

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. $6-4x+3y-1-5x-2y+9 = \boxed{14-9x+y}$

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

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

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

$$2. \boxed{-56a}$$

$$3. \boxed{-10ax}$$

$$4. \boxed{27ab}$$

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

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

$$7. \boxed{60xy}$$

$$8. \boxed{-24abc}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\begin{aligned}
 22. \quad & 2(2a^2 - 2a - 3a + 3) - 3(3a^2 - 2a + 3a - 2) \\
 &= 4a^2 - 10a + 6 - 9a^2 - 3a + 6 \\
 &= \boxed{-5a^2 - 13a + 12}
 \end{aligned}$$

$$23. \quad \boxed{4ab}$$

$$24. \quad \boxed{-5y}$$

$$25. \quad \boxed{4x}$$

$$26. \quad \boxed{-6}$$

$$27. \quad \boxed{10m - 4}$$

$$28. \quad \boxed{-2x + 3}$$

$$29. \quad \boxed{-2x^2 + 3x + 6}$$

$$30. \quad \boxed{a^2 + 4a + 3}$$

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

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

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

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

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

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

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

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

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

$$10. \frac{2NC}{P(n+1)} = \frac{2 \times 52 \times 60}{1800(25+1)} = \frac{2 \times 52 \times 60}{1800 \times 26} = \boxed{0.1\dot{3}}$$

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

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

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

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

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. $\boxed{1}$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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. $525.21875^{\frac{2}{5}} = \boxed{12.25}$

$$4. \quad 21.6^{\frac{4}{3}} = \boxed{60.154991}$$

$$5. \quad \sqrt[12]{1.125^7} = \boxed{1.071122}$$

$$6. \quad \sqrt[6]{1.095} = \boxed{1.015241}$$

$$7. \quad 4^{\left(\frac{1}{3}\right)} = \frac{1}{4^{\frac{1}{3}}} = \frac{1}{1.587401} = \boxed{0.629961}$$

$$8. \quad 1.06^{\left(\frac{1}{12}\right)} = \frac{1}{1.06^{\frac{1}{12}}} = \frac{1}{1.004868} = \boxed{0.995156}$$

$$9. \quad \frac{1.03^{60} - 1}{0.03} = \frac{5.891603 - 1}{0.03} = \boxed{163.053437}$$

$$10. \quad \frac{1 - 1.05^{-36}}{0.05} = \frac{1 - 0.172657}{0.05} = \boxed{16.546852}$$

$$11. \quad \boxed{2.158925}$$

$$12. \quad \boxed{0.589664}$$

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

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

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

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

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

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

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

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

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

$$(1+i) = 1.029998$$

$$i = \boxed{0.029998}$$

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

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

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

$$(1+i) = 1.019999$$

$$i = \boxed{0.019999}$$

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

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

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

$$(1+i) = 1.04$$

$$i = \boxed{0.04}$$

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

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

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

$$(1+i) = 1.01$$

$$i = \boxed{0.01}$$

Exercise 2.4

A. 1. $2^9 = 512$

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

2. $3^7 = 2187$

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

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

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

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

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

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

$$2j = \log_e 18$$

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

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

$$-3x = \log_e 12$$

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

$$\text{B. } 1. \ \log_2 32 = 5$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

$$\text{IOC retains } 0.10(1\,339\,000\,000) = \boxed{\$133\,900\,000 \text{ (C\$133.9 million)}}$$

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

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

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

4. Annual growth rate in broadcast revenue since Lake Placid = $(1.339 \text{ billion} / 21.7 \text{ million})^{1/30} - 1 = 0.147301 = \boxed{14.73\% \text{ per year}}$

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. $-2x = 7 - 3x$

$$\boxed{x = 7}$$

$$11. x + 6 = -2$$

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

$$12. 3x = 9 + 2x$$

$$\boxed{x = 9}$$

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

$$\boxed{x = 5}$$

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

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

$$15. x + 0.6x = 32$$

$$1.6x = 32$$

$$\boxed{x = 20}$$

$$16. x - 0.3x = 210$$

$$0.7x = 210$$

$$\boxed{x = 300}$$

$$17. x - 0.04x = 192$$

$$0.96x = 192$$

$$\boxed{x = 200}$$

$$18. x + 0.07x = 64.20$$

$$1.07x = 64.20$$

$$\boxed{x = 60}$$

$$\text{B. } 1. \quad 3x + 5 = 7x - 11$$

$$-4x = -16$$

$$\boxed{x = 4}$$

$$\begin{aligned} \text{LS: } 3x + 5 &= 3(4) + 5 \\ &= 12 + 5 \\ &= 17 \end{aligned}$$

$$\begin{aligned} \text{RS: } 7x - 11 &= 7(4) - 11 \\ &= 28 - 11 \\ &= 17 \end{aligned}$$

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

$$-3x = -9$$

$$\boxed{x = 3}$$

$$\text{LS: } 5 - 4x = 5 - (4)(3)$$

$$= 5 - 12$$

$$= -7$$

$$\text{RS: } = -4 - x$$

$$= -4 - 3$$

$$= -7$$

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

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

$$-8x = 0$$

$$\boxed{x = 0}$$

$$\text{LS: } = 2 - 3x - 9$$

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

$$= -7$$

$$\text{RS: } = 2x - 7 + 3x$$

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

$$= -7$$

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

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

$$-7x = 14$$

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

$$\text{LS: } = 4x - 8 - 9x$$

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

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

$$\text{RS: } = 10 + 2x - 4$$

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

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

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

$$-x = -5$$

$$\boxed{x = 5}$$

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

$$= 3(5) + 14$$

$$= 15 + 14 = 29$$

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

$$= 4(5) + 9$$

$$= 20 + 9 = 29$$

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

$$10x = -20$$

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

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

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

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

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

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

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

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

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

$$-x = -21$$

$$\boxed{x = 21}$$

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

$$= 8 + 4(21)$$

$$= 8 + 84 = 92$$

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

$$= 5(21) - 13$$

$$= 105 - 13 = 92$$

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

$$\boxed{x = 8}$$

$$\text{LS: } = -3 + 2x + 5$$

$$= -3 + 2(8) + 5$$

$$= -3 + 16 + 5$$

$$= 18$$

$$\text{RS: } = 5x - 36 + 14$$

$$= 5(8) - 36 + 14$$

$$= 40 - 36 + 14 = 18$$

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

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

$$14x - 26 = -54$$

$$14x = -28$$

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

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

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

$$= -30 - 24$$

$$= -54$$

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

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

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

$$2x-9=-15$$

$$2x=-6$$

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

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

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

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

$$= -33+18$$

$$= -15$$

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

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

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

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

$$-7x=-35$$

$$\boxed{x=5}$$

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

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

$$= 17-9=8$$

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

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

$$= 35-27=8$$

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

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

$$8x=24$$

$$\boxed{x=3}$$

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

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

$$= 12+6$$

$$= 18$$

$$\text{RS} = 18$$

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

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

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

$$41x = 205$$

$$\boxed{x = 5}$$

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

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

$$= 162 + 25$$

$$= 187$$

$$\text{RS} = 187$$

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

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

$$2x = 28$$

$$\boxed{x = 14}$$

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

$$= 140 - 4[27]$$

$$= 140 - 108$$

$$= 32$$

$$\text{RS} = 32$$

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

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

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

$$-26x = -52$$

$$\boxed{x = 2}$$

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

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

$$= -8$$

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

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

$$4x - x = 60$$

$$3x = 60$$

$$\boxed{x = 20}$$

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

$$8x + 5x = 208$$

$$13x = 208$$

$$\boxed{x = 16}$$

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

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

$$18x = -18$$

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

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

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

$$-17x = -51$$

$$\boxed{x = 3}$$

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

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

$$34x = 17$$

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

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

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

$$-39x = 26$$

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

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

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

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

$$26x - 29 = -55$$

$$26x = -26$$

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

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

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

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

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

$$-38x = -76$$

$$\boxed{x = 2}$$

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

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

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

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

$$30x = 25$$

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

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

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

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

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

$$-84x = 63$$

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

$$\text{D. 1. } y = mx + b$$

$$y - b = mx$$

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

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

$$Sr = M$$

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

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

$$\boxed{PMT = PVi}$$

$$4. \quad I = Prt$$

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

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

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

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

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

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

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

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

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

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

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

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

Exercise 2.7

- A. 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 \$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 \$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 \$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 \$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 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 \$11.36.

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

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

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

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

$$4x = 1080$$

$$x = 270$$

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

8. Let the shorter piece be x cm.

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

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

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

$$3x = 75$$

$$x = 25$$

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

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 .

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

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

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

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

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

$$-10x = -420$$

$$x = 42$$

The number of type B lights is 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 .

Number of nickels = $3x - 4$

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

Value of the dimes = $10x$ cents

Value of nickels = $5(3x - 4)$ cents

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

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) $4(2a - 5) - 3(3 - 6a)$
 $= 8a - 20 - 9 + 18a$
 $= \boxed{26a - 29}$
 (l) $2a(x - a) - a(3x + 2) - 3a(-5x - 4)$
 $= 2ax - 2a^2 - 3ax - 2a + 15ax + 12a$
 $= \boxed{14ax - 2a^2 + 10a}$

$$(m) \quad (m-1)(2m-5)$$

$$= 2m^2 - 2m - 5m + 5$$

$$= \boxed{2m^2 - 7m + 5}$$

$$(n) \quad (3a-2)(a^2-2a-3)$$

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

$$= \boxed{3a^3 - 8a^2 - 5a + 6}$$

$$(o) \quad 3(2x-4)(x-1) - 4(x-3)(5x+2)$$

$$= 3(2x^2 - 4x - 2x + 4) - 4(5x^2 - 15x + 2x - 6)$$

$$= 6x^2 - 18x + 12 - 20x^2 + 52x + 24$$

$$= \boxed{-14x^2 + 34x + 36}$$

$$(p) \quad -2a(3m-1)(m-4) - 5a(2m+3)(2m-3)$$

$$= -2a(3m^2 - m - 12m + 4) - 5a(4m^2 + 6m - 6m - 9)$$

$$= -6am^2 + 26am - 8a - 20am^2 + 45a$$

$$= \boxed{-26am^2 + 26am + 37a}$$

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

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

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

$$-5(2a-3b) - 2(a+5b)$$

$$= -10a + 15b - 2a - 10b$$

$$= -12a + 5b$$

$$= -12\left(-\frac{1}{4}\right) + 5\left(\frac{2}{3}\right) = 3 + 3\frac{1}{3} = \boxed{6\frac{1}{3}}$$

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

$$\frac{2NC}{P(n+1)} = \frac{\overset{1}{2} \times 12 \times \overset{48}{432}}{\underset{\frac{900}{100}}{1800} \times (35+1)} = \frac{\overset{1}{12} \times \overset{16}{48}}{\underset{\frac{3}{1}}{100} \times 36} = \frac{16}{100} = \boxed{0.16}$$

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

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

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

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

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

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

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

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

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

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

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

$$(b) \sqrt[5]{1.075} = \boxed{1.012126}$$

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

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

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

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

$$\begin{aligned} (g) \ln\left(\frac{5500}{1.10^{16}}\right) &= \ln 5500 - \ln 1.10^{16} \\ &= \ln 5500 - 16 \ln 1.10 \\ &= 8.612503 - 16(0.095310) \\ &= 8.612503 - 1.524963 \\ &= \boxed{7.087540} \end{aligned}$$

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

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) $x - 8 = -5$

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

$$\boxed{x = 3}$$

(f) $x + 9 = -2$

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

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

(g) $x + 0.02x = 255$

$$1.02x = 255$$

$$\boxed{x = 250}$$

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

$$0.9x = 36$$

$$9x = 360$$

$$\boxed{x = 40}$$

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

$$-5x = 5$$

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

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

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

$$2x = 14$$

$$\boxed{x = 7}$$

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

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

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

$$\boxed{x = 39}$$

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

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

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

$$\boxed{x = 56}$$

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

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

$$29x = 49 + 36x$$

$$-7x = 49$$

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

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

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

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

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

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

$$-2x = -10$$

$$\boxed{x = 5}$$

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

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

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

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

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

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

$$2x = -6$$

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

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

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

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

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

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

$$36x = -21$$

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

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

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

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

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

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

$$231x - 617 = 1617$$

$$\boxed{x = 7}$$

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

$$= \frac{7}{6}(35) - \frac{3}{8}(64) = 7(7) - 24 = 49 - 24 = 25$$

$$\text{RS} = 25$$

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

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

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

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

$$276x = -92$$

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

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

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

$$= 5 - 6 = -1$$

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

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

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

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

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

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

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

$$-182x = 91$$

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

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

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

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

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

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

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

8. (a) $I = Prt$

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

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

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

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

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

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

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

(c) $D = rL$

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

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

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

9. (a) Let the size of the workforce be x .

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

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

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

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

$$5x = 4140$$

$$x = 828$$

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

(b) 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 \$63 350.

(c) 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 = \$117.

(d) 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 $\$(184\,000 - 139\,500) =$ \$44 500.

(e) Let the cost of power be \$x.

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

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

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

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

$$25x = 26\,400$$

$$x = 1056$$

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

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

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

(f) 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 \$37 500

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

(h) 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.

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

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 $4(25 + 16) = \boxed{164}$.

Self-Test

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

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

(c) $-2(3a - 4) - 5(2a + 3)$
 $= -6a + 8 - 10a - 15$
 $= \boxed{-16a - 7}$

(d) $-6(x - 2)(x + 1)$
 $= -6(x^2 - 2x + x - 2)$
 $= -6(x^2 - x - 2)$
 $= \boxed{-6x^2 + 6x + 12}$

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

$$\begin{aligned}
 \text{(d) } \ln(3.00e^{-0.2}) &= \ln 3.00 + \ln e^{-0.2} \\
 &= \ln 3.00 - 0.2 \ln e \\
 &= 1.098612 - 0.2 \\
 &= \boxed{0.898612}
 \end{aligned}$$

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

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

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

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

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

Since the bases are common

$$4 = n - 2$$

$$\boxed{n = 6}$$

$$(b) \quad \frac{5}{2} = 40 \left(\frac{1}{2} \right)^{n-1}$$

$$\frac{1}{2} = 8 \left(\frac{1}{2} \right)^{n-1}$$

$$\frac{1}{16} = \left(\frac{1}{2} \right)^{n-1}$$

$$\left(\frac{1}{2} \right)^4 = \left(\frac{1}{2} \right)^{n-1}$$

$$4 = n - 1$$

$$\boxed{n = 5}$$

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

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

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

$$(b) \quad x - 0.06x = 8.46$$

$$0.94x = 8.46$$

$$\boxed{x = 9}$$

$$(c) \quad 0.2x - 4 = 6 - 0.3x$$

$$0.5x = 10$$

$$\boxed{x = 20}$$

$$(d) \quad (3 - 5x) - (8x - 1) = 43$$

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

$$-13x = 39$$

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

$$(e) \quad 4(8x - 2) - 5(3x + 5) = 18$$

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

$$17x - 33 = 18$$

$$17x = 51$$

$$\boxed{x = 3}$$

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

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

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

$$29x = 1015$$

$$\boxed{x = 35}$$

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

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

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

$$99x - 165 = 2310$$

$$99x = 2475$$

$$\boxed{x = 25}$$

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

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

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

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

$$71x = 142$$

$$\boxed{x = 2}$$

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. (a) 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 $\boxed{\$240}$.

- (b) 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 $2(2100) + 400 = \boxed{4600 \text{ square metres}}$.

- (c) 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 $95 - 40 = \boxed{55}$.

(d) 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

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

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

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

$$\boxed{\text{The clerk must reduce the total by } \$0.11x.}$$

2. The number of rotations in 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

1. $\$73\,566 - \$49\,355 = \$24\,211$
2. The contributions continue until the 65th year. Therefore, total contributions $(65 - 45) \times 12$ months per year $\times \$100 = \$24\,000$.
3. The contributions continue until the 65th year.
 - a. Total contributions $(65 - 45) \times 12$ months per year $\times \$100 = \$24\,000$. Total value of TFSA = $\$29\,529$. Therefore, interest earned is $\$29\,529 - 24\,000 = \$5\,529$.
 - b. Total contributions $(65 - 45) \times 12$ months per year $\times \$250 = \$60\,000$. Total value of TFSA = $\$73\,566$. Therefore, interest earned is $\$73\,566 - 60\,000 = \$13\,566$.
4. Annual salary of $\$48\,000/12$ months = $\$4000.00$ per month.
 - a. $\$150/\$4000 = 0.0375$ or 3.75% of salary
 - b. $\$250/\$4000 = 0.0625 = 6.25\%$ of salary

