

## Chapter 2 Review of Basic Algebra

### Exercise 2.1

- A. 1.  $\boxed{19a}$
2.  $\boxed{3m}$
3.  $\boxed{-a-10}$
4.  $\boxed{-3a-14}$
5.  $\boxed{-2x-4y}$
6.  $\boxed{3p+q}$
7.  $\boxed{14f-4v}$
8.  $\boxed{2c-3d}$
9.  $\boxed{0.8x}$
10.  $\boxed{1.06x}$
11.  $\boxed{1.4x}$
12.  $\boxed{0.98x}$
13.  $\boxed{2.79x}$
14.  $\boxed{4.05y}$
15.  $\boxed{-x^2-x-8}$
16.  $\boxed{-ax+x-2}$
17.  $2x-3y-x-4y = \boxed{x-7y}$
18.  $-4+5a+2-3a = \boxed{2a-2}$
19.  $12b+4c+9+8-8b-2c-15 = \boxed{4b+2c+2}$
20.  $a^2-ab+b^2-3a^2-5ab+4b^2 = \boxed{-2a^2-6ab+5b^2}$
21.  $-3m^2+4m+5-4+2m+2m^2 = \boxed{-m^2+6m+1}$
22.  $6-4x+3y-1-5x-2y+9 = \boxed{14-9x+y}$

23.  $7a - 5b + 3a - 4b - 5b = \boxed{10a - 14b}$

24.  $3f - f^2 + fg - f + 3f^2 + 2fg = \boxed{2f + 2f^2 + 3fg}$

25.  $4b^4d + 2ac^7 - (-5b^4d) - 3ac$   
 $= \boxed{9b^4d + 2ac^7 - 3ac}$

26.  $(8t^2 - 6t - 9) - (7t^2 - 6t + 7)$   
 $= 8t^2 - 6t - 9 - 7t^2 + 6t - 7$   
 $= \boxed{t^2 - 16}$

27.  $\frac{18y}{2} - \frac{12}{5} + 3\frac{1}{4}y$   
 $= 9y - 2.4 + 3.25y$   
 $= \boxed{12.25y - 2.4}$

28.  $1.3x + x^2 + \frac{x}{2} - 2x + 4$   
 $= x^2 + (1.3 + 0.5 - 2)x + 4$   
 $= \boxed{x^2 - 0.2x + 4}$

29.  $\frac{k}{(1+0.05)} + \frac{k}{(1+0.05)^2}$   
 $= 0.952381k + 0.907029k$   
 $= \boxed{1.859410k}$

30.  $x\left(1 + 0.052 \times \frac{142}{365}\right) + \frac{x}{\left(1 + 0.052 \times \frac{91}{365}\right)}$   
 $= 1.020230x + 0.993806x$   
 $= \boxed{2.014036x}$

B. 1.  $\boxed{-12x}$

2.  $\boxed{-56a}$

3.  $\boxed{-10ax}$

4.  $\boxed{27ab}$

5.  $\boxed{-2x^2}$

6.  $\boxed{24m^2}$

7.  $\boxed{60xy}$

8.  $\boxed{-24abc}$

9.  $\boxed{-2x + 4y}$

10.  $\boxed{10x - 20}$

11.  $\boxed{2ax^2 - 3ax - a}$

12.  $\boxed{-24x + 12bx + 6b^2x}$

13.  $20x - 24 - 6 + 15x = \boxed{35x - 30}$

14.  $-24a + 3b + 14a - 18b = \boxed{-10a - 15b}$

15.  $-15ax + 3a + 5a - 2ax - 3ax - 3a = \boxed{-20ax + 5a}$

16.  $24y - 32 - 4y + 2 - 1 + y = \boxed{21y - 31}$

17.  $3x^2 - x + 6x - 2 = \boxed{3x^2 + 5x - 2}$

18.  $5m^2 - 2mn - 15mn + 6n^2 = \boxed{5m^2 - 17mn + 6n^2}$

19.  $x^3 - x^2y + xy^2 + x^2y - xy^2 + y^3 = \boxed{x^3 + y^3}$

20.  $a^3 - 2a^2 + a - a^2 + 2a - 1 = \boxed{a^3 - 3a^2 + 3a - 1}$

21.  $10x^2 - 8x - 5x + 4 - 3x^2 + 21x - 5x + 35 = \boxed{7x^2 + 3x + 39}$

22.  $2(2a^2 - 2a - 3a + 3) - 3(3a^2 - 2a + 3a - 2)$

$$= 4a^2 - 10a + 6 - 9a^2 - 3a + 6$$

$$= \boxed{-5a^2 - 13a + 12}$$

23.  $3x^2(x^2 + 2x - 3) - 4x(x^2 + 2x - 3) + (x^2 + 2x - 3)$

$$= 3x^4 + 6x^3 - 9x^2 - 4x^3 - 8x^2 + 12x + x^2 + 2x - 3$$

$$= 3x^4 + 2x^3 - 16x^2 + 14x - 3$$

24.  $(5b^2 + 5b - 5)(b^3 + 4b + 2)$

$$= 5b^2(b^3 + 4b + 2) + 5b(b^3 + 4b + 2) - 5(b^3 + 4b + 2)$$

$$= 5b^5 + 20b^3 + 10b^2 + 5b^4 + 20b^2 + 10b - 5b^3 - 20b - 10$$

$$= 5b^5 + 5b^4 + 15b^3 + 30b^2 - 10b - 10$$

25.  $\boxed{4ab}$

26.  $\boxed{-5y}$

27.  $\boxed{4x}$

28.  $\boxed{-6}$

29.  $\boxed{10m - 4}$

30.  $\boxed{-2x + 3}$

31.  $\boxed{-2x^2 + 3x + 6}$

32.  $\boxed{a^2 + 4a + 3}$

C. 1.  $3x - 2y - 3 = 3(-4) - 2(-5) - 3 = -12 + 10 - 3 = \boxed{-5}$

$$\begin{aligned}
2. \quad & \frac{1}{2}(3x^2 - x - 1) - \frac{1}{4}(5 - 2x - x^2) \\
&= \frac{1}{2}[3(-3)^2 - (-3) - 1] - \frac{1}{4}[5 - 2(-3) - (-3)^2] \\
&= \frac{1}{2}(27 + 3 - 1) - \frac{1}{4}(5 + 6 - 9) \\
&= \frac{1}{2}(29) - \frac{1}{4}(2) \\
&= 14.5 - 0.5 \\
&= \boxed{14}
\end{aligned}$$

3.  $(pq - vq) - f = (p - v)q - f = (12 - 7)2000 - 4500 = 10\,000 - 4500 = \boxed{5500}$

4.  $F/C = 13\,000/0.65 = \boxed{20\,000}$

5.  $(1 - d_1)(1 - d_2)(1 - d_3) = (1 - 0.35)(1 - 0.08)(1 - 0.02) = (0.65)(0.92)(0.98) = \boxed{0.58604}$

6.  $C + 0.38C = 0.24C = (1 + 0.38 + 0.24)C = 1.62C = 1.62(\$25.00) = \boxed{\$40.50}$

7.  $\frac{RP(n+1)}{2N} = \frac{0.21 \times \$1200 \times (77+1)}{2 \times 26} = \boxed{\$378}$

8.  $\frac{I}{Pt} = \frac{63}{840 \times \frac{219}{365}} = \frac{63}{840 \times 0.60} = \boxed{0.125}$

9.  $\frac{I}{rt} = \frac{\$198}{0.165 \times \frac{146}{365}} = \frac{\$198}{0.165 \times 0.40} = \boxed{\$3000}$

$$10. \frac{2NC}{P(n+1)} = \frac{2 \times 52 \times 60}{1800(25+1)} = \frac{2 \times 52 \times 60}{1800 \times 26} = \boxed{0.13}$$

$$11. P(1+rt) = \$880 \left( 1 + 0.12 \times \frac{76}{365} \right) \\ = \$880(1 + 0.024986) = \$880(1.024986) = \boxed{\$901.99}$$

$$12. FV(1-rt) = \$1200 \left( 1 - 0.175 \times \frac{256}{365} \right) \\ = \$1200(1 - 0.122740) = \$1200(0.877260) = \boxed{\$1052.71}$$

$$13. \frac{P}{1-dt} = \frac{\$1253}{1 - 0.135 \times \frac{284}{365}} = \frac{\$1253}{1 - 0.083219} = \frac{\$1253}{0.916781} = \boxed{\$1400.06}$$

$$14. \frac{S}{1+rt} = \frac{\$1752}{1 + 0.152 \times \frac{228}{365}} = \frac{\$1752}{1 + 0.094948} = \frac{\$1752}{1.094948} = \boxed{\$1600.08}$$

$$15. S \left[ 1 + r \times \frac{t}{365} \right] \quad \text{for} \quad S = 3240, r = 0.125, t = 290 \\ = 3240 \left[ 1 + (0.125) \left( \frac{290}{365} \right) \right] \\ = 3240 (1.099315) \\ = \boxed{3561.780822}$$

$$16. (SP \times X) - FC - (VC \times X) \quad \text{for} \quad SP = 13, X = 125, FC = 875, VC = L \\ = (13 \times 125) - 875 - (4 \times 125) \\ = 1625 - 875 - 500 \\ = \boxed{250}$$

$$17. (1+i)^m - 1 \quad \text{for} \quad i = 0.0275, m = 2 \\ = (1 + 0.0275)^2 - 1 \\ = 1.055756 - 1 \\ = \boxed{0.055756}$$

$$\begin{aligned}
 18. \text{ PmT} \left[ \frac{(1+i)^n - 1}{i} \right] & \text{ for } \text{PmT} = 500, i = 0.025, n = 2 \\
 & = 500 \left[ \frac{(1+0.025)^2 - 1}{0.025} \right] \\
 & = 500 \left[ \frac{0.050625}{0.025} \right] \\
 & = 500(2.025) \\
 & = \boxed{1012.50}
 \end{aligned}$$

$$\begin{aligned}
 19. 1 - [(1-d_1)(1-d_2)] & \text{ for } d_1 = 0.15, d_2 = 0.04 \\
 & = 1 - [(1-0.15)(1-0.04)] \\
 & = 1 - [(0.85)(0.96)] \\
 & = 1 - (0.816) \\
 & = \boxed{0.184}
 \end{aligned}$$

$$\begin{aligned}
 20. \left[ \frac{(FV)(i)}{(1+i)^n - 1} \right] & \text{ for } FV = 10\,000, i = 0.0075, n = 20 \\
 & = \left[ \frac{(10\,000)(0.0075)}{(1+0.0075)^{20} - 1} \right] \\
 & = \left( \frac{750}{0.0161184} \right) \\
 & = \boxed{4653.063194}
 \end{aligned}$$

**Exercise 2.2**

A. 1.  $\boxed{81}$

2.  $\boxed{1}$

3.  $\boxed{16}$

4.  $\boxed{1}$

5.  $\boxed{\frac{16}{81}}$

6.  $\boxed{\frac{625}{1296}}$

7.  $\boxed{-\frac{1}{64}}$

8.  $\boxed{-\frac{8}{27}}$

9.  $\boxed{0.25}$

10.  $\boxed{113.379904}$

11.  $\boxed{-0.001}$

12.  $\boxed{-335.544320}$

13.  $\boxed{1}$

14.  $\boxed{1}$

15.  $\boxed{\frac{1}{9}}$

16.  $\boxed{512}$

17.  $\boxed{-\frac{1}{125}}$

18.  $\boxed{\frac{1}{167.9616}}$

19.  $\boxed{125}$

20.  $\boxed{\frac{81}{16}}$

21.  $\boxed{\frac{1}{1.01}}$

22.  $\boxed{1}$

23.  $\boxed{-11.526683}$

24.  $\frac{1}{(1.07)^0} = \frac{1}{1} = \boxed{1}$

25.  $\frac{1}{(1+0.025)^{10}} = \frac{1}{1.280085} = \boxed{0.781198}$

26.  $100(1+0.0225)^7 = 100(1.168539) = \boxed{116.853901}$

27.  $425(1+0.16)^{-4} = 425(0.938480) = \boxed{398.85413}$

28.  $\left(\frac{1500}{200}\right)^{0.5} - 1 = 1.105995 - 1 = \boxed{0.105995}$

29.  $\frac{(1+0.03)^{25}}{0.03} = \frac{2.093778}{0.03} = \boxed{69.792598}$

30.  $\left[\frac{1-(1.01)^{-20}}{0.01}\right] = \frac{1-0.819544}{0.01} = \frac{0.180456}{0.01} = \boxed{18.045553}$

B. 1.  $2^5 \times 2^3 = 2^{5+3} = \boxed{2^8}$

2.  $(-4)^3 \times (-4) = (-4)^{3+1} = \boxed{(-4)^4}$

3.  $4^7 \div 4^4 = 4^{7-4} = \boxed{4^3}$

4.  $(-3)^9 \div (-3)^7 = (-3)^{9-7} = \boxed{(-3)^2}$

5.  $(2^3)^5 = 2^{3 \times 5} = \boxed{2^{15}}$

6.  $[(-4)^3]^6 = (-4)^{3 \times 6} = \boxed{(-4)^{18}}$

7.  $a^4 \times a^{10} = a^{4+10} = \boxed{a^{14}}$

8.  $m^{12} \div m^7 = m^{12-7} = \boxed{m^5}$

9.  $3^4 \times 3^6 \times 3 = 3^{4+6+1} = \boxed{3^{11}}$

10.  $(-1)^3(-1)^7(-1)^5 = (-1)^{3+7+5} = \boxed{(-1)^{15}}$

11.  $\frac{6^7 \times 6^3}{6^9} = 6^{7+3-9} = \boxed{6}$

12.  $\frac{(x^4)(x^5)}{x^7} = x^{4+5-7} = \boxed{x^2}$

13.  $\left(\frac{3}{5}\right)^4 \left(\frac{3}{5}\right)^7 = \left(\frac{3}{5}\right)^{4+7} = \boxed{\frac{3^{11}}{5^{11}}}$

14.  $\left(\frac{1}{6}\right)^5 \div \left(\frac{1}{6}\right)^3 = \left(\frac{1}{6}\right)^{5-3} = \boxed{\frac{1}{6^2}}$



$$15. \left(-\frac{3}{2}\right)\left(-\frac{3}{2}\right)^6\left(-\frac{3}{2}\right)^4 = \left(-\frac{3}{2}\right)^{1+6+4} = \boxed{\frac{(-3)^{11}}{2^{11}}}$$

$$16. \left(-\frac{3}{4}\right)^8 \div \left(-\frac{3}{4}\right)^7 = \left(-\frac{3}{4}\right)^{8-7} = \boxed{-\frac{3}{4}}$$

$$17. (1.025)^{80}(1.025)^{70} = (1.025)^{80+70} = \boxed{1.025^{150}}$$

$$18. 1.005^{240} \div 1.005^{150} = 1.005^{240-150} = \boxed{1.005^{90}}$$

$$19. [1.04^{20}]^4 = 1.04^{20 \times 4} = \boxed{1.04^{80}}$$

$$20. \left[\left(-\frac{3}{7}\right)^5\right]^3 = \left(-\frac{3}{7}\right)^{5 \times 3} = \boxed{\frac{-3^{15}}{7^{15}}}$$

$$21. (1+i)^{100}(1+i)^{100} = (1+i)^{100+100} = \boxed{(1+i)^{200}}$$

$$22. (1-r)^2(1-r)^2(1-r)^2 = (1-r)^{2+2+2} = \boxed{(1-r)^6}$$

$$23. [(1+i)^{80}]^2 = (1+i)^{80 \times 2} = \boxed{(1+i)^{160}}$$

$$24. [(1-r)^{40}]^3 = (1-r)^{40 \times 3} = \boxed{(1-r)^{120}}$$

$$25. (ab)^5 = \boxed{a^5b^5}$$

$$26. (2xy)^4 = \boxed{16x^4y^4}$$

$$27. (m^3n)^8 = \boxed{m^{24}n^8}$$

$$28. \left(\frac{a^3b^2}{x}\right)^4 = \boxed{\frac{a^{12}b^8}{x^4}}$$

$$29. 2^3 \times 2^5 \times 2^{-4} = 2^{3+5-4} = \boxed{2^4}$$

$$30. 5^2 \div 5^{-3} = 5^{2-(-3)} = \boxed{5^5}$$

$$31. \left(\frac{a}{b}\right)^{-8} = \boxed{\frac{b^8}{a^8}}$$

$$32. \left(\frac{1+i}{i}\right)^{-n} = \boxed{\frac{i^n}{(1+i)^n}}$$

**Exercise 2.3**

- A. 1.  $\sqrt{5184} = \boxed{72.0000}$
2.  $\sqrt{205.9225} = \boxed{14.3500}$
3.  $\sqrt[3]{2187} = \boxed{3.0000}$
4.  $\sqrt[10]{1.1046221} = \boxed{1.0100}$
5.  $\sqrt[20]{4.3184} = 1.075886 = \boxed{1.0759}$
6.  $\sqrt[16]{0.00001526} = 0.500002 = \boxed{0.5000}$
7.  $\sqrt[6]{1.0825} = \boxed{1.0133}$
8.  $\sqrt[12]{1.15} = 1.011715 = \boxed{1.0117}$
- B. 1.  $3025^{\frac{1}{2}} = \boxed{55}$
2.  $2401^{\frac{1}{4}} = \boxed{7}$
3.  $525.21875^{\frac{2}{5}} = \boxed{12.25}$
4.  $21.6^{\frac{4}{3}} = \boxed{60.154991}$
5.  $\sqrt[12]{1.125^7} = \boxed{1.071122}$
6.  $\sqrt[6]{1.095} = \boxed{1.015241}$
7.  $4^{\left(\frac{1}{3}\right)} = \frac{1}{4^{\frac{1}{3}}} = \frac{1}{1.587401} = \boxed{0.629961}$
8.  $1.06^{\left(\frac{-1}{12}\right)} = \frac{1}{1.06^{\frac{1}{12}}} = \frac{1}{1.004868} = \boxed{0.995156}$
9.  $\frac{1.03^{60} - 1}{0.03} = \frac{5.891603 - 1}{0.03} = \boxed{163.053437}$
10.  $\frac{1 - 1.05^{-36}}{0.05} = \frac{1 - 0.172657}{0.05} = \boxed{16.546852}$
11.  $\boxed{2.158925}$
12.  $\boxed{0.589664}$

$$13. 26.50(1.043)\left(\frac{3.536138-1}{0.043}\right) = 26.50(1.043)(58.979962) = \boxed{1630.176673}$$

$$14. 350.00(1.05)\left(\frac{2.653298-1}{0.05}\right) = 350.00(1.05)(33.065954) = \boxed{12\,151.73813}$$

$$15. 133.00\left(\frac{1-0.520035}{0.056}\right) = 133.00(8.570795) = \boxed{1139.915716}$$

$$16. 270.00\left(\frac{1-0.759412}{0.035}\right) = 270.00(6.873956) = \boxed{1855.967995}$$

$$17. 5000.00(0.581251) + 137.50\left(\frac{1-0.581251}{0.0275}\right) \\ = 2906.252832 + 137.50(15.227252) = 2906.252832 + 2093.747168 = \boxed{5000.00}$$

$$18. 1000.00(0.623167) + 300.00\left(\frac{1-0.623167}{0.03}\right) \\ = 623.166939 + 300.00(12.561102) = 623.166939 + 3768.330608 = \boxed{4391.497547}$$

$$19. 112.55 = 100.00(1+i)^4$$

$$(1+i)^4 = 1.1255$$

$$(1+i) = 1.1255^{0.25}$$

$$(1+i) = 1.029998$$

$$i = \boxed{0.029998}$$

$$20. 380.47 = 300.00(1+i)^{12}$$

$$(1+i)^{12} = 1.268233$$

$$(1+i) = 1.268233^{0.083}$$

$$(1+i) = 1.019999$$

$$i = \boxed{0.019999}$$

$$21. 3036.77 = 2400.00(1+i)^6$$

$$(1+i)^6 = 1.265321$$

$$(1+i) = 1.265321^{0.16}$$

$$(1+i) = 1.04$$

$$i = \boxed{0.04}$$

22.  $1453.36 = 800.00(1+i)^{60}$

$$(1+i)^{60} = 1.8167$$

$$(1+i) = 1.8167^{0.016}$$

$$(1+i) = 1.01$$

$$i = \boxed{0.01}$$

**Exercise 2.4**

A. 1.  $2^9 = 512$

$$\boxed{9 = \log_2 512}$$

2.  $3^7 = 2187$

$$\boxed{7 = \log_3 2187}$$

3.  $5^{-3} = \frac{1}{125}$

$$\boxed{-3 = \log_5 \frac{1}{125}}$$

4.  $10^{-5} = 0.00001$

$$\boxed{-5 = \log_{10} 0.00001}$$

5.  $e^{2j} = 18$

$$2j = \log_e 18$$

or  $\boxed{2j = \ln 18}$

6.  $e^{-3x} = 12$

$$-3x = \log_e 12$$

or  $\boxed{-3x = \ln 12}$

B. 1.  $\log_2 32 = 5$

$$\boxed{2^5 = 32}$$

2.  $\log_3 \frac{1}{81} = -4$

$$\boxed{3^{-4} = \frac{1}{81}}$$

$$3. \log_{10} 10 = 1$$

$$\boxed{10^1 = 10}$$

$$4. \ln e^2 = 2$$

$$\boxed{e^2 = e^2}$$

$$C. 1. \ln 2 = \boxed{0.693147}$$

$$2. \ln 200 = \boxed{5.298317}$$

$$3. \ln 0.105 = \boxed{-2.253795}$$

$$\begin{aligned} 4. \ln [300(1.10^{15})] &= \ln 300 + \ln 1.10^{15} \\ &= \ln 300 + 15(\ln 1.10) \\ &= 5.703782 + 15(0.095310) \\ &= 5.703782 + 1.429653 \\ &= \boxed{7.133435} \end{aligned}$$

$$\begin{aligned} 5. \ln \left[ \frac{2000}{1.09^9} \right] &= \ln 2000 - \ln 1.09^9 \\ &= \ln 2000 - 9(\ln 1.09) \\ &= 7.600902 - 9(0.086178) \\ &= 7.600902 - 0.775599 \\ &= \boxed{6.825303} \end{aligned}$$

$$\begin{aligned} 6. \ln 850 \left[ \frac{1.01^{-120}}{0.01} \right] &= \ln 850 + \ln 1.01^{-120} - \ln 0.01 \\ &= \ln 850 - 120(\ln 1.01) - \ln 0.01 \\ &= 6.745236 - 120(0.009950) - (-4.605170) \\ &= 6.745236 - 1.194040 + 4.605170 \\ &= \boxed{10.156367} \end{aligned}$$

### ***Business Math News Box***

1. The IOC distributes 90% of broadcast revenue to other organizations in the Olympic Movement. It retains 10% to cover operational and administrative costs.

$$\text{IOC retains } 0.10(1\,496\,000\,000) = \boxed{\$149\,600\,000 \text{ (C\$149.6 million)}}$$

2. IOC distribution (C\$ millions) =  $\boxed{\text{C\$}133.9 \times 10^6}$

3. Estimate for total Vancouver Winter Games revenue = Revenue from broadcast partnerships / 0.50  
 = 1 339 000 000 / 0.50 = \$2 678 000 000

Answer expressed in exponent form =  $\boxed{\text{C}\$2678 \times 10^6 \text{ million}}$

Estimate for total Sochi Winter Games revenue = Revenue from broadcast partnerships / 0.50  
 = 1 496 000 000 / 0.50 = \$2 992 000 000

Answer expressed in exponent form =  $\text{C}\$2992 \times 10^6 \text{ million}$

4. Annual growth rate in broadcast revenue since Lake Placid =  $(1.496 \text{ billion} / 21.7 \text{ million})^{1/34} - 1$   
 = 0.132590 =  $\boxed{13.26\% \text{ per year}}$

### Exercise 2.5

A. 1.  $15x = 45$

$$\boxed{x = 3}$$

2.  $-7x = 35$

$$\boxed{x = -5}$$

3.  $0.9x = 72$

$$\boxed{x = 80}$$

4.  $0.02x = 13$

$$\boxed{x = 650}$$

5.  $\frac{1}{6}x = 3$

$$\boxed{x = 18}$$

6.  $-\frac{1}{8}x = 7$

$$\boxed{x = -56}$$

7.  $\frac{3}{5}x = -21$

$$\frac{1}{5}x = -7$$

$$\boxed{x = -35}$$

8.  $-\frac{4}{3}x = -32$

$$\frac{1}{3}x = 8$$

$$\boxed{x = 24}$$

9.  $x - 3 = -7$

$$\boxed{x = -4}$$

10.  $-2x = 7 - 3x$

$$\boxed{x = 7}$$

11.  $x + 6 = -2$

$$\boxed{x = -8}$$

12.  $3x = 9 + 2x$

$$\boxed{x = 9}$$

13.  $4 - x = 9 - 2x$

$$\boxed{x = 5}$$

14.  $2x + 7 = x - 5$

$$\boxed{x = -12}$$

15.  $x + 0.6x = 32$

$$1.6x = 32$$

$$\boxed{x = 20}$$

16.  $x - 0.3x = 210$

$$0.7x = 210$$

$$\boxed{x = 300}$$

17.  $x - 0.04x = 192$

$$0.96x = 192$$

$$\boxed{x = 200}$$

18.  $x + 0.07x = 64.20$

$$1.07x = 64.20$$

$$\boxed{x = 60}$$

B. 1.  $3x + 5 = 7x - 11$

$$-4x = -16$$

$$\boxed{x = 4}$$

LS:  $3x + 5 = 3(4) + 5$

$$= 12 + 5$$

$$= 17$$

RS:  $7x - 11 = 7(4) - 11$

$$= 28 - 11$$

$$= 17$$

2.  $5 - 4x = -4 - x$

$$-3x = -9$$

$$\boxed{x = 3}$$

LS:  $5 - 4x = 5 - (4)(3)$

$$= 5 - 12$$

$$= -7$$

RS:  $= -4 - x$

$$= -4 - 3$$

$$= -7$$

3.  $2 - 3x - 9 = 2x - 7 + 3x$

$$-3x - 7 = 5x - 7$$

$$-8x = 0$$

$$\boxed{x = 0}$$

LS:  $= 2 - 3x - 9$

$$= 2 - 3(0) - 9$$

$$= -7$$

RS:  $= 2x - 7 + 3x$

$$= 2(0) - 7 + 3(0)$$

$$= -7$$

4.  $4x - 8 - 9x = 10 + 2x - 4$

$$-5x - 8 = 6 + 2x$$

$$-7x = 14$$

$$\boxed{x = -2}$$

LS:  $= 4x - 8 - 9x$

$$= 4(-2) - 8 - 9(-2)$$

$$= -8 - 8 + 18 = 2$$

RS:  $= 10 + 2x - 4$

$$= 10 + 2(-2) - 4$$

$$= 10 - 4 - 4 = 2$$



$$5. \quad 3x + 14 = 4x + 9$$

$$-x = -5$$

$$\boxed{x = 5}$$

$$\text{LS:} = 3x + 14$$

$$= 3(5) + 14$$

$$= 15 + 14 = 29$$

$$\text{RS:} = 4x + 9$$

$$= 4(5) + 9$$

$$= 20 + 9 = 29$$

$$6. \quad 16x - 12 = 6x - 32$$

$$10x = -20$$

$$\boxed{x = -2}$$

$$\text{LS:} = 16x - 12$$

$$= 16(-2) - 12$$

$$= -32 - 12 = -44$$

$$\text{RS:} = 6x - 32$$

$$= 6(-2) - 32$$

$$= -12 - 32 = -44$$

$$7. \quad 5 + 3 + 4x = 5x + 12 - 25$$

$$+4x - 5x = +12 - 25 - 5 - 3$$

$$-x = -21$$

$$\boxed{x = 21}$$

$$\text{LS:} = 5 + 3 + 4x$$

$$= 8 + 4(21)$$

$$= 8 + 84 = 92$$

$$\text{RS:} = 5x + 12 - 25$$

$$= 5(21) - 13$$

$$= 105 - 13 = 92$$

$$\begin{aligned}
 8. \quad & -3 + 2x + 5 = 5x - 36 + 14 \\
 & + 2x - 5x = -36 + 14 + 3 - 5 \\
 & -3x = -24 \\
 & \boxed{x = 8}
 \end{aligned}$$

$$\begin{aligned}
 \text{LS:} &= -3 + 2x + 5 \\
 &= -3 + 2(8) + 5 \\
 &= -3 + 16 + 5 \\
 &= 18
 \end{aligned}$$

$$\begin{aligned}
 \text{RS:} &= 5x - 36 + 14 \\
 &= 5(8) - 36 + 14 \\
 &= 40 - 36 + 14 = 18
 \end{aligned}$$

$$\begin{aligned}
 9. \quad & x - 50 = 100 + 0.34x + 0.21x \\
 & x - 50 = 100 + 0.55x \\
 & x - 0.55x = 150 \\
 & (1 - 0.55)x = 150 \\
 & 0.45x = 150 \\
 & \boxed{x = 333.\dot{3}}
 \end{aligned}$$

CHECK:

<u>L.S.</u>		<u>R.S.</u>
$333.\dot{3} - 50$		$100 + 0.34(333.\dot{3}) + 0.21(333.\dot{3})$
$= 283.\dot{3}$		$= 100 + 113.\dot{3} + 70$
		$= 283.\dot{3}$

$$10. \frac{x}{1 + 0.25 \times \frac{6}{12}} = \frac{2^3}{3^2} x$$

$$\frac{x}{1.125} = \frac{8}{9} x$$

$$0.\bar{8}x - 0.\bar{8}x = 0$$

$$\boxed{x = \text{all real numbers}}$$

CHECK:

$$\begin{array}{l} \text{L.S.} \\ \frac{1}{1 + 0.25 \times \frac{6}{12}} \end{array}$$

$$\begin{array}{l} = \frac{1}{1.125} \\ = 0.\bar{8} \end{array}$$

$$\begin{array}{l} \text{R.S.} \\ \frac{2^3}{3^2}(1) \\ = \frac{8}{9}(1) \\ = 0.\bar{8} \end{array}$$

### Exercise 2.6

A. 1.  $12x - 4(9x - 20) = 320$

$$12x - 36x + 80 = 320$$

$$-24x = 240$$

$$\boxed{x = -10}$$

$$\text{LS} = 12(-10) - 4[9(-10) - 20]$$

$$= -120 - 4[-90 - 20]$$

$$= -120 + 440$$

$$= 320$$

$$\text{RS} = 320$$

2.  $5(x - 4) - 3(2 - 3x) = -54$

$$5x - 20 - 6 + 9x = -54$$

$$14x - 26 = -54$$

$$14x = -28$$

$$\boxed{x = -2}$$

$$\text{LS} = 5[-2 - 4] - 3[2 - 3(-2)]$$

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

$$= -30 - 24$$

$$= -54$$

$$\text{RS} = -54$$

$$3. \quad 3(2x - 5) - 2(2x - 3) = -15$$

$$6x - 15 - 4x + 6 = -15$$

$$2x - 9 = -15$$

$$2x = -6$$

$$\boxed{x = -3}$$

$$\text{LS} = 3[2(-3) - 5] - 2[2(-3) - 3]$$

$$= 3[-65] - 2[-6 - 3]$$

$$= 3(-11) - 2(-9)$$

$$= -33 + 18$$

$$= -15$$

$$\text{RS} = -15$$

$$4. \quad 17 - 3(2x - 7) = 7x - 3(2x - 1)$$

$$17 - 6x + 21 = 7x - 6x + 3$$

$$-6x + 38 = x + 3$$

$$-7x = -35$$

$$\boxed{x = 5}$$

$$\text{LS} = 17 - 3[2(5) - 7]$$

$$= 17 - 3[10 - 7]$$

$$= 17 - 9 = 8$$

$$\text{RS} = 7(5) - 3[2(5) - 1]$$

$$= 35 - 3[10 - 1]$$

$$= 35 - 27 = 8$$

$$5. \quad 4x + 2(2x - 3) = 18$$

$$4x + 4x - 6 = 18$$

$$8x = 24$$

$$\boxed{x = 3}$$

$$\text{LS} = 4(3) + 2[2(3) - 3]$$

$$= 12 + 2[6 - 3]$$

$$= 12 + 6$$

$$= 18$$

$$\text{RS} = 18$$

$$6. \quad -3(1-11x) + (8x-15) = 187$$

$$-3 + 33x + 8x - 15 = 187$$

$$33x + 8x = 187 + 3 + 15$$

$$41x = 205$$

$$\boxed{x = 5}$$

$$\text{LS} = -3[(1-11(5))] + [8(5)-15]$$

$$= -3[-54] + 25$$

$$= 162 + 25$$

$$= 187$$

$$\text{RS} = 187$$

$$7. \quad 10x - 4(2x-1) = 32$$

$$10x - 8x + 4 = 32$$

$$2x = 28$$

$$\boxed{x = 14}$$

$$\text{LS} = 10(14) - 4[2(14) - 1]$$

$$= 140 - 4[27]$$

$$= 140 - 108$$

$$= 32$$

$$\text{RS} = 32$$

$$8. \quad -2(x-4) + 12(3-2x) = -8$$

$$-2x + 8 + 36 - 24x = -8$$

$$-2x - 24x = -8 - 8 - 36$$

$$-26x = -52$$

$$\boxed{x = 2}$$

$$\text{LS} = -2(2-4) + 12[3-2(2)]$$

$$= -4 + 8 + 36 - 48$$

$$= -8$$

$$\text{RS} = -8$$

$$9. \quad x \left( 1 + 0.12 \times \frac{65}{365} \right) = 1225.64$$

$$1.021370x = 1225.64$$

$$x = 1199.996245$$

$$\boxed{x = 1200.00}$$

CHECK:

<u>L.S.</u>	<u>R.S.</u>
$1200\left(1+0.12\times\frac{65}{365}\right)$	1225.64
$=1200(1.021370)$	
$=1225.643836$	

$$10. x + \frac{x}{1.25} + \frac{x}{(1.25)^2} = 3148 + \frac{1000}{(1.25)^3}$$

$$x + 0.80x + 0.64x = 3148 + 512$$

$$2.44x = 3660$$

$$\boxed{x = 1500}$$

CHECK:

<u>L.S.</u>	<u>R.S.</u>
$1500 + \frac{1500}{1.25} + \frac{1500}{(1.25)^2}$	3660
$= 1500 + 1200 + 960$	
$= 3660$	

$$B. 1. x - \frac{1}{4}x = 15$$

$$4x - x = 60$$

$$3x = 60$$

$$\boxed{x = 20}$$

$$2. x + \frac{5}{8}x = 26$$

$$8x + 5x = 208$$

$$13x = 208$$

$$\boxed{x = 16}$$

$$3. \frac{2}{3}x - \frac{1}{4} = -\frac{7}{4} - \frac{5}{6}x$$

$$8x - 3 = -21 - 10x$$

$$18x = -18$$

$$\boxed{x = -1}$$

$$4. \quad \frac{5}{3} - \frac{2}{5}x = \frac{1}{6}x - \frac{1}{30}$$

$$50 - 12x = 5x - 1$$

$$-17x = -51$$

$$\boxed{x = 3}$$

$$5. \quad \frac{3}{4}x + 4 = \frac{113}{24} - \frac{2}{3}x$$

$$18x + 96 = 113 - 16x$$

$$34x = 17$$

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

$$6. \quad 2 - \frac{3}{2}x = \frac{2}{3}x + \frac{31}{9}$$

$$36 - 27x = 12x + 62$$

$$-39x = 26$$

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

$$7. \quad 1 - \frac{1}{3}x = 15 + \frac{2}{3}x$$

$$3\left[1 - \frac{1}{3}x\right] = 3\left[15 + \frac{2}{3}x\right]$$

$$3 - x = 45 + 2x$$

$$-42 = 3x$$

$$\boxed{x = -14}$$

$$8. \quad \frac{3x-2}{5} = \frac{2x-1}{3}$$

$$3(3x-2) = 5(2x-1)$$

$$9x - 6 = 10x - 5$$

$$\boxed{x = -1}$$

$$9. \quad \frac{21}{8} - \frac{2}{5}x = \frac{11}{4}x - \frac{1}{10}$$

$$40 \left[ \frac{21}{8} - \frac{2}{5}x \right] = 40 \left[ \frac{11}{4}x - \frac{1}{10} \right]$$

$$105 - 16x = 110x - 4$$

$$109 = 126x$$

$$\boxed{x = \frac{109}{126}}$$

$$10. \quad -\frac{2}{3}x - \frac{1}{12}x = \frac{3}{4} + \frac{1}{24}x$$

$$24 \left[ -\frac{2}{3}x - \frac{1}{12}x \right] = 24 \left[ \frac{3}{4} + \frac{1}{24}x \right]$$

$$-16x - 2x = 18 + x$$

$$-18x = 18 + x$$

$$-18 = 19x$$

$$\boxed{x = \frac{-18}{19}}$$

$$C. 1. \quad \frac{3}{4}(2x-1) - \frac{1}{3}(5-2x) = -\frac{55}{12}$$

$$9(2x-1) - 4(5-2x) = -55$$

$$18x - 9 - 20 + 8x = -55$$

$$26x - 29 = -55$$

$$26x = -26$$

$$\boxed{x = -1}$$

$$2. \quad \frac{4}{5}(4-3x) + \frac{53}{40} = \frac{3}{10}x - \frac{7}{8}(2x-3)$$

$$32(4-3x) + 53 = 12x - 35(2x-3)$$

$$128 - 96x + 53 = 12x - 70x + 105$$

$$-96x + 181 = -58x + 105$$

$$-38x = -76$$

$$\boxed{x = 2}$$



$$3. \quad \frac{2}{3}(2x-1) - \frac{3}{4}(3-2x) = 2x - \frac{20}{9}$$

$$24(2x-1) - 27(3-2x) = 72x - 80$$

$$48x - 24 - 81 + 54x = 72x - 80$$

$$102x - 105 = 72x - 80$$

$$30x = 25$$

$$\boxed{x = \frac{5}{6}}$$

$$4. \quad \frac{4}{3}(3x-2) - \frac{3}{5}(4x-3) = \frac{11}{60} + 3x$$

$$80(3x-2) - 36(4x-3) = 11 + 180x$$

$$240x - 160 - 144x + 108 = 11 + 180x$$

$$96x - 52 = 11 + 180x$$

$$-84x = 63$$

$$\boxed{x = -\frac{3}{4}}$$

$$5. \quad \frac{2}{3}(5x-1) = -\frac{3}{5}(x+2)$$

$$15 \left[ \frac{2}{3}(5x-1) \right] = 15 \left[ -\frac{3}{5}(x+2) \right]$$

$$10(5x-1) = -9(x+2)$$

$$50x - 10 = -9x - 18$$

$$59x = -8$$

$$\boxed{x = \frac{-8}{59}}$$

D. 1.  $y = mx + b$

$$y - b = mx$$

$$\boxed{x = \frac{y-b}{m}}$$

2.  $r = \frac{M}{S}$

$$Sr = M$$

$$\boxed{S = \frac{M}{r}}$$

$$3. \quad PV = \frac{PMT}{i}$$

$$\boxed{PMT = PVi}$$

$$4. \quad I = Prt$$

$$\boxed{t = \frac{I}{Pr}}$$

$$5. \quad S = P(1 + rt)$$

$$\frac{S}{P} = 1 + rt$$

$$\frac{S}{P} - 1 = rt$$

$$r = \frac{\frac{S}{P} - 1}{t}$$

$$r = \frac{S - P}{Pt}$$

$$\boxed{r = \frac{S - P}{Pt}}$$

$$6. \quad PV = FV(1 + i)^{-n}$$

$$\frac{PV}{FV} = (1 + i)^{-n}$$

$$\left[ \frac{PV}{FV} \right]^{\frac{1}{n}} = 1 + i$$

$$\left[ \frac{FV}{PV} \right]^{\frac{1}{n}} = 1 + i$$

$$\boxed{i = \left[ \frac{FV}{PV} \right]^{\frac{1}{n}} - 1}$$

$$7. \quad P = \frac{S}{(1 + rt)} \quad \text{for } t$$

$$P(1 + rt) = S$$

$$P + Prt = S$$

$$Prt = S - P$$

$$\boxed{t = \frac{S - P}{Pr}}$$

$$8. \quad N = L(1-d) \quad \text{for } d$$

$$N = L - dL$$

$$dL = L - N$$

$$\boxed{d = \frac{L - N}{L}}$$

$$9. \quad f = (1+i)^m - 1 \quad \text{for } i$$

$$(1+f) = (1+i)^m$$

$$(1+f)^{\frac{1}{m}} = ((1+i)^m)^{\frac{1}{m}}$$

$$(1+f)^{\frac{1}{m}} = 1+i$$

$$\boxed{i = (1+f)^{\frac{1}{m}} - 1}$$

$$10. \quad FV = PV(1+i)^n \quad \text{for } n$$

$$\frac{FV}{PV} = (1+i)^n$$

$$\ln\left(\frac{FV}{PV}\right) = n \ln(1+i)$$

$$\boxed{n = \frac{\ln\left(\frac{FV}{PV}\right)}{\ln(1+i)}}$$

### Exercise 2.7

1. Let the cost be \$x.

$$\text{Selling price} = \$\left(x + \frac{3}{4}x\right)$$

$$\therefore x + \frac{3}{4}x = 49.49$$

$$4x + 3x = 197.96$$

$$7x = 197.96$$

$$x = 28.28$$

The cost was  $\boxed{\$28.28}$ .

2. Let the regular selling price be \$ $x$ .

$$\text{Sale price} = \$\left(x - \frac{1}{3}x\right)$$

$$\therefore x - \frac{1}{3}x = 576$$

$$3x - x = 1728$$

$$2x = 1728$$

$$x = 864$$

The regular selling price was  $\boxed{\$864.}$

3. Let the price be \$ $x$ .

$$\text{Total} = \$x + 0.05x$$

$$\therefore x + 0.05x = \$36.75$$

$$1.05x = \$36.75$$

$$x = 35.00$$

The price was  $\boxed{\$35.00.}$

4. Let the regular price be \$ $x$ .

$$\text{Sale price} = \$(x - 0.40x)$$

$$\therefore x - 0.40x = 11.34$$

$$0.60x = 11.34$$

$$x = 18.90$$

The regular selling price was  $\boxed{\$18.90.}$

5. Let the last month's index be  $x$ .

$$\text{This month's index} = x - \frac{1}{12}x$$

$$\therefore x - \frac{1}{12}x = 176$$

$$12x - x = 2112$$

$$11x = 2112$$

$$x = 192$$

Last month the index was  $\boxed{192.}$

6. Let the original hourly wage be  $\$x$ .

$$\text{New hourly wage} = \$\left(x + \frac{1}{8}x\right)$$

$$\therefore x + \frac{1}{8}x = 12.78$$

$$8x + x = 102.24$$

$$9x = 102.24$$

$$x = 11.36$$

The hourly wage before the increase was  $\boxed{\$11.36}$ .

7. Let Vera's sales be  $\$x$ .

$$\text{Tai's sales} = \$(3x - 140)$$

$$\text{Total sales} = \$(x + 3x - 140)$$

$$\therefore x + 3x - 140 = 940$$

$$4x = 1080$$

$$x = 270$$

$$\text{Tai's sales} = 3(270) - 140 = \boxed{\$670}$$

8. Let the shorter piece be  $x$  cm.

$$\text{Length of longer piece} = (2x + 15) \text{ cm.}$$

$$\text{Total length} = (x + 2x + 15) \text{ cm}$$

$$\therefore x + 2x + 15 = 90$$

$$3x = 75$$

$$x = 25$$

$$\text{The longer piece is } 2(25) \text{ cm} + 15 \text{ cm} = \boxed{65 \text{ cm.}}$$

9. Let the cost of a ticket be  $\$x$ .

$$\text{Total} = \$(x + 5.00) \times 1.05 \times 2$$

$$\therefore (x + 5.00) \times 1.05 \times 2 = 197.40$$

$$(x + 5.00) \times 2.10 = 197.40$$

$$(x + 5.00) = 94.00$$

$$x = 89.00$$

The cost per ticket is  $\boxed{\$89.00}$ .

10. Let Ken's investment be \$ $x$ .

$$\text{Martina's investment} = \$\left(\frac{2}{3}x + 2500\right)$$

$$\text{Total investment} = \$\left(x + \frac{2}{3}x + 2500\right)$$

$$\therefore x + \frac{2}{3}x + 2500 = 55\,000$$

$$\frac{5x}{3} = 52\,500$$

$$x = 31\,500$$

$$\text{Martina's investment is } \frac{2}{3} \times 31\,500 + 2500 = \boxed{\$23\,500.}$$

11. Let the number of chairs produced by the first shift be  $x$ .

$$\text{Number of chairs produced by the second shift} = \frac{4}{3}x - 60.$$

$$\text{Total production} = x + \frac{4}{3}x - 60 = 2320.$$

$$\therefore x + \frac{4}{3}x - 60 = 2320$$

$$\frac{7}{3}x = 2380$$

$$x = 1020$$

$$\text{Production by the second shift is } \frac{4}{3} \times 1020 - 60 = \boxed{1300.}$$

12. Let the number of type A lights be  $x$ .

$$\text{Number of type B lights} = 60 - x.$$

$$\text{Value of type A lights} = \$40x.$$

$$\text{Value of type B lights} = \$(60 - x)50.$$

$$\therefore 40x + 50(60 - x) = 2580$$

$$40x + 3000 - 50x = 2580$$

$$-10x = -420$$

$$x = 42$$

$$\text{The number of type B lights is } \boxed{18.}$$

13. Let the number of units of Product A be  $x$ ;  
 then the number of units of Product B is  $60 - x$ .  
 The number of hours for Product A is  $4x$ ;  
 The number of hours for Product B is  $3(60 - x)$ .

$$\therefore 4x + 3(60 - x) = 200$$

$$4x + 180 - 3x = 200$$

$$x = 20$$

Production of Product A is 20 units.

14. Let the number of dimes be  $x$ .

$$\text{Number of nickels} = 3x - 4$$

$$\text{Number of quarters} = \frac{3}{4}x + 1$$

$$\text{Value of the dimes} = 10x \text{ cents}$$

$$\text{Value of nickels} = 5(3x - 4) \text{ cents}$$

$$\text{Value of quarters} = 25\left(\frac{3}{4}x + 1\right) \text{ cents}$$

$$\therefore 10x + 5(3x - 4) + 25\left(\frac{3}{4}x + 1\right) = 880$$

$$10x + 15x - 20 + \frac{75}{4}x + 25 = 880$$

$$25x + \frac{75}{4}x = 875$$

$$175x = 3500$$

$$x = 20$$

Alick has 20 dimes, 56 nickels, and 16 quarters.

15. Let the number of \$12 tickets be  $x$ .

$$\text{Number of \$8 tickets} = 3x + 10$$

$$\text{Number of \$15 tickets} = \frac{4}{5}x - 3$$

$$\text{Value of the \$12 tickets} = \$12x$$

$$\text{Value of the \$8 tickets} = \$8(3x + 10)$$

$$\text{Value of the \$15 tickets} = \$15\left(\frac{4}{5}x - 3\right)$$

$$\therefore 12x + 8(3x + 10) + 15\left(\frac{4}{5}x - 3\right) = 1475$$

$$12x + 24x + 80 + 12x - 45 = 1475$$

$$48x = 1440$$

$$x = 30$$

Sales were 

30 \$12 tickets,
100 \$ 8 tickets,
and 21 \$15 tickets.

16. Let the number of medium pizzas be  $x$ .

$$\text{Number of large pizzas} = 3x - 1$$

$$\text{Number of small pizzas} = 2x + 1$$

$$\text{Value of medium pizzas} = \$15x$$

$$\text{Value of large pizzas} = \$18(3x - 1)$$

$$\text{Value of small pizzas} = \$11(2x + 1)$$

$$\therefore 15x + 18(3x - 1) + 11(2x + 1) = 539$$

$$15x + 54x - 18 + 22x + 11 = 539$$

$$91x = 546$$

$$x = 6$$

Sales were 

6 medium pizzas,
17 large pizzas,
and 13 small pizzas.

17. Let the taxable income (in dollars) be  $x$ .

Then  $x - 44\,701$  is the amount by which his income exceeds \$44 701.

$$6705.15 + 0.22(x - 44701) = 7162.53$$

$$6705.15 + 0.22x - 9834.22 = 7162.53$$

$$0.22x = 10\,291.60$$

$$x = \$46\,780$$

His taxable income is \$46 780.



18. Let the amount invested at 3% be  $\$x$ .

Then the amount invested at 4.5% is  $(3000 - x)$ .

$$0.03x + 0.045(3000 - x) = 128.25$$

$$0.03x + 135 - 0.045x = 128.25$$

$$-0.015x = \boxed{-6.75}$$

$$x = \$450 \text{ at } 3\%$$

$$3000 - 450 = \$2550 \text{ at } 4.5\%$$

19. Let  $x$  be the number on the second shift.

Then  $2x$  is the number on the first shift.

And  $x - 12$  is the number on the third shift.

$$x + 2x + (x - 12) = 196$$

$$4x - 12 = 196$$

$$4x = 208$$

$$x = 52 \text{ on the second shift}$$

$$2x = 2(52) = 104 \text{ on the first shift}$$

$$x - 12 = 52 - 12 = 40 \text{ on the third shift}$$

20. Let  $x$  be the number of options received by each employee.

Then  $1.5x$  is the number received by each team leader.

And  $3x$  is the number received by each senior manager.

$$421x + 22(1.5x) + 7(3x) =$$

$$421x + 33x + 21x =$$

$$475x = 171\,000$$

$$x = 360 \text{ options for each employee}$$

$$1.5x = 1.5(360) = 540 \text{ options for each team leader}$$

$$(2)(540) = 1080 \text{ options for each senior manager}$$

$$\text{Check: } 421(360) + 22(540) + 7(1080) = 171\,000$$

21. Let the amount of money spent on recreational players be  $\$x$ .

If twice as much money was spent on rep players, then the amount spent on recreational players can be determined by

$$\$x + \$2x = \$4320$$

$$\$3x = \$4320$$

$$\$x = \$1440$$

And therefore, the amount spent on rep players was  $\$4320 - \$1440 = \$2880$ .

Let the number of Youth Large shirts purchased for recreational players be  $y$ .

$$\$10y + \$8(50) + \$8(50) = \$1440$$

$$\$10y + \$400 + \$400 = \$1440$$

$$\$10y = \$640$$

$$y = 64$$

64 Youth Large shirts were purchased for recreational players.

Let the number of Adult Small and Adult Medium shirts be  $z$ .

For rep players, the cost of shirts is given by

$$\$8(50 - 10) + \$10(3 \times 64) + \$16z + \$16z = \$2880$$

Therefore, the number of shirts of each Adult size ordered can be calculated as

$$\$320 + \$1920 + \$16(2z) = \$2880$$

$$\$2240 + \$16(2z) = \$2880$$

$$\$16(2z) = \$640$$

$$2z = 40$$

$$z = 20$$

20 Adult Small and 20 Adult Medium shirts were purchased for rep players.

$$(50 + 50 + 64) + (40 + 192 + 20 + 20) = 436$$

There are a total of 436 players in the organization.

### Review Exercise

1. (a)  $3x - 4y - 3y - 5x = \boxed{-2x - 7y}$

(b)  $2x - 0.03x = \boxed{1.97x}$

(c)  $(5a - 4) - (3 - a) = 5a - 4 - 3 + a = \boxed{6a - 7}$

(d)  $-(2x - 3y) - (-4x + y) + (y - x) = -2x + 3y + 4x - y + y - x = \boxed{x + 3y}$

(e)  $(5a^2 - 2b - c) - (3c + 2b - 4a^2)$

$$= 5a^2 - 2b - c - 3c - 2b + 4a^2 = \boxed{9a^2 - 4b - 4c}$$

(f)  $-(2x - 3) - (x^2 - 5x + 2) = -2x + 3 - x^2 + 5x - 2 = \boxed{-x^2 + 3x + 1}$

2. (a)  $3(-5a) = \boxed{-15a}$

(b)  $-7m(-4x) = \boxed{28mx}$

(c)  $14m \div (-2m) = \boxed{-7}$

$$(d) (-15a^2b) \div (5a) = \boxed{-3ab}$$

$$(e) -6(-3x)(2y) = \boxed{36xy}$$

$$(f) 4(-3a)(b)(-2c) = \boxed{24abc}$$

$$(g) -4(3x - 5y - 1) = \boxed{-12x + 20y + 4}$$

$$(h) x(1 - 2x - x^2) = \boxed{x - 2x^2 - x^3}$$

$$(i) (24x - 16) \div (-4) = \boxed{-6x + 4}$$

$$(j) (21a^2 - 12a) \div 3a = \boxed{7a - 4}$$

$$(k) \quad 4(2a - 5) - 3(3 - 6a) \\ = 8a - 20 - 9 + 18a \\ = \boxed{26a - 29}$$

$$(l) \quad 2a(x - a) - a(3x + 2) - 3a(-5x - 4) \\ = 2ax - 2a^2 - 3ax - 2a + 15ax + 12a \\ = \boxed{14ax - 2a^2 + 10a}$$

$$(m) \quad (m - 1)(2m - 5) \\ = 2m^2 - 2m - 5m + 5 \\ = \boxed{2m^2 - 7m + 5}$$

$$(n) \quad (3a - 2)(a^2 - 2a - 3) \\ = 3a^3 - 2a^2 - 6a^2 + 4a - 9a + 6 \\ = \boxed{3a^3 - 8a^2 - 5a + 6}$$

$$(o) \quad 3(2x - 4)(x - 1) - 4(x - 3)(5x + 2) \\ = 3(2x^2 - 4x - 2x + 4) - 4(5x^2 - 15x + 2x - 6) \\ = 6x^2 - 18x + 12 - 20x^2 + 52x + 24 \\ = \boxed{-14x^2 + 34x + 36}$$

$$(p) \quad -2a(3m - 1)(m - 4) - 5a(2m + 3)(2m - 3) \\ = -2a(3m^2 - m - 12m + 4) - 5a(4m^2 + 6m - 6m - 9) \\ = -6am^2 + 26am - 8a - 20am^2 + 45a \\ = \boxed{-26am^2 + 26am + 37a}$$

3. (a) for  $x = -2$ ,  $y = 5$ ,

$$3xy - 4x - 5y = 3(-2)(5) - 4(-2) - 5(5) = -30 + 8 - 25 = \boxed{-47}$$

(b) for  $a = -\frac{1}{4}$ ,  $b = \frac{2}{3}$ ,

$$\begin{aligned} & -5(2a - 3b) - 2(a + 5b) \\ &= -10a + 15b - 2a - 10b \\ &= -12a + 5b \\ &= -12\left(-\frac{1}{4}\right) + 5\left(\frac{2}{3}\right) = 3 + 3\frac{1}{3} = \boxed{6\frac{1}{3}} \end{aligned}$$

(c) for  $N = 12$ ,  $C = 432$ ,  $P = 1800$ ,  $n = 35$ ,

$$\frac{2NC}{P(n+1)} = \frac{2 \times 12 \times 432}{1800 \times (35+1)} = \frac{12 \times 48}{100 \times 36} = \frac{16}{100} = \boxed{0.16}$$

(d) for  $I = 600$ ,  $r = 0.15$ ,  $P = 7300$ ,

$$\frac{365 I}{rP} = \frac{365 \times 600}{0.15 \times 7300} = \frac{2}{0.01} = \boxed{200}$$

(e) for  $A = \$720$ ,  $d = 0.135$ ,  $t = \frac{280}{365}$ ,

$$A(1 - dt) = \$720 \left( 1 - 0.135 \times \frac{280}{365} \right) = \$720(1 - 0.103562) = 645.435616 = \boxed{\$645.44}$$

(f) for  $S = 2755$ ,  $r = 0.17$ ,  $t = \frac{219}{365}$ ,

$$\frac{S}{1 + rt} = \frac{2755}{1 + 0.17 \times \frac{219}{365}} = \frac{2755}{1 + 0.034 \times 3} = \frac{2755}{1 + 0.102} = \boxed{2500}$$

4. (a)  $(-3)^5 = \boxed{-243}$ (b)  $\left(\frac{2}{3}\right)^4 = \boxed{\frac{16}{81}}$ (c)  $(-5)^0 = \boxed{1}$

$$(d) (-3)^{-1} = \boxed{-\frac{1}{3}}$$

$$(e) \left(\frac{2}{5}\right)^{-4} = \left(\frac{5}{2}\right)^4 = \boxed{\frac{625}{16}}$$

$$(f) (1.01)^0 = \boxed{1}$$

$$(g) (-3)^5(-3)^4 = (-3)^9 = \boxed{-19\,683}$$

$$(h) 4^7 \div 4^2 = 4^5 = \boxed{1024}$$

$$(i) [(-3)^2]^5 = (-3)^{10} = \boxed{59\,049}$$

$$(j) (m^3)^4 = \boxed{m^{12}}$$

$$(k) \left(\frac{2}{3}\right)^3 \left(\frac{2}{3}\right)^7 \left(\frac{2}{3}\right)^{-6} = \left(\frac{2}{3}\right)^4 = \boxed{\frac{16}{81}}$$

$$(l) \left(-\frac{5}{4}\right)^5 \div \left(-\frac{5}{4}\right)^3 = \left(-\frac{5}{4}\right)^2 = \boxed{\frac{25}{16}}$$

$$(m) (1.03^{50})(1.03^{100}) = \boxed{1.03^{150}}$$

$$(n) (1+i)^{180} \div (1+i)^{100} = \boxed{(1+i)^{80}}$$

$$(o) [(1.05)^{30}]^5 = \boxed{1.05^{150}}$$

$$(p) (-2xy)^4 = \boxed{16x^4y^4}$$

$$(q) \left(\frac{a^2b}{3}\right)^{-4} = \left(\frac{3}{a^2b}\right)^4 = \boxed{\frac{81}{a^8b^4}}$$

$$(r) (1+i)^{-n} = \boxed{\frac{1}{(1+i)^n}}$$

$$5. (a) \sqrt{0.9216} = \boxed{0.96}$$

$$(b) \sqrt[4]{1.075} = \boxed{1.012126}$$

$$(c) 14.974458^{1/40} = \boxed{1.07}$$

$$(d) 1.08^{-5/12} = \frac{1}{1.08^{5/12}} = \boxed{0.968442}$$

$$(e) \ln 3 = \boxed{1.098612}$$

$$(f) \ln 0.05 = \boxed{-2.995732}$$

$$(g) \ln(5.1) / \ln(1.015) \\ = 1.629241 / 0.014889 \\ = 109.428635$$

$$(h) \ln\left(\frac{5500}{1.10^{16}}\right) = \ln 5500 - \ln 1.10^{16} \\ = \ln 5500 - 16 \ln 1.10 \\ = 8.612503 - 16(0.095310) \\ = 8.612503 - 1.524963 \\ = \boxed{7.087540}$$

$$(i) \ln\left[375(1.01)\left(\frac{1-1.01^{-72}}{0.01}\right)\right] = \ln 375 + \ln 1.01 + \ln(1-1.01^{-72}) - \ln 0.01 \\ = \ln 375 + \ln 1.01 + \ln(1-0.488496) - \ln 0.01 \\ = \ln 375 + \ln 1.01 + \ln 0.511504 - \ln 0.01 \\ = 5.926926 + 0.009950 - 0.670400 - (-4.605170) \\ = \boxed{9.871647}$$

$$6. (a) 9x = -63$$

$$\boxed{x = -7}$$

$$(b) 0.05x = 44$$

$$5x = 4400$$

$$\boxed{x = 880}$$

$$(c) -\frac{1}{7}x = 3$$

$$-x = 21$$

$$\boxed{x = -21}$$

$$(d) \frac{5}{6}x = -15$$

$$\frac{1}{6}x = -3$$

$$\boxed{x = -18}$$

$$(e) \quad x - 8 = -5$$

$$x - 8 + 8 = -5 + 8$$

$$\boxed{x = 3}$$

$$(f) \quad x + 9 = -2$$

$$x + 9 - 9 = -2 - 9$$

$$\boxed{x = -11}$$

$$(g) \quad x + 0.02x = 255$$

$$1.02x = 255$$

$$\boxed{x = 250}$$

$$(h) \quad x - 0.1x = 36$$

$$0.9x = 36$$

$$9x = 360$$

$$\boxed{x = 40}$$

$$(i) \quad 4x - 3 = 9x + 2$$

$$-5x = 5$$

$$\boxed{x = -1}$$

$$(j) \quad 9x - 6 - 3x = 15 + 4x - 7$$

$$6x - 6 = 8 + 4x$$

$$2x = 14$$

$$\boxed{x = 7}$$

$$(k) \quad x - \frac{1}{3}x = 26$$

$$\frac{2}{3}x = 26$$

$$\frac{1}{3}x = 13$$

$$\boxed{x = 39}$$

$$(1) x + \frac{3}{8}x = 77$$

$$\frac{11}{8}x = 77$$

$$\frac{1}{8}x = 7$$

$$\boxed{x = 56}$$

$$7. (a) -9(3x - 8) - 8(9 - 7x) = 5 + 4(9x + 11)$$

$$-27x + 72 - 72 + 56x = 5 + 36x + 44$$

$$29x = 49 + 36x$$

$$-7x = 49$$

$$\boxed{x = -7}$$

$$\text{Check LS} = -9[3(-7) - 8] - 8[9 - 7(-7)] = -9(-29) - 8(58) = -203$$

$$\text{RS} = 5 + 4[9(-7) + 11] = 5 + 4(-52) = 5 - 208 = -203$$

$$(b) 21x - 4 - 7(5x - 6) = 8x - 4(5x - 7)$$

$$21x - 4 - 35x + 42 = 8x - 20x + 28$$

$$-14x + 38 = -12x + 28$$

$$-2x = -10$$

$$\boxed{x = 5}$$

$$\text{Check LS} = 21(5) - 4 - 7[5(5) - 6] = 105 - 4 - 7(19) = 101 - 133 = -32$$

$$\text{RS} = 8(5) - 4[5(5) - 7] = 40 - 4(18) = 40 - 72 = -32$$

$$(c) \quad \frac{5}{7}x + \frac{1}{2} = \frac{5}{14} + \frac{2}{3}x$$

$$42\left(\frac{5}{7}x\right) + 42\left(\frac{1}{2}\right) = 42\left(\frac{5}{14}\right) + 42\left(\frac{2}{3}x\right)$$

$$6(5x) + 21(1) = 3(5) + 14(2x)$$

$$30x + 21 = 15 + 28x$$

$$2x = -6$$

$$\boxed{x = -3}$$

$$\text{Check LS} = \frac{5}{7}(-3) + \frac{1}{2} = \frac{-30 + 7}{14} = -\frac{23}{14}$$

$$\text{RS} = \frac{5}{14} + \frac{2}{3}(-3) = \frac{5}{14} - 2 = -\frac{23}{14}$$



$$(d) \quad \frac{4x}{3} + 2 = \frac{9}{8} - \frac{x}{6}$$

$$8(4x) + 24(2) = 3(9) - 4(x)$$

$$32x + 48 = 27 - 4x$$

$$36x = -21$$

$$\boxed{x = -\frac{7}{12}}$$

$$\text{Check LS} = \frac{4}{3} \left( -\frac{7}{12} \right) + 2 = -\frac{28}{36} + 2 = -\frac{7}{9} + \frac{18}{9} = \frac{11}{9}$$

$$\text{RS} = \frac{9}{8} - \frac{1}{6} \left( -\frac{7}{12} \right) = \frac{9}{8} + \frac{7}{72} = \frac{81+7}{72} = \frac{88}{72} = \frac{11}{9}$$

$$(e) \quad \frac{7}{5}(6x-7) - \frac{3}{8}(7x+15) = 25$$

$$56(6x-7) - 15(7x+15) = 40(25)$$

$$336x - 392 - 105x - 225 = 1000$$

$$231x - 617 = 1617$$

$$\boxed{x = 7}$$

$$\text{Check LS} = \frac{7}{5}[6(7)-7] - \frac{3}{8}[7(7)+15]$$

$$= \frac{7}{5}(35) - \frac{3}{8}(64) = 7(7) - 24 = 49 - 24 = 25$$

$$\text{RS} = 25$$

$$(f) \quad \frac{5}{9}(7-6x) - \frac{3}{4}(3-15x) = \frac{1}{12}(3x-5) - \frac{1}{2}$$

$$20(7-6x) - 27(3-15x) = 3(3x-5) - 18$$

$$140 - 120x - 81 + 405x = 9x - 15 - 18$$

$$285x + 59 = 9x - 33$$

$$276x = -92$$

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

$$\text{Check LS} = \frac{5}{9} \left[ 7 - 6 \left( -\frac{1}{3} \right) \right] - \frac{3}{4} \left[ 3 - 15 \left( -\frac{1}{3} \right) \right]$$

$$= \frac{5}{9} (7 + 2) - \frac{3}{4} (3 + 5)$$

$$= 5 - 6 = -1$$

$$\text{RS} = \frac{1}{12} \left[ 3 \left( -\frac{1}{3} \right) - 5 \right] - \frac{1}{2}$$

$$= \frac{1}{12} (-6) - \frac{1}{2}$$

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

$$(g) \quad \frac{5}{6} (4x - 3) - \frac{2}{5} (3x + 4) = 5x - \frac{16}{15} (1 - 3x)$$

$$25(4x - 3) - 12(3x + 4) = 150x - 32(1 - 3x)$$

$$100x - 75 - 36x - 48 = 150x - 32 + 96x$$

$$64x - 123 = 246x - 32$$

$$-182x = 91$$

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

$$\text{Check LS} = \frac{5}{6} \left[ 4 \left( -\frac{1}{2} \right) - 3 \right] - \frac{2}{5} \left[ 3 \left( -\frac{1}{2} \right) + 4 \right]$$

$$= \frac{5}{6} (-2 - 3) - \frac{2}{5} \left[ -\frac{3}{2} + 4 \right]$$

$$= \frac{5}{6} (-5) - \frac{2}{5} \left( \frac{5}{2} \right) = -\frac{25}{6} - 1 = -\frac{31}{6}$$

$$\text{RS} = 5 \left( -\frac{1}{2} \right) - \frac{16}{15} \left[ 1 - 3 \left( -\frac{1}{2} \right) \right]$$

$$= -\frac{5}{2} - \frac{16}{15} \left( 1 + \frac{3}{2} \right) = -\frac{5}{2} - \frac{16}{15} \left( \frac{5}{2} \right)$$

$$= -\frac{5}{2} - \frac{8}{3} = \frac{-15 - 16}{6} = -\frac{31}{6}$$

8. (a)  $I = Prt$

$$\boxed{r = \frac{I}{Pt}}$$

$$(b) \quad S = P(1 + rt)$$

$$\frac{S}{P} = 1 + rt$$

$$\frac{S}{P} - 1 = rt$$

$$t = \frac{\frac{S}{P} - 1}{r}$$

$$t = \frac{S - P}{Pr}$$

$$\boxed{t = \frac{S - P}{Pr}}$$

$$(c) \quad D = rL$$

$$\boxed{r = \frac{D}{L}}$$

$$(d) \quad FV = PMT \left[ \frac{(1 + p)^n - 1}{p} \right]$$

$$\boxed{PMT = \left[ \frac{FVp}{(1 + p)^n - 1} \right]}$$

9. Let the size of the workforce be  $x$ .

$$\text{Number laid off} = \frac{1}{6}x$$

$$\text{Number after the layoff} = x - \frac{1}{6}x$$

$$\therefore x - \frac{1}{6}x = 690$$

$$\frac{5}{6}x = 690$$

$$5x = 4140$$

$$x = 828$$

$$\therefore \text{the number laid off is } \frac{1}{6} \times 828 = \boxed{138.}$$

10. Let last year's average property value be \$ $x$ .

$$\text{Current average value} = \$\left(x + \frac{2}{7}x\right)$$

$$\therefore x + \frac{2}{7}x = 81\,450$$

$$\frac{9}{7}x = 81\,450$$

$$\frac{1}{7}x = 9050$$

$$x = 63\,350$$

$\therefore$  Last year's average value was  $\boxed{\$63\,350}$ .

11. Let the quoted price be \$ $x$ .

$$\therefore x + \frac{1}{20}x = 2457$$

$$\frac{21}{20}x = 2457$$

$$\frac{1}{20}x = 117$$

$$x = 2340$$

$\therefore$  The gratuities =  $\frac{1}{20}$  of 2340 =  $\boxed{\$117}$ .

12. Let the value of the building be \$ $x$ .

$$\text{Value of the land} = \$\frac{1}{3}x - 2000$$

$$\text{Total value of the property} = \$x + \frac{1}{3}x - 2000$$

$$\therefore x + \frac{1}{3}x - 2000 = 184\,000$$

$$\frac{4}{3}x = 186\,000$$

$$\frac{1}{3}x = 46\,500$$

$$x = 139\,500$$

The value assigned to land is  $\$(184\,000 - 139\,500) = \boxed{\$44\,500}$ .

13. Let the cost of power be \$ $x$ .

$$\text{Cost of heat} = \$\left(\frac{3}{4}x + 22\right)$$

$$\text{Cost of water} = \$\left(\frac{1}{3}x - 11\right)$$

$$\text{Total cost} = x + \frac{3}{4}x + 22 + \frac{1}{3}x - 11 = 2010 + 10\% \text{ of } 2010.$$

$$12x + 9x + 4x = 12(2010 + 201 - 11)$$

$$25x = 26\,400$$

$$x = 1056$$

$$\text{Cost of heat} = \frac{3}{4} \times 1056 + 22 = \boxed{\$814}$$

$$\text{Cost of power} = \boxed{\$1056}$$

$$\text{Cost of water} = \frac{1}{3} \times 1056 - 11 = \boxed{\$341}$$

14. Let the amount allocated to newspaper advertising be \$ $x$ .

$$\text{Amount allocated to TV advertising} = \$(3x + 1000)$$

$$\text{Amount allocated to direct selling} = \frac{3}{4}[x + 3x + 1000]$$

$$\therefore x + 3x + 1000 + \frac{3}{4}[4x + 1000] = 87\,500$$

$$4x + \frac{3}{4}[4x + 1000] = 86\,500$$

$$16x + 12x + 3000 = 346\,000$$

$$28x = 343\,000$$

$$x = 12\,250$$

The amount allocated to newspaper advertising is \$12 250; the amount allocated to TV advertising is \$37 750; the amount allocated to direct selling is  $\boxed{\$37\,500}$

15. Let the number of minutes on Machine B be  $x$ .

$$\text{Time on Machine A} = \frac{4}{5}x - 3 \text{ minutes}$$

$$\text{Time on Machine C} = \frac{5}{6}\left(x + \frac{4}{5}x - 3\right) \text{ minutes}$$

$$\text{Total time} = x + \frac{4}{5}x - 3 + \frac{5}{6}\left(x + \frac{4}{5}x - 3\right) \text{ minutes}$$

$$\therefore x + \frac{4}{5}x - 3 + \frac{5}{6}\left(x + \frac{4}{5}x - 3\right) = 77$$

$$30x + 24x - 90 + 25\left(x + \frac{4}{5}x - 3\right) = 30(77)$$

$$54x - 90 + 25x + 20x - 75 = 2310$$

$$99x - 165 = 2310$$

$$99x = 2475$$

$$x = 25$$

Time on Machine B is 25 minutes; time on Machine A is  $\frac{4}{5}(25) - 3 = 17$  minutes; time on

Machine C is  $\frac{5}{6}(25 + 17) = \boxed{35 \text{ minutes.}}$

16. Let the number of pairs of superlight poles be  $x$ .

Number of pairs of ordinary poles =  $72 - x$

Value of superlight poles =  $\$30x$

Value of ordinary poles =  $\$16(72 - x)$

Total value of all poles =  $\$30x + 16(72 - x)$

$$30x + 16(72 - x) = 1530$$

$$30x + 1152 - 16x = 1530$$

$$14x = 378$$

$$x = 27$$

The number of pairs of superlight poles is 27; the number of pairs of ordinary poles is 45.

17. Let the number of \$2 coins be  $x$ .

Number of \$1 coins =  $\frac{3}{5}x + 1$

Number of quarters =  $4\left(x + \frac{3}{5}x + 1\right)$

Value of the \$2 coins =  $\$2x$

Value of the \$1 coins =  $\$ \left[ \frac{3}{5}x + 1 \right]$

$$\text{Value of the quarters} = \$\frac{1}{4}(4)\left(x + \frac{3}{5}x + 1\right) = x + \frac{3}{5}x + 1$$

$$\text{Total value} = 2x + \frac{3}{5}x + 1 + x + \frac{3}{5}x + 1 = 107$$

$$10x + 3x + 5 + 5x + 3x + 5 = 535$$

$$21x + 10 = 535$$

$$21x = 525$$

$$x = 25$$

The number of \$2 coins is 25; the number of \$1 coins is  $\left(\frac{3}{5} \times 25 + 1\right) = 16$ ; the number of quarters is  $4(25 + 16) = \boxed{164}$ .

18. Let  $x$  represent Jaime's monthly savings.

Jaime has \$975 after paying for school and transportation.

$$0.30(975) + 600 + x = 975$$

$$892.50 + x = 975$$

$$x = 82.50$$

Jamie saves \$82.50 per month.

19. Let  $x$  represent the total valuation of Baldwin Industries.

Then Inspire Inc.'s stake is  $0.49x$  and Crown Company's stake is  $0.24x$ .

$$0.80(0.49x) = \$19\,600\,000$$

$$0.392x = \$19\,600\,000$$

$$x = \$50\,000\,000$$

$$0.24(50\,000\,000) = \$12\,000\,000$$

Crown Company's stake in Baldwin Industries is worth \$12 Million.

### Self-Test

1. (a)  $4 - 3x - 6 - 5x = \boxed{-2 - 8x}$

(b)  $(5x - 4) - (7x + 5) = 5x - 4 - 7x - 5 = \boxed{-2x - 9}$

(c)  $-2(3a - 4) - 5(2a + 3)$

$$= -6a + 8 - 10a - 15$$

$$= \boxed{-16a - 7}$$

$$\begin{aligned}
 \text{(d)} \quad & -6(x-2)(x+1) \\
 & = -6(x^2 - 2x + x - 2) \\
 & = -6(x^2 - x - 2) \\
 & = \boxed{-6x^2 + 6x + 12}
 \end{aligned}$$

2. (a) For  $x = -3, y = 5$

$$\begin{aligned}
 & 2x^2 - 5xy - 4y^2 \\
 & = 2(-3)^2 - 5(-3)(5) - 4(5)^2 \\
 & = 18 + 75 - 100 \\
 & = \boxed{-7}
 \end{aligned}$$

(b) For  $a = \frac{2}{3}, b = -\frac{3}{4}$

$$\begin{aligned}
 & 3(7a - 4b) - 4(5a + 3b) \\
 & = 21a - 12b - 20a - 12b \\
 & = a - 24b \\
 & = \frac{2}{3} - 24\left(-\frac{3}{4}\right) \\
 & = \frac{2}{3} + 18 \\
 & = \boxed{18\frac{2}{3}}
 \end{aligned}$$

(c) For  $N = 12, C = 400, P = 2000, n = 24$

$$\frac{2NC}{P(n+1)} = \frac{(2)(12)(400)}{2000(24+1)} = \frac{2(12)(400)}{2000(25)} = \boxed{0.192}$$

(d) For  $I = 324, P = 5400, r = 0.15$

$$\frac{I}{Pr} = \frac{324}{5400 \times 0.15} = \boxed{0.4}$$

(e) For  $S = 1606, d = 0.125, t = \frac{240}{365}$

$$\begin{aligned}
 S(1 - dt) & = 1606 \left( 1 - 0.125 \times \frac{240}{365} \right) \\
 & = 1606(1 - 0.082192) \\
 & = 1606(0.917808) \\
 & = \boxed{1474}
 \end{aligned}$$



$$(f) \text{ For } S = 1566, r = 0.10, t = \frac{292}{365}$$

$$\begin{aligned} \frac{S}{1+rt} &= \frac{1566}{1+0.10 \times \frac{292}{365}} \\ &= \frac{1566}{1+0.08} \\ &= \boxed{1450} \end{aligned}$$

$$3. (a) (-2)^3 = \boxed{-8}$$

$$(b) \left(-\frac{2}{3}\right)^2 = \boxed{\frac{4}{9}}$$

$$(c) (4)^0 = \boxed{1}$$

$$(d) (3)^2(3)^5 = (3)^7 = \boxed{2187}$$

$$(e) \left(\frac{4}{3}\right)^{-2} = \frac{1}{\left(\frac{4}{3}\right)^2} = \frac{1}{\frac{16}{9}} = \boxed{\frac{9}{16}}$$

$$(f) (-x^3)^5 = \boxed{-x^{15}}$$

$$4. (a) \sqrt[10]{1.35} = 1.35^{\frac{1}{10}} = 1.35^{0.10} = \boxed{1.030465}$$

$$(b) \frac{1-1.03^{-40}}{0.03} = \frac{1-0.306557}{0.03} = \frac{0.693443}{0.03} = \boxed{23.114772}$$

$$(c) \ln 1.025 = \boxed{0.024693}$$

$$(d) \ln(3.00e^{-0.2})$$

$$= \ln 3.00 + \ln e^{-0.2}$$

$$= \ln 3.00 - 0.2 \ln e$$

$$= 1.098612 - 0.2$$

$$= \boxed{0.898612}$$

$$\begin{aligned}
 \text{(e) } \ln \left( \frac{600}{1.06^{11}} \right) &= \ln 600 - \ln 1.06^{11} \\
 &= \ln 600 - 11 \ln 1.06 \\
 &= 6.396930 - 11(0.058269) \\
 &= 6.396930 - 0.640958 \\
 &= \boxed{5.755972}
 \end{aligned}$$

$$\begin{aligned}
 \text{(f) } \ln \left[ 250 \left( \frac{1.07^5 - 1}{0.07} \right) \right] &= \ln 250 + \ln (1.07^5 - 1) - \ln 0.07 \\
 &= \ln 250 + \ln 0.402552 - \ln 0.07 \\
 &= 5.521461 - 0.909932 - (-2.659260) \\
 &= 5.521461 - 0.909932 + 2.659260 \\
 &= \boxed{7.270789}
 \end{aligned}$$

$$\begin{aligned}
 5. \text{ (a) } \frac{1}{81} &= \left( \frac{1}{3} \right)^{n-2} \\
 \frac{1}{3^4} &= \left( \frac{1}{3} \right)^{n-2} \\
 \left( \frac{1}{3} \right)^4 &= \left( \frac{1}{3} \right)^{n-2}
 \end{aligned}$$

Since the bases are common

$$4 = n - 2$$

$$\boxed{n = 6}$$

$$\begin{aligned}
 \text{(b) } \frac{5}{2} &= 40 \left( \frac{1}{2} \right)^{n-1} \\
 \frac{1}{2} &= 8 \left( \frac{1}{2} \right)^{n-1} \\
 \frac{1}{16} &= \left( \frac{1}{2} \right)^{n-1} \\
 \left( \frac{1}{2} \right)^4 &= \left( \frac{1}{2} \right)^{n-1} \\
 4 &= n - 1 \\
 \boxed{n = 5}
 \end{aligned}$$

$$6. \text{ (a) } -\frac{2}{3}x = 24$$

$$x = 24 \left( -\frac{3}{2} \right)$$

$$\boxed{x = -36}$$

$$\text{(b) } x - 0.06x = 8.46$$

$$0.94x = 8.46$$

$$\boxed{x = 9}$$

$$\text{(c) } 0.2x - 4 = 6 - 0.3x$$

$$0.5x = 10$$

$$\boxed{x = 20}$$

$$\text{(d) } (3 - 5x) - (8x - 1) = 43$$

$$3 - 5x - 8x + 1 = 43$$

$$-13x = 39$$

$$\boxed{x = -3}$$

$$\text{(e) } 4(8x - 2) - 5(3x + 5) = 18$$

$$32x - 8 - 15x - 25 = 18$$

$$17x - 33 = 18$$

$$17x = 51$$

$$\boxed{x = 3}$$

$$\text{(f) } x + \frac{3}{10}x + \frac{1}{2} + x + \frac{3}{5}x + 1 = 103$$

$$2x + \frac{3}{10}x + \frac{3}{5}x + \frac{3}{2} = 103$$

$$20x + 3x + 6x + 15 = 1030$$

$$29x = 1015$$

$$\boxed{x = 35}$$

$$\text{(g) } x + \frac{4}{5}x - 3 + \frac{5}{6} \left( x + \frac{4}{5}x - 3 \right) = 77$$

$$30x + 24x - 90 + 25 \left( x + \frac{4}{5}x - 3 \right) = 30(77)$$

$$54x - 90 + 25x + 20x - 75 = 2310$$

$$99x - 165 = 2310$$

$$99x = 2475$$

$$\boxed{x = 25}$$

$$(h) \frac{2}{3}(3x-1) - \frac{3}{4}(5x-3) = \frac{9}{8}x - \frac{5}{6}(7x-9)$$

$$16(3x-1) - 18(5x-3) = 27x - 20(7x-9)$$

$$48x - 16 - 90x + 54 = 27x - 140x + 180$$

$$-42x + 38 = -113x + 180$$

$$71x = 142$$

$$\boxed{x = 2}$$

7. (a)  $I = Prt$

$$\boxed{P = \frac{I}{rt}}$$

$$(b) S = \frac{P}{1-dt}$$

$$\frac{S}{P} = \frac{1}{1-dt}$$

$$\frac{P}{S} = 1-dt$$

$$dt = 1 - \frac{P}{S}$$

$$d = \frac{1 - \frac{P}{S}}{t}$$

$$d = \frac{\frac{S-P}{S}}{t}$$

$$\boxed{d = \frac{S-P}{St}}$$

8. Let the regular selling price be  $\$x$ .

$$\text{Reduction in price} = \$\frac{1}{5}x$$

$$\therefore x - \frac{1}{5}x = 192$$

$$\frac{4}{5}x = 192$$

$$x = 240$$

The regular selling price is  $\boxed{\$240}$ .

9. Let the floor space occupied by shipping be  $x$ .

$$\text{Floor space occupied by weaving} = 2x + 400$$

$$\text{Total floor space} = x + 2x + 400$$

$$\therefore x + 2x + 400 = 6700$$

$$3x = 6300$$

$$x = 2100$$

The floor space occupied by weaving is  $2(2100) + 400 = \boxed{4600}$  square metres.

10. Let the number of units of Product A be  $x$ .

$$\text{Number of units of Product B} = 95 - x$$

$$\text{Number of hours for Product A} = 3x$$

$$\text{Number of hours for Product B} = 5(95 - x)$$

$$\therefore 3x + 5(95 - x) = 395$$

$$3x + 475 - 5x = 395$$

$$-2x = -80$$

$$x = 40$$

The number of units of Product B is  $95 - 40 = \boxed{55}$ .

11. Let the sum of money invested in the bank be  $\$x$ .

$$\text{Sum of money invested in the credit union} = \$\frac{2}{3}x + 500$$

$$\text{Yield on the bank investment} = \$\frac{1}{12}x$$

$$\text{Yield on the credit union investment} = \$\frac{1}{9}\left(\frac{2}{3}x + 500\right)$$

$$\therefore \frac{1}{12}x + \frac{1}{9}\left(\frac{2}{3}x + 500\right) = 1000$$

$$3x + 4\left(\frac{2}{3}x + 500\right) = 36\,000$$

$$3x + \frac{8}{3}x + 2000 = 36\,000$$

$$\frac{17x}{3} = 34\,000$$

$$17x = 102\,000$$

$$x = 6000$$

The sum of money invested in the credit union certificate is

$$\$\left(\frac{2}{3} \times 6000 + 500\right) = \boxed{\$4500.}$$

### Challenge Problems

1. Counting a nickel as a quarter overstates the total by \$0.20; for  $x$  nickels, the total must be reduced by \$0.20 $x$ .

Counting a dime as a penny understates the total by \$0.09; for  $x$  dimes, the total must be increased by \$0.09 $x$ .

$$\text{The total adjustment} = -0.20x + 0.09x = -\$0.11x$$

The clerk must reduce the total by \$0.11 $x$ .

2. There are 5 tires, so each tire is idle at some point. Therefore, the number of rotations is 5.

$$\text{The distance per rotation} = \frac{4000}{5} = 800 \text{ km;}$$

each tire will be used for four rotations for a total distance of 3200 km. (See table below.)

<i>Rotation</i>	<i>Tire A</i>	<i>Tire B</i>	<i>Tire C</i>	<i>Tire D</i>	<i>Tire E</i>	<i>Distance travelled</i>
1	800	800	800	800	—	800
2	800	800	800	—	800	800
3	800	800	—	800	800	800
4	800	—	800	800	800	800
5	—	800	800	800	800	800
Total	3200	3200	3200	3200	3200	4000

3. The lowest possible two-digit number is 10;  
the highest possible two-digit number is 99.

For a difference in value of \$17.82, the two-digit numbers must differ by 18, such as 10 and 28, 11 and 29, etc.

The lowest possible correct value of the cheque is \$10.28;  
the largest possible correct value of the cheque is \$81.99.

In either case the difference between is \$17.82.

(a) FALSE In the possible correct cheque value \$81.99, the  $x$ -value 81 is greater than 70.

(b) TRUE In the possible correct cheque value \$18.36, the  $y$ -value 36 equals  $2x$ .

(c) TRUE A cheque cannot have zero cents.

(d) FALSE Let the correct amount be  $\$A$ ;  
then the incorrect amount is  $\$2A$ ;  
the difference is  $\$A$ ;

$$A = 17.82$$

For the correct value \$17.82, the incorrect cheque value \$82.17 is unequal to  $2(\$17.82)$ .

(e) FALSE In the possible correct amount \$10.28, the sum of the digits is  $1 + 0 + 2 + 8 = 11$ , which is not divisible by 9.

### Case Study

- $\$73\,566 - \$49\,355 = \boxed{\$24\,211}$
- The contributions continue until the 65th year. Therefore, total contributions  $(65 - 45) \times 12$  months per year  $\times \$100 = \boxed{\$24\,000}$ .
- The contributions continue until the 65th year.
  - Total contributions  $(65 - 45) \times 12$  months per year  $\times \$100 = \$24\,000$ . Total value of TFSA = \$29 529. Therefore, interest earned is  $\$29\,529 - 24\,000 = \boxed{\$5529}$ .
  - Total contributions  $(65 - 45) \times 12$  months per year  $\times \$250 = \$60\,000$ . Total value of TFSA = \$73 566. Therefore, interest earned is  $\$73\,566 - 60\,000 = \boxed{\$13\,566}$ .
- Annual salary of  $\$48\,000/12$  months = \$4000.00 per month.
  - $\$150/\$4000 = 0.0375$  or  $\boxed{3.75\% \text{ of salary}}$
  - $\$250/\$4000 = 0.0625 = \boxed{6.25\% \text{ of salary}}$

