \$856s = \$499,048}$

Subtract: $\$1284r + 0 = \$442,980$

$$r = 345$$

Substitute into ①: $345 + s = 583$

$$s = 238$$

The club had 238 student members and 345 regular members.

28. Let a represent the adult airfare and c represent the child airfare.

Mrs. Ramsey's cost: $a + 2c = \$610$ ①

Chudnowskis' cost: $2a + 3c = \$1050$ ②

① $\times 2$: $\underline{2a + 4c = \$1220}$

Subtract: $0 + -c = -\$170$

Substitute $c = \$170$ into ①: $a + 2(\$170) = \610

$$a = \$610 - \$340 = \$270$$

The airfare is \$270 per adult and \$170 per child.

Exercise 2.5 (continued)

29. Let h represent the rate per hour and k represent the rate per km.

$$\text{Vratislav's cost: } 2h + 47k = \$ 54.45 \quad \textcircled{1}$$

$$\text{Bryn's cost: } 5h + 93k = \$127.55 \quad \textcircled{2}$$

To eliminate h ,

$$\textcircled{1} \times 5: \quad 10h + 235k = \$272.25 \quad \textcircled{1}$$

$$\textcircled{2} \times 2: \quad 10h + 186k = \$255.10 \quad \textcircled{2}$$

$$\begin{array}{r} \text{Subtract:} \\ 0 + 49k = \$ 17.15 \\ k = \$0.35 \text{ per km} \end{array}$$

Substitute into $\textcircled{1}$:

$$2h + 47(\$0.35) = \$54.45$$

$$2h = \$54.45 - \$16.45$$

$$h = \$19.00 \text{ per hour}$$

Budget Truck Rentals charged \$19.00 per hour plus \$0.35 per km.

Advanced Problems

30. Step 2: Each of 4 children receive $0.5(\text{Wife's share})$.

Each of 13 grandchildren receive $0.\bar{3}(\text{Child's share})$.

Total distribution = \$759,000. Let w represent the wife's share.

Step 3: Total amount = Wife's share + 4(Child's share) + 13(Grandchild's share)

$$\text{Step 4: } \$759,000 = w + 4(0.5w) + 13(0.\bar{3})(0.5w)$$

$$\begin{aligned} \text{Step 5: } \$759,000 &= w + 2w + 2.1\bar{6}w \\ &= 5.1\bar{6}w \end{aligned}$$

$$w = \$146,903.226$$

$$\text{Each child will receive } 0.5(\$146,903.226) = \$73,451.61$$

$$\text{and each grandchild will receive } 0.\bar{3}(\$73,451.61) = \$24,483.87.$$

31. Step 2: Stage B workers = $1.6(\text{Stage A workers})$

Stage C workers = $0.75(\text{Stage B workers})$

Total workers = 114. Let A represent the number of Stage A workers.

Step 3: Total workers = A workers + B workers + C workers

$$\text{Step 4: } 114 = A + 1.6A + 0.75(1.6A)$$

$$\text{Step 5: } 114 = 3.8A$$

$$A = 30$$

30 workers should be allocated to Stage A, $1.6(30) = \underline{48}$ workers to Stage B,
and $114 - 30 - 48 = \underline{36}$ workers to Stage C.

32. Step 2: Hillside charge = $2(\text{Barnett charge}) - \1000

Westside charge = Hillside charge + \$2000

Total charges = \$27,600. Let B represent the Barnett charge.

Step 3: Total charges = Barnett charge + Hillside charge + Westside charge

$$\text{Step 4: } \$27,600 = B + 2B - \$1000 + 2B - \$1000 + \$2000$$

$$\text{Step 5: } \$27,600 = 5B$$

$$B = \$5520$$

Hence, the Westside charge is $2(\$5520) - \$1000 + \$2000 = \underline{\underline{\$12,040}}$

Exercise 2.6

Basic Problems

$$1. \quad c = \frac{V_f - V_i}{V_i} \times 100 = \frac{\$100 - \$95}{\$95} \times 100 = \underline{\underline{5.26\%}}$$

$$2. \quad c = \frac{V_f - V_i}{V_i} \times 100 = \frac{35 \text{ kg} - 135 \text{ kg}}{135 \text{ kg}} \times 100 = \underline{\underline{-74.07\%}}$$

$$3. \quad c = \frac{V_f - V_i}{V_i} \times 100 = \frac{0.13 - 0.11}{0.11} \times 100 = \underline{\underline{18.18\%}}$$

$$4. \quad c = \frac{V_f - V_i}{V_i} \times 100 = \frac{0.085 - 0.095}{0.095} \times 100 = \underline{\underline{-10.53\%}}$$

$$5. \quad V_f = V_i (1+c) = \$134.39[1+(-0.12)] = \$134.39(0.88) = \underline{\underline{\$118.26}}$$

$$6. \quad V_f = V_i (1+c) = 112g(1+1.12) = \underline{\underline{237.44g}}$$

$$7. \quad V_i = \frac{V_f}{1+c} = \frac{\$75}{1+2.00} = \underline{\underline{\$25.00}}$$

$$8. \quad V_i = \frac{V_f}{1+c} = \frac{\$75}{1+(-0.50)} = \underline{\underline{\$150.00}}$$

$$9. \quad \text{Given: } V_i = \$90, V_f = \$100$$

$$c = \frac{\$100 - \$90}{\$90} \times 100 = \underline{\underline{11.11\%}}$$

\$100 is 11.11% more than \$90.

$$10. \quad \text{Given: } V_i = \$110, V_f = \$100$$

$$c = \frac{V_f - V_i}{V_i} \times 100 = \frac{\$100 - \$110}{\$110} \times 100 = \underline{\underline{-9.09\%}}$$

\$100 is 9.09% less than \$110.

$$11. \quad \text{Given: } c = 25\%, V_f = \$100$$

$$V_i = \frac{V_f}{1+c} = \frac{\$100}{1+0.25} = \underline{\underline{\$80.00}}$$

\$80.00 increased by 25% equals \$100.00.

$$12. \quad \text{Given: } V_f = \$75, c = 75\%$$

$$V_i = \frac{V_f}{1+c} = \frac{\$75}{1+0.75} = \underline{\underline{\$42.86}}$$

\$75 is 75% more than \$42.86.

$$13. \quad \text{Given: } V_i = \$759.00, V_f = \$754.30$$

$$c = \frac{V_f - V_i}{V_i} \times 100 = \frac{\$754.30 - \$759.00}{\$759.00} \times 100 = \underline{\underline{-0.62\%}}$$

\$754.30 is 0.62% less than \$759.00.

Exercise 2.6 (continued)

14. Given: $V_i = \$75$, $c = 75\%$

$$V_f = V_i(1 + c) = \$75(1 + 0.75) = \underline{\underline{\$131.25}}$$

\$75.00 becomes \$131.25 after an increase of 75%.

15. Given: $V_f = \$100$, $c = -10\%$

$$V_i = \frac{V_f}{1 + c} = \frac{\$100}{1 + (-0.10)} = \underline{\underline{\$111.11}}$$

\$100.00 is 10% less than \$111.11.

16. Given: $V_f = \$100$, $c = -20\%$

$$V_i = \frac{V_f}{1 + c} = \frac{\$100}{1 + (-0.20)} = \underline{\underline{\$125.00}}$$

\$125 after a reduction of 20% equals \$100.

17. Given: $V_i = \$900$, $c = -90\%$

$$V_f = V_i(1 + c) = \$900[1 + (-0.9)] = \underline{\underline{\$90.00}}$$

\$900 after a decrease of 90% is \$90.00.

18. Given: $c = 0.75\%$, $V_i = \$10,000$

$$V_f = V_i(1 + c) = \$10,000(1 + 0.0075) = \underline{\underline{\$10,075.00}}$$

\$10,000 after an increase of $\frac{3}{4}\%$ is \$10,075.00.

19. Given: $c = 210\%$, $V_f = \$465$

$$V_i = \frac{V_f}{1 + c} = \frac{\$465}{1 + 2.1} = \underline{\underline{\$150.00}}$$

\$150.00 after being increased by 210% equals \$465.

Intermediate Problems

20. Let the retail price be p . Then

$$p + 0.13p = \$281.37$$

$$\underline{\$281.37}$$

$$p = \frac{1.13}{1.13} = \underline{\underline{\$249.00}}$$

The jacket's retail price was \$249.00.

21. Let the number of students enrolled in September, 2014 be s . Then

$$s + 0.0526s = 1200$$

$$1.0526s = 1200$$

$$\underline{1200}$$

$$s = \frac{1200}{1.0526} \approx \underline{\underline{1140}}$$

Rounded to the nearest person, the number of students enrolled in September, 2014 was 1140.

22. Let next year's sales be n . Then

$$n = \$18,400(1 + 0.12)$$

$$n = \underline{\$20,608}$$

Nykita is expecting next year's sales to be \$20,608.

Exercise 2.6 (continued)

23. Given: $V_i = \$285,000$, $V_f = \$334,000$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$334,000 - \$285,000}{\$285,000} \times 100\% = \underline{17.19\%}$$

The value of Amir's real estate investment grew by 17.19%.

24. Let Jamal's earnings this year be e . Then

$$e = \$87,650(1 - 0.065)$$

$$e = \$81,952.75$$

Rounded to the nearest dollar, Jamal's earnings this year were \$81,953.

25. Let the population figure on July 1, 2011 be p . Then

$$p + 0.0439p = 35,851,800$$

$$p = \frac{35,851,800}{1.0439} \approx 34,344,094$$

Rounded to the nearest 1000, the population on July 1, 2011 was 34,344,000.

26. a. Given: $V_i = 32,400$, $V_f = 27,450$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{27,450 - 32,400}{32,400} \times 100\% = \underline{-15.28\%}$$

The number of hammers sold declined by 15.28%.

- b. Given: $V_i = \$15.10$, $V_f = \$15.50$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$15.50 - \$15.10}{\$15.10} \times 100\% = \underline{2.65\%}$$

The average selling price increased by 2.65%.

- c. Year 1 revenue = $32,400(\$15.10) = \$489,240$

$$\text{Year 2 revenue} = 27,450(\$15.50) = \$425,475$$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$425,475 - \$489,240}{\$489,240} \times 100\% = \underline{-13.03\%}$$

The revenue decreased by 13.03%.

27. a. Given: $V_i = \$0.55$, $V_f = \$1.55$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$1.55 - \$0.55}{\$0.55} \times 100\% = \underline{181.82\%}$$

The share price rose by 181.82% in the first year.

- b. Given: $V_i = \$1.55$, $V_f = \$0.75$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$0.75 - \$1.55}{\$1.55} \times 100\% = \underline{-51.61\%}$$

The share price declined by 51.61% in the second year.

- c. Given: $V_i = \$0.55$, $V_f = \$0.75$

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$0.75 - \$0.55}{\$0.55} \times 100\% = \underline{\underline{36.36\%}}$$

The share price rose by 36.36% over 2 years.

Exercise 2.6 (continued)

$$28. \text{ Initial unit price} = \frac{\$5.49}{1.65 \text{ l}} = \$3.327 \text{ per litre}$$

$$\text{Final unit price} = \frac{\$7.98}{2.2 \text{ l}} = \$3.627 \text{ per litre}$$

The percent increase in the unit price is

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$3.627 - \$3.327}{\$3.327} \times 100\% = \underline{\underline{9.02\%}}$$

$$29. \text{ Initial unit price} = \frac{1098 \text{ cents}}{700 \text{ g}} = 1.5686 \text{ cents per g}$$

$$\text{Final unit price} = \frac{998 \text{ cents}}{600 \text{ g}} = 1.6633 \text{ cents per g}$$

The percent increase in unit price is

$$c = \frac{V_f - V_i}{V_i} \times 100 = \frac{1.6633 - 1.5686}{1.5686} \times 100 = \underline{\underline{6.04\%}}$$

$$30. \text{ Given: } V_f = \$348,535, c = -1.8\%$$

$$V_i = \frac{V_f}{1+c} = \frac{\$348,535}{0.982} \approx \underline{\underline{\$354,900}}$$

Rounded to the nearest \$100, the average price one month ago was \$354,900.

$$31. \text{ Given: } V_f = \$348.60, c = -0.30$$

$$V_i = \frac{V_f}{1+c} = \frac{\$348.60}{1+(-0.30)} = \frac{\$348.60}{0.70} = \underline{\underline{\$498.00}}$$

The regular price of the boots is \$498.00.

$$32. \text{ Given: } V_f = 231,200,000, c = 3.66\%$$

$$V_i = \frac{V_f}{1+c} = \frac{231,200,000}{1+0.0366} = \frac{231,200,000}{1.0366} \approx \underline{\underline{223,037,000}}$$

Rounded to the nearest 1000 units, Apple sold 223,037,000 iPhones in 2014.

$$33. \text{ Given: } V_f = \$2,030,000,000, c = 241\%$$

$$c = \frac{V_f - V_i}{V_i} \times 100$$

$$241 = \frac{\$2,030,000,000 - V_i}{V_i} \times 100$$

$$2.41 = \frac{\$2,030,000,000 - V_i}{V_i}$$

$$2.41 V_i = \$2,030,000,000 - V_i$$

$$3.41 V_i = \$2,030,000,000$$

$$V_i = \frac{\$2,030,000,000}{3.41} \approx \$595,308,000$$

Rounded to the nearest \$1000, Twitter's 2013 advertising revenues were \$595,308,000.

Exercise 2.6 (continued)

34. The fees to Fund A will be

$$\frac{(\text{Fees to Fund A}) - (\text{Fees to Fund B})}{(\text{Fees to Fund B})} \times 100\% = \frac{2.38\% - 1.65\%}{1.65\%} \times 100\% = \underline{44.24\%}$$

more than the fees to Fund B.

35. Percent change in the GST rate

$$= \frac{(\text{Final GST rate}) - (\text{Initial GST rate})}{(\text{Initial GST rate})} \times 100\% = \frac{5\% - 6\%}{6\%} \times 100\% = \underline{-16.67\%}$$

The GST paid by consumers was reduced by 16.67%.

36. Given: $V_f = \$0.45$, $c = 76\%$

$$V_i = \frac{V_f}{1+c} = \frac{\$0.45}{1+(-0.76)} = \$1.88$$

$$\text{Price decline} = V_i - V_f = \$1.88 - \$0.45 = \underline{\$1.43}$$

The share price dropped by \$1.43.

37. If the Canadian dollar is worth 1.5% less than the US dollar,

$$\text{Canadian dollar} = (1 - 0.015)(\text{US dollar}) = 0.985(\text{US dollar})$$

$$\frac{\text{Canadian dollar}}{0.985}$$

$$\text{Hence, US dollar} = \frac{0.985}{1} = 1.0152(\text{Canadian dollar})$$

Therefore, the US dollar is worth 1.52% more than the Canadian dollar.

$$\frac{115 \text{ cents}}{100 \text{ g}}$$

38. Current unit price = $\frac{100 \text{ g}}{1} = 1.15 \text{ cents per g}$

$$\text{New unit price} = 1.075(1.15 \text{ cents per g}) = 1.23625 \text{ cents per g}$$

$$\text{Price of an 80-g bar} = (80 \text{ g}) \times (1.23625 \text{ cents per g}) = 98.9 \text{ cents} = \underline{\$0.99}$$

39. Canada's exports to US exceeded imports from the US by 14.1%.

$$\text{That is, Exports} = 1.141(\text{Imports})$$

$$\frac{\text{Exports}}{1.141}$$

$$\text{Therefore, Imports} = \frac{1.141}{1.141} = 0.8764(\text{Exports})$$

That is, Canada's imports from US (= US exports to Canada) were

$$1 - 0.8764 = 0.1236 = \underline{12.36\%}$$

less than Canada's exports to US (= US imports from Canada.)

40. Given: 2014 sales revenues were 14.2% less than 2013 sales revenues

$$\text{Hence, (Sales for 2014)} = (1 - 0.142)(\text{Sales for 2013}) = 0.858(\text{Sales for 2013})$$

$$\text{Therefore, (Sales for 2013)} = \frac{0.858}{0.858} = 1.1655(\text{Sales for 2014})$$

That is, sales revenues for 2013 were 116.55% of sales revenues for 2014.

Exercise 2.6 (continued)

Advanced Problems

41. Given: For the appreciation, V_i = Purchase price, $c = 140\%$, V_f = List price
For the price reduction, V_i = List price, $c = -10\%$, $V_f = \$172,800$

$$\text{List price} = \frac{V_f}{1+c} = \frac{\$172,800}{1+(-0.1)} = \$192,000$$

$$\text{Original purchase price} = \frac{V_f}{1+c} = \frac{\$192,000}{1+1.4} = \$80,000$$

The owner originally paid \$80,000 for the property.

42. Given: For the markup, V_i = Cost, $c = 22\%$, V_f = List price
For the markdown, V_i = List price, $c = -10\%$, $V_f = \$17,568$

$$\text{List price} = \frac{V_f}{1+c} = \frac{\$17,568}{1+(-0.10)} = \$19,520$$

$$\text{Cost (to dealer)} = \frac{V_f}{1+c} = \frac{\$19,520}{1+0.22} = \$16,000$$

The dealer paid \$16,000 for the car.

43. Next year there must be 15% fewer students per teacher.
With the same number of students,

$$\frac{\text{Students}}{\text{Teachers next year}} = 0.85 \left(\frac{\text{Students}}{\text{Teachers now}} \right)$$

$$\text{Therefore, Teachers next year} = \frac{0.85}{1} \times \text{Teachers now} = 0.85 \text{ (Teachers now)}$$

That is, if the number of students does not change, the number of teachers must be increased by 17.65%.

44. Use ppm as the abbreviation for “pages per minute”.
Given: Lightning printer prints 30% more ppm than the Reliable printer.
That is, the Lightning’s printing speed is 1.30 times the Reliable’s printing speed.
Therefore, the Reliable’s printing speed is

$$\frac{1}{1.3} = 0.7692 = 76.92\% \text{ of the Lightning’s printing speed}$$

Therefore, the Reliable’s printing speed is

$$100\% - 76.92\% = 23.08\% \text{ less than the Lightning’s speed.}$$

The Lightning printer will require 23.08% less time than the Reliable for a long printing job.

45. Given: Euro is worth 32% more than the Canadian dollar.
That is,

$$\text{Euro} = 1.32(\text{Canadian dollar})$$

$$\text{Therefore, Canadian dollar} = \frac{\text{Euro}}{1.32} = 0.7576(\text{Euro}) = 75.76\% \text{ of a Euro.}$$

That is, the Canadian dollar is worth $100\% - 75.76\% = \underline{24.24\% \text{ less}}$ than the Euro.

Exercise 2.6 (continued)

46. Let us use OT as an abbreviation for "overtime".

The number of OT hours permitted by this year's budget is

$$\frac{\text{OT budget (this year)}}{\text{OT hourly rate (this year)}}$$

$$\text{OT hours (this year)} = \frac{\text{OT budget (this year)}}{\text{OT hourly rate (this year)}}$$

The number of overtime hours permitted by next year's budget is

$$\begin{aligned} \text{OT hours (next year)} &= \frac{\text{OT budget (next year)}}{\text{OT hourly rate (next year)}} = \frac{1.03[\text{OT budget (this year)}]}{1.05[\text{OT hourly rate (this year)}]} \\ &= \frac{\text{OT budget (this year)}}{0.98095 \text{ OT hourly rate (this year)}} \\ &= 98.10\% \text{ of this year's OT hours} \end{aligned}$$

The number of OT hours must be reduced by $100\% - 98.10\% = \underline{1.90\%}$.

Review Problems

Basic Problems

1. a. $2(7x - 3y) - 3(2x - 3y) = 14x - 6y - 6x + 9y = \underline{8x + 3y}$
 b. $15x - (4 - 10x + 12) = 15x - 4 + 10x - 12 = \underline{25x - 16}$

2. Given: $NI = \$200,000$, $CM = \$8$, $X = 40,000$

$$\begin{aligned} NI &= (CM)X - FC \\ \$200,000 &= \$8(40,000) - FC \\ \$200,000 - \$320,000 &= -FC \\ -\$120,000 &= -FC \\ FC &= \underline{\$120,000} \end{aligned}$$

3. Given: $S = \$1243.75$, $P = \$1200$, $t = \frac{7}{12}$

$$\begin{aligned} S &= P(1 + rt) \\ \$1243.75 &= \$1200 \left[1 + r \left(\frac{7}{12} \right) \right] \\ \frac{\$1243.75}{\$1200} &= 1 + r \left(\frac{7}{12} \right) \\ 1.0365 - 1 &= r \left(\frac{7}{12} \right) \\ 0.0365 &= 0.58\bar{3} r \\ r &= \frac{0.0365}{0.58\bar{3}} \\ r &= 0.0626 \times 100\% = \underline{6.26\%} \end{aligned}$$

4. a. $3.1t + 145 = 10 + 7.6t$
 $3.1t - 7.6t = 10 - 145$
 $-4.5t = -135$
 $t = \underline{30}$
 b. $1.25y - 20.5 = 0.5y - 11.5$
 $1.25y - 0.5y = -11.5 + 20.5$

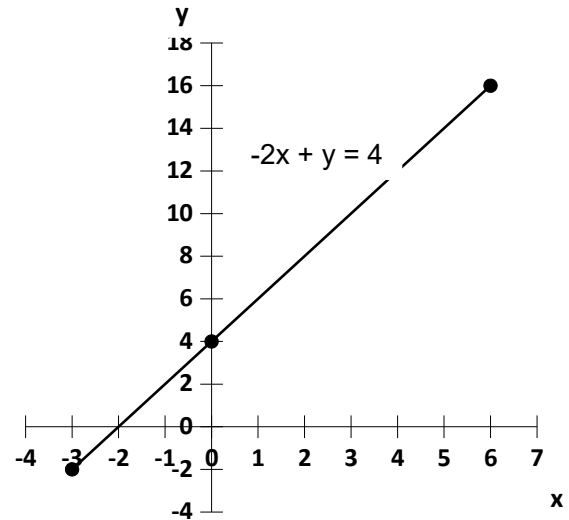
$$0.75y = 9$$

$$\underline{\underline{y = 12}}$$

Review Problems (continued)

5.

$x:$	-3	0	6
$y:$	-2	4	16



6. In each part, rearrange the equation to render it in the form $y = (\text{slope})x + (\text{intercept})$

a. $2b + 3 = 5a$

$$2b = 5a - 3$$

$$b = \frac{5}{2}a - \frac{3}{2}$$

The slope is $\frac{5}{2}$ and the b-intercept is $\underline{\underline{-\frac{3}{2}}}$.

b. $3a - 4b = 12$

$$-4b = -3a + 12$$

$$b = \frac{3}{4}a - 3$$

The slope is $\frac{3}{4}$ and the b-intercept is $\underline{\underline{-3}}$.

c. $7a = -8b$

$$8b = -7a$$

$$b = -\frac{7}{8}a$$

The slope is $-\frac{7}{8}$ and the b-intercept is $\underline{\underline{0}}$.

Review Problems (continued)

7. Step 2: Total revenue for the afternoon: \$240.75
Total number of swimmers for the afternoon: 126
Adult price: \$3.50
Child price: \$1.25
Let A represent the number of adults and C represent the number of children.

Step 3: Total number of swimmers = Number of adults + Number of children
Total revenue = Revenue from adults + Revenue from children

$$\begin{aligned}\text{Step 4: } 126 &= A + C && \textcircled{1} \\ \$240.75 &= \$3.50A + \$1.25C && \textcircled{2}\end{aligned}$$

Step 5: Rearrange $\textcircled{1}$: $A = 126 - C$
Substitute into $\textcircled{2}$: $\$240.75 = \$3.50(126 - C) + \$1.25C$
Solve: $\$240.75 = \$441 - \$3.50C + \$1.25C$
 $\$240.75 = \$441 - \$2.25C$
 $\$240.75 - \$441 = -\$2.25C$
 $-\$200.25 = -\$2.25C$
 $C = -\$200.25 / -\$2.25 = 89$

There were 89 children and $126 - 89 = \underline{37 \text{ adults}}$ who swam during the afternoon.

8. Step 2: Total kilometres paved = 11.5.
There were 4.25 more kilometres paved on day two than on day one.
Let the number of kilometres paved on day one be X .
Then the number of kilometres paved on day two is $(X + 4.25)$

Step 3: Total Kms paved = Kms paved on day one + Kms paved on day two

$$\text{Step 4: } 11.5 = X + (X + 4.25)$$

$$\begin{aligned}\text{Step 5: } 11.5 &= 2X + 4.25 \\ 2X &= 11.5 - 4.25 \\ 2X &= 7.25 \\ X &= 7.25/2 = 3.625\end{aligned}$$

3.625 kilometres were paved on day one and $3.625 + 4.25 = \underline{7.875 \text{ kilometres}}$ were paved on day two.

9. a. Given: $c = 17.5\%$, $V_i = \$29.43$
 $V_f = V_i(1 + c) = \$29.43(1.175) = \underline{\$34.58}$
\$34.58 is 17.5% more than \$29.43.
- b. Given: $V_f = \$100$, $c = -80\%$
 $V_i = \frac{V_f}{1+c} = \frac{\$100}{1-0.80} = \underline{\$500.00}$
80% off \$500 leaves \$100.
- c. Given: $V_f = \$100$, $c = -15\%$

$$V_i = \frac{V_f}{1+c} = \frac{\$100}{1-0.15} = \underline{\$117.65}$$

\$117.65 reduced by 15% equals \$100.

(continued)

Review Problems (continued)

9. d. Given: $V_i = \$47.50$, $c = 320\%$
 $V_f = V_i(1+c) = \$47.50(1+3.2) = \underline{\$199.50}$
 \$47.50 after an increase of 320% is \$199.50.
- e. Given: $c = -62\%$, $V_f = \$213.56$
 $V_i = \frac{V_f}{1+c} = \frac{\$213.56}{1-0.62} = \underline{\$562.00}$
 \$562 decreased by 62% equals \$213.56.
- f. Given: $c = 125\%$, $V_f = \$787.50$
 $V_i = \frac{V_f}{1+c} = \frac{\$787.50}{1+1.25} = \underline{\$350.00}$
 \$350 increased by 125% equals \$787.50.
- g. Given: $c = -30\%$, $V_i = \$300$
 $V_f = V_i(1+c) = \$300(1-0.30) = \underline{\$210.00}$
 \$210 is 30% less than \$300.

Intermediate Problems

10. $\frac{9y-7}{3} - 2.3(y-2) = 3y - 2.\bar{3} - 2.3y + 4.6 = \underline{0.7y + 2.2\bar{6}}$
11. $4(3a+2b)(2b-a) - 5a(2a-b) = 4(6ab - 3a^2 + 4b^2 - 2ab) - 10a^2 + 5ab$
 $= \underline{-22a^2 + 21ab + 16b^2}$
12. a. $L(1-d_1)(1-d_2)(1-d_3) = \$340(1-0.15)(1-0.08)(1-0.05) = \underline{\$252.59}$
 b. $\frac{R}{i} \left[1 - \frac{1}{(1+i)^n} \right] = \frac{\$575}{0.085} \left[1 - \frac{1}{(1+0.085)^3} \right] = \$6764.706(1-0.7829081) = \underline{\$1468.56}$
13. $N = L(1-d_1)(1-d_2)(1-d_3)$
 $\$324.30 = \$498(1-0.20)(1-d_2)(1-0.075)$
 $\$324.30 = \$368.52(1-d_2)$
 $\frac{\$324.30}{\$368.52} = (1-d_2)$
 $d_2 = 1 - 0.8800 = \underline{0.120} = \underline{12.0\%}$
14. a. $6(4y-3)(2-3y) - 3(5-y)(1+4y) = 6(8y - 12y^2 - 6 + 9y) - 3(5 + 20y - y - 4y^2)$
 $= \underline{-60y^2 + 45y - 51}$
 b. $\frac{5b-4}{4} - \frac{25-b}{1.25} + \frac{7}{8}b = 1.25b - 1 - 20 + 0.8b + 0.875b = \underline{2.925b - 21}$
 c. $\frac{96nm^2 - 72n^2m^2}{48n^2m} = \frac{4m - 3nm}{2n} = \frac{4m}{2n} - \frac{3nm}{2n} = 2\frac{m}{n} - 1.5m$

$$15. \quad \frac{(-3x^2)^3(2x^{-2})}{6x^5} = \frac{(-27x^6)(2x^{-2})}{6x^5} = -\frac{9}{x}$$

Review Problems (continued)

$$16. \quad \begin{aligned} a. \quad & 1.0075^{24} = \underline{1.19641} \\ b. \quad & (1.05)^{1/6} - 1 = \underline{0.00816485} \\ c. \quad & \frac{(1+0.0075)^{36} - 1}{0.0075} = \underline{41.1527} \end{aligned}$$

$$17. \quad \begin{aligned} a. \quad & \begin{array}{rcl} 4a - 5b = 30 & & \textcircled{1} \\ 2a - 6b = 22 & & \textcircled{2} \end{array} \\ & \text{To eliminate a,} \\ & \begin{array}{rcl} \textcircled{1} \times 1: & 4a - 5b = 30 \\ \textcircled{2} \times 2: & \underline{4a - 12b = 44} \\ \text{Subtract:} & & 7b = -14 \\ & & b = -2 \end{array} \\ & \text{Substitute into } \textcircled{1}: 4a - 5(-2) = 30 \\ & \quad 4a = 30 - 10 \\ & \quad a = 5 \\ & \text{Hence, } (a, b) = \underline{(5, -2)} \end{aligned}$$

$$b. \quad \begin{aligned} & \begin{array}{rcl} 76x - 29y = 1050 & & \textcircled{1} \\ -13x - 63y = 250 & & \textcircled{2} \end{array} \\ & \text{To eliminate x,} \\ & \begin{array}{rcl} \textcircled{1} \times 13: & 988x - 377y = 13,650 \\ \textcircled{2} \times 76: & \underline{-988x - 4788y = 19,000} \\ \text{Add:} & & -5165y = 32,650 \\ & & y = -6.321 \end{array} \\ & \text{Substitute into } \textcircled{1}: 76x - 29(-6.321) = 1050 \\ & \quad 76x = 1050 - 183.31 \\ & \quad x = 11.40 \\ & \text{Hence, } (x, y) = \underline{(11.40, -6.32)} \end{aligned}$$

$$18. \quad \begin{aligned} & \begin{array}{rcl} 3x + 5y = 11 & & \textcircled{1} \\ 2x - y = 16 & & \textcircled{2} \end{array} \\ & \text{To eliminate y,} \\ & \begin{array}{rcl} \textcircled{1}: & 3x + 5y = 11 \\ \textcircled{2} \times 5: & \underline{10x - 5y = 80} \\ \text{Add:} & & 13x + 0 = 91 \\ & & x = 7 \end{array} \\ & \text{Substitute into equation } \textcircled{2}: 2(7) - y = 16 \\ & \quad y = -2 \\ & \text{Hence, } (x, y) = \underline{(7, -2)} \end{aligned}$$

19. The homeowner pays \$28 per month plus \$2.75 per cubic metre of water used.

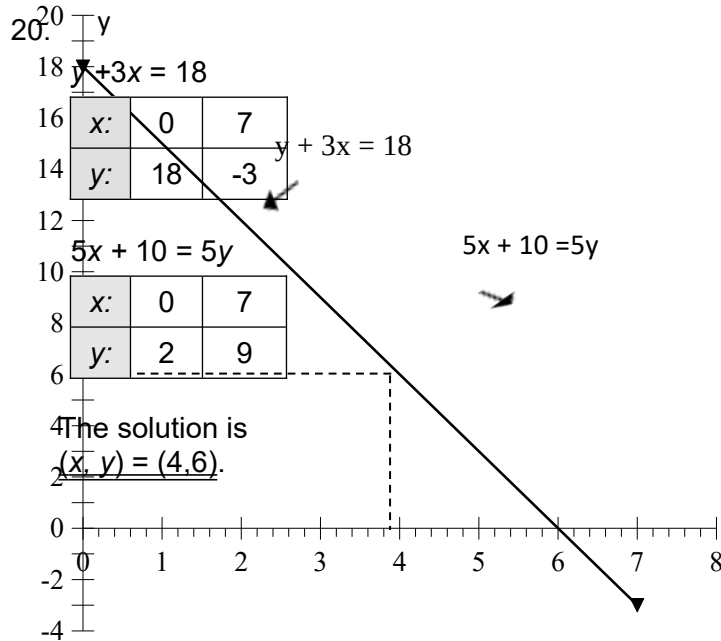
Then $B = \$28 + \$2.75C$

Expressing this equation in the form $y = mx + b$

$$B = \$2.75C + \$28$$

On a plot of B vs. C , slope = \$2.75 and B -intercept = \$28.

Review Problems (continued)



21. Given: Grace's share = $1.2(\text{Kajsa's share})$; Mary Anne's share = $\frac{5}{8}(\text{Grace's share})$

Total allocated = \$36,000

Let K represent Kajsa's share.

$$(\text{Kajsa's share}) + (\text{Grace's share}) + (\text{Mary Anne's share}) = \$36,000$$

$$K + 1.2K + \frac{5}{8}(1.2K) = \$36,000$$

$$2.95K = \$36,000$$

$$K = \$12,203.39$$

Kajsa should receive \$12,203.39. Grace should receive $1.2K = \$14,644.07$.

Mary Anne should receive $(\$14,644.07) \times \frac{5}{8} = \9152.54 .

22. Given: Total initial investment = \$7800; Value 1 year later = \$9310

Percent change in ABC portion = 15%

Percent change in XYZ portion = 25%

Let X represent the amount invested in XYZ Inc.

The solution "idea" is:

$$(\text{Amount invested in ABC})1.15 + (\text{Amount invested in XYZ})1.25 = \$9310$$

Hence,

$$(\$7800 - X)1.15 + (X)1.25 = \$9310$$

$$\$8970 - 1.15X + 1.25X = \$9310$$

$$0.10X = \$9310 - \$8970$$

$$X = \$3400$$

Rory invested \$3400 in XYZ Inc. and $\$7800 - \$3400 = \underline{\underline{\$4400}}$ in ABC Ltd.

Review Problems (continued)

23. Let R represent the price per kg for red snapper and
let L represent the price per kg for lingcod. Then

$$370R + 264L = \$2454.20 \quad \textcircled{1}$$

$$255R + 304L = \$2124.70 \quad \textcircled{2}$$

To eliminate R,

$$\textcircled{1} \times 370: R + 0.71351L = \$6.6330$$

$$\textcircled{2} \times 255: R + 1.19216L = \$8.3322$$

$$\text{Subtract:} \quad -0.47865L = -\$1.6992$$

$$L = \$3.55$$

$$\text{Substitute into } \textcircled{1}: 370R + 264(\$3.55) = \$2454.20$$

$$370R = \$1517.00$$

$$R = \$4.10$$

Nguyen was paid \$3.55 per kg for lingcod and \$4.10 per kg for red snapper.

24. Given:

	<u>Year 1 value (V_i)</u>	<u>Year 2 value (V_f)</u>
Gold produced:	34,300 oz.	23,750 oz.
Average price:	\$1160	\$1280

$$a. \text{ Percent change in gold production} = \frac{23,750 - 34,300}{34,300} \times 100\% = \underline{\underline{-30.76\%}}$$

$$b. \text{ Percent change in price} = \frac{\$1280 - \$1160}{\$1160} \times 100\% = \underline{\underline{10.34\%}}$$

$$c. \text{ Year 1 revenue, } V_i = 34,300(\$1160) = \$39.788 \text{ million}$$

$$\text{Year 2 revenue, } V_f = 23,750(\$1280) = \$30.400 \text{ million}$$

$$\text{Percent change in revenue} = \frac{\$30.400 - \$39.788}{\$39.788} \times 100\% = \underline{\underline{-23.60\%}}$$

25. Given: For the first year, $V_i = \$3.40$, $V_f = \$11.50$.

For the second year, $V_i = \$11.50$, $c = -35\%$.

$$c = \frac{V_f - V_i}{V_i} \times 100\% = \frac{\$11.50 - \$3.40}{\$3.40} \times 100\% = \underline{\underline{238.24\%}}$$

a. The share price increased by 238.24% in the first year.

$$b. \text{ Current share price, } V_f = V_i(1 + c) = \$11.50(1 - 0.35) = \underline{\underline{\$7.48}}.$$

26. Given: For the first year, $c = 150\%$

For the second year, $c = -40\%$, $V_f = \$24$

The price at the beginning of the second year was

$$V_i = \frac{V_f}{1 + c} = \frac{\$24}{1 - 0.40} = \$40.00 = V_f \text{ for the first year.}$$

The price at the beginning of the first year was

$$V_i = \frac{V_f}{1 + c} = \frac{\$40.00}{1 + 1.50} = \underline{\underline{\$16.00}}$$

Barry bought the stock for \$16.00 per share.

Review Problems (continued)

27. Given: Last year's revenue = \$2,347,000
 Last year's expenses = \$2,189,000
- a. Given: Percent change in revenue = 10%; Percent change in expenses = 5%
- Anticipated revenues, $V_f = V_i(1 + c) = \$2,347,000(1.1) = \$2,581,700$
 Anticipated expenses = $\$2,189,000(1.05) = \underline{\$2,298,450}$
 Anticipated profit = $\$283,250$
 Last year's profit = $\$2,347,000 - \$2,189,000 = \$158,000$

$$\frac{\$283,250 - \$158,000}{\$158,000} \times 100\% = \underline{79.27\%}$$

 Percent increase in profit = $\underline{79.27\%}$
- b. Given: $c(\text{revenue}) = -10\%$; $c(\text{expenses}) = -5\%$
 Anticipated revenues = $\$2,347,000(1 - 0.10) = \$2,112,300$
 Anticipated expenses = $\$2,189,000(1 - 0.05) = \underline{\$2,079,550}$
 Anticipated profit = $\$32,750$

$$\frac{\$32,750 - \$158,000}{\$158,000} \times 100\% = \underline{-79.27\%}$$

 Percent change in profit = $\underline{-79.27\%}$
 The operating profit will decline by 79.27%.

28. a.
$$\frac{(1.00\bar{6})^{240} - 1}{0.00\bar{6}} = \frac{4.926802 - 1}{0.00\bar{6}} = \underline{589.020}$$

b.
$$(1 + 0.025)^{1/3} - 1 = \underline{0.00826484}$$

Advanced Problems

29.
$$\left(-\frac{2x^2}{3}\right)^{-2} \left(\frac{5^2}{6x^3}\right) \left(-\frac{15}{x^5}\right)^{-1} = \left(\frac{3}{2x^2}\right)^2 \left(\frac{25}{6x^3}\right) \left(-\frac{x^5}{15}\right) = -\frac{5}{8x^2}$$

30. a.
$$\frac{x}{1.08^3} + \frac{x}{2}(1.08)^4 = \$850$$

$$0.793832x + 0.680245x = \$850$$

$$x = \underline{\$576.63}$$

$$\frac{\$576.63}{1.08^3} + \frac{\$576.63}{2}(1.08)^4 = \$457.749 + \$392.250 = \$850.00$$

 Check:
$$2x \left(1 + 0.085 \times \frac{77}{365}\right) + \frac{x}{1 + 0.085 \times \frac{132}{365}} = \$1565.70$$

 b.
$$2.03586x + 0.97018x = \$1565.70$$

$$x = \underline{\$520.85}$$

Check:
$$2(\$520.85) \left(1 + 0.085 \times \frac{77}{365}\right) + \frac{\$520.85}{1 + 0.085 \times \frac{132}{365}} = \$1060.38 + \$505.32 = \$1565.70$$

31.
$$\frac{S}{1+rt} = \$2500(1.1025)^2 + \frac{\$1500}{1 + 0.09 \times \frac{93}{365}} = \$3038.766 + \$1466.374 = \underline{\$4505.14}$$

Review Problems (continued)

$$32. \quad a. \quad \frac{2x}{1+0.13 \times \frac{92}{365}} + x \left(1 + 0.13 \times \frac{59}{365} \right) = \$831$$

$$1.93655x + 1.02101x = \$831$$

$$2.95756x = \$831$$

$$x = \underline{\underline{\$280.97}}$$

$$b. \quad \frac{x}{3x(1.03^5) + 1.03^3} + x = \frac{\$2500}{1.03^2}$$

$$3.47782x + 0.915142x + x = \$2356.49$$

$$x = \underline{\underline{\$436.96}}$$

33. 60% of a $\frac{3}{8}$ interest was purchased for \$65,000.
Let the V represent the implied value of the entire partnership.

$$\text{Then } 0.60 \times \frac{3}{8} V = \$65,000$$

$$V = \frac{8 \times \$65,000}{0.60 \times 3} = \underline{\underline{\$288,889}}$$

The implied value of the chalet was \$288,889.

34. Let b represent the base salary and r represent the commission rate. Then

$$r(\$27,000) + b = \$2815.00 \quad \textcircled{1}$$

$$r(\$35,500) + b = \$3197.50 \quad \textcircled{2}$$

$$\text{Subtract: } -\$8500r = -\$382.50$$

$$r = 0.045$$

$$\text{Substitute into } \textcircled{1}: 0.045(\$27,000) + b = \$2815$$

$$b = \$1600$$

Deanna's base salary is \$1600 per month and her commission rate is 4.5%.

35. Let the regular season ticket prices be R for the red section and B for the blue section. Then

$$2500R + 4500B = \$50,250 \quad \textcircled{1}$$

$$2500(1.3R) + 4500(1.2B) = \$62,400 \quad \textcircled{2}$$

$$\textcircled{1} \times 1.2: \quad 2500(1.2R) + 4500(1.2B) = \$60,300$$

$$\text{Subtract: } 2500(0.1R) + 0 = \$2100$$

$$R = \$8.40$$

$$\text{Substitute into } \textcircled{1}: 2500(\$8.40) + 4500B = \$50,250$$

$$B = \$6.50$$

The ticket prices for the playoffs cost

$$1.3 \times \$8.40 = \underline{\underline{\$10.92}} \text{ in the "reds"}$$

$$\text{and } 1.2 \times \$6.50 = \underline{\underline{\$7.80}} \text{ in the "blues".}$$