Beginning and Intermediate Algebra

Student Solutions Manual

Complete worked solutions to odd problems

Solutions manual has not been cross checked for accuracy.
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Thank you!

Beginning and Intermediate Algebra

Student Solutions Manual Table of Contents

Chapter 0: Arithmetic

0.1

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

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

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

7) $3-(-5)$
$3+5=8$

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

11) $3-(-1)$
$3+1=4$

13) $6-3$
$6-3=3$

15) $(-5)+3=2$

17) $2-3$
$2+(-3)=-1$

19) $(-8)-(-5)$
$-8+5=-3$

21) $(-2)+(-5)=-7$

23) $5-(-6$
$5+6=11$

25) $-6+3=-3$

27) $4-7$
$4+(-7)=-3$

29) $(-7)+7=0$

31) $(4)(-1)=-4$

33) $(10)(-8)=-80$

35) $(-4)(-2)=8$

37) $(-7)(8)=-56$

39) $(9)(-4)=-36$

41) $(-5)(2)=-10$

43) $(-5)(4)=-20$

45) $(4)(-6)=-24$

47) $\frac{-49}{-7}=7$

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

51) $\frac{20}{10}=2$

53) $\frac{-35}{-5}=7$

55) $\frac{-8}{-2}=4$

57) $\frac{-16}{2}=-8$

59) $\frac{60}{-10}=-6$

0.2

1) $\frac{42}{12}=\frac{21}{6}=\frac{7}{2}$

3) $\frac{35}{25}=\frac{7}{5}$

5) $\frac{54}{36}=\frac{27}{18}=\frac{9}{6}=\frac{3}{2}$

7) $\frac{45}{36}=\frac{15}{12}=\frac{5}{4}$

9) $\frac{27}{18}=\frac{9}{6}=\frac{3}{2}$

11) $\frac{40}{16}=\frac{20}{8}=\frac{10}{4}=\frac{5}{2}$

13) $\frac{63}{18}=\frac{21}{6}=\frac{7}{2}$

15) $\frac{80}{60}=\frac{40}{30}=\frac{20}{15}=\frac{4}{3}$

17) $\frac{72}{60}=\frac{36}{30}=\frac{18}{15}=\frac{6}{5}$

19) $\frac{36}{24}=\frac{18}{12}=\frac{9}{6}=\frac{3}{2}$

21) $\frac{1\cancel{(9)}}{1}\cdot\frac{\left(\frac{8}{\cancel{9}}\right)}{1}=\frac{8}{1}=8$

23) $\frac{(2)}{1}\cdot-\frac{2}{9}=-\frac{4}{9}$

25) $\overset{-1}{\cancel{(-2)}}\left(\frac{13}{\cancel{8}}\right)\cancel{4}=-\frac{13}{4}$

27) $\overset{-3}{\cancel{\left(-\frac{6}{5}\right)}}\left(-\frac{11}{\cancel{8}}\right)\cancel{4}=\frac{33}{20}$

29) $\frac{\cancel{4}\,(8)}{\cancel{1}\,1}\left(\frac{1}{\cancel{2}\,\cancel{1}}\right)=\frac{4}{1}=4$
1 2

31) $\left(\frac{2}{3}\right)\left(\frac{3}{4}\right) = \frac{1}{2}$

33) $\frac{1}{1}\left(\frac{3}{1}\right) = \frac{3}{1} = 3$

35) $\left(\frac{1}{2}\right)\left(-\frac{7}{5}\right) = -\frac{7}{10}$

37) $\frac{-2}{1} \div \frac{7}{4}$
$\left(\frac{-2}{1}\right)\left(\frac{4}{7}\right) = -\frac{8}{7}$

39) $\frac{-1}{9} \div \frac{-1}{2}$
$\left(\frac{+1}{9}\right)\left(\frac{2}{+1}\right) = \frac{2}{9}$

41) $\frac{-3}{2} \div \frac{13}{7}$
$\left(\frac{-3}{2}\right)\left(\frac{7}{13}\right) = -\frac{21}{26}$

43) $\frac{-1}{1} \div \frac{2}{3}$
$\left(\frac{-1}{1}\right)\left(\frac{3}{2}\right) = -\frac{3}{2}$

45) $\frac{8}{9} \div \frac{1}{5}$
$\left(\frac{8}{9}\right)\left(\frac{5}{1}\right) = \frac{40}{9}$

47) $\frac{-9}{7} \div \frac{1}{5}$
$\left(-\frac{9}{7}\right)\left(\frac{5}{1}\right) = -\frac{45}{7}$

49) $\frac{-2}{9} \div \frac{-3}{2}$
$\left(\frac{+2}{9}\right)\left(\frac{2}{+3}\right) = \frac{4}{27}$

51) $\frac{1}{10} \div \frac{3}{2}$
$5\left(\frac{1}{10}\right)\left(\frac{2}{3}\right) = \frac{1}{15}$

53) $\frac{1}{3} + \left(-\frac{4}{3}\right) = -\frac{3}{3} = -1$

55) $\frac{3}{7} - \frac{1}{7} = \frac{2}{7}$

57) $\frac{11}{6} + \frac{7}{6} = \frac{18}{6} = 3$

59) $\left(\frac{4}{4}\right)\frac{3}{5} + \frac{5}{4}\left(\frac{4}{4}\right)$
$\frac{12}{20} + \frac{25}{20} = \frac{37}{20}$

61) $\left(\frac{4}{4}\right)\frac{2}{5} + \frac{5}{4}\left(\frac{5}{5}\right)$
$\frac{8}{20} + \frac{25}{20} = \frac{33}{20}$

63) $\left(\frac{7}{7}\right)\frac{9}{8} + \left(\frac{-2}{7}\right)\left(\frac{8}{8}\right)$
$\frac{63}{56} + \frac{-16}{56} = \frac{47}{56}$

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

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

69) $\left(\frac{4}{4}\right)\frac{1}{5} + \frac{3}{4}\left(\frac{5}{5}\right)$
$\frac{4}{20} + \frac{15}{20} = \frac{19}{20}$

71) $\left(\frac{8}{8}\right)\frac{-5}{7} - \frac{15}{8}\left(\frac{7}{7}\right)$
$\frac{-40}{56} + \frac{-105}{56} = \frac{-145}{56}$

73) $\left(\frac{7}{7}\right)\frac{6}{1} - \frac{8}{7}$
$\frac{42}{7} - \frac{8}{7} = \frac{34}{7}$

75) $\left(\frac{4}{4}\right)\frac{3}{2} - \frac{15}{8}$
$\frac{12}{8} - \frac{15}{8} = -\frac{3}{8}$

77) $\left(\frac{3}{3}\right)\left(\frac{-15}{8}\right) + \frac{5}{3}\left(\frac{8}{8}\right)$
$\frac{-45}{24} + \frac{40}{24} = \frac{-5}{24}$

79) $\left(\frac{6}{6}\right)\frac{-1}{1} - \left(-\frac{1}{6}\right)$
$\frac{-6}{6} + \frac{1}{6} = -\frac{5}{6}$

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

0.3

1) $-6 \cdot 4(-1)$
$-24(-1)$
24

3) $3 + (8) \div |4|$
$3 + 8 \div (4)$
$3 + 2$
5

5) $8 \div 4 \cdot 2$
$2 \cdot 2$
4

7) $[-9 - (2 - 5)] \div (-6)$
$[-9 - (-3)] \div (-6)$
$[(-6)] \div (-6)$
1

9) $-6 + (-3 - 3)^2 \div |3|$

$-6 + (6)^2 \div 3$

$-6 + 36 \div 3$

$-6 + 12$

6

11) $4 - 2|3^2 - 16|$

$4 - 2|9 - 16|$

$4 - 2|-7|$

$4 - 2(7)$

$4 - 14$

-10

13) $[-1 - (-5)]|3 + 2|$

$[4](5)$

20

15) $\frac{2+4|7+2^2|}{4 \cdot 2 + 5 \cdot 3}$

$Numerator: 2 + 4|7 + 2^2|$

$2 + 4|7 + 4|$

$2 + 4|11|$

$2 + 4(11)$

$2 + 44$

46

$Denominator: 4 \cdot 2 + 5 \cdot 3$

$8 + 15$

23

$Fraction: \frac{46}{23} = 2$

17) $[6 \cdot 2 + 2 - (-6)]\left(-5 + \left|\left(-\frac{18}{6}\right)\right|\right)$

$[12 + 2 - (-6)](-5 + |-3|)$

$[14 - (-6)](-5 + (3))$

$[20](-2)$

-40

19) $\frac{-13-2}{2-(-1)^3+(-6)-[-1-(-3)]}$

$Numerator: -13 - 2$

-15

$Denominator: 2 - (-1)^3 + (-6) - [-1 - (-3)]$

$2 - (-1)^3 + (-6) - [2]$

$2 - (-1) + (-6) - [2]$

$3 + (-6) - [2]$

$-3 - [2]$

-5

$Fraction: -\frac{15}{-5} = 3$

21) $6 \cdot \frac{-8-4+(-4)-[-4-(-3)]}{(4^2+3^2)\div 5}$

$Numerator: -8-4+(-4)-[\underline{-4-(-3)}]$

$\underline{-8-4}+(-4)-[-1]$

$\underline{-12+(-4)}-[-1]$

$\underline{-16-[-1]}$

-15

$Denominator: (\underline{4^2}+\underline{3^2})\div 5$

$\underline{(16+9)}\div 5$

$\underline{(25)\div 5}$

5

$Fraction: 6 \cdot \underline{-\frac{15}{5}} = 6 \cdot -3 = -18$

23) $\frac{2^3+4}{-18-6+(-4)-[-5(-1)(-5)]}$

$Numerator: \underline{2^3}+4$

$\underline{8+4}$

12

$Denominator: -18-6+(-4)-[\underline{-5(-1)}(-5)]$

$-18-6+(-4)-[\underline{5(-5)}]$

$\underline{-18-6}+(-4)-[-25]$

$\underline{-24+(-4)}-[-25]$

$\underline{-28-[-25]}$

-3

$Fraction: \frac{12}{-3} = -4$

25) $\frac{5+3^2-24\div 6\cdot 2}{[5+3(2^2-5)]+|2^2-5|^2}$

$Numerator: 5+\underline{3^2}-24\div 6\cdot 2$

$5+9-\underline{24\div 6}\cdot 2$

$5+9-\underline{4\cdot 2}$

$\underline{5+9}-8$

$\underline{14-8}$

6

$Denominator: [5+3(\underline{2^2}-5)]+|\underline{2^2}-5|^2$

$[5+3\underline{(4-5)}]+\underline{|4-5|}^2$

$[5+\underline{3(-1)}]+|-1|^2$

$\underline{[5-3]}+(-1)^2$

$[2]+\underline{(-1)^2}$

$\underline{2+1}$

3

$Fraction: \frac{6}{3} = 2$

0.4

1) $p + 1 + q - m,\ use\ m = 1, p = 3, q = 4$

$(3) + 1 + (4) - (1)$

$4 + (4) - (1)$

$8 - (1)$

7

3) $p - \frac{pq}{6}, use\ p = 6, q = 5$

$(6) - \frac{(6)(5)}{6}$

$(6) - (5)$

1

5) $c^2 - (a - 1), use\ a = 3, c = 5$

$(5)^2 - [(3) - 1]$

$(5)^2 - [2]$

$25 - [2]$

23

7) $5j + \frac{kh}{2}\ , use\ h = 5, j = 4, k = 2$

$5(4) + \frac{(2)(5)}{2}$

$5(4) + 5$

$20 + 5$

25

9) $\frac{4-(p-m)}{2} + q, use\ m - 4, p = 6, q = 6$

$\frac{4-[(6)-(4)]}{2} + (6)$

$\frac{4-[2]}{2} + (6)$

$\frac{2}{2} + 6$

$1 + 6 = 7$

11) $m + n + m + \frac{n}{2}, use\ m = 1, n = 2$

$(1) + (2) + (1) + \frac{(2)}{2}$

$(1) + (2) + (1) + 1$

$3 + (1) + 1$

$4 + 1$

5

13) $q - p - (q - 1 - 3), use\ p = 3, q = 6$

$(6) - (3) - [(6) - 1 - 3]$

$(6) - (3) - [5 - 3]$

$(6) - (3) - [2]$

$3 - [2]$

1

15) $y - [4 - y - (z - x)], use\ x = 3, y = 1, z = 6$

$(1) - \{4 - (1) - [(6) - (3)]\}$

$(1) - \{4 - (1) - [3]\}$

$(1) - \{3 - [3]\}$

$(1) - \{0\}$

1

17) $k \times 3^2 - (j + k) - 5, use\ j = 4, k = 5$

$(5)3^2 - [(4) + (5)] - 5$

$(5)3^2 - [9] - 5$

$(5)9 - [9] - 5$

$45 - [9] - 5$

$36 - 5$

31

19) $zx - \left(z - \frac{4+x}{6}\right), use\ x = 2, z = 6$

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

$(6)(2) - \left[(6) - \frac{6}{6}\right]$

$(6)(2) - [(6) - 1]$

$(6)(2) - [5]$

$12 - [5]$

7

21) $r - 9 + 10$

$r + 1$

23) $n + n$

$2n$

25) $8v + 7v$

$15v$

27) $-7x - 2x$
$-9x$

29) $k - 2 + 7$
$k + 5$

31) $x - 10 - 6x + 1$
$-5x - 9$

33) $m - 2m$
$-m$

35) $9n - 1 + n + 4$
$10n + 3$

37) $-8(x - 4)$
$-8x + 32$

39) $8n(n + 9)$
$8n^2 + 72n$

41) $7k(-k + 6)$
$-7k^2 + 42k$

43) $-6(1 + 6x)$
$-6 - 36x$

45) $8m(5 - m)$
$40m - 8m^2$

47) $-9x(4 - x)$
$-36x + 9x^2$

49) $-9b(b - 10)$
$-9b^2 + 90b$

51) $-8n(5 + 10n)$
$-40n - 80n^2$

53) $9(b + 10) + 5b$
$9b + 90 + 5b$
$14b + 90$

55) $-3x(1 - 4x) - 4x^2$
$-3x + 12x^2 - 4x^2$
$8x^2 - 3x$

57) $-4k^2 - 8k(8k + 1)$
$-4k^2 - 64k^2 - 8k$
$-68k^2 - 8k$

59) $1 - 7(5 + 7p)$
$1 - 35 - 49p$
$-49 - 49p$

61) $-10 - 4(n - 5)$
$-10 - 4n + 20$
$-4n + 10$

63) $4(x + 7) + 8(x + 4)$
$4x + 28 + 8x + 32$
$12x + 60$

65) $-8(n + 6) - 8n(n + 8)$
$-8n - 48 - 8n^2 - 64n$
$-8n^2 - 72n - 48$

67) $7(7 + 3v) + 10(3 - 10v)$
$49 + 21v + 30 - 100v$
$-79v + 79$

69) $2n(-10n + 5) - 7(6 - 10n)$
$-20n^2 + 10n - 42 + 70n$
$-20n^2 + 80n - 42$

71) $5(1 - 6k) + 10(k - 8)$
$5 - 30k + 10k - 80$
$-20k - 75$

73) $(8n^2 - 3n) - (5 + 4n^2)$
$8n^2 - 3n - 5 - 4n^2$
$4n^2 - 3n - 5$

75) $(5p - 6) + (1 - p)$
$5p - 6 + 1 - p$
$4p - 5$

77) $(2 - 4v^2) + (3v^2 + 2v)$

$2 - 4v^2 + 3v^2 + 2v$

$-v^2 + 2v + 2$

79) $(4 - 2k^2) + (8 - 2k^2)$

$4 - 2k^2 + 8 - 2k^2$

$-4k^2 + 12$

81) $(x^2 - 8) + (2x^2 - 7)$

$x^2 - 8 + 2x^2 - 7$

$3x^2 - 15$

Chapter 1: Solving Linear Equations

1.1

1) $v + 9 = 16$
$-9 \quad -9$
$v = 7$

3) $x - 11 = -16$
$+11 \quad +11$
$x = -5$

5) $30 = a + 20$
$-20 \quad -20$
$10 = a$

7) $x - 7 = -26$
$+7 \quad +7$
$x = -19$

9) $13 = n - 5$
$+5 \quad +5$
$18 = n$

11) $\frac{340}{-17} = \frac{-17x}{-17}$
$-20 = x$

13) $(12)(-9) = \frac{n}{12}(12)$
$-108 = n$

15) $\frac{20v}{20} = \frac{-160}{20}$
$v = -8$

17) $\frac{340}{20} = \frac{20n}{20}$
$17 = n$

19) $\frac{16x}{16} = \frac{320}{16}$
$x = 20$

21) $-16 + n = -13$
$+16 \quad +16$
$n = 3$

23) $p - 8 = -21$
$+8 \quad +8$
$p = -13$

25) $\frac{180}{12} = \frac{12x}{12}$
$15 = x$

27) $\frac{20b}{20} = \frac{-200}{20}$
$b = -10$

29) $(14)\frac{r}{14} = \frac{5}{14}(14)$
$r = 5$

31) $-7 = a + 4$
$-4 \quad -4$
$-11 = a$

33) $10 = x - 4$
$+4 \quad +4$
$14 = x$

35) $\frac{13a}{13} = \frac{-143}{13}$
$a = -11$

37) $(20)\frac{p}{20} = -12(20)$
$p = -240$

39) $9 + m = -7$
$-9 \quad -9$
$m = -16$

1.2

1) $5 + \frac{n}{4} = 4$
$-5 \quad -5$
$(4)\frac{n}{4} = -1(4)$
$n = -4$

3) $102 = -7r + 4$
$-4 \quad -4$
$\frac{98}{-7} = (-7r)/-7$
$-14 = r$

5) $-8n + 3 = -77$
$-3 \quad -3$
$\frac{-8n}{-8} = \frac{-80}{-8}$
$n = 10$

7) $\frac{0}{-6} = \frac{-6v}{-6}$
$0 = v$

9) $-8 = \frac{x}{5} - 6$
$+6 \quad +6$
$(5)(-2) = \frac{x}{5}(5)$
$-10 = x$

11) $0 = -7 + \frac{k}{2}$
$+7 \quad +7$
$(2)7 = \frac{k}{2}(2)$
$14 = k$

13) $-12 + 3x = 0$
$+12 \quad +12$
$\frac{3x}{3} = \frac{12}{3}$
$x = 4$

15) $24 = 2n - 8$

$+8 \quad +8$

$\frac{32}{2} = \frac{2n}{2}$

$16 = n$

17) $2 = -12 + 2r$

$+12 \quad +12$

$\frac{14}{2} = \frac{2r}{2}$

$7 = r$

19) $\frac{b}{3} + 7 = 10$

$-7 \quad -7$

$(3)\frac{b}{3} = 3(3)$

$b = 9$

21) $152 = 8n + 64$

$-64 \quad -64$

$\frac{88}{8} = \frac{8n}{8}$

$11 = n$

23) $-16 = 8a + 64$

$-64 \quad -64$

$\frac{-80}{8} = \frac{8a}{8}$

$-10 = a$

25) $56 + 8k = 64$

$-56 \quad -56$

$\frac{8k}{8} = \frac{8}{8}$

$k = 1$

27) $-2x + 4 = 22$

$-4 \quad -4$

$\frac{-2x}{-2} = \frac{18}{-2}$

$x = -9$

29) $-20 = 4p + 4$

$-4 \quad -4$

$\frac{-24}{4} = \frac{4p}{4}$

$-6 = p$

31) $-5 = 3 + \frac{n}{2}$

$-3 \quad -3$

$(2)(-8) = \frac{n}{2}(2)$

$-16 = n$

33) $\frac{r}{8} - 6 = -5$

$+6 \quad +6$

$(8)\frac{r}{8} = 1(8)$

$r = 8$

35) $-40 = 4n - 32$

$+32 \quad +32$

$\frac{-8}{4} = \frac{4n}{4}$

$-2 = n$

37) $87 = 3 - 7v$

$-3 \quad -3$

$\frac{84}{-7} = \frac{-7v}{-7}$

$-12 = v$

39) $-x + 1 = -11$

$-1 \quad -1$

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

$x = 12$

1.3

1) $2 - (-3a - 8) = 1$

$2 + 3a + 8 = 1$

$10 + 3a = 1$

$-10 \quad -10$

$\frac{3a}{3} = \frac{-9}{3}$

$a = -3$

3) $-5(-4 + 2v) = -50$

$20 - 10v = -50$

$-20 \quad -20$

$-\frac{10v}{-10} = -\frac{70}{-10}$

$v = 7$

5) $66 = 6(6 + 5x)$

$66 = 36 + 30x$

$-36 \quad -36$

$\frac{30}{30} = \frac{30x}{30}$

$1 = x$

7) $0 = -8(p - 5)$

$0 = -8p + 40$

$-40 \quad -40$

$\frac{-40}{-8} = \frac{-8p}{-8}$

$5 = p$

9) $-2+2(8x-7)=-16$

$-2+16x-14=-16$

$16x-16=-16$

$+16 \quad +16$

$\frac{16x}{16}=\frac{0}{16}$

$x=0$

11) $-21x+12=-6-3x$

$+21x \qquad +21x$

$12=-6+18x$

$+6 \quad +6$

$\frac{18}{18}=\frac{18x}{18}$

$1=x$

13) $-1-7m=-8m+7$

$+8m \quad +8m$

$-1+m=7$

$+1 \qquad +1$

$m=8$

15) $1-12r=29-8r$

$+12r \qquad +12r$

$1=29+4r$

$-29 \quad -29$

$\frac{-28}{4}=\frac{4r}{4}$

$-7=r$

17) $20-7b=-12b+30$

$+12b \quad +12b$

$20+5b=30$

$-20 \quad -20$

$\frac{5b}{5}=\frac{10}{5}$

$b=2$

19) $-32-24v=34-2v$

$+24v \qquad +24v$

$-32=34+22v$

$-34 \quad -34$

$\frac{-66}{22}=\frac{22v}{22}$

$-3=v$

21) $-2-5(2-4m)=33+5m$

$-2-10+20m=33+5m$

$-12+20m=33+5m$

$-5m \qquad -5m$

$-12+15m=33$

$+12 \qquad +12$

$\frac{15m}{15}=\frac{45}{15}$

$m=3$

23) $-4n+11=2(1-8n)+3n$

$-4n+11=2-16n+3n$

$-4n+11=2-13n$

$+13n \qquad +13n$

$9n+11=2$

$-11 \quad -11$

$\frac{9n}{9}=\frac{-9}{9}$

$n=-1$

25) $-6v-29=-4v-5(v+1)$

$-6v-29=-4v-5v-5$

$-6v-29=-9v-5$

$+9v \qquad +9v$

$3v-29=-5$

$+29 \quad +29$

$\frac{3v}{3}=\frac{24}{3}$

$v=8$

27) $2(4x-4)=-20-4x$

$8x-8=-20-4x$

$+4x \qquad +4x$

$12x-8=-20$

$+8 \quad +8$

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

$x=-1$

29) $-a-5(8a-1)=39-7a$

$-a-40a+5=39-7a$

$-41a+5=39-7a$

$+41a \qquad +41a$

$5=39+34a$

$-39 \quad -39$

$\frac{-34}{34}=\frac{34a}{34}$

$-1=a$

31) $-57=-(-p+1)+2(6+8p)$

$-57=p-1+12+16p$

$-57=17p+11$

$-11 \qquad -11$

$-\frac{68}{17}=\frac{17p}{17}$

$-4=p$

33) $-2(m-2)+7(m-8)=-67$

$-2m+4+7m-56=-67$

$5m-52=-67$

$+52 \quad +52$

$\frac{5m}{5}=\frac{-15}{5}$

$m=-3$

35) $50=8(7+7r)-(4r+6)$

$50=56+56r-4r-6$

$50=52r+50$

$-50 \qquad -50$

$\frac{0}{52}=\frac{52r}{52}$

$0=r$

37) $-8(n-7)+3(3n-3)=41$

$-8n+56+9n-27=41$

$n+47=41$

$-47 \quad -47$

$n=-6$

39) $-61=-5(5r-4)+4(3r-4)$

$-61=-25r+20+12r-16$

$-61=-13r+4$

$-4 \qquad -4$

$\frac{-65}{-13}=\frac{-13r}{-13}$

$5=r$

41) $-2(8n-4)=8(1-n)$

$-16n+8=8-8n$

$+16n \qquad +16n$

$8=8+8n$

$-8 \quad -8$

$\frac{0}{8}=\frac{8n}{8}$

$0=n$

43) $-3(-7v+3)+8v=5v-4(1-6v)$

$21v-9+8v=5v-4+24v$

$29v-9=29v-4$

$-29v \qquad -29v$

$-9=-4$

$false, \ No\ Solution\ \emptyset$

45) $-7(x-2)=-4-6(x-1)$

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

$-7x+14=2-6x$

$+7x \qquad +7x$

$14=2+x$

$-2 \quad -2$

$12=x$

47) $-6(8k+4)=-8(6k+3)-2$

$-48k-24=-48k-24-2$

$-48k-24=-48k-26$

$+48k \qquad +48k$

$-24=-26$

$false$

$No\ Solution\ \emptyset$

49) $-2(1-7p)=8(p-7)$

$-2+14p=8p-56$

$-8p \quad -8p$

$-2+6p=-56$

$+2 \qquad +2$

$\frac{6p}{6}=\frac{-54}{6}$

$p=-9$

1. 4

1) $\frac{3}{5}(1+p)=\frac{21}{20}$

$(20)\frac{3}{5}+(20)\frac{3}{5}p=\frac{21}{20}(20)$

$12+12p=21$

$-12 \quad -12$

$\frac{12p}{12}=\frac{9}{12}$

$p=\frac{3}{4}$

3) $0=-\frac{5}{4}x-\frac{6}{5}$

$(4)0=(4)\left(-\frac{5}{4}x\right)+\frac{3}{2}(4)$

$0=-5x+6$

$-6 \quad -6$

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

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

5) $(24)\frac{3}{4}-(24)\frac{5}{4}m=\frac{113}{24}(24)$

$18-30m=113$

$-18 \quad -18$

$-\frac{30m}{-30}=\frac{95}{-30}$

$m=-\frac{19}{6}$

7) $\frac{635}{72}=-\frac{5}{2}\left(-\frac{11}{4}+x\right)$

$(72)\frac{635}{72}=(72)\frac{55}{8}-\frac{5}{2}x(72)$

$635=495-180x$

$-495 \quad -495$

$\frac{140}{-180}=\frac{-180x}{-180}$

$-\frac{7}{9}=x$

9) $(5)2b+(5)\frac{9}{5}=-\frac{11}{5}(5)$

$10b+9=-11$

$-9 \quad -9$

$\frac{10b}{10}=\frac{-20}{10}$

$b=-2$

11) $\frac{3}{2}\left(\frac{7}{3}n+1\right)=\frac{3}{2}$

$(2)\frac{7}{2}n+(2)\frac{3}{2}=\frac{3}{2}(2)$

$7n+3=3$

$-3 \quad -3$

$\frac{7n}{7}=\frac{0}{7}$

$n=0$

13) $-a-\frac{5}{4}\left(-\frac{8}{3}a+1\right)=-\frac{19}{4}$

$-a(12)+(12)\frac{10}{3}a-(12)\frac{5}{4}=-\frac{19}{4}(12)$

$-12a+40a-15=-57$

$28a-15=-57$

$+15 \quad +15$

$\frac{28a}{28}=\frac{-42}{28}$

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

15) $\frac{55}{6}=-\frac{5}{2}\left(\frac{3}{2}p-\frac{5}{3}\right)$

$(12)\frac{55}{6}=(12)-\frac{15}{4}p+\frac{25}{6}(12)$

$110=-45p+50$

$-50 \quad -50$

$\frac{60}{-45}=\frac{-45p}{-45}$

$-\frac{4}{3}=p$

17) $\frac{16}{9}=-\frac{4}{3}\left(-\frac{4}{3}n-\frac{4}{3}\right)$

$(9)\frac{16}{9}=(9)\frac{16}{9}n+\frac{16}{9}(9)$

$16=16n+16$

$-16 \quad -16$

$\frac{0}{16}=\frac{16n}{16}$

$0=n$

19) $-\frac{5}{8}=\frac{5}{4}\left(r-\frac{3}{2}\right)$

$-\frac{5}{8}(8)=(8)\frac{5}{4}r-\frac{15}{8}(8)$

$-5=10r-15$

$+15 \quad +15$

$\frac{10}{10}=\frac{10r}{10}$

$1=r$

21) $-\frac{11}{3}+\frac{3}{2}b=\frac{5}{3}\left(b-\frac{5}{3}\right)$

$-\frac{11}{3}(6)+(6)\frac{3}{2}b=(6)\frac{5}{3}b-\frac{25}{6}(6)$

$-22+9b=15b-25$

$-9b \quad -9b$

$-22=6b-25$

$+25 \quad +25$

$\frac{3}{6}=\frac{6b}{6}$

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

23) $-\left(-\frac{5}{2}x-\frac{3}{2}\right)=-\frac{3}{2}+x$

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

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

$-2x \quad -2x$

$3x+3=-3$

$-3 \quad -3$

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

$x=-2$

25) $(16)\frac{45}{16}+(16)\frac{3}{2}n=(16)\frac{7}{4}n-\frac{19}{16}(16)$

$45+24n=28n-19$

$-24n \quad -24n$

$45=4n-19$

$+19 \quad +19$

$\frac{64}{4}=\frac{4n}{4}$

$16=n$

27) $\frac{3}{2}\left(v+\frac{3}{2}\right)=-\frac{7}{4}v-\frac{19}{6}$

$(12)\frac{3}{2}v+(12)\frac{9}{4}=-\frac{7}{4}v(12)-\frac{19}{6}(12)$

$18v+27=-21v-38$

$+21v \quad +21v$

$39v+27=-38$

$-27 \quad -27$

$\frac{39v}{39}=-\frac{65}{39}$

$v=-\frac{5}{3}$

29) $\frac{47}{9}+\frac{3}{2}x=\frac{5}{3}\left(\frac{5}{2}x+1\right)$

$(18)\frac{47}{9}+(18)\frac{3}{2}x=(18)\frac{25}{6}x+(18)\frac{5}{3}$

$94+27x=75x+30$

$-27x \quad -27x$

$94=48x+30$

$-30 \quad -30$

$\frac{64}{48}=\frac{48x}{48}$

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

1.5

1) $\frac{ab}{a}=\frac{c}{a}\ for\ b$

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

3) $(g)\frac{f}{g}x=b(g)\ for\ x$

$\frac{fx}{f}=\frac{bg}{f}$

$x=\frac{bg}{f}$

5) $(b)3x=\frac{a}{b}(b)\ for\ x$

$\frac{3bx}{3b}=\frac{a}{3b}$

$x=\frac{a}{3b}$

7) $\frac{E}{c^2}=\frac{mc^2}{c^2}\ for\ m$

$\frac{E}{c^2}=m$

9) $(3)V = (3)\frac{4}{3}\pi r^3 \; for \; \pi$

$\frac{3v}{4r^3} = \frac{4\pi r^3}{4r^3}$

$\frac{3v}{4r^3} = \pi$

11) $a + c = b \;\; for \;\; c$

$-a \quad -a$

$c = b - a$

13) $c(m+n) = \frac{4y}{m+n}(m+n) \; for \; y$

$\frac{c(m+n)}{4} = \frac{4y}{4}$

$\frac{c(m+n)}{4} = y$

15) $(12)V = \frac{\pi Dn}{12}(12) \; for \; D$

$\frac{12v}{\pi n} = \frac{\pi Dn}{\pi n}$

$\frac{12v}{\pi n} = D$

17) $\frac{p}{p-c} = \frac{n(p-c)}{p-c} \;\; for \; n$

$\frac{p}{p-c} = n$

19) $(L)T = \frac{D-d}{L}(L) \; for \; D$

$LT = D - d$

$+d \quad +d$

$LT + d = D$

21) $\frac{L}{1+at} = \frac{L_0(1+at)}{1+at}$

$\frac{L}{1+at} = L_o$

23) $2m + p = 4m + q \;\; for \; m$

$-2m \quad = 2m$

$p = 2m + q$

$-q \quad -q$

$\frac{p-q}{2} = \frac{2m}{2}$

$\frac{p-q}{2} = m$

25) $(r)\frac{k-m}{r} = q(r) \; for \; k$

$k - m = qr$

$+m \quad +m$

$k = qr + m$

27) $h = vt - 16t^2 \; for \; v$

$+16t^2 \quad +16t^2$

$\frac{h+16t^2}{t} = \frac{vt}{t}$

$\frac{h+16t^2}{2} = v$

29) $Q_1 = P(Q_2 - Q_1) \; for \; Q_2$

$Q_1 = PQ_2 - PQ_1$

$+PQ_1 \quad +PQ_1$

$\frac{Q_1+PQ_1}{P} = \frac{PQ_2}{P}$

$\frac{Q_1+PQ_1}{P} = Q_2$

31) $(d)R = \frac{kA(T_1+T_2)}{d}(d) \;\; for \; T_1$

$dR = kA(T_1 + T_2)$

$dR = kAT_1 + kAT_2$

$-kAT_2 \quad -kAT_2$

$\frac{dR-kAT_2}{kA} = \frac{kAT_1}{kA}$

$\frac{dR-kAT_2}{kA} = T_1$

33) $ax + b = c \;\; for \; a$

$-b \quad -b$

$\frac{ax}{x} = \frac{c-b}{x}$

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

35) $\frac{lwh}{lh} = \frac{V}{lh} \;\; for \; w$

$w = \frac{V}{lh}$

37) $\frac{1}{a}(a) + b(a) = \frac{c}{a}(a) \; for \; a$

$1 + ba = c$

$-1 \quad -1$

$\frac{ba}{b} = \frac{c-1}{b}$

$a = \frac{c-1}{b}$

39) $at - bw = 5 \quad for\ t$

$+bw \quad +bw$

$\frac{at}{a} = \frac{5+bw}{a}$

$t = \frac{5+bw}{a}$

41) $ax + bx = c \quad for \quad a$

$-bx \quad -bx$

$\frac{ax}{x} = \frac{c-bx}{x}$

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

43) $x + 5y = 3 \quad for \quad y$

$-x \qquad -x$

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

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

45) $3x + 2y = 7 \quad for \quad y$

$-3x \qquad -3x$

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

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

47) $5a - 7b = 4 \quad for \quad b$

$-5a \qquad -5a$

$\frac{-7b}{-7} = \frac{4-5a}{-7}$

$b = \frac{4-5a}{-7}$

49) $4x - 5y = 8 \quad for \quad y$

$-4x \qquad -4x$

$\frac{-5y}{-5} = \frac{8-4x}{-5}$

$y = \frac{8-4x}{-5}$

1.6

1) $|m| = -6$

$false$

$No\ Solution \emptyset$

3) $|n| = 4$

$n = 4, -4$

5) $|b| = 7$

$b = 7, -7$

7) $(7)\frac{|x|}{7} = 5(7)$

$|x| = 35$

$x = 35, -35$

9) $-10 + |k| = -15$

$+10 \qquad +10$

$|k| = -5$

$false$

$No\ Solution \emptyset$

11) $10|x| + 7 = 57$

$-7 \quad -7$

$\frac{10|x|}{10} = \frac{50}{10}$

$|x| = 5$

$x = 5, -5$

13) $10 - 5|m| = 70$

$-10 \qquad -10$

$-\frac{5|m|}{-5} = \frac{60}{-5}$

$|m| = -12$

$false$

$No\ Solution \emptyset$

15) $9|x| - 4 = 5$

$+4 \quad +4$

$\frac{9|x|}{9} = \frac{9}{9}$

$|x| = 1$

$x = 1, -1$

17) $\left|\frac{n}{10}\right| = 1$

$(10)\frac{n}{10} = 1(10), -1(10)$

$n = 10, -10$

19) $|v + 10| = 2$

$v + 10 = 2, \quad -2$

$-10 \quad -10 \quad -10$

$v = -8, -12$

21) $-4 - |a - 5| = -13$

$+4 \qquad\qquad +4$

$\frac{-|a-5|}{-1} = \frac{-9}{-1}$

$|a - 5| = 9$

$a - 5 = 9, \quad -9$

$+5 \quad +5 \quad +5$

$a = 14, -4$

23) $\frac{10|-6x|}{10} = \frac{60}{10}$

$|-6x| = 6$

$-\frac{6x}{-6} = \frac{6}{-6}, \ -\frac{6}{-6}$

$x = -1, 1$

25) $\frac{-7\left|\frac{n}{7}\right|}{-7} = -\frac{2}{-7}$

$\left|\frac{n}{7}\right| = \frac{2}{7}$

$(7)\frac{n}{7} = \frac{2}{7}(7), -\frac{2}{7}(7)$

$n = 2, -2$

27) $-8|-7 + p| - 6 = -14$

$+6 \quad +6$

$\frac{-8|-7+p|}{-8} = \frac{-8}{-8}$

$|-7 + p| = 1$

$-7 + p = 1 \ , \ -1$

$+7 \qquad +7 \quad +7$

$p = 8, 6$

29) $-3|7 + x| - 7 = -1$

$+7 \quad +7$

$\frac{-3|7+x|}{-3} = \frac{6}{-3}$

$|7 + x| = -2$

$false$

$No\ Solution \emptyset$

31) $|-7 - 5r| = 32$

$-7 - 5r = 32 \ , \ -32$

$+7 \qquad +7 \qquad +7$

$-\frac{5r}{-5} = \frac{39}{-5} \ , \frac{-25}{-5}$

$r = -\frac{39}{5}, 5$

33) $|8n - 6| = 66$

$8n - 6 = 66 \ , \ -66$

$+6 \quad +6 \quad +6$

$\frac{8n}{8} = \frac{72}{8} \ , -\frac{60}{8}$

$n = 9, -\frac{15}{2}$

35) $|2v + 7| = 11$

$2v + 7 = 11, \quad -11$

$-7 \quad -7 \quad -7$

$\frac{2v}{2} = \frac{4}{2}, \quad -\frac{18}{2}$

$v = 2, -9$

37) $\frac{9|10+6x|}{9} = \frac{72}{9}$

$|10 + 6x| = 8$

$10 + 6x = 8, \quad -8$

$-10 \qquad -10 \quad -10$

$\frac{6x}{6} = -\frac{2}{6}, \ -\frac{18}{6}$

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

39) $-3 + |6 + 6k| = -45$

$+3 \qquad\qquad +3$

$|6 + 6k| = -42$

$false$

$No\ Solution \emptyset$

41) $|2n+5|+5=0$

$\underline{\quad -5 \quad -5}$

$|2n+5|=-5$

$false \quad No\ Solution \emptyset$

43) $3-2|5-m|=9$

$\underline{-3 \qquad\qquad -3}$

$\frac{-2|5-m|}{-2}=\frac{6}{-2}$

$|5-m|=-3$

$false \quad No\ Solution \emptyset$

45) $|-10x-4|-10=66$

$\underline{+10 \quad +10}$

$|-10x-4|=76$

$-10x-4=76 \quad , \quad -76$

$\underline{+4 \quad +4 \qquad +4}$

$\frac{-10x}{-10}=\frac{80}{-10} \quad , \quad \frac{-72}{-10}$

$x=-8, \frac{36}{5}$

47) $|2+3x|=|4-2x|$

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

$\underline{+2x \qquad +2x}$ $\qquad$ $2+3x=-4+2x$

$2+5x=4$ $\qquad$ $\underline{-2x \qquad -2x}$

$\underline{-2 \qquad -2}$ $\qquad$ $2+x=-4$

$\frac{5x}{5}=\frac{2}{5}$ $\qquad$ $\underline{-2 \qquad -2}$

$x=\frac{2}{5}$ $\qquad$ $x=-6$

$x=\frac{2}{5}, -6$

49) $\left|\frac{2x-5}{3}\right|=\left|\frac{3x+4}{2}\right|$

$(6)\frac{2x-5}{3}=\frac{3x+4}{2}\ (6) \quad , \quad \frac{2x-5}{3}=\frac{-(3x+4)}{2}$

$4x-10=9x+12 \quad (6)\frac{2x-5}{3}=\frac{-3x-4}{2}\ (6)$

$\underline{-4x \qquad -4x}$ $\qquad$ $4x-10=-9x-12$

$-10=5x+12 \quad \underline{+9x \qquad +9x}$

$\underline{-12 \qquad -12}$ $\qquad$ $13x-10=-12$

$\frac{-22}{5}=\frac{5x}{5}$ $\qquad$ $\underline{+10 \quad +10}$

$-\frac{22}{5}=x$ $\qquad$ $\frac{13x}{13}=-\frac{2}{13}$

$x=-\frac{2}{13}$

$x=-\frac{22}{5}, -\frac{2}{13}$

1.7

1) c varies directly as a

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

3) w varies inversely as x

$wx=k$

5) f varies jointly as x and y

$\frac{f}{xy}=k$

7) h is directly proportional to b

$\frac{h}{b}=k$

9) a is inversely proportional to b

$ab=k$

11) p is jointly proportional to q and r and p = 12 when q = 8 and r = 3

$\frac{p}{qr} = k$

$\frac{12}{(8)(3)} = \frac{12}{24} = \frac{1}{2}$

13) t varies directly as the square of u and t = 6 when u = 3

$\frac{t}{u^2} = k$

$\frac{(6)}{(3)^2} = \frac{6}{9} = \frac{2}{3}$

15) w is inversely proportional to the cube of x and w is 54 when x = 3

$wx^3 = k$

$(54)(3)^3 = 54(27) = 1458$

17) a is jointly proportional with the square of x and the square root of y and a = 25 when x = 5 and y = 9

$\frac{a}{x^2\sqrt{y}} = k$

$\frac{(25)}{(5)^2\sqrt{(9)}} = \frac{25}{25 \cdot 3} = \frac{1}{3}$

19) The electrical current, in amperes, in a circuit varies directly as the voltage. When 15 volts are applied, the current is 5 amperes. What is the current when 18 volts are applied?

$\frac{a}{v} = k$

$\frac{(5)}{15} = \frac{1}{3}$

$(18)\frac{a}{18} = \frac{1}{3}(18)$

$a = 6\ amperes$

21) Hooke's law states that the distance that a spring is stretched by hanging object varies directly as the mass of the object. If the distance is 20 cm when the mass is 3 kg, what is the distance when the mass is 5 kg?

$\frac{d}{m} = k$

$\frac{20}{(3)} = \frac{20}{3}$

$\frac{x}{5} = \frac{20}{3}$

$x = \frac{100}{3} = 33.3\ cm.$

23) The number of aluminum cans used each year varies directly as the number of people using the cans. If 250 people use 60,000 cans in one year, how many cans are used each year in Dallas, which has a population of 1,008,000?

$\frac{c}{p} = k$

$\frac{60000}{250} = 250$

$(1{,}000{,}000)\frac{c}{1{,}000{,}000} = 240\ (1{,}000{,}000)$

$c = 241{,}920{,}000\ cans$

25) According to Fidelity Investment Vision Magazine, the average weekly allowance of children varies directly as their grade level. In a recent year, the average allowance of a 9th-grade student was 9.66 dollars per week. What was the average weekly allowance of a 4th-grade student?

$\frac{a}{g} = k$ $\qquad \frac{(9.66)}{(9)} = 1.07$

$(4)\frac{x}{4} = 1.07(4)$

$x = \$4.28$

27) The number of kilograms of water in a human body varies directly as the mass of the body. A 96-kg person contains 64 kg of water. How many kilo grams of water are in a 60-kg person?

$\frac{w}{m} = k$ $\qquad \frac{(64)}{(96)} = \frac{2}{3}$

$(60)\frac{x}{60} = \frac{2}{3}(60)$

$x = 40\ kg$

29) The weight of an object on Mars varies directly as its weight on Earth. A person weighs 95lb on Earth weighs 38 lb on Mars. How much would a 100-lb person weigh on Mars?

$\frac{m}{e} = k$ $\qquad \frac{38}{95} = \frac{2}{5}$

$(100)\frac{m}{100} = \frac{2}{5}(100)$

$m = 40\ lbs$

31) The time required to empty a tank varies inversely as the rate of pumping. If a pump can empty a tank in 45 min at the rate of 600 kL/min, how long will it take the pump to empty the same tank at the rate of 1000 kL/min?

$tr = k$ $\qquad (45)(600) = 27000$

$\frac{t(1000)}{1000} = \frac{27000}{1000}$

$t = 27\ min$

33) The stopping distance of a car after the brakes have been applied varies directly as the square of the speed r. If a car, traveling 60 mph can stop in 200 ft, how fast can a car go and still stop in 72 ft?

$\frac{d}{r^2} = k$ $\quad \frac{(200)}{(60)^2} = \frac{200}{600} = \frac{1}{18}$

$(r^2)\frac{72}{r^2} = \frac{1}{18}r^2$

$(18)(72) = \frac{r^2}{18}(18)$

$\sqrt{1296} = \sqrt{r^2}$

$36\ mph = r$

35) The intensity of a light from a light bulb varies inversely as the square of the distance from the bulb. Suppose intensity is 90 W/m^2 (watts per square meter) when the distance is 5 m. How much further would it be to a point where the intensity is 40 W/m^2?

$Id^2 = k$ $\quad (90)(5)^2 = k$

$90(25) = 2250$

$\frac{40d^2}{40} = \frac{2250}{40}$

$\sqrt{d^2} = \sqrt{56.25}$

$d = 7.5$

$7.5 - 5 = 2.5\ m\ further$

37) The intensity of a television signal varies inversely as the square of the distance from the transmitter. If the intensity is 25 W/m^2 at a distance of 2 km, how far from the transmitter are you when the intensity is 2.56 W/m^2?

$Id^2 = k$ $\quad (25)(2)^2 = k$

$25(4) = 100$

$\frac{(2.56)d^2}{2.56} = \frac{100}{2.56}$

$\sqrt{d^2} = \sqrt{39.0625}$

$d = 6.25\ m$

1.8

1) When five is added to three more than a certain number, the result is 19. What is the number?

$x + 3 + 5 = 19$

$x + 8 = 19$

$-8 \quad -8$

$x = 11$

3) When 18 is subtracted from six times a certain number, the result is − 42. What is the number?

$$6x - 18 = -42$$
$$+18 \quad +18$$
$$\frac{6x}{6} = \frac{-24}{6}$$
$$x = -4$$

5) A number plus itself, plus twice itself, plus 4 times itself, is equal to − 104. What is the number?

$$x + x + 2x + 4x = -104$$
$$\frac{8x}{8} = \frac{-104}{8}$$
$$x = -13$$

7) Eleven less than seven times a number is five more than six times the number. Find the number.

$$7x - 11 = 6x + 5$$
$$-6x \quad -6x$$
$$x - 11 = 5$$
$$+11 \quad +11$$
$$x = 16$$

9) The sum of three consecutive integers is 108. What are the integers?

$F: x$
$S: x + 1$
$T: x + 2$

$$3x + 3 = 108$$
$$-3 \quad -3$$
$$\frac{3x}{3} = \frac{105}{3}$$
$$x = 35 \qquad 35, 36, 37$$

11) Find three consecutive integers such that the sum of the first, twice the second, and three times the third is − 76.

$F: x \rightarrow x$
$2S: 2(x + 1) \rightarrow 2x + 2$
$3T: 3(x + 2) \rightarrow 3x + 6$

$$6x + 8 = -76$$
$$-8 \quad -8$$
$$\frac{6x}{6} = \frac{-84}{6}$$
$$x = -14 \qquad -14, -13, -12$$

13) The sum of three consecutive odd integers is 189. What are the integers?

$F: x$

$S: x + 2$

$T: \underline{x + 4}$

$3x + 6 = 189$

$\underline{-6 \quad -6}$

$\frac{3x}{3} = \frac{183}{3}$

$x = 61$ $\quad 61, 63, 65$

15) Find three consecutive odd integers such that the sum of the first, two times the second, and three times the third is 70.

$F: x \quad \rightarrow x$

$2S: 2(x + 2) \rightarrow 2x + 4$

$3T: 3(x + 4) \rightarrow \underline{3x + 12}$

$6x + 16 = 70$

$\underline{-16 \quad -16}$

$\frac{6x}{6} = \frac{54}{6}$

$x = 9$ $\quad 9, 11, 13$

17) Two angles of a triangle are the same size. The third angle is 12 degrees smaller than the first angle. Find the measure the angles.

$F: x \quad (64)$

$S: x \quad (64)$

$T: \underline{x - 12} \quad (64 - 12 = 52)$

$3x - 12 = 180$

$\underline{+12 \quad +12}$

$\frac{3x}{3} = \frac{192}{3}$

$x = 64$ $\quad 64°, 64°, 52°$

19) The third angle of a triangle is the same size as the first. The second angle is 4 times the third. Find the measure of the angles.

$F: x \quad (30)$

$S: 4x \quad (4 \cdot 30 = 120)$

$T: \underline{x} \quad (30)$

$\frac{6x}{6} = \frac{180}{6}$

$x = 30$ $\quad 30°, 120°, 30°$

21) The second angle of a triangle is twice as large as the first. The measure of the third angle is 20 degrees greater than the first. How large are the angles?

$F: x$ (40)

$S: 2x$ $(2 \cdot 40 = 80)$

$T: x + 20$ $(40 + 20 = 60)$

$4x + 20 = 180$

$-20 \quad -20$

$\frac{4x}{4} = \frac{160}{4}$

$x = 40$ $40°, 80°, 60°$

23) The second angle of a triangle is five times as large as the first. The measure of the third angle is 12 degrees greater than that of the first angle. How large are the angles?

$F: x$ (24)

$S: 5x$ $(5 \cdot 24 = 120)$

$T: x + 12$ $(24 + 12 = 36)$

$7x + 12 = 180$

$-12 \quad -12$

$\frac{7x}{7} = \frac{168}{7}$

$x = 24$ $24°, 120°, 36°$

25) The second angle of a triangle is four times the first and the third is 5 degrees more than twice the first. Find the measures of the angles.

$F: x$ (25)

$S: 4x$ $(4 \cdot 25 = 100)$

$T: 2x + 5$ $(2 \cdot 25 + 4 = 50 + 5 = 55)$

$7x + 5 = 180$

$-5 \quad -5$

$\frac{7x}{7} = \frac{175}{7}$

$x = 25$ $25°, 100°, 55°$

27) The perimeter of a rectangle is 304 cm. The length is 40 cm longer than the width. Find the length and width.

$L: x + 40$ $(56 + 40 = 96)$

$W: x$ (56)

$2(2x + 40) = 304$

$4x + 80 = 304$

$-80 \quad -80$

$\frac{4x}{4} = \frac{224}{4}$

$x = 56$ $56\ x\ 96$

29) The perimeter of a rectangle is 280 meters. The width is 26 meters less than the length. Find the length and width.

$L: x$ (83)

$W: x - 26$ $(83 - 26 = 57)$

$2(2x - 26) = 280$

$4x - 52 = 280$

$+52 \quad +52$

$\frac{4x}{4} = \frac{332}{4}$

$x = 83$ $57\ x\ 83$

31) A mountain cabin on 1 acre of land costs S30,000. If the land cost 4 times as much as the cabin, what was the cost of each?

$C: x$ (6000)

$L: 4x$ $(4 \cdot 6000 = 24000)$

$\frac{5x}{5} = \frac{30000}{5}$

$x = 6000$ $Cabin: \$6{,}000, Land: \$24{,}000$

33) A bicycle and a bicycle helmet cost S240. How much did each cost, if the bicycle cost 5 times as much as the helmet?

$B: 5x$ $(5 \cdot 40 = 200)$

$H: x$ (40)

$\frac{6x}{6} = \frac{240}{6}$

$x = 40$ $Bike: \$200, Helmet: \$40$

35) If Mr. Brown and his son together had S220, and Mr. Brown had 10 times as much as his son, how much money had each?

$B: 10x$ $(10 \cdot 20 = 200)$

$S: x$ (20)

$\frac{11x}{11} = \frac{220}{22}$

$x = 20$ $Mr.\ Brown: \$200, Son: \$20$

37) Aaron had 7 times as many sheep as Beth, and both together had 608. How many sheep had each?

$A: 7x$ $(7 \cdot 76 = 532)$

$B: x$ (76)

$\frac{8x}{8} = \frac{608}{8}$

$x = 76$ $Aaron: 532\ Sheeep, Beth: 76\ Sheep$

39) Jamal and Moshe began a business with a capital of S7500. If Jamal furnished half as much capital as Moshe, how much did each furnish?

$J: x$ (2500)

$M: 2x$ $(2 \cdot 2500 = 5000)$

$\frac{3x}{3} = \frac{7500}{3}$

$x = 2500$ $Jamal: \$2500, Moshe: \$5000$

41) A 6 ft board is cut into two pieces, one twice as long as the other. How long are the pieces?

$L: 2x$ $(2 \cdot 2 = 4)$

$S: x$ (2)

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

$x = 2$ $4ft \ \& \ 2ft$

43) An electrician cuts a 30 ft piece of wire into two pieces. One piece is 2 ft longer than the other. How long are the pieces?

$L: x + 2$ $(14 + 2 = 16)$

$S: x$ (14)

$2x + 2 = 30$

$-2 \quad -2$

$\frac{2x}{2} = \frac{28}{2}$

$x = 14$ $16ft \ \& \ 14ft$

45) The cost of a private pilot course is $1,275. The flight portion costs $625 more than the ground school portion. What is the cost of each?

$F: x + 625$ $(325 + 625 = 950)$

$G: x$ (325)

$2x + 625 = 1275$

$-625 \quad -625$

$\frac{2x}{2} = \frac{650}{2}$

$x = 325$ $Flight: \$950, Ground: \$325$

1.9

1) rA boy is 10 years older than his brother. In 4 years he will be twice as old as his brother. Find the present age of each.

	Now	+4
H-boy	x+10	x+14
B-Brother	x	x+4

$H = 2B$

$(x + 14) = 2(x + 4)$

$x + 14 = 2x + 8$

$-x \quad -x$

$14 = x + 8$

$-8 \quad -8$

$6 = x$ $Boy: 16, Brother: 6$

3) Pat is 20 years older than his son James. In two years Pat will be twice as old as James. How old are they now?

	Now	+2
P	x+20	x+22
J	x	x+2

$$P = 2J$$
$$x + 22 = 2(x + 2)$$
$$x + 22 = 2x + 4$$
$$-x \qquad -x$$
$$22 = x + 4$$
$$-4 \qquad -4$$
$$18 = x$$

$Pat: 38,\ James: 18$

5) Fred is 4 years older than Barney. Five years ago the sum of their ages was 48. How old are they now?

	Now	−5
F	x+4	x-1
B	x	x-5

$$F + B = 48$$
$$(x - 1) + (x - 5) = 48$$
$$2x - 6 = 48$$
$$+6 \quad +6$$
$$\frac{2x}{2} = \frac{54}{2}$$
$$x = 27$$

$Fred: 31, Barney: 27$

7) Tim is 5 years older than JoAnn. Six years from now the sum of their ages will be 79. How old are they now?

	Now	+6
T	x+5	x+11
J	x	x+6

$$T + J = 79$$
$$(x + 11) + (x + 6) = 79$$
$$2x + 17 = 79$$
$$-17 \quad -17$$
$$\frac{2x}{2} = \frac{62}{2}$$
$$x = 31$$

$Tim: 36,\ JoAnn: 31$

9) The sum of the ages of John and Mary is 32. Four years ago, John was twice as old as Mary. Find the present age of each.

	Now	-4
J	x	x-4
M	32-x	28-x

$$J = 2m$$
$$(x - 4) = 2(28 - x)$$
$$x - 4 = 56 - 2x$$
$$+2x \qquad +2x$$
$$3x - 4 = 56$$
$$+4 \quad +4$$
$$\frac{3x}{3} = \frac{60}{3}$$
$$x = 20$$

$John: 20,\ Mary: 12$

11) The sum of the ages of a china plate and a glass plate is 16 years. Four years ago the china plate was three times the age of the glass plate. Find the present age of each plate.

	Now	-4
C	x	x-4
G	16-x	12-x

$$C = 3G$$
$$(x-4) = 3(12-x)$$
$$x - 4 = 36 - 3x$$
$$+3x \qquad\qquad +3x$$
$$4x - 4 = 36$$
$$+4 \quad +4$$
$$\frac{4x}{4} = \frac{40}{4}$$
$$x = 10 \qquad China: 10,\ Glass: 6$$

13) A is now 34 years old, and B is 4 years old. In how many years will A be twice as old as B?

	Now	+t
A	34	34+t
B	4	4+t

$$A = 2B$$
$$34 + t = 2(4 + t)$$
$$34 + t = 8 + 2t$$
$$-t \qquad -t$$
$$34 = 8 + t$$
$$-8 \quad -8$$
$$26 = t$$

15) An Oriental rug is 52 years old and a Persian rug is 16 years old. How many years ago was the Oriental rug four times as old as the Persian Rug?

	Now	-t
O	52	52-t
P	16	16-t

$$O = 4P$$
$$52 - t = 4(16 - t)$$
$$52 - t = 64 - 4t$$
$$+4t \qquad +4t$$
$$52 + 3t = 64$$
$$-52 \qquad -52$$
$$\frac{3t}{3} = \frac{12}{3}$$
$$t = 4$$

17) The age of the older of two boys is twice that of the younger; 5 years ago it was three times that of the younger. Find the age of each.

	Now	-5
O	2x	2x-5
Y	x	x-5

$$O = 3Y$$
$$2x - 5 = 3(x - 5)$$
$$2x - 5 = 3x - 15$$
$$-2x \qquad -2x$$
$$-5 = x - 15$$
$$+15 \qquad +15$$
$$10 = x \qquad Older: 20, Younger: 10$$

19) Marge is twice as old as Consuelo. The sum of their ages seven years ago was 13. How old are they now?

	Now	-7
M	2x	2x-7
C	x	x-7

$$M + C = 13$$
$$(2x - 7) + (x - 7) = 13$$
$$3x - 14 = 13$$
$$+14 \quad +14$$
$$\frac{3x}{3} = \frac{27}{3}$$
$$x = 9 \qquad Marge: 18,\ Consuelo: 9$$

21) A silver coin is 28 years older than a bronze coin. In 6 years, the silver coin will be twice as old as the bronze coin. Find the present age of each coin.

	Now	+6
S	x+28	x+34
B	x	x+6

$$S = 2B$$
$$(x + 34) = 2(x + 6)$$
$$x + 34 = 2x + 12$$
$$-x \qquad -x$$
$$34 = x + 12$$
$$-12 \qquad -12$$
$$22 = x \qquad Silver: 50, bronze: 22$$

23) A limestone statue is 56 years older than a marble statue. In 12 years, the limestone will be three times as old as the marble statue. Find the present age of the statues.

	Now	+12
L	x+56	x+68
M	x	x+12

$$L = 3M$$
$$(x + 68) = 3(x + 12)$$
$$x + 68 = 3x + 36$$
$$-x \qquad -x$$
$$68 = 2x + 36$$
$$-36 \qquad -36$$
$$\frac{32}{2} = \frac{2x}{2}$$
$$16 = x \qquad Limestone: 72,\ Marble: 16$$

25) Brandon is 9 years older than Ronda. In four years the sum of their ages will be 91. How old are they now?

	Now	+4
B	x+9	x+13
R	x	x+4

$$B + R = 91$$
$$(x + 13) + (x + 4) = 91$$
$$2x + 17 = 91$$
$$-17 \quad -17$$
$$\frac{2x}{2} = \frac{74}{2}$$
$$x = 37 \qquad Brandon: 46,\ Ronda: 37$$

27) A father is three times as old as his son, and his daughter is 3 years younger than the son. If the sum of their ages 3 years ago was 63 years, find the present age of the father.

	Now	-3
F	3x	3x-3
S	x	x-3
D	x-3	x-6

$F + S + D + 63$

$(3x - 3) + (x - 3) + (x - 6) = 63$

$5x - 12 = 63$

$+12 \quad +12$

$\frac{5x}{5} = \frac{75}{5}$

$x = 15$

$Father: 45,\ Son = 15,\ Daughter: 12$

29) The sum of the ages of two ships is 12 years. Two years ago, the age of the older ship was three times the age of the newer ship. Find the present age of each ship.

	Now	-2
O	x	x-2
Y	12-x	10-x

$O = 3Y$

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

$x - 2 = 30 - x$

$+x \qquad +x$

$2x - 2 = 30$

$+2 \quad +2$

$\frac{4x}{4} = \frac{32}{4}$

$x = 8$ 8 & 4

31) Ann is eighteen years older than her son. One year ago, she was three times as old as her son. How old are they now?

	Now	-1
A	x+18	x+17
S	x	x-1

$A = 3S$

$(x + 17) = 3(x - 1)$

$x + 17 = 3x - 3$

$-x \qquad -x$

$17 = 2x - 3$

$+3 \qquad +3$

$\frac{20}{2} = \frac{2x}{2}$

$10 = x$ $Ann: 28,\ Son: 10$

33) A mosaic is 74 years older than the engraving. Thirty years ago, the mosaic was three times as old as the engraving. Find the present age of each.

	Now	-30
M	x+74	x+44
E	x	x-30

$$M = 3E$$
$$(x + 44) = 3(x - 30)$$
$$x + 44 = 3x - 90$$
$$-x \qquad -x$$
$$44 = 2x - 90$$
$$+90 \qquad +90$$
$$\frac{134}{2} = \frac{2x}{2}$$
$$67 = x$$

$Mosaic: 141,\ Engraving: 67$

35) A wool tapestry is 32 years older than a linen tapestry. Twenty years ago, the wool tapestry was twice as old as the linen tapestry. Find the present age of each.

	Now	-20
W	x+32	x+12
L	x	x-20

$$W = 2L$$
$$(x + 12) = 2(x - 20)$$
$$x + 12 = 2x - 20$$
$$-x \qquad -x$$
$$12 = x - 20$$
$$+20 \qquad +20$$
$$32 = x$$

$Wool: 84,\ Linen: 52$

37) Nicole is 26 years old. Emma is 2 years old. In how many years will Nicole be triple Emma's age?

	Now	+t
N	26	26+t
E	2	2+t

$$N = 3E$$
$$(26 + t) = 3(2 + t)$$
$$26 + t = 6 + 3t$$
$$-t \qquad -t$$
$$26 = 6 + 2t$$
$$-6 \quad -6$$
$$\frac{20}{2} = \frac{2t}{2}$$
$$10 = t$$

39) Mike is 4 years older than Ron. In two years, the sum of their ages will be 84. How old are they now?

	Now	+2
M	x+4	x+6
R	x	x+2

$$M + R = 84$$
$$(x + 6) + (x + 2) = 84$$
$$2x + 8 = 84$$
$$-8 \quad -8$$
$$\frac{2x}{2} = \frac{76}{2}$$
$$x = 38$$

$Mike: 42,\ Ron: 38$

1.10

1) A is 60 miles from B. An automobile at A starts for B at the rate of 20 miles an hour at the same time that an automobile at B starts for A at the rate of 25 miles an hour. How long will it be before the automobiles meet?

	r	t	d
A	20	t	20t
B	25	t	25t

$$20t + 25t = 60$$
$$\frac{45t}{45} = \frac{60}{45}$$
$$t = 1.33\ hr$$

3) Two trains travel toward each other from points which are 195 miles apart. They travel at rate of 25 and 40 miles an hour respectively. If they start at the same time, how soon will they meet?

	r	t	d
	25	t	25t
	40	t	40t

$$25t + 40t = 195$$
$$\frac{65t}{65} = \frac{195}{65}$$
$$t = 3\ hr$$

5) A passenger and a freight train start toward each other at the same time from two points 300 miles apart. If the rate of the passenger train exceeds the rate of the freight train by 15 miles per hour, and they meet after 4 hours, what must the rate of each be?

	r	t	d
P	r+15	4	4r+60
F	r	4	4r

$$4r + 4r + 60 = 300$$
$$8r + 60 = 300$$
$$-60 \quad -60$$
$$\frac{8r}{8} = \frac{240}{8}$$
$$r = 30 \qquad Passenger: 45\ mph,\ Freight: 30\ mph$$

7) A man having ten hours at his disposal made an excursion, riding out at the rate of 10 miles an hour and returning on foot, at the rate of 3 miles an hour. Find the distance he rode.

	r	t	D
r	10	t	10t
w	3	10-t	30-3t

$$10t = 30 - 3t$$
$$+3t \qquad +3t$$
$$\frac{13t}{13} = \frac{30}{13}$$
$$t = \frac{30}{13}$$
$$d = 10\left(\frac{30}{13}\right) = \frac{300}{13} mi$$

9) A boy rides away from home in an automobile at the rate of 28 miles an hour and walks back at the rate of 4 miles an hour. The round trip requires 2 hours. How far does he ride?

	r	t	d
r	28	t	28t
w	4	2-t	8-4t

$$28t = 8 - 4t$$
$$+4t \qquad +4t$$
$$\frac{32t}{32} = \frac{8}{32}$$
$$t = .25$$
$$d = 28(.25) = 7\ mi.$$

11) A family drove to a resort at an average speed of 30 mph and later returned over the same road at an average speed of 50 mph. Find the distance to the resort if the total driving time was 8 hours.

	r	t	d
T	30	t	30t
R	50	8-t	400-50t

$$30t = 400 - 50t$$
$$+50t \qquad +50t$$
$$\frac{80t}{80} = \frac{400}{80}$$
$$t = 5$$
$$d = 30(5) = 150\ mi.$$

13) A, who travels 4 miles an hour starts from a certain place 2 hours in advance of B, who travels 5 miles an hour in the same direction. How many hours must B travel to overtake A?

	r	t	D
A	4	t+2	4t+8
B	5	t	5t

$$4t + 8 = 5t$$
$$-4t \qquad -4t$$
$$8hr = t$$

15) A motorboat leaves a harbor and travels at an average speed of 8 mph toward a small island. Two hours later a cabin cruiser leaves the same harbor and travels at an average speed of 16 mph toward the same island. In how many hours after the cabin cruiser leaves will the cabin cruiser be alongside the motorboat?

	r	t	d
M	8	t+2	8t+16
C	16	t	16t

$$8t + 16 = 16t$$
$$-8t \qquad -8t$$
$$\frac{16}{8} = \frac{8t}{8}$$
$$2hr = t$$

17) A car traveling at 48 mph overtakes a cyclist who, riding at 12 mph, has had a 3 hour head start. How far from the starting point does the car overtake the cyclist?

	r	t	d
Car	48	t	48t
Cy	12	t+3	12t+36

$$48t = 12t + 36$$
$$-12t - 12t$$
$$\frac{36t}{36} = \frac{36}{36}$$
$$t = 1$$
$$d = 48(1) = 48\ mi.$$

19) Two men are traveling in opposite directions at the rate of 20 and 30 miles an hour at the same time and from the same place. In how many hours will they be 300 miles apart?

	r	t	d
	20	t	20t
	30	t	30t
			300

$$20t + 30t = 300$$
$$\frac{50t}{50} = \frac{300}{50}$$
$$t = 6\ hr$$

21) A motorboat leaves a harbor and travels at an average speed of 18 mph to an island. The average speed on the return trip was 12 mph. How far was the island from the harbor if the total trip took 5 h?

	r	t	d
T	18	t	18t
R	12	5-t	60-12t

$$18t = 60 - 12t$$
$$+12t \qquad +12t$$
$$\frac{30t}{30} = \frac{60}{30}$$
$$t = 2$$
$$d = 18(2) = 36\ mi$$

23) A jet plane traveling at 570 mph overtakes a propeller-driven plane that has had a 2 h head start. The propeller-driven plane is traveling at 190 mph. How far from the starting point does the jet overtake the propeller-driven plane?

	r	t	d
J	570	t	570t
P	190	t+2	190t+380

$$570t = 190t + 380$$
$$-190t - 190t$$
$$\frac{380t}{380} = \frac{380}{380}$$
$$t = 1$$
$$d = 570(1) = 570\ mi.$$

25) As part of flight training, a student pilot was required to fly to an airport and then return. The average speed on the way to the airport was 100 mph, and the average speed returning was 150 mph. Find the distance between the two airports if the total flight time was 5 h.

	r	t	d
T	100	t	100t
R	150	5-t	750-150t

$$100t = 750 - 150t$$
$$+150t \qquad +150t$$
$$\frac{250t}{250} = \frac{750}{250}$$
$$t = 3$$
$$d = 100(3) = 300\ mi.$$

27) A car traveling at 56 mph overtakes a cyclist who, riding at 14 mph, has had a 3 h head start. How far from the starting point does the car overtake the cyclist?

	r	t	d
Car	56	t	56t
Cy	14	t+3	14t+42

$$56t = 14t + 42$$
$$-14t - 14t$$
$$\frac{42t}{42} = \frac{42}{42}$$
$$t = 1$$
$$d = 56(1) = 56\ mi$$

29) A bus traveling at a rate of 60 mph overtakes a car traveling at a rate of 45 mph. If the car had a 1 h head start, how far from the starting point does the bus overtake the car?

	r	t	d
B	60	t	60t
C	45	t+1	45t+45

$$60t = 45t + 45$$
$$-45t \quad -45t$$
$$\frac{15t}{15} = \frac{45}{15}$$
$$t = 3$$
$$d = 60(3) = 180\ mi.$$

31) A truck leaves a depot at 11 A.M. and travels at a speed of 45 mph. At noon, a van leaves the same place and travels the same route at a speed of 65 mph. At what time does the van overtake the truck?

	r	t	d
T	45	t+1	45t+45
V	65	t	65t

$$45t + 45 = 65t$$
$$-45t \qquad -45t$$
$$\frac{45}{20} = \frac{20t}{20}$$
$$2.25 = t$$
$$2.25 = 2\ hr\ 15min.$$
$$12{:}00pm + 2{:}15 = 2{:}15pm$$

33) Three campers left their campsite by canoe and paddled downstream at an average rate of 10 mph. They then turned around and paddled back upstream at an average rate of 5 mph to return to their campsite. How long did it take the campers to canoe downstream if the total trip took 1 hr?

	r	t	d
d	10	t	10t
v	5	1-t	5-5t

$$10t = 5 - 5t$$
$$+5t \qquad +5t$$
$$\frac{15t}{15} = \frac{5}{15}$$
$$t = \frac{1}{3}\ hr = 20\ min.$$

35) A student walks and jogs to college each day. The student averages 5 km/hr walking and 9 km/hr jogging. The distance from home to college is 8 km, and the student makes the trip in one hour. How far does the student jog?

	r	t	d
W	5	t	5t
J	9	1-t	9-9t
			8

$$5t + 9 - 9t = 8$$
$$-4t + 9 = 8$$
$$-9 \quad -9$$
$$-\frac{4t}{-4} = -\frac{1}{-4}$$
$$t = .25$$
$$d = 9 - 9(.25) = 9 - 2.25 = 6.75\ mi$$

37) On a 220 mi trip, a car traveled at an average speed of 50 mph and then reduced its average speed to 35 mph for the remainder of the trip. The trip took a total of 5 h. How long did the car travel at each speed?

	r	t	d
F	50	t	50t
S	35	5-t	175-35t
			220

$$50t + 175 - 35t = 220$$
$$15t + 175 = 220$$
$$\underline{\quad -175 - 175 \quad}$$
$$\frac{15t}{15} = \frac{45}{15}$$
$$t = 3$$
$$3hr \text{ @ } 50\ mph, 2\ hr \text{ @ } 35\ mph$$

Chapter 2: Graphing

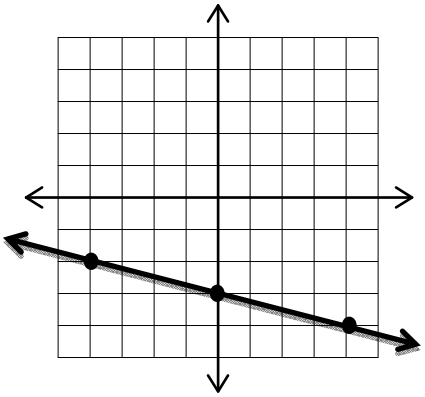
2.1

1) $B(4,-3), C(1,2), D(-1,4), E(-5,0), F(2,-3), G(1,3), H(-1,-4), I(-2,-1), J(0,2), K(-4,3)$

3) $y = -\frac{1}{4}x - 3$

$let\ x = -4$
$y = -\frac{1}{4}(-4) - 3$
$= 1 - 3$
$= -2$
$let\ x = 0$
$y = -\frac{1}{4}(0) - 3$
$= 0 - 3$
$= -3$
$let\ x = 4$
$y = -\frac{1}{4}(4) - 3$
$= -1 - 3$
$= -4$

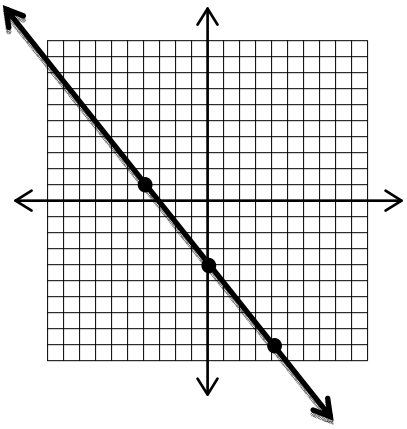
x	y
-4	-2
0	-3
4	-4



5) $y = -\frac{5}{4}x - 4$

$let\ x = -4$
$y = -\frac{5}{4}(-4) - 4$
$= 5 - 4$
$= 1$
$let\ x = 0$
$y = -\frac{5}{4}(0) - 4$
$= 0 - 4$
$= -4$
$let\ x = 4$
$y = -\frac{5}{4}(4) - 4$
$= -5 - 4$
$= -9$

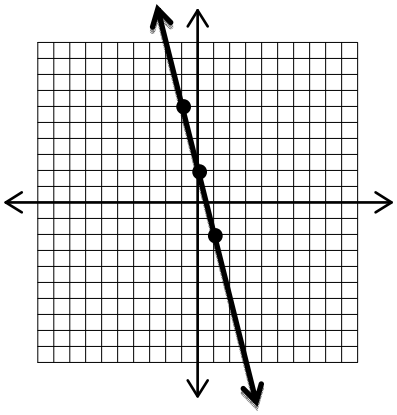
x	y
-4	1
0	-4
4	-9



7) $y = -4x + 2$

$let\ x = -1$
$y = -4(-1) + 2$
$= 4 + 2$
$= 6$
$let\ x = 0$
$y = -4(0) + 2$
$= 0 + 2$
$= 2$
$let\ x = 1$
$y = -4(1) + 2$
$= -4 + 2$
$= -2$

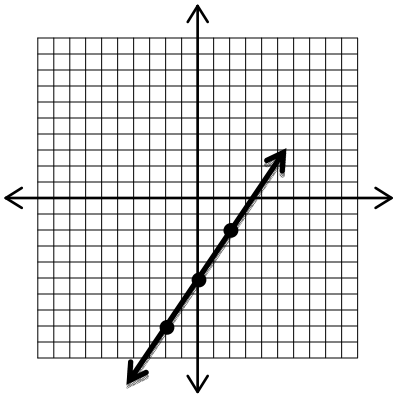
x	y
-1	6
0	2
1	-2



9) $y = \frac{3}{2}x - 5$

$let\ x = -2$
$y = \frac{3}{2}(-2) - 5$
$= -3 - 5$
$= -8$
$let\ x = 0$
$y = \frac{3}{2}(0) - 5$
$= 0 - 5$
$= -5$
$let\ x = 2$
$y = \frac{3}{2}(2) - 5$
$= 3 - 5$
$= -2$

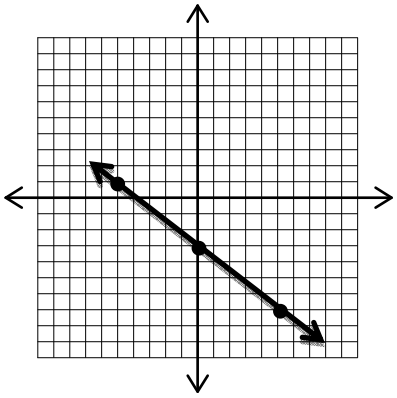
x	y
-2	-8
0	-5
2	-2



11) $y = -\frac{4}{5}x - 3$

$let\ x = -5$
$y = -\frac{4}{5}(-5) - 3$
$= 4 - 3$
$= 1$
$let\ x = 0$
$y = -\frac{4}{5}(0) - 3$
$= 0 - 3$
$= -3$
$let\ x = 5$
$y = -\frac{4}{5}(5) - 3$
$= -4 - 3$
$= -7$

x	y
-5	1
0	-3
5	-7



13) $x + 5y = -15$

$\underline{-x \qquad\qquad -x}$

$\frac{5y}{5} = \frac{-x}{5} - \frac{15}{5}$

$y = -\frac{1}{5}x - 3$

$let\ x = -5$

$y = -\frac{1}{5}(-5) - 3$

$= 1 - 3$

$= -2$

$let\ x = 0$

$y = -\frac{1}{5}(0) - 3$

$= 0 - 3$

$= -3$

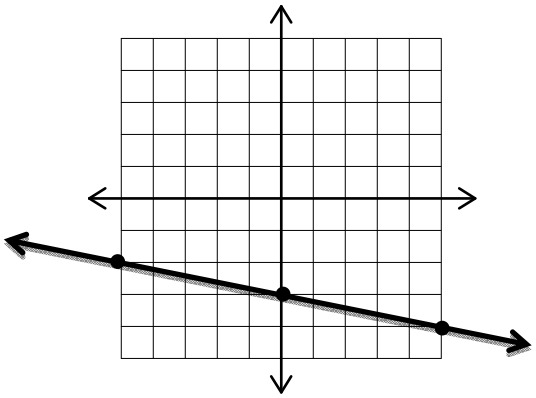
$let\ x = 5$

$y = -\frac{1}{5}(5) - 3$

$= -1 - 3$

-4

x	y
-5	-2
0	-3
5	-4



15) $4x + y = 5$

$\underline{-4x \qquad -4x}$

$y = -4x + 5$

$let\ x = -1$

$y = -4(-1) + 5$

$= 4 + 5$

$= 9$

$let\ x = 0$

$y = -4(0) + 5$

$= 0 + 5$

$= 5$

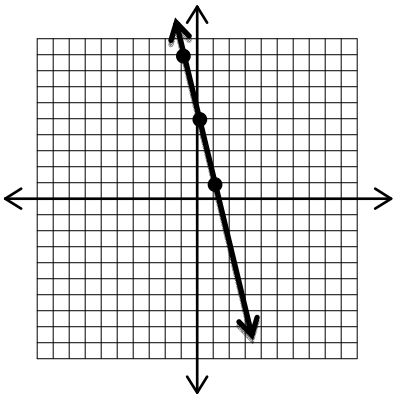
$let\ x = 1$

$y = -4(1) + 5$

$= -4 + 5$

$= 1$

x	y
-1	9
0	5
1	1



17) $2x - y = 2$

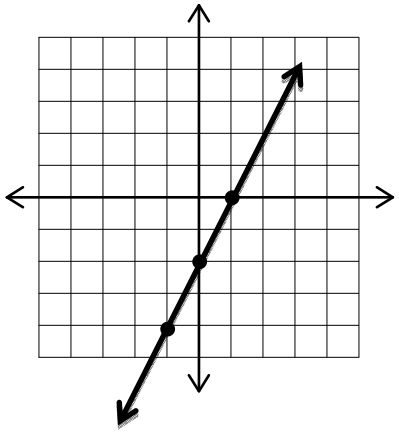
$-2x \qquad -2x$

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

$y = 2x - 2$

$let\ x = -1$
$y = 2(-1) - 2$
$= -2 - 2$
$= -4$
$let\ x = 0$
$y = 2(0) - 2$
$= 0 - 2$
$= -2$
$let\ x = 1$
$y = 2(1) - 2$
$= 2 - 2$
$= 0$

x	y
-1	-4
0	-2
1	0



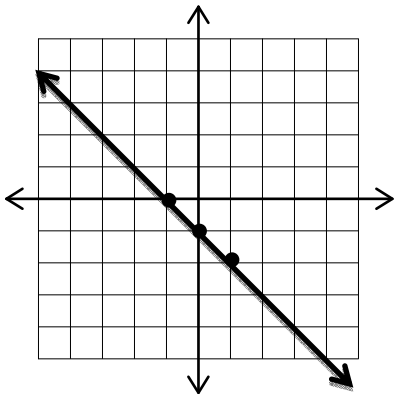
19) $x + y = -1$

$-x \qquad -x$

$y = -x - 1$

$let\ x = -1$
$y = -(-1) - 1$
$= 1 - 1$
$= 0$
$let\ x = 0$
$y = -(0) - 1$
$= 0 - 1$
$= -1$
$let\ x = 1$
$y = -(1) - 1$
$= -1 - 1$
$= -2$

x	y
-1	-0
0	-1
1	-2



21) $x - y = -3$

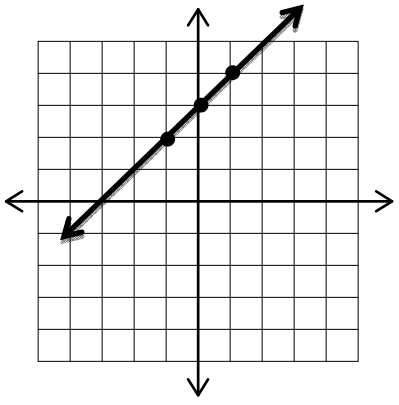
$-x \qquad -x$

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

$y = x + 3$

$let\ x = -1$
$y = (-1) + 3$
$= -1 + 3$

x	y
-1	2



$= 2$

$let\ x = 0$

$y = (0) + 3$

$= 3$

$let\ x = 1$

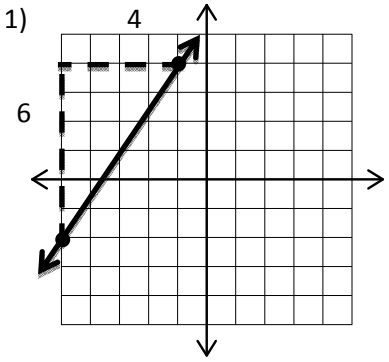
$y = (1) + 3$

$= 4$

0	3
1	4

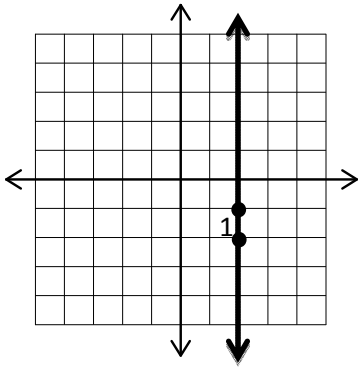
2.2

1)



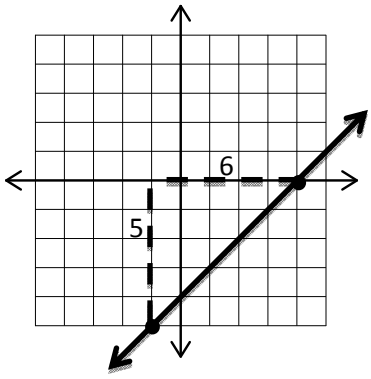
$m = \frac{6}{4} = \frac{3}{2}$

3)



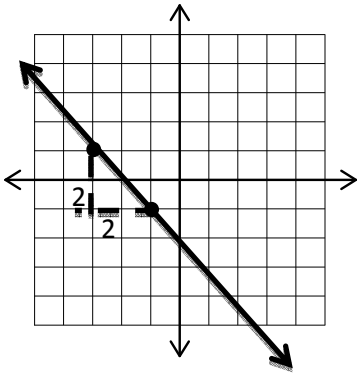
$m = \frac{1}{0} = undefined$

5)



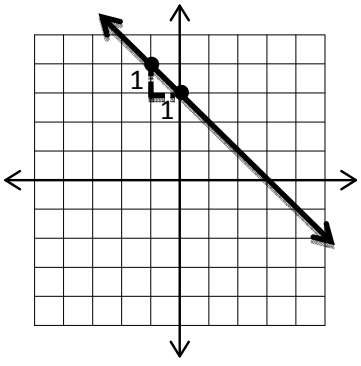
$m = \frac{5}{6}$

7)



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

9)



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

11) $(-2, 10), (-2, -15)$

$m = \frac{-15-10}{-2-(-2)} = \frac{-25}{0} =$

$undefined$

13) $(-15, 10), 16, -7)$

$m = \frac{-7-10}{16-(-15)} = \frac{-17}{31}$

15) $(10, 18), (-11, -10)$

$m = \frac{-10-18}{-11-10} = \frac{-28}{-21} =$

$4/3$

17) $(-16, -14), (11, -14)$

$m = \frac{-14-(-14)}{11-(-16)} = \frac{0}{27} = 0$

19) $(-4, 14), (-16, 8)$

$m = \frac{8-14}{-16-(-4)} = \frac{-6}{-12} = \frac{1}{2}$

21) $(12, -19), (6, 14)$

$m = \frac{14-(-19)}{6-12} = \frac{33}{-6} = \frac{11}{-2}$

23) $(-5, -10), (-5, 20)$

$m = \frac{20 — 10}{-5 — 5} = \frac{30}{0} =$

$undefined$

25) $(-17, 19), (10, -7)$

$m = \frac{-7-19}{10-(-17)} = -\frac{26}{27}$

27) $(7, -14), (-8, -9)$

$m = \frac{-9-(-14)}{-8-7} = \frac{5}{-15} =$

$-\frac{1}{3}$

29) $(-5,7),(-18,14)$

$$m=\frac{14-7}{-18-(-5)}=\frac{7}{-13}$$

31) $(2,6)\ and\ (x,2); slope\ \frac{4}{7}$

$$\frac{4}{7}=\frac{2-6}{x-2}$$

$$\frac{(x-2)}{1}\frac{4}{7}=\frac{-4}{x-2}\frac{(x-2)}{1}$$

$$\frac{4}{7}(x-2)=-4$$

$$(7)\left(\frac{4}{7}x-\frac{8}{7}\right)=-4(7)$$

$$4x-8=-28$$

$$+8\quad +8$$

$$\frac{4x}{4}=-\frac{20}{4}$$

$$x=-5$$

33) $(-3,-2)\ and\ (x,6); slope=-\frac{8}{5}$

$$-\frac{8}{5}=\frac{6-(-2)}{x-(-3)}$$

$$(x+3)\frac{-8}{5}=\frac{8}{x+3}\ (x+3)$$

$$-\frac{8}{5}(x+3)=8$$

$$5\left(-\frac{8}{5}x-\frac{24}{5}\right)=8(5)$$

$$-8x-24=40$$

$$+24\ +24$$

$$-\frac{8x}{-8}=\frac{64}{-8}$$

$$x=-8$$

35) $(-8,y)\ and\ (-1,1); slope=\frac{6}{7}$

$$\frac{6}{7}=\frac{1-y}{-1-(-8)}$$

$$(7)\frac{6}{7}=\frac{1-y}{7}\ (7)$$

$$6=1-y$$

$$-1\quad -1$$

$$\frac{5}{-1}=\frac{-y}{-1}$$

$$-5=y$$

37) $(x,-7) and\ (-9,-9); slope=\frac{2}{5}$

$$\frac{2}{5}=\frac{-9-(-7)}{-9-x}$$

$$(-9-x)\frac{2}{5}=\frac{-2}{-9-x}\ (-9-x)$$

$$\frac{2}{5}(-9-x)=-2$$

$$5\left(-\frac{18}{5}-\frac{2}{5}x\right)=(-2)5$$

$$-18-2x=-10$$

$$+18\qquad +18$$

$$\frac{-2x}{-2}=\frac{8}{-2}$$

$$x=-4$$

39) $(x,5)\ and\ (8,0); slope=-\frac{5}{6}$

$$-\frac{5}{6}=\frac{0-5}{8-x}$$

$$(8-x)-\frac{5}{6}=\frac{-5}{8-x}\ (8-x)$$

$$-\frac{5}{6}(8-x)=-5$$

$$6(-\frac{20}{3}+\frac{5}{6}x=(-5)6$$

$$-40+5x=-30$$

$$+40\qquad +40$$

$$\frac{5x}{5}=\frac{10}{5}$$

$$x=2$$

2.3

1) $slope=2\ \ y-intercept=5$

$$y=mx+b$$

$$y=2x+5$$

3) $slope=1\ \ y-intercept=-4$

$$y=mx+b$$

$$y=x-4$$

5) $slope=-\frac{3}{4}\ \ y-intercept=-1$

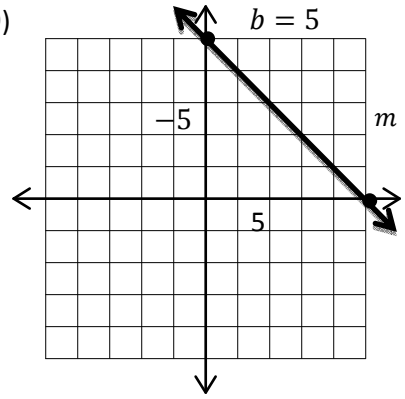
$$y=mx+b$$

$$y=-\frac{3}{4}x-1$$

7) $slope=\frac{1}{3}\ \ y-intercept=1$

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

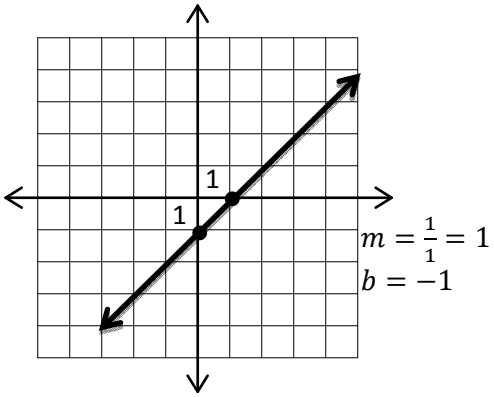
9)



$y = mx + b$

$y = -x + 5$

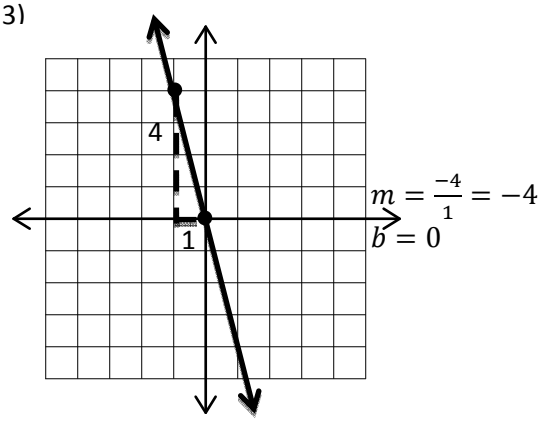
11)



$y = mx + b$

$y = x - 1$

13)



$y = mx + b$

$y = -4x$

15) $x + 10y = -37$

$-x \qquad\qquad -x$

$\frac{10y}{10} = \frac{-x}{10} - \frac{37}{10}$

$y = -\frac{1}{10}x - \frac{37}{10}$

17) $2x + y = -1$

$-2x \qquad -2x$

$y = -2x - 1$

19) $7x - 3y = 24$

$-7x \qquad\qquad -7x$

$\frac{-3y}{-3} = \frac{-7x}{-3} + \frac{24}{-3}$

$y = \frac{7}{3}x - 8$

21) $x = -8$

23) $y - 4 = -(x + 5)$

$y - 4 = -x - 5$

$+4 \qquad +4$

$y = -x - 1$

25) $y - 4 = 4(x - 1)$

$y - 4 = 4x - 4$

$+4 \qquad +4$

$y = 4x$

27) $y + 5 = -4(x - 2)$

$y + 5 = -4x + 8$

$-5 \qquad -5$

$y = -4x + 3$

29) $y + 1 = -\frac{1}{2}(x - 4)$

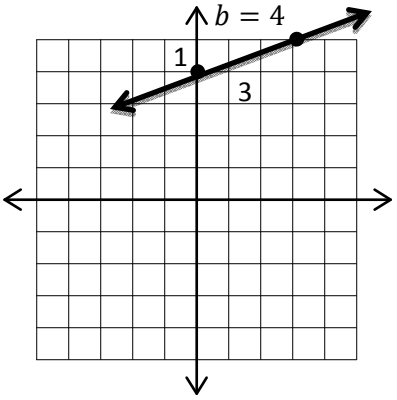
$y + 1 = -\frac{1}{2}x + 2$

$-1 \qquad -1$

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

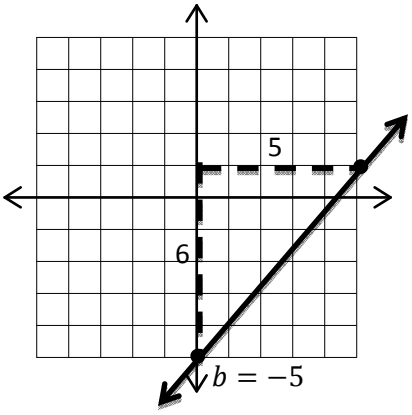
31) $y = \frac{1}{3}x + 4$

$m = \frac{1}{3}, b = 4$



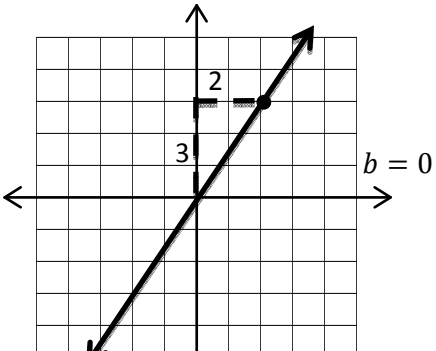
33) $y = \frac{6}{5}x - 5$

$m = \frac{6}{5}, b = -5$



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

$m = \frac{3}{2}, b = 0$



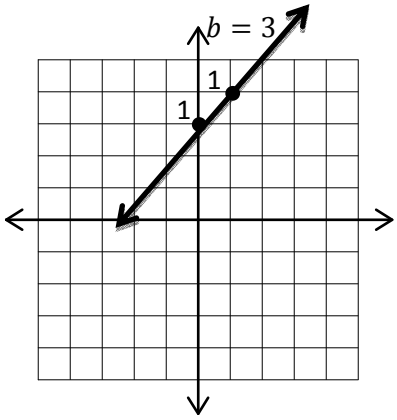
37) $x - y + 3 = 0$

$\underline{-x \quad -3 \quad -x - 3}$

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

$y = x + 3$

$m = 1, b = 3$



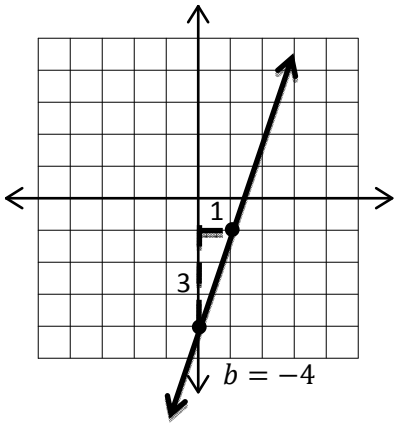
39) $-y - 4 + 3x = 0$

$\underline{+4 - 3x \quad -3x + 4}$

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

$y = 3x - 4$

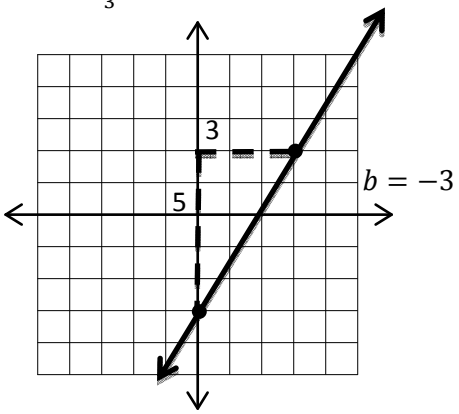
$m = 3, b = -4$



41) $\frac{-3y}{-3} = \frac{-5x}{-3} + \frac{9}{-3}$

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

$m = \frac{5}{3}, b = -3$



2.4

1) $Through\ (2,3), slope = undefined$
$x = 2$

3) $Through\ (2,2), slope = \frac{1}{2}$
$y - y_1 = m(x - x_1)$
$y - 2 = \frac{1}{2}(x - 2)$

5) $Through\ (-1,-5), slope = 9$
$y - y_1 = m(x - x_1)$
$y + 5 = 9(x + 1)$

7) $Through\ (-4,1), slope = \frac{3}{4}$
$y - y_1 = m(x - x_1)$
$y - 1 = \frac{3}{4}(x + 4)$

9) $Through\ (0,-2), slope = -3$
$y - y_1 = m(x - x_1)$
$y + 2 = -3(x - 0)$
$y + 2 = -3x$

11) $Through\ (0,-5), slope = -\frac{1}{4}$
$y - y_1 = m(x - x_1)$
$y + 5 = -\frac{1}{4}(x - 0)$
$y + 5 = -\frac{1}{4}x$

13) $Through\ (-5,-3), slope = \frac{1}{5}$
$y - y_1 = m(x - x_1)$
$y + 3 = \frac{1}{5}(x + 5)$

15) $Through\ (-1,4), slope = -\frac{5}{4}$
$y - y_1 = m(x - x_1)$
$y - 4 = -\frac{5}{4}(x + 1)$

17) $Through\ (-1,-5), slope = 2$
$y - y_1 = m(x - x_1)$
$y + 5 = 2(x + 1)$
$y + 5 = 2x + 2$
$-5 \qquad -5$
$y = 2x - 3$

19) $Through\ (5,-1), slope = -\frac{3}{5}$
$y - y_1 = m(x - x_1)$
$y + 1 = -\frac{3}{5}(x - 5)$
$y + 1 = -\frac{3}{5}x + 3$
$-1 \qquad -1$

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

21) $Through\ (-4,1), slope = \frac{1}{2}$

$y - y_1 = m(x - x_1)$

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

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

$+1 \qquad +1$

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

23) $Through\ (4,-2), slope = -\frac{3}{2}$

$y - y_1 = m(x - x_1)$

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

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

$-2 \qquad -2$

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

25) $Through\ (-5,-3), slope = -\frac{2}{5}$

$y - y_1 = m(x - x_1)$

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

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

$-3 \qquad -3$

$y = -\frac{2}{5}x - 5$

27) $Through\ (2,-2), slope = 1$

$y - y_1 = m(x - x_1)$

$y + 2 = 1(x - 2)$

$y + 2 = x - 2$

$-2 \qquad -2$

$y = x - 4$

29) $Through\ (-3,4), slope = undefined$

$x = -3$

31) $Through\ (-4,2), slope = -\frac{1}{2}$

$y - y_1 = m(x - x_1)$

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

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

$+2 \qquad +2$

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

33) $Through\ (-4,3)\ \&\ (-3,1)$

$m = \frac{1-3}{-3-(-4)} = \frac{-2}{1} = -2$

$y - y_1 = m(x - x_1)$

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

35) $Through\ (5,1)\ \&\ (-3,0)$

$m = \frac{0-1}{-3-5} = \frac{-1}{-8} = \frac{1}{8}$

$y - y_1 = m(x - x_1)$

$y - 1 = \frac{1}{8}(x - 5)$

37) $Through\ (-4,-2)\ \&\ (0,4)$

$m = \frac{4-(-2)}{0-(-4)} = \frac{6}{4} = \frac{3}{2}$

$y - y_1 = m(x - x_1)$

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

39) $Through\ (3,5)\ \&\ (-5,3)$

$m = \frac{3-5}{-5-3} = \frac{-2}{-8} = \frac{1}{4}$

$y - y_1 = m(x - x_1)$

$y - 5 = \frac{1}{2}(x - 3)$

41) $Through\ (3,-3)\ \&\ (-4,5)$

$m = \frac{5-(-3)}{-4-3} = \frac{8}{-7}$

$y - y_1 = m(x - x_1)$

$y + 3 = -\frac{8}{7}(x - 3)$

43) $Through\ (-5,1)\ \&\ (-1,-2)$

$m = \frac{-2-1}{-1-(-5)} = -\frac{3}{4}$

$y - y_1 = m(x - x_1)$

$y - 1 = -\frac{3}{4}(x + 5)$

$y - 1 = -\frac{3}{4}x - \frac{15}{4}$

$y - \frac{4}{4} = -\frac{3}{4}x - \frac{15}{4}$

$+\frac{4}{4} \qquad\qquad + \frac{4}{4}$

$y = -\frac{3}{4}x - \frac{11}{4}$

45) *Through* $(-5, 5)$ & $(2, -3)$

$m = \frac{-3-5}{2-(-5)} = -\frac{8}{7}$

$y - y_1 = m(x - x_1)$

$y - 5 = -\frac{8}{7}(x + 5)$

$y - 5 = -\frac{8}{7}x - \frac{40}{7}$

$y - \frac{35}{7} = -\frac{8}{7}x - \frac{40}{7}$

$+\frac{35}{7} \qquad\qquad + \frac{35}{7}$

$y = -\frac{8}{7}x - \frac{5}{7}$

47) *Through* $(4, 1)$ & $(1, 4)$

$m = \frac{4-1}{1-4} = \frac{3}{-3} = -1$

$y - y_1 = m(x - x_1)$

$y - 1 = -1(x - 4)$

$y - 1 = -x + 4$

$+1 \qquad\qquad + 1$

$y = -x + 4$

49) *Through* $(0, 2)$ & $(5, -3)$

$m = \frac{-3-2}{5-0} = \frac{-5}{5} = -1$

$y - y_1 = m(x - x_1)$

$y - 2 = -1(x - 0)$

$y - 2 = -x$

$+2 \qquad + 2$

$y = -x + 2$

51) *Through* $(0, 3)$ & $(-1, -1)$

$m = \frac{-1-3}{-1-0} = \frac{-4}{-1} = 4$

$y - y_1 = m(x - x_1)$

$y - 3 = 4(x - 0)$

$y - 3 = 4x$

$+3 \qquad + 3$

$y = 4x + 3$

2.5

1) $y = 2x + 4$

$m = 2$

$\parallel m = 2$

3) $y = 4x - 5$

$m = 4$

$\parallel m = 4$

5) $x - y = 4$

$-x \qquad\qquad - x$

$\frac{(-y)}{-1} = \frac{-x}{-1} + \frac{4}{-1}$

$y = x - 4$

$m = 1$

$\parallel m = 1$

7) $7x + y = -2$

$-7x \qquad\qquad - 7x$

$y = -7x - 2$

$m = -7$

$\parallel m = -7$

9) $x = 3$

$m = undefined$

$\perp m = 0$

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

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

$\perp m = 3$

13) $x - 3y = -6$

$-x \qquad -x$

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

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

$m = \frac{1}{3}$

$\perp m = 3$

15) $x + 2y = 8$

$-x \qquad -x$

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

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

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

$\perp m = 2$

18) $Through\ (2,5), par\ to\ x = 4$

$m = undefined$

$\parallel m = undefined$

$x = 2$

19) $Through\ (3,4), par\ to\ y = \frac{9}{2}x - 5$

$m = \frac{9}{2}$

$\parallel m = \frac{9}{2}$

$y - 4 = \frac{9}{2}(x - 3)$

21) $Through\ (2,3), par\ to\ x = 0$

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

$\parallel m = \frac{7}{5}$

$y - 3 = \frac{7}{5}(x - 2)$

23) $Through\ (4,2), par\ to\ x = 0$

$m = undefined$

$\parallel m = underfined$

$x = 4$

25) $Through\ (1,-5), perp\ to\ y = x + 1$

$m = 1$

$\perp m = -1$

$y + 5 = -1(x - 1)$

27) $Through\ (5,2) perp\ to\ y = -5x - 3$

$m = -5$

$\perp m = \frac{1}{5}$

$y - 2 = \frac{1}{5}(x - 5)$

29) $Through\ (4,2) perp\ to\ y = 4x$

$m = 4$

$\perp m = -\frac{1}{4}$

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

31) $Through\ (2,-2), perp\ to\ y = \frac{1}{3}x$

$m = \frac{1}{3}$

$\perp m = -3$

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

33) $Through\ (4,-3), par\ to\ y = -2x$

$m = -2$

$\parallel m = -2$

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

$y + 3 = -2x + 8$

$-3 \qquad -3$

$y = -2x + 5$

35) $Through\ (-3,1), par\ to\ y = -\frac{4}{3}x - 1$

$m = -\frac{4}{3}$

$\| \; m = -\frac{4}{3}$

$y - 1 = -\frac{4}{3}(x + 3)$

$y - 1 = -\frac{4}{3}x - 4$

$+1 \qquad\qquad +1$

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

37) $Through\ (-4, -1)\ par\ y = -\frac{1}{2}x + 1$

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

$\| \; m = -\frac{1}{2}$

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

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

$-1 \qquad\qquad -1$

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

39) $Through\ (-2, -1)\ par\ y = -\frac{1}{2}x - 2$

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

$\| \; m = -\frac{1}{2}$

$y + 1 = -\frac{1}{2}(x + 2)$

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

$-1 \qquad\qquad -1$

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

41) $Through\ (4, 3), perp\ to\ y = -x - 1$

$m = -1$

$\perp \; m = 1$

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

$y - 3 = x - 4$

$+3 \qquad +3$

$y = x - 1$

43) $Through\ (5, 2), perp\ to\ x = 0$

$m = undefined$

$\perp \; m = 0$

$y = 2$

45) $Through\ (-2, 5), perp\ to\ y = x - 2$

$m = 1$

$\perp \; m = -1$

$y - 5 = -1(x + 2)$

$y - 5 = -x - 2$

$+5 \qquad +5$

$y = -x + 3$

47) $Through\ (4, -3), perp\ to\ y = \frac{1}{2}x - 3$

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

$\perp \; m = -2$

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

$y + 3 = -2x + 8$

$-3 \qquad -3$

$y = -2x + 5$

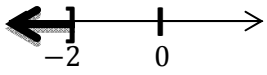
Chapter 3: Inequalities

3.1

1) $n > -5$

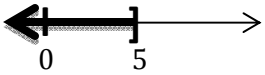
$(-5, 0)$

3) $-2 \geq k$



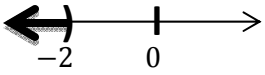
$(-\infty, -2]$

5) $5 \geq x$



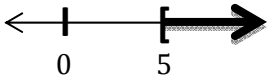
$(-\infty, 5]$

7)



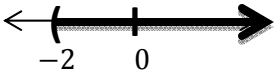
$x < -2$

9)



$x \geq 5$

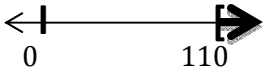
11)



$x > -2$

13) $(11)\frac{x}{11} \geq 10(11)$

$x \geq 110$

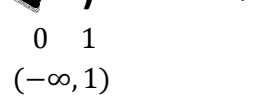


$[110, \infty)$

15) $2 + r < 3$

$-2 \quad -2$

$r < 1$



$(-\infty, 1)$

17) $8 + \frac{n}{3} \geq 6$

$-8 \quad -8$

$(3)\frac{n}{3} \geq -2(3)$

$n \geq -6$

$[-6, \infty)$

19) $(5)2 > \frac{a-2}{5}(5)$

$10 > a - 2$

$+2 \quad +2$

$12 > a$

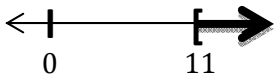
$(-\infty, 12)$

21) $-47 \geq 8 - 5x$

$-8 \quad -8$

$-\frac{55}{-5} \geq -\frac{5x}{-5}$

$11 \leq x$



$[11, \infty)$

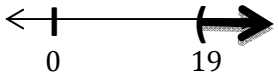
23) $-2(3 + k) < -44$

$-6 - 2k < -44$

$+6 \quad +6$

$-\frac{2k}{-2} < -\frac{38}{-2}$

$k > 19$



$(19, \infty)$

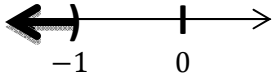
25) $18 < -2(-8 + p)$

$18 < 16 - 2p$

$-16 \quad -16$

$\frac{2}{-2} < -\frac{2p}{-2}$

$-1 > p$



$(-\infty, -1)$

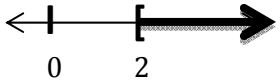
27) $24 \geq -6(m - 6)$

$24 \geq -6m + 36$

$-36 \quad -36$

$-\frac{12}{-6} \geq -\frac{6m}{-6}$

$2 \leq m$



$[2, \infty)$

29) $-r - 5(r - 6) < -18$

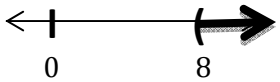
$-r - 5r + 30 < -18$

$-6r + 30 < -18$

$-30 \quad -30$

$-\frac{6r}{-6} < -\frac{48}{-6}$

$r > 8$



$(8, \infty)$

31) $24 + 4b < 4(1 + 6b)$

$24 + 4b < 4 + 24b$

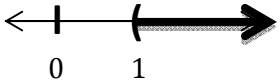
$-4b \quad -4b$

$24 < 4 + 20b$

$-4 \quad -4$

$\frac{20}{20} < \frac{20b}{20}$

$1 < b$



$(1, \infty)$

33) $-5v - 5 < -5(4v + 1)$

$-5v - 5 < -20v - 5$

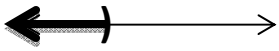
$+20v \quad +20v$

$15v - 5 < -5$

$+5 \quad +5$

$15v < 0$

$v < 0$



0

$(-\infty, 0)$

35) $4 + 2(a + 5) < -2(-a - 4)$

$4 + 2a + 10 < 2a + 8$

$14 + 2a < 2a + 8$

$-2a \quad -2a$

$14 < 8$

$false$

$No\ solution\ \emptyset$

37) $-(k - 2) > -k - 20$

$-k + 2 > -k - 20$

$+k \quad +k$

$2 > -20$

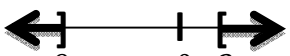
$true$

$All\ real\ numbers\ \mathbb{R}$

3.2

1) $(3)\frac{n}{3} \leq -3\ (3)\ or\ \frac{-5n}{-5} \leq \frac{-10}{-5}$

$n \leq -9 \quad or \quad n \geq 2$



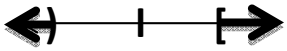
$-9 \quad 0 \quad 2$

$(-\infty, -9] \cup [2, \infty)$

3) $x + 7 \geq 12\ or\ \frac{9x}{9} < -\frac{45}{9}$

$-7 \quad -7 \quad or \quad x < -5$

$x \geq 5$



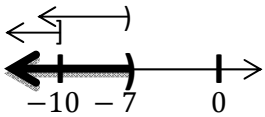
$-5 \quad 0 \quad 5$

$(-\infty, -5) \cup [5, \infty)$

5) $x - 6 < -13\ or\ \frac{6x}{6} \leq \frac{-60}{6}$

$+6 \quad +6$

$x < -7 \quad or \quad x \leq -10$



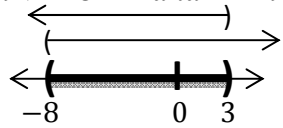
$-10 \quad -7 \quad 0$

$(-\infty, -7)$

7) $(8)\frac{v}{8} > -1(8)\ and\ v - 2 < 1$

$+2 \quad +2$

$v > -8 \quad and \quad v < 3$



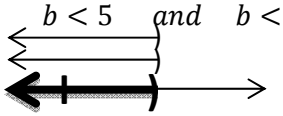
$-8 \quad 0 \quad 3$

$(-8, 3)$

9) $-8 + b < -3\ and\ \frac{4b}{4} < \frac{20}{4}$

$+8 \quad +8$

$b < 5 \quad and \quad b < 5$



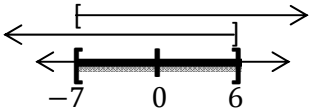
$0 \quad 5$

$(-\infty, 5)$

11) $a + 10 \geq 3\ and\ \frac{8a}{8} \leq \frac{48}{8}$

$-10 \quad -10$

$a \geq -7\ and\ a \leq 6$



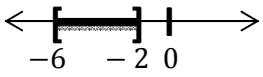
$-7 \quad 0 \quad 6$

$[-7, 6]$

13) $3 \le 9 + x \le 7$

$-9 - 9 \quad -9$

$-6 \le x \le -2$

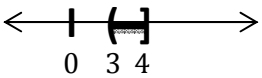


$[-6, -2]$

15) $11 < 8 + k \le 12$

$-8 \quad -8 \quad -8$

$3 < k \le 4$

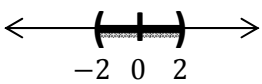


$(3, 4]$

17) $-3 < x - 1 < 1$

$+1 \quad +1 \quad +1$

$-2 < x < 2$



$(-2, 2)$

19) $-4 < 8 - 3m \le 11$

$-8 \quad -8 \quad -8$

$\frac{-12}{-3} < \frac{-3m}{-3} \le \frac{3}{-3}$

$4 > m \ge -1$

$-1 \le m < 4$

$[-1, 4)$

21) $-16 \le 2n - 10 \le -22$

$-16 \not\le -22$

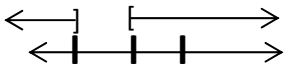
No solution $\emptyset$

23) $-5b + 10 \le 30$ *and* $7b + 2 \le -40$

$-10 \quad -10 \qquad -2 \quad -2$

$\frac{-5b}{-5} \le \frac{20}{-5}$ *and* $\frac{7b}{7} \le \frac{-42}{7}$

$b \ge -4$ *and* $b \le -6$



No Solution $\emptyset$

25) $3x - 9 < 2x + 10$ *and* $5 + 7x \le 10x - 10$

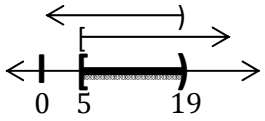
$-2x \quad -2x \qquad -7x \quad -7x$

$x - 9 < 10$ *and* $5 \le 3x - 10$

$+9 \quad +9 \qquad +10 \quad +10$

$x < 19$ $\qquad \frac{15}{3} \le \frac{3x}{3}$

$5 \le x$



$[5, 19)$

27) $-8 - 6v \le 8 - 8v$ *and* $7v + 9 \le 6 + 10v$

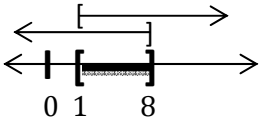
$+8v \quad +8v \qquad -7v \quad -7v$

$-8 + 2v \le 8$ *and* $9 \le 6 + 3v$

$+8 \quad +8 \qquad -6 \quad -6$

$\frac{2v}{2} \le \frac{16}{2}$ *and* $\frac{3}{3} \le \frac{3v}{3}$

$v \le 8$ *and* $1 \le v$



$[1, 8]$

29) $1 + 5k \le 7k - 3$ *or* $k - 10 > 2k + 10$

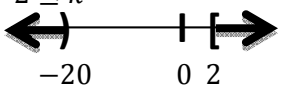
$-5k - 5k \qquad -k \quad -k$

$1 \le 2k - 3$ *or* $-10 > k + 10$

$+3 \quad +3 \qquad -10 \quad -10$

$\frac{4}{2} \le \frac{2k}{2}$ *or* $-20 > k$

$2 \le k$



$(-\infty, -20) \cup [2, \infty)$

31) $2x + 9 \ge 10x + 1$ *and* $3x - 2 < 7x + 2$

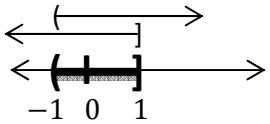
$-2x \quad -2x \qquad -3x \quad -3x$

$9 \ge 8x + 1$ *and* $-2 < 4x + 2$

$-1 \quad -1 \qquad -2 \quad -2$

$\frac{8}{8} \ge \frac{8x}{8}$ *and* $\frac{-4}{4} < \frac{4x}{4}$

$1 \ge x$ *and* $-1 < x$



$(-1, 1]$

3.3

1) $|n| \leq -11$

$false$

$No\ Solution\ \emptyset$

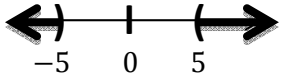
3) $|b| \leq -10$

$false$

$No\ Solution\ \emptyset$

5) $|x| > 5$

$x > 5\ or\ x < -5$

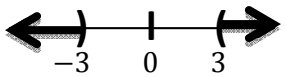


$(-\infty, -5) \cup (5, \infty)$

7) $\frac{10|n|}{10} > \frac{30}{10}$

$|n| > 3$

$n > 3\ or\ n < -3$



$(-\infty, -3) \cup (3, \infty)$

9) $\frac{-3|x|}{-3} < \frac{36}{-3}$

$x > -12$

$false$

$No\ Solution\ \emptyset$

11) $|n| + 4 > -5$

$-4 \quad -4$

$|n| > -9$

$true$

$All\ Real\ Numbers\ \mathbb{R}$

13) $10 - 8|p| \geq 18$

$-10 \qquad -10$

$\frac{-8|p|}{-8} \geq \frac{8}{-8}$

$|p| \geq -1$

$false$

$No\ solutoin\ \emptyset$

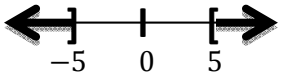
15) $9|n| - 3 \geq 42$

$+3 \quad +3$

$\frac{9|n|}{9} \geq \frac{45}{9}$

$|n| \geq 5$

$n \geq 5\ or\ n \leq -5$



$(-\infty, -5) \cup (5, \infty)$

17) $\left|\frac{m}{9}\right| \geq -5$

$true$

$All\ Real\ Numbers\ \mathbb{R}$

19) $|9 + x| > -2$

$true$

$All\ Real\ Numbers\ \mathbb{R}$

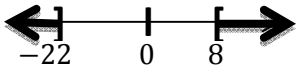
21) $\left|\frac{x+7}{3}\right| \geq 5$

$(3)\frac{v+7}{3} \geq 5(3)\ or\ (3)\frac{v+7}{3} \leq -5(3)$

$v + 7 \geq 15 \quad or \quad v + 7 \leq -15$

$-7 \quad -7 \qquad -7 \quad -7$

$v \geq 8 \qquad or \qquad v \leq -22$



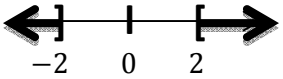
$(-\infty, -22] \cup [8, \infty)$

23) $\frac{7|-7x|}{7} \geq \frac{98}{7}$

$|-7x| \geq 14$

$\frac{-7x}{-7} \geq \frac{14}{-7}\ \ or\ \ \frac{-7x}{-7} \leq \frac{-14}{-7}$

$x \leq -2\ \ or\ \ x \geq 2$



$(-\infty, -2) \cup (2, \infty)$

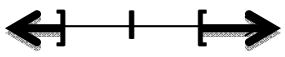
25) $-5 + |-8k| \geq 51$

$+5 \qquad +5$

$|-8k| \geq 56$

$\frac{|-8k|}{-8} \geq \frac{56}{-8}$ *or* $\frac{|-8k|}{-8} \leq \frac{-56}{-8}$

$k \leq -7$ *or* $k \geq 7$



$-7 \quad 0 \quad 7$

$(-\infty, -7) \cup (7, \infty)$

27) $8 - 4\left|\frac{x}{9}\right| > 12$

$-8 \qquad -8$

$\frac{-4\left|\frac{x}{9}\right|}{-4} > \frac{4}{-4}$

$\left|\frac{x}{9}\right| < -1$

false

No Solution $\emptyset$

29) $7|-9 + m| + 3 \geq 66$

$-3 \quad -3$

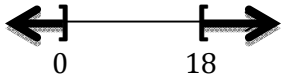
$\frac{7|-9+m|}{7} \geq \frac{63}{7}$

$|-9 + m| \geq 9$

$-9 + m \geq 9$ *or* $-9 + m \leq -9$

$+9 \qquad +9 \qquad +9 \qquad +9$

$m \geq 18$ *or* $m \leq 0$



$0 \quad 18$

$(-\infty, 0) \cup (18, \infty)$

31) $|3n + 10| \leq -26$

false

No Solution $\emptyset$

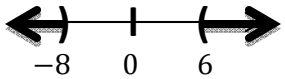
33) $|10b + 10| > 70$

$10b + 10 > 70$ *or* $10b + 10 < -70$

$-10 \quad -10 \qquad -10 \quad -10$

$\frac{10b}{10} > \frac{60}{10}$ *or* $\frac{10b}{10} < \frac{-80}{10}$

$b > 6$ *or* $b < -8$



$-8 \quad 0 \quad 6$

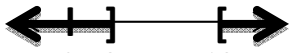
$(-\infty, -8) \cup (6, \infty)$

35) $|-10 + x| \geq 8$

$-10 + x \geq 8$ *or* $-10 + x \leq -8$

$+10 \quad +10 \qquad +10 \quad +10$

$x \geq 18$ *or* $x \leq 2$



$0 \quad 2 \quad 18$

$(-\infty, 2) \cup (18, \infty)$

37) $|-10 + a| - 3 \geq 7$

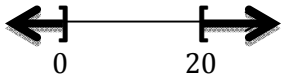
$+3 \quad +3$

$|-10 + a| \geq 10$

$-10 + a \geq 10$ *or* $-10 + a \leq -10$

$+10 \quad +10 \qquad +10 \quad +10$

$a \geq 20$ *or* $a \geq 0$



$0 \quad 20$

$(-\infty, 0) \cup (20, \infty)$

39) $|3x - 1| - 9 \leq -8$

$+9 \quad +9$

$|3x - 1| \leq 1$

$-1 \leq 3x - 1 \leq 1$

$+1 \quad +1 \quad +1$

$\frac{0}{3} \leq \frac{3x}{3} \leq \frac{2}{3}$

$0 \leq x \leq \frac{2}{3}$

$0 \quad \frac{2}{3} \quad 1$

$[0, \frac{2}{3}]$

41) $-8|8n-1|+4 \geq -116$

$-4 \quad -4$

$\frac{-8|8n-1|}{-8} \geq \frac{-120}{-8}$

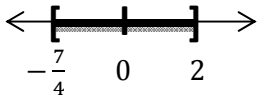
$|8n-1| \geq 15$

$-15 \leq 8n-1 \leq 15$

$+1 \quad +1 \quad +1$

$\frac{-14}{8} \leq \frac{8n}{8} \leq \frac{16}{8}$

$-\frac{7}{4} \leq n \leq 2$



$-\frac{7}{4} \quad 0 \quad 2$

$[-\frac{7}{4}, 2]$

43) $-10+9|3p-9| < -37$

$+10 \quad +10$

$\frac{9|3p-9|}{9} < \frac{-27}{9}$

$|3p-9| < -3$

$false$

$No\ Solution\ \emptyset$

45) $9|2-10n|-8 > 100$

$+8 \quad +8$

$\frac{9|2-10n|}{9} > \frac{108}{9}$

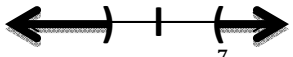
$|2-10n| > 12$

$2-10n > 12 \ \ or \ \ 2-10n < -12$

$-2 \quad -2 \quad -2 \quad -2$

$\frac{-10n}{-10} > \frac{10}{-10} \ or \quad \frac{-10n}{-10} < \frac{-14}{-10}$

$n < -1 \ or \quad n > \frac{7}{5}$



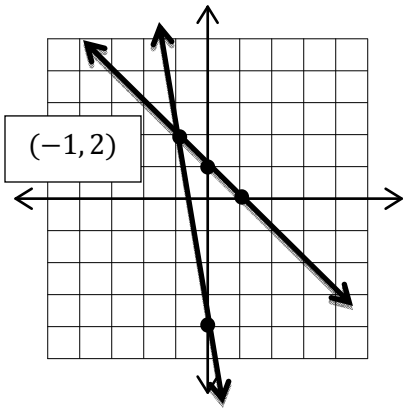
$-1 \quad 0 \quad \frac{7}{5}$

$(-\infty, -1) \cup (\frac{7}{5}, \infty)$

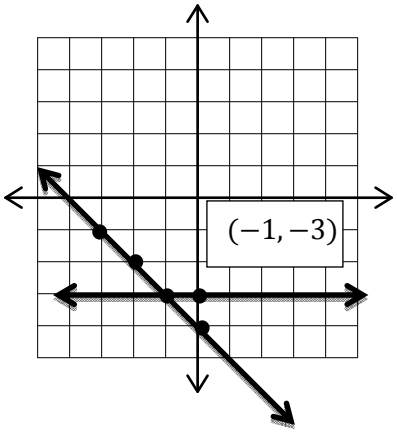
Chapter 4: Systems of Equations

4.1

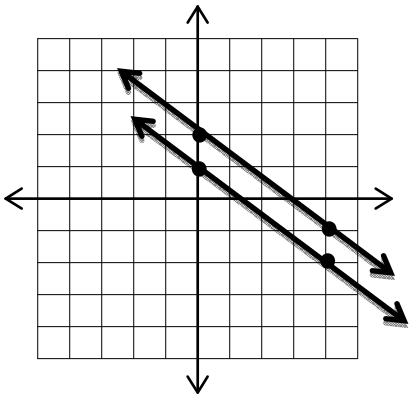
1) $y = -x + 1$
$y = -5x - 3$



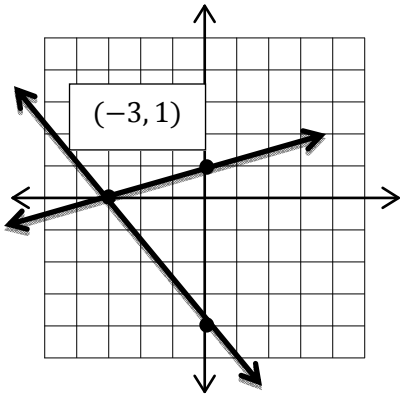
3) $y = -3$
$y = -x - 4$



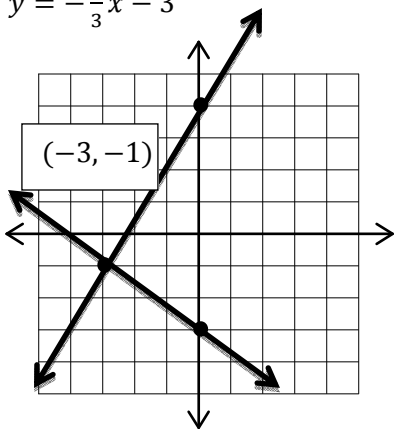
5) $y = -\frac{3}{4}x + 1$
$y = -\frac{3}{4}x + 2$ No Solution



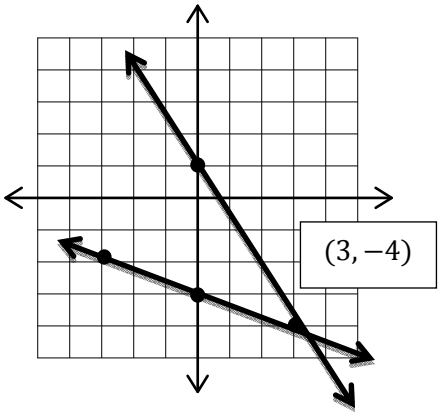
7) $y = \frac{1}{3}x + 2$
$y = -\frac{5}{3}x - 4$



9) $y = \frac{5}{3}x + 4$
$y = -\frac{2}{3}x - 3$



11) $x + 3y = -9$ $\quad 5x + 3y = 3$
$-x \quad -x \quad -5x \quad -5x$
$\frac{3y}{3} = -\frac{x}{3} - \frac{9}{3}$ $\quad \frac{3y}{3} = -\frac{5x}{3} + \frac{3}{3}$
$y = -\frac{1}{3}x - 3$ $\quad y = -\frac{5}{3}x + 1$

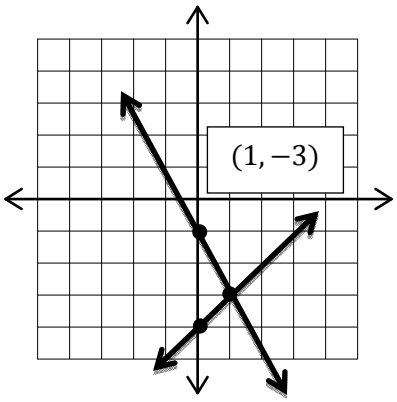


13) $x - y = 4$ $\quad 2x + y = -1$

$-x \quad -x \quad -2x \quad -2x$

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

$y = x - 4$

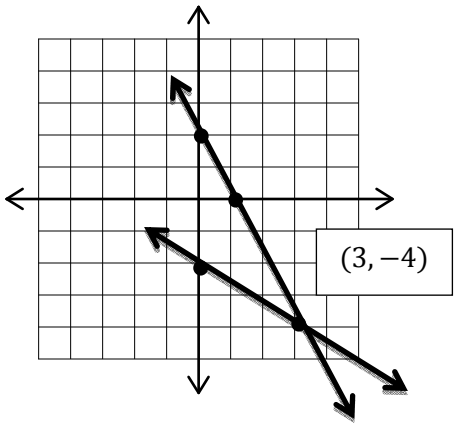


15) $2x + 3y = -6$ $\quad 2x + y = 2$

$-2x \quad -2x \quad -2x \quad -2x$

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

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

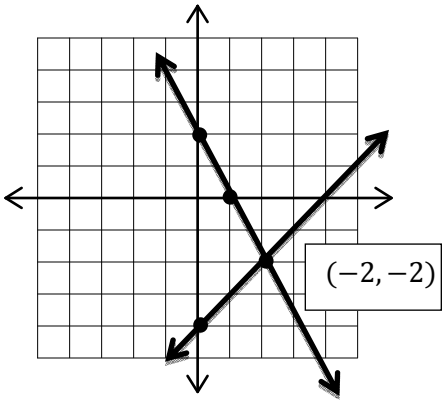


17) $2x + y = 2$ $\quad x - y = 4$

$-2x \quad -2x \quad -x \quad -x$

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

$y = x - 4$

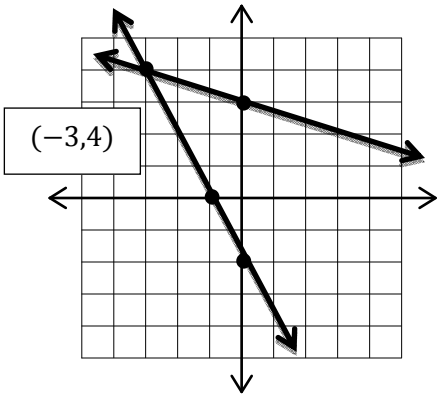


19) $2x + y = 2$ $\quad x + 3y = 9$

$-2x \quad -2x \quad -x \quad -x$

$y = -2x + 2$ $\quad \frac{3y}{3} = -\frac{x}{3} + \frac{9}{3}$

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

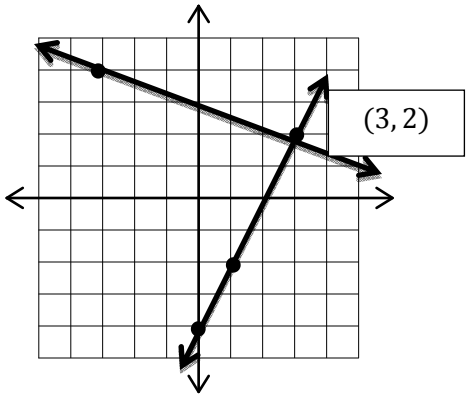


21) $0 = -6x - 9y + 36$ $\quad 12 = 6x - 3y$

$+9y \quad +9y \quad -6x \quad -6x$

$\frac{9y}{9} = -\frac{6x}{9} + \frac{36}{9}$ $\quad -\frac{6x}{-3} + \frac{12}{-3} = \frac{-3y}{-3}$

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

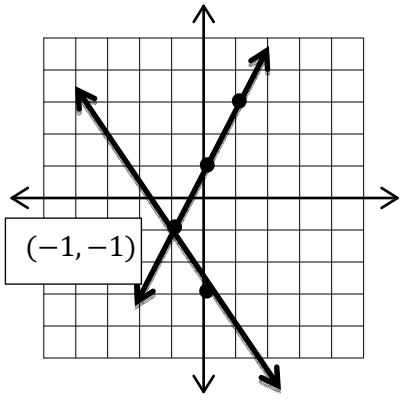


23) $2x - y = -1$ $\quad 0 = -2x - y - 3$

$-2x \quad -2x \quad +y \quad +y$

$-\frac{y}{-1} = -\frac{2x}{-1} - \frac{1}{-1}$ $\quad y = -2x - 3$

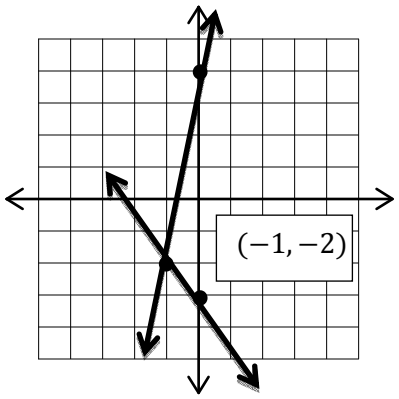
$y = 2x + 1$



25) $3 + y = -x$ $\quad -\frac{4}{-1} - \frac{6x}{-1} = -\frac{y}{-1}$

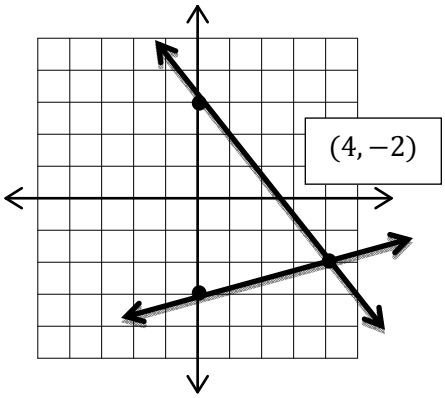
$\underline{-3 \quad -3}$ $\quad 4 + 6x = y$

$y = -x - 3$



29) $-\frac{12}{4} + \frac{x}{4} = \frac{4y}{4}$ $\quad \frac{12}{4} - \frac{5x}{4} = \frac{4y}{4}$

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

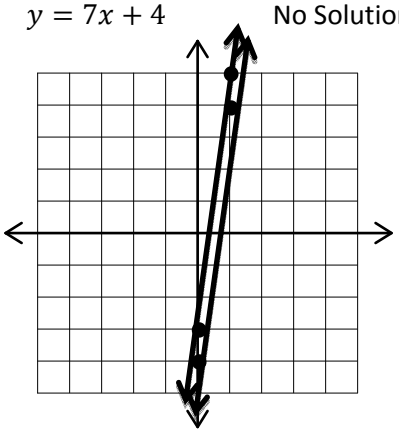


27) $-y + 7x = 4$ $\quad -y - 3 + 7x = 0$

$\underline{-7x \ -7x \quad +y \qquad +y}$

$-\frac{y}{-1} = -\frac{7x}{-1} + \frac{4}{-1}$ $\quad -3 + 7x = y$

$y = 7x + 4$ $\quad$ No Solution



4.2

1) $y = -3x$

$y = 6x - 9$

$-3x = 6x - 9$

$\underline{-6x \ -6x}$

$-\frac{9x}{-9} = -\frac{9}{-9}$

$x = 1$

$y = -3(1) = -3$

$(1, -3)$

3) $y = -2x - 9$

$y = 2x - 1$

$-2x - 9 = 2x - 1$

$\underline{+2x \qquad +2x}$

$-9 = 4x - 1$

$\underline{+1 \qquad +1}$

$-\frac{8}{4} = \frac{4x}{4}$

$-2 = x$

$y = -2(-2) - 9$

$y = 4 - 9$

$y = -5$

$(-2, -5)$

5) $y = 6x + 4$

$y = -3x - 5$

$6x + 4 = -3x - 5$

$\underline{+3x \qquad +3x}$

$9x + 4 = -5$

$\underline{-4 \quad -4}$

$\frac{9x}{9} = \frac{-9}{9}$

$x = -1$

$y = 6(-1) + 4$

$y = -6 + 4$

$y = -2$

$(-1, -2)$

7) $y = 3x + 2$
$y = -3x + 8$
$3x + 2 = -3x + 8$
$+3x \quad + 3x$
$6x + 2 = 8$
$-2 \quad -2$
$\frac{6x}{6} = \frac{6}{6}$
$x = 1$
$y = 3(1) + 2$
$y = 3 + 2$
$y = 5$
$(1, 5)$

9) $y = 2x - 3$
$y = -2x + 9$
$2x - 3 = -2x + 9$
$+2x \quad + 2x$
$4x - 3 = 9$
$+3 \quad +3$
$\frac{4x}{4} = \frac{12}{4}$
$x = 3$
$y = 2(3) - 3$
$y = 6 - 3$
$y = 3$
$(3, 3)$

11) $y = 6x - 6$
$-3x - 3y = -24$
$-3x - 3(6x - 6) = -24$
$-3x - 18x + 18 = -24$
$-21x + 18 = -24$
$-18 \quad -18$
$\frac{-21x}{-21} = \frac{-42}{-21}$
$x = 2$
$y = 6(2) - 6$
$y = 12 - 6$
$y = 6$
$(2, 6)$

13) $y = -6$
$3x - 6y = 30$
$3x - 6(-6) = 30$
$3x + 36 = 30$
$-36 \quad -36$
$\frac{3x}{3} = \frac{-6}{3}$
$x = -2$
$(-2, -6)$

15) $y = -5$
$3x + 4y = -17$
$3x + 4(-5) = -17$
$3x - 20 = -17$
$+20 \quad +20$
$\frac{3x}{3} = \frac{3}{3}$
$x = 1$
$(1, -5)$

17) $-2x + 2y = 18$
$y = 7x + 15$
$-2x + 2(7x + 15) = 18$
$-2x + 14x + 30 = 18$
$12x + 30 = 18$
$-30 \quad -30$
$\frac{12x}{12} = \frac{-12}{12}$
$x = -1$
$y = 7(-1) + 15$
$y = -7 + 15$
$y = 8$
$(-1, 8)$

19) $y = -8x + 19$
$-x + 6y = 16$
$-x + 6(-8x + 19) = 16$
$-x - 48x + 114 = 16$
$-49x + 114 = 16$
$-114 \quad -114$
$\frac{-49x}{-49} = \frac{-98}{-49}$
$x = 2$
$y = -8(2) + 19$
$y = -16 + 19$
$y = 3$
$(2, 3)$

21) $7x - 2y = -7$
$y = 7$
$7x - 2(7) = -7$
$7x - 14 = -7$
$+14 \quad +14$
$\frac{7x}{7} = \frac{7}{7}$
$x = 1$
$(1, 7)$

23) $x - 5y = 7$
$2x + 7y = -20$
$x - 5y = 7$
$+5y \quad +5y$
$x = 5y + 7$
$2(5y + 7) + 7y = -20$
$10y + 14 + 7y = -20$
$17y + 14 = -20$
$-14 \quad -14$
$\frac{17y}{17} = \frac{-34}{17}$
$y = -2$
$x - 5(-2) = 7$
$x + 10 = 7$
$-10 \quad -10$
$x = -3$
$(-3, -2)$

25) $-2x - y = -5$
$x - 8y = -23$
$+8y \quad +8y$
$x = 8y - 23$
$-2(8y - 23) - y = -5$
$-16y + 46 - y = -5$
$-17y + 46 = -5$
$-46 \quad -46$
$\frac{-17y}{-17} = \frac{-51}{-17}$
$y = 3$
$x - 8(3) = -23$
$x - 24 = -23$
$+24 \quad +24$
$x = 1$
$(1, 3)$

27) $-6x + y = 20$
$-3x - 3y = -18$
$-6x + y = 20$
$+6x \quad +6x$
$y = 6x + 20$
$-3x - 3(6x + 20) = -18$
$-3x - 18x - 60 = -18$
$-21x - 60 = -18$
$+60 \quad +60$
$\frac{-21x}{-21} = \frac{42}{-21}$
$x = -2$
$y = 20 + 6(-2)$
$y = 20 - 12$
$y = 8$
$(-2, 8)$

29) $3x + y = 9$
$2x + 8y = -16$
$3x + y = 9$
$-3x \quad -3x$
$y = -3x + 9$
$2x + 8(-3x + 9) = -16$
$2x - 24x + 72 = -16$
$-22x + 72 = -16$
$-72 \quad -72$
$\frac{-22x}{-22} = \frac{-88}{-22}$
$x = 4$
$y = -3(4) + 9$
$y = -12 + 9$
$y = -3$
$(4, -3)$

32) $2x + y = 2$
$3x + 7y = 14$
$2x + y = 2$
$-2x \quad -2x$
$y = 2 - 2x$
$3x + 7(2 - 2x) = 14$
$3x + 14 - 14x = 14$
$-11x + 14 = 14$
$-14 \quad -14$
$\frac{-11x}{-11} = \frac{0}{-11}$
$x = 0$
$y = 2 - 2(0)$
$y = 2 - 0$
$y = 2$
$(0, 2)$

34) $x + 5y = 15$
$-3x + 2y = 6$
$x + 5y = 15$
$-5y \quad -5y$
$x = 15 - 5y$
$-3(15 - 5y) + 2y = 6$
$-45 + 15y + 2y = 6$
$-45 + 17y = 6$
$+45 \quad +45$
$\frac{17y}{17} = \frac{51}{17}$
$y = 3$
$x = 15 - 5(3)$
$x = 15 - 15$
$x = 0$
$(0, 3)$

36) $-2x + 4y = -16$
$y = -2$
$-2x + 4(-2) = -16$
$-2x - 8 = -16$
$+8 \quad +8$
$\frac{-2x}{-2} = \frac{-8}{-2}$
$x = 4$
$(4, -2)$

38) $-6x + 6y = -12$
$8x - 3y = 16$
$-6x + 6y = -12$
$+6x \quad +6x$
$\frac{6y}{6} = \frac{6x}{6} - \frac{12}{6}$
$y = x - 2$
$8x - 3(x - 2) = 16$
$8x - 3x + 6 = 16$
$5x + 6 = 16$
$-6 \quad -6$
$\frac{5x}{5} = \frac{10}{5}$
$x = 2$
$y = (2) - 2$
$y = 0$
$(2, 0)$

39) $2x + 3y = 16$

$-7x - y = 20$

$+7x \qquad +7x$

$-\frac{y}{-1} = \frac{7x}{-1} + 20/-1$

$y = -7x - 20$

$2x + 3(-7x - 20) = 16$

$2x - 21x - 60 = 16$

$-19x - 60 = 16$

$+60 \quad +60$

$\frac{-19x}{-19} = \frac{76}{-19}$

$x = -4$

$y = -7(-4) - 20$

$y = 28 - 20$

$y = 8$

$(-4, 8)$

4.3

1) $4x + 2y = 0$

$-4x - 9y = -28$

$-\frac{7y}{-7} = -\frac{28}{-7}$

$y = 4$

$4x + 2(4) = 0$

$4x + 8 = 0$

$-8 \quad -8$

$\frac{4x}{4} = -\frac{8}{4}$

$x = -2$

$(-2, 4)$

3) $-9x + 5y = -22$

$9x - 5y = 13$

$0 = -9$

$false$

No Solution $\emptyset$

5) $-6x + 9y = 3$

$6x - 9y = -9$

$0 = -6$

$false$

No Solution $\emptyset$

7) $-1(4x - 6y) = (-10) - 1$

$4x - 6y = -14$

$-4x + 6y = 10$

$0 = 10$

$false$

No Solution $\emptyset$

9) $-1(-x - 5y) = 28(-1)$

$-x + 4y = -17$

$x + 5y = -28$

$\frac{9y}{9} = -\frac{45}{9}$

$y = -5$

$-x - 5(-5) = 28$

$-x + 25 = 28$

$-25 \quad -25$

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

$x = -3$

$(-3, -5)$

11) $2(2x - y) = (5)2$

$5x + 2y = -28$

$4x - 2y = 10$

$\frac{9x}{9} = \frac{-18}{9}$

$x = -2$

$2(-2) - y = 5$

$-4 - y = 5$

$+4 \qquad +4$

$\frac{-y}{-1} = \frac{9}{-1}$

$y = -9$

$(-2, -9)$

13) $10x + 6y = 24$

$-6(-6x + y) = (4)(-6)$

$10x + 6y = 24$

$36x - 6y = -24$

$\frac{46x}{46} = \frac{0}{46}$

$x = 0$

$10(0) + 6y = 24$

$\frac{6y}{6} = \frac{24}{6}$

$y = 4 \quad (0, 4)$

15) $3(2x+4y)=(24)3$

$4x-12y=8$

$6x+12y=72$

$\frac{10x}{10}=\frac{80}{10}$

$x=8$

$2(8)+4y=24$

$16+4y=24$

$-16 \quad -16$

$\frac{4y}{4}=\frac{8}{4}$

$y=2$

$(8,2)$

17) $2(-7x+4y)=(-4)2$

$10x-8y=-8$

$-14x+8y=8$

$\left(-\frac{4x}{4}\right)=-\frac{16}{-4}$

$x=4$

$-7(4)+4y=-4$

$-28+4y=-4$

$+28 \quad +28$

$\frac{4y}{4}=\frac{24}{4}$

$y=6$

$(4,6)$

19) $5x+10y=20$

$2(-6x-5y)=(-3)2$

$5x+10y=20$

$-12x-10y=-6$

$\left(-\frac{7x}{7}\right)=14/-7$

$x=-2$

$5(-2)+10y=20$

$-10+10y=20$

$+10 \quad +10$

$\frac{10y}{10}=\frac{30}{10}$

$y=3$

$(-2,3)$

21) $5(-7x-3y)=12(5)$

$-3(-6x-5y)=20(-3)$

$-35x-15y=60$

$18x+15y=-60$

$-\frac{17x}{-17}=\frac{0}{-17}$

$x=0$

$-7(0)-3y=12$

$\frac{-3y}{-3}=\frac{12}{-3}$

$y=-4$

$(0,-4)$

23) $7(9x-2y)=(-18)7$

$-2(5x-7y)=(-10)(-2)$

$63x-14y=-126$

$-10x+14y=20$

$\frac{53x}{53}=\frac{-106}{53}$

$x=-2$

$9(-2)-2y=-18$

$-18-2y=-18$

$+18 \quad +18$

$\frac{-2y}{-2}=\frac{0}{-2}$

$y=0$

$(-2,0)$

25) $3(9x+6y)=(-21)3$

$2(-10x-9y)=28(2)$

$27x+18y=-63$

$-20x-18y=56$

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

$x=-1$

$9(-1)+6y=-21$

$-9+6y=-21$

$+9 \quad +9$

$\frac{6y}{6}=-\frac{12}{6}$

$y=-2$

$(-1,-2)$

27) $3(-7x+5y)=(-8)3$

$5(-3x-3y)=12(5)$

$-21x+15=-24$

$-15x-15=60$

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

$x=-1$

$-7(-1)+5y=-8$

$7+5y=-8$

$-7 \quad -7$

$\frac{5y}{5}=-\frac{15}{5}$

$y=-3$

$(-1,-3)$

29) $5(-8x-8y)=(-8)5$

$4(10x+9y)=(1)4$

$-40x-40y=-40$

$40x+36y=4$

$\frac{-4y}{-4}=\frac{-36}{-4}$

$y=9$

$-8x-8(9)=-8$

$-8x-72=-8$

$+72 \quad +72$

$\frac{-8x}{8}=\frac{64}{8}$

$x=8$

$(8,9)$

31) $9y=7-x$

$-18y+4x=-26$

$9y=7-x$

$+x \quad +x$

$2(9y+x)=(7)2$

$-18y+4x=-26$

$18y+2x=14$

$\frac{6x}{6}=\frac{-12}{6}$

$x=-2$

$9y=7-(-2)$

$\frac{9y}{9}=\frac{9}{9}$

$y=1$

$(-2,1)$

33) $0 = 9x + 5y$

$(7)y = \frac{2}{7}x(7)$

$7y = 2x$

$-7y \quad -7y$

$(-9)0 = (2x - 7y)(-9)$

$2(0) = (9x + 5y)2$

$0 = -18x + 63y$

$0 = \quad 18x + 10y$

$\frac{0}{73} = \frac{73y}{73}$

$0 = y$

$0 = 9x + 5(0)$

$\frac{0}{9} = \frac{9x}{9}$

$0 = x$

$(0,0)$

4.4

1) $(I) \quad a - 2b + c = 5$

$(II) 2a + b - c = -1$

$(III) 3a + 3b - 2c = -4$

$A: -1(3a - b) = 4(-1)$

$B: 5a - b = 6$

$-3a + b = -4$

$\frac{2a}{2} = \frac{2}{2}$

$a = 1$

$(1, -1, 2)$

$(I) \quad a - 2b + c = 5$

$(II) 2a + b - c = -1$

$A: 3a - b = 4$

$A: 3(1) - b = 4$

$3 - b = 4$

$-3 \qquad -3$

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

$b = -1$

$(I)\ 2(a - 2b + c) = (5)2$

$(III) 3a + 3b - 2c = -4$

$2a - 4b + 2c = 10$

$B: 5a - b = 6$

$(I)\ (1) - 2(-1) + c = 5$

$1 + 2 + c = 5$

$3 + c = 5$

$-3 \qquad -3$

$c = 2$

3) $(I)\ 3x + y - z = 11$

$(II)\ x + 3y = z + 13$

$(III)\ x + y - 3z = 11$

$(II) x + 3y = z + 13$

$-z - z$

$(II)\ x + 3y - z = 13$

$A: -2x + 2y = 2$

$B: -8x - 2y = -22$

$-\frac{10x}{-10} = -\frac{20}{-10}$

$x = 2$

$(2, 3, -2)$

$(I) - 1(3x + y - z) = 11(-1)$

$(II) \quad x + 3y - z = 13$

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

$A: -2x + 2y = 2$

$A: -2(2) + 2y = 2$

$-4 + 2y = 2$

$+4 \qquad +4$

$\frac{2y}{2} = \frac{6}{2}$

$y = 3$

$(I) - 3(3x + y - z) = 11(-3)$

$(III) \quad x + y - 3z = 11$

$-9x - 3y + 3z = -33$

$B: -8x - 2y = -22$

$(I)\ 3(2) + 3 - z = 11$

$6 + 3 - z = 11$

$9 - z = 11$

$-9 \qquad -9$

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

$z = -2$

5) $(I)x + 6y + 3z = 4$
$(II)\ 2x + y + 2z = 3$
$(III)3x - 2y + z = 0$

$(I)\ x + 6y + 3z = 4$
$(III)\ 3(3x - 2y + z) = (0)3$
$x + 6y + 3z = 4$
$\underline{9x - 6y + 3z = 0}$
$A: 10x + 6z = 4$

$(II)2(2x + y + 2z) = (3)2$
$(III)\ 3x - 2y + z = 0$
$\underline{4x + 2y + 4z = 6}$
$B: 7x + 5z = 6$

$A:\ -5(10x + 6z) = 4(-5)$
$B: 6(7x + 5z) = 6(6)$
$-50x - 30z = -20$
$\underline{42x + 30z = 36}$
$\frac{-8x}{-8} = \frac{16}{-8}$
$x = -2$

$A: 10(-2) + 6z = 4$
$-20 + 6z = 4$
$\underline{+20 \qquad +20}$
$\frac{6z}{6} = \frac{24}{6}$
$z = 4$
$(-2, -1, 4)$

$(I)\ (-2) + 6y + 3(4) = 4$
$-2 + 6y + 12 = 4$
$10 + 6y = 4$
$\underline{-10 \qquad -10}$
$\frac{6y}{6} = \frac{-6}{6}$
$y = -1$

7) $(I)\ x + y + z = 6$
$(II)2x - y - z = -3$
$(III)\ x - 2y + 3z = 6$

$(I)\ x + y + z = 6$
$(II)\underline{2x - y - z = -3}$
$\frac{3x}{3} = \frac{3}{3}$
$x = 1$

$(II)2(1) - y - z = -3$
$2 - y - z = -3$
$\underline{-2 \qquad -2}$
$A:\ -y - z = -5$

$A: 3(-y - z) = (-5)3$
$B: -2y + 3z = 5$
$\underline{-3y - 3z = -15}$
$-\frac{5y}{-5} = -\frac{10}{-5}$
$y = 2$

$A:\ -(2) - z = -5$
$\underline{+2 \qquad +2}$
$-\frac{z}{-1} = -\frac{3}{-1}$
$z = 3$

$(III)1 - 2y + 3z = 6$
$\underline{-1 \qquad -1}$
$B:\ -2y + 3z = 5$

$(1, 2, 3)$

9) $(I)\ x + y - z = 0$
$(II)x - y - z = 0$
$(III)x + y + 2x = 0$

$(I)\ x + y - z = 0$
$\underline{(II)x - y - z = 0}$
$A: 2x - 2z = 0$

$(II)x - y - z = 0$
$\underline{(III)\ x + y + 2z = 0}$
$B: 2x + z = 0$

$A: (-1)(2x - 2z) = 0(-1)$
$B: 2x + z = 0$
$\underline{-2x + 2z = 0}$
$\frac{3z}{0} = 0$
$x = 0$

$A: 2x - 2(0) = 0$
$\frac{2x}{2} = \frac{0}{2}$
$x = 0$

$(I)\ 0 + y - 0 = 0$
$y = 0$

$(0, 0, 0)$

11) $(I) -2x + y - 3z = 1$
$(II)\ \ x - 4y + z = 6$
$(III) 4x + 16y + 4z = 24$

$(I) -2x + y - 3z = 1$
$(II) 2(x - 4y + z) = 6(2)$
$-2x + y - 3z = 1$
$\underline{2x - 8y + 2z = 12}$
$A: \quad -7y - z = 13$

$(I) 2(-2x + y - 3z) = (1)2$
$(III) 4x + 16y + 4z = 24$
$\underline{-4x + 2y - 6z = 2}$
$B: 18y - 2z = 26$

$A: -2(-7y - z) = 13(-2)$
$B: 18y - 2z = 26$
$\underline{14y + 2z = -26}$
$\frac{32y}{32} = \frac{0}{32}$
$y = 0$

$A: -7(0) - z = 13$
$-\frac{z}{-1} = \frac{13}{-1}$
$z = -13$
$(19, 0, -13)$

$(I) -2x + 0 - 3(-13) = 1$
$-2x + 39 = 1$
$\underline{-39 \quad -39}$
$-\frac{2x}{-2} = -\frac{38}{-2}$
$x = 19$

13) $(I) 2x + y - 3z = 0$
$(II) x - 4y + z = 0$
$(III) 4x + 16y + 4z = 0$

$(I) 4(2x + y - 3z) = (0)4$
$(II)\ \ x - 4y + z = 0$
$\underline{-8x + 4y - 12z = 0}$
$A: 9x - 11z = 0$

$(II) 4(x - 4y + z) = (0)4$
$(III) 4x + 16y + 4z = 0$
$\underline{4x - 16y + 4z = 0}$
$B: \quad 8x + 8z = 2$

$A: 8(9x - 11z) = 0(8)$
$B: -9(8x + 8z) = 2(-9)$
$72x - 88z = 0$
$\underline{-72x - 72z = 0}$
$\frac{-160z}{-160} = 0$
$z = 0$

$A: 9x - 11(0) = 0$
$\frac{9x}{9} = \frac{0}{9}$
$x = 0$

$(I) 2(0) + y - 3(0) = 0$
$y = 0$

$(0, 0, 0)$

15) $(I)\ 3x + 2y + 2x = 3$
$(II)\ x + 2y - z = 5$
$(III) 2x - 4y + z = 0$

$(II)\ x + 2y - z = 5$
$(III)\ 2x - 4y + z = 0$
$A: 3x - 2y = 5$

$(I)\ 3x + 2y + 2x = 3$
$(II)\ 2(x + 2y - z) = (5)2$
$3x + 2y + 2z = 3$
$\underline{2x + 4y - 2z = 10}$
$B: 5x + 6x = 13$

$A: 3(3x - 2y) = (5)5$
$B: 5x + 6y = 13$
$\underline{9x - 6y = 15}$
$\frac{14x}{14} = \frac{28}{14}$
$x = 2$

$A: 3(2) - 2y = 5$
$6 - 2y = 5$
$\underline{-6 \qquad -6}$
$-\frac{2y}{-2} = -\frac{1}{-2}$
$y = \frac{1}{2}$

$(I)\ 3(2) + 2\left(\frac{1}{2}\right) + 2z = 3$
$6 + 1 + 2z = 3$
$7 + 2z = 3$
$\underline{-7 \qquad -7}$
$\frac{2z}{2} = -\frac{4}{2}$
$z = -2$

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

17) $(I) x - 2y + 3z = 4$
$(II)\ 2x - y + z = -1$
$(III)\ 4x + y + z = 1$

$A: 3(6x + 2y) = (0)3$
$B: \ -2(9x + 5z) = 6(-2)$
$18x + 6z = 0$
$-18x - 10z = -12$
$-\frac{4z}{-4} = -\frac{12}{-4}$
$z = 3$

$(II)\ 2x - y + z = -1$
$(III) 4x + y + z = 1$
$A: 6x + 2z = 0$

$A: 6x + 2(3) = 0$
$6x + 6 = 0$
$-6 \quad -6$
$\frac{6x}{6} = \frac{-6}{6}$
$x = -1$

$(I)\ x - 2y + 3z = 4$
$(III)\ 2(4x + y + z) = (1)2$
$x - 2y + 3z = 4$
$8x + 2y + 2z = 2$
$B: 9x + 5z = 6$

$(I)\ (-1) - 2y + 3(3) = 4$
$8 - 2y = 4$
$-8 \quad -8$
$\frac{-2y}{-2} = \frac{-4}{-2}$
$y = 2$

$(-1, 2, 3)$

19) $(I)\ x - y + 2z = 0$
$(II) x - 2y + 3z = -1$
$(III) 2x - 2y + z = -3$

$(I) x - (2) + 2(1) = 0$
$x - 2 + 2 = 0$
$x = 0$

$(I)(-1)(x - y + 2z) = 0(-1)$
$(II) x - 2y + 3z = -1$
$-x + y - 2z = 0$
$A: -y + z = -1$
$-y + (1) = -1$
$-1 \quad -1$
$-\frac{y}{-1} = -\frac{2}{-1}$
$y = 2$

$(I)\ (-2)(x - y + 2z) = 0(-2)$
$(III) 2x - 2y + z = -3$
$-2x + 2y - 4z = 0$
$-\frac{3z}{-3} = -\frac{3}{-3}$
$z = 1$

$(0, 2, 1)$

21) $(I)\ 4x - 3y + 2z = 40$
$(II)\ 5x + 9y - 7z = 47$
$(III) 9x + 8y - 3z = 97$

$A: \ 7(17x - z) = (167)7$
$B: 59x + 7z = 611$
$119x - 7z = 1169$
$\frac{178x}{178} = \frac{1780}{178}$
$x = 10$

$(I) 3(4x - 3y + 2z) = (40)3$
$(II) 5x + 9y - 7z = 47$
$12x - 9y + 6z = 120$
$A: 17x - z = 167$

$A: 17(10) - z = 167$
$170 - z = 167$
$-170 \quad -170$
$-\frac{z}{-1} = -\frac{3}{-1}$
$z = 3$

$(I)\ 8(4x - 3y + 2z) = (40)8$
$(III) 3(9x + 8y - 3z) = (97)3$
$32x - 24y + 16z = 320$
$27x + 24y - 9z = 291$
$B: 59x + 7z = 611$

$(I)\ 4(10) - 3y + 2(3) = 40$
$46 - 3y = 40$
$-46 \quad -46$
$-\frac{3y}{-3} = -\frac{6}{-3}$
$y = 2$

$(10, 2, 3)$

23) $(I)3x+3y-2z=13$
$(II)\ 6x+2y-5z=13$
$(III)5x-2y-5z=-1$

$A: 19(11x-10z)=(12)19$
$B: (-10)(21x-19z)=23(-10)$
$209x-190z=228$
$\underline{-210+190z=-230}$
$-\frac{x}{-1}=-\frac{2}{-1}$
$x=2$
$(2,3,1)$

$(II)6x+2y-5z=13$
$(III)\underline{5x-2y-5z=-1}$
$A: 11x-10z=12$

$A: 11(2)-10z=12$
$22-10z=12$
$\underline{-22\qquad -22}$
$-\frac{10z}{-10}=-\frac{10}{-10}$
$z=1$

$(I)2(3x+3y-2z)=(13)2$
$(III)3(5x-2y-5z)=(-1)3$
$6x+6y-4z=26$
$\underline{15x-6y-15z=-3}$
$B: 21x-19z=23$

$(I)\ 3(2)+3y-2(1)=13$
$4+3y=13$
$\underline{-4\qquad -4}$
$\frac{3y}{3}=\frac{9}{3}$
$y=3$

25) $(I)\ 3x-4y+2z=1$
$(II)2x+3y-3z=-1$
$(III)\ x+10y-8z=7$

$A: -34y+26z=-20$
$B: -2(-17y+13z)=-15(-2)$
$-34y+26z=-20$
$\underline{34y-26z=30}$
$0=10$
$false$
$No\ solution\ \theta$

$(I)\ 3x-4y+2z=1$
$(III)(-3)(x+10y-8z)=7(-3)$
$3x-4y+2z=1$
$\underline{-3x-30y+24z=-21}$
$A: -34y+26z=-20$

$(II)2x+3y-3z=-1$
$(III)(-2)(x+10y-8z)=7(-2)$
$2x+3y-3z=-1$
$\underline{-2x-20y+16z=-14}$
$B: -17y+13z=-15$

27) $(I)m+6n+3p=8$
$(II)\ 3m+4n=-3$
$(III)5m+7n=1$

$(I)(-25)+6(18)+3p=8$
$-25+108+3p=8$
$83+3p=8$
$\underline{-83\qquad -83}$
$\frac{3p}{3}=-\frac{75}{3}$
$p=-25$

$(II)(-5)(3m+4n)=(-3)(-5)$
$(III)3(5m+7n)=(1)3$
$-15m-20n=15$
$\underline{15m+21n=3}$
$n=18$

$(II)3m+4(18)=-3$
$3m+72=-3$
$\underline{-72\qquad -72}$
$\frac{3m}{3}=-\frac{75}{3}$
$m=-25$

$(-25,18,-25)$

29) $(I)\ -2w + 2x + 2y - 2z = -10$
$(II)\ w + x + y + z = -5$
$(III)\ 3w + 2x + 2y + 4z = -11$
$(IV) w + 3x - 2y + 2z = -6$

$(I)\ -2w + 2x + 2y - 2z = -10$
$(II)(-2)(w + x + y + z) = (-5)(-2)$
$-2w + 2x + 2y - 2z = -10$
$-2w - 2x - 2y - 2z = 10$
$A:\ -4w - 4z = 0$

$A: 3(-4w - 4z) = 0(3)$
$B: 2(5w + 6z) = (-1)2$
$-12w - 12z = 0$
$10w + 12z = -2$
$-\frac{2w}{-2} = -\frac{2}{-2}$
$w = 1$

$(I)\ (-1)(-2w + 2x + 2y - 2z) = (-10)(-1)$
$(III)\ 3w + 2x + 2y + 4z = -11$
$2w - 2x - 2y + 2z = 10$
$B: 5w + 6z = -1$

$A:\ -4(1) - 4z = 0$
$-4 - 4z = 0$
$+4 \quad +4$
$-\frac{4z}{-4} = \frac{4}{-4}$
$z = -1$

$(III)\ 3(1) + 2x + 2y + 4(-1) = -11$
$3 + 2x + 2y - 4 = -11$
$2x + 2y - 1 = -11$
$+1 \quad +1$
$C: 2x + 2y = -10$

$(IV)\ (1) + 3x - 2y + 2(-1) = -6$
$1 + 3x - 2y - 2 = -6$
$3x - 2y - 1 = -6$
$+1 \quad +1$
$D: 3x - 2y = -5$

$C: 2x + 2y = -10$
$D: 3x - 2y = -5$
$\frac{5x}{5} = -\frac{15}{5}$
$x = -3$

$C: 2(-3) + 2y = -10$
$-6 + 2y = -10$
$+6 \quad +6$
$\frac{2y}{2} = -\frac{4}{2}$
$y = -2$

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

31) $(I)\ w+x+y+z=2$

$(II)\ w+2x+2y+4z=1$

$(III)\ -w+x-y-z=-2$

$(IV)\ -w+3x+y-z=-2$

$(I)\ w+x+y+z=2$

$(III)\ \underline{-w+x-y-z=-6}$

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

$x=-2$

$(III)(-1)(-w+x-y-z)=(-6)(-1)$

$(IV)\ -w+3x+y-z=-2$

$\underline{w-x+y+z=6}$

$2x+2y=4$

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

$-4+2y=4$

$+4 \quad +4$

$\frac{2y}{2}=\frac{8}{2}$

$y=4$

$(II)\ w+2x+2y+4z=1$

$(IV)\ \underline{-2+3x+y-z=-2}$

$5x+3y+3z=-1$

$5(-2)+3(4)+3z=-1$

$-10+12+3z=-1$

$2+3z=-1$

$\underline{-2 \quad -2}$

$\frac{3z}{3}=\frac{-3}{3}$

$z=-1$

$(I)\ w+(-2)+(4)+(-1)=2$

$w+1=2$

$\underline{-1 \quad -1}$

$w=1$

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

4.5

1) A collection of dimes and quarters is worth S15.25. There are 103 coins in all. How many of each is there?

N	V	T
D	10	10D
Q	25	25Q
103		1525

$(-10)(D+Q)=(103)(-10)$

$10D+25Q=1525$

$\underline{-10D-10Q=-1030}$

$\frac{15Q}{15}=\frac{495}{15}$

$Q=33$

$D+33=103$

$\underline{-33 \quad -33}$

$D=70$

$70\ dimes$

$33\ Quarters$

3) The attendance at a school concert was 578. Admission was $2.00 for adults and $1.50 for children. The total receipts were S985.00. How many adults and how many children attended?

N	V	T
A	2	2A
C	1.5	1.5C
578		985

$-2(A+C)=(578)(-2)$

$2A+1.5C=985$

$\underline{-2A-2C=-1156}$

$\frac{-0.5C}{-0.5}=\frac{-1156}{-0.5}$

$C=342$

$236\ Adults$

$342\ Children$

$A+342=578$

$\underline{-342 \quad -342}$

$A=236$

5) A boy has \$2.25 in nickels and dimes. If there are twice as many dimes as nickels, how many of each kind has he?

N	V	T
N	5	5N
D=2N	10	20N
		225

$5N + 20N = 225$

$\frac{25N}{25} = \frac{225}{25}$

$N = 9$

$D = 2(9) = 18$

$9\ Nickels$

$18\ Dimes$

7) A collection of 27 coins consisting of nickels and dimes amounts to \$2.25. How many coins of each kind are there?

N	V	T
N	S	SN
D	10	10D
27		225

$(-10)(N + D) = (27)(-10)$

$5N + 10D = 225$

$-10N - 10D = -270$

$\frac{-5N}{-5} = \frac{-45}{-5}$

$N = 9$

$9 + D = 27$

$-9 \quad -9$

$D = 18$

$18\ Dimes$

$9\ Nickels$

9) There were 429 people at a play. Admission was \$1 each for adults and 75 cents each for children. The receipts were \$372.50. How many children and how many adults attended?

N	V	T
A	1	A
C	.75	.75C
429		372.50

$(-1)(A + C) = (429)(-1)$

$A + .75C = 372.5$

$-A - C = -429$

$\frac{-.25C}{-.25} = \frac{-56.5}{-.25}$

$C = 226$

$A + 226 = 429$

$-226 \quad -226$

$A = 203$

$203\ Adults$

$226\ Children$

11) There were 203 tickets sold for a volleyball game. For activity-card holders, the price was \$1.25 each and for non-card holders the price was \$2 each. The total amount of money collected was \$310. How many of each type of ticket was sold?

N	V	T
A	1.25	1.25A
N	2	2N
203		310

$-2(A + N) = (203)(-2)$

$1.25A + 2N = 310$

$-2A - 2N = -406$

$\frac{-.75A}{-.75} = \frac{-96}{-.75}$

$A = 128$

$128 + N = 203$

$-128 \quad -128$

$N = 75$

$75\ Non\ Card$

$128\ Activity\ Card$

13) At a recent Vikings game $445 in admission tickets was taken in. The cost of a student ticket was $1.50 and the cost of a non-student ticket was $2.50. A total of 232 tickets were sold. How many students and how many nonstudents attended the game?

N	V	T
5	1.5	1.55
N	2.5	2.5N
232		445

$-1.5(5+N) = (232)(-1.5)$

$1.55 + 2.5N = 445$

$-1.55 - 1.5N = 348$

$N = 97$

$S + 97 = 232$

$-97 \quad -97$

$S = 135$

$97\ Non-Students$

$135\ Students$

15) A coin purse contains 18 coins in nickels and dimes. The coins have a total value of $1.15. Find the number of nickels and dimes in the coin purse.

N	V	T
N	5	5N
D	10	100
18		115

$-5(N+D) = (18)(-5$

$5N + 10D = 115$

$-5N - 5D = -90$

$\frac{5D}{5} = \frac{25}{5}$

$D = 5$

$N + 5 = 18$

$-5 \quad -5$

$N = 13$

$13\ Nickels$

$5\ Dimes$

17)) A postal clerk sold some 15¢ stamps and some 25¢ stamps. Altogether, 15 stamps were sold for a total cost of $3.15. How many of each type of stamps were sold?

N	V	T
F	15	15F
T	25	25T
15		315

$-15(F+T) = (15)(-15)$

$15F + 25T = 315$

$-15F - 15T = -225$

$\frac{10T}{10} = \frac{90}{10}$

$T = 9$

$F + 9 = 15$

$-9 \quad -9$

$F = 6$

$6\ Fifteen\ cents, 9\ twenty - five\ cents$

19) The total value of dimes and quarters in a bank is $6.05. There are six more quarters than dimes. Find the number of each type of coin in the bank.

N	V	T
D	10	10D
Q=D+6	25	25D+150
		605

$10D + 25D + 150D = 605$

$35D + 150 = 605$

$-150 \quad -150$

$\frac{35D}{35} = \frac{455}{35}$

$D = 13$

$Q = 13 + 6$

$Q = 19$

$13\ Dimes$

$19\ Quarters$

21) A coin bank contains nickels and dimes. The number of dimes is 10 less than twice the number of nickels. The total value of all the coins is $2.75. Find the number of each type of coin in the bank.

N	V	T
N	5	5N
D=2N−10	10	20N−100
		275

$5N + 20N - 100 = 275$

$25N - 100 = 275$

$+100 \quad +100$

$\frac{25N}{25} = \frac{375}{25}$

$N = 15$ $\quad 15\ Nickels$

$D = 2(15) - 10$

$D = 30 - 20$

$D = 10$ $\quad 20\ Dimes$

23) A bank teller cashed a check for $200 using twenty dollar bills and ten dollar bills. In all, twelve bills were handed to the customer. Find the number of twenty dollar bills and the number of ten dollar bills.

N	V	T
W	20	20W
T	10	10T
12		200

$-10(W + T) = (12)(-10)$

$20W + 10T = 200$

$-10W - 10T = -120$

$\frac{10W}{10} = \frac{80}{10}$

$W = 8$ $\quad 4\ Tens$

$8\ Twenties$

$8 + T = 12$

$-8 \qquad -8$

$T = 4$

25) A total of $27000 is invested, part of it at 12% and the rest at 13%. The total interest after one year is $3385. How much was invested at each rate?

N	V	T
x	.12	.12x
y	.13	.13y
27000		3385

$-.12(x + y) = (27000)(-.12)$

$.12x + .13y = 3385$

$-.12x - .12y = -3240$

$\frac{-.01y}{-.01} = \frac{-145}{-.01}$

$y = 14500$ $\quad \$12{,}500\ @12\%$

$\$14{,}500\ @\ 13\%$

$x + 14500 = 27000$

$-14500 \quad -14500$

$x = 12500$

27) A total of $9000 is invested, part of it at 10% and the rest at 12%. The total interest after one year is $1030. How much was invested at each rate?

N	V	T
x	.10	.1x
y	.12	.12y
9000		1030

$-.1(x + y) = (9000)(-.1)$

$.1 + .12y = 1030$

$-.1x - .1y = -900$

$\frac{.02y}{.02} = \frac{130}{.02}$

$y = 6500$ $\quad \$2500\ @\ 10\%$

$\$6500\ @\ 12\%$

$x + 6500 = 9000$

$-6500 \quad -6500$

$x = 2500$

29) An inheritance of $10000 is invested in 2 ways, part at 9.5% and the remainder at 11%. The combined annual interest was $1038.50. How much was invested at each rate?

N	V	T
x	.095	.095x
y	.11	.11y
10000		1038.50

$-.095(x+y) = (10000)(-.095)$

$.095x + .11y = 1038.50$

$-.095x - .095y = -950$

$\frac{0.015y}{.015} = \frac{88.5}{.015}$

$y = 5900$

$x + 5900 = 10000$

$-5900 \quad -5900$

$x = 4100$

$4100 @ 9.5\%$

$5900 @ 11\%$

31) Jason earned $256 interest last year on his investments. If $1600 was invested at a certain rate of return and $2400 was invested in a fund with a rate that was double the rate of the first fund, find the two rates of interest.

N	V	T
1600	x	1600x
2400	2x	4800x
		256

$1600x + 4800x = 256$

$\frac{6400x}{6400} = \frac{256}{6400}$

$x = 0.04$

$2x = 0.08$

$1600 @ 4\%$

$2400 @ 8\%$

33) A total of $8500 is invested, part of it at 6% and the rest at 3.5%. The total interest after one year is $385. How much was invested at each rate?

N	V	T
x	.06	.06x
y	.035	.035y
8500		385

$-.035(x+y) = (8500)(-.035)$

$.06x + .035y = 385$

$-.035x - .035y = -297.5$

$\frac{.025x}{.025} = \frac{87.5}{.025}$

$x = 3500$

$3500 + y = 8500$

$-3500 \quad -3500$

$y = 5000$

$3500 @ 6\%$

$5000 @ 3.5\%$

35) A total of $15000 is invested, part of it at 8% and the rest at 11%. The total interest after one year is $1455. How much was invested at each rate?

N	V	T
x	.08	.08x
y	.11	.11y
15000		1455

$-.08(x+y) = (15000)(-.08)$

$.08x + .11y = 1455$

$-.08x - .08y = -1200$

$\frac{.03y}{.03} = \frac{255}{.03}$

$y = 8500$

$x + 8500 = 15000$

$-8500 \quad -8500$

$x = 6500$

$6500 @ 8\%$

$8500 @ 11\%$

37) A total of $6000 is invested, part of it at 4.25% and the rest at 5.75%. The total interest after one year is $300. How much was invested at each rate?

N	V	T
x	.0425	.0425x
y	.0575	.0575y
6000		300

$-.0425(x+y) = (6000)(-.0425)$

$.0425x + .0575y = 300$

$-.0425x - .0425y = -255$

$\frac{.015y}{.015} = \frac{45}{.014}$

$y = 3000$

$x + 3000 = 6000$

$-3000 \quad -3000$

$x = 3000$

$3000 @ 4.25\%$

$3000 @ 5.75\%$

39) A total of $11000 is invested, part of it at 6.8% and the rest at 8.2%. The total interest after one year is $797. How much was invested at each rate?

N	V	T
x	.068	.068x
y	.082	.082y
11000		797

$-.068(x+y) = (11000)(-.068)$

$.068x + .082y = 797$

$-.068x - .068y = -748$

$\frac{.014y}{.014} = \frac{49}{.014}$

$y = 3500$

$x + 3500 = 11000$

$-3500 \quad -3500$

$x = 7500$

$7500 @ 6.8\%$

$3500 @ 8.2\%$

42) Samantha earned $1480 in interest last year on her investments. If $5000 was invested at a certain rate of return and $11000 was invested in a fund with a rate that was two-thirds the rate of the first fund, find the two rates of interest.

N	V	T
5000	x	5000x
11000	$\frac{2}{3}$x	$\frac{22000}{3}$x
		1480

$3\left(5000x + \frac{22000}{3}x\right) = (1480)3$

$15000x + 22000x = 4440$

$\frac{37000x}{37000} = \frac{4440}{37000}$

$x = .12$

$\frac{2}{3}(.12) = .08$

$\$5000 @ 12\%$

$\$11000 @ 8\%$

44) 30 coins having a value of $3.30 consists of nickels, dimes and quarters. If there are twice as many quarters as dimes, how many coins of each kind were there?

N	V	T
N	5	5N
D	10	10D
Q=2D	25	25D
30		330

$N + D + 2D = 30$

$5N + 10D + 50D = 330$

$(-5)(N + 3D) = (30)(-5)$

$5N + 60D = 330$

$-5N - 15D = -150$

$\frac{45D}{45} = \frac{180}{45}$

$D = 4$

$N + 3(4) = 30$

$N + 12 = 30$

$-12 \quad -12$

$N = 18$

$Q = 2(4) = 8$

$18\ Nickels$

$4\ Dimes$

$8\ Quarters$

4.6

1) A tank contains 8000 liters of a solution that is 40% acid. How much water should be added to make a solution that is 30% acid?

A	P	T
8000	.4	3200
w	0	0
8000+w	.3	2400+.3w

$$3200 = 2400 + .3w$$
$$-2400 \quad -2400$$
$$\frac{800}{.3} = \frac{.3w}{.3}$$
$$w = 2{,}666.67\ L.$$

3) Of 12 pounds of salt water 10% is salt; of another mixture 3% is salt. How many pounds of the second should be added to the first in order to get a mixture of 5% salt?

A	P	T
12	.1	1.2
x	.03	.03x
12+x	.05	.6+.05x

$$1.2 + .03x = .6 + .05x$$
$$-.03x \quad -.03x$$
$$1.2 = .6 + .02x$$
$$-.6 \quad -.6$$
$$\frac{.6}{.02} = \frac{.02x}{.02}$$
$$x = 30\ lbs$$

5) How many pounds of a 4% solution of borax must be added to 24 pounds of a 12% solution of borax to obtain a 10% solution of borax?

A	P	T
x	.04	.04x
24	.12	2.88
x+24	.10	.1x+.24

$$.04x + 2.88 = .1x + 2.4$$
$$-.04x \quad -.04x$$
$$2.88 = .06x + 2.4$$
$$-2.4 \quad -2.4$$
$$\frac{.48}{.06} = \frac{.06x}{.06}$$
$$x = 8\ lbs$$

7) A 100 LB bag of animal feed is 40% oats. How many pounds of oats must be added to this feed to produce a mixture which is 50% oats?

A	P	T
100	.4	40
x	1	X
100+x	.5	50+.5x

$$40 + x = 50 + .5x$$
$$-.5x \quad -.5x$$
$$40 + .5x = 50$$
$$-40 \quad -40$$
$$\frac{.5x}{.5} = \frac{10}{.5}$$
$$x = 20\ lbs$$

9) How many pounds of tea that cost $4.20 per pound must be mixed with 12 lb of tea that cost $2.25 per pound to make a mixture that costs $3.40 per pound?

A	P	T
x	4.2	4.2x
12	2.25	27
x+12	3.40	3.4x+40.8

$$4.2x + 27 = 3.4x + 40.8$$
$$-3.4x \quad -3.4x$$
$$0.8x + 27 = 40.8$$
$$-27 \quad -27$$
$$\frac{0.8x}{0.8} = \frac{13.8}{.8}$$
$$x = 12.25\ lbs$$

11) How many kilograms of hard candy that cost $7.50 per kilogram must be mixed with 24 kg of jelly beans that cost $3.25 per kilogram to make a mixture that sells for $4.50 per kilogram?

A	P	T
x	7.5	7.5x
24	3.25	78
x+24	4.5	4.5x+108

$$7.5x + 78 = 4.5x + 108$$
$$-4.5x \quad -4.5x$$
$$3x + 78 = 108$$
$$-78 \quad -78$$
$$\frac{3x}{3} = \frac{30}{3}$$
$$x = 10kg$$

13) How many pounds of lima beans that cost 90¢ per pound must be mixed with 16 lb of corn that cost 50¢ per pound to make a mixture of vegetables that costs 65¢ per pound?

A	P	T
x	.9	.9x
16	.5	8
X+16	.65	.65x+10.4

$$.9x + 8 = .65x + 10.4$$
$$-.65x \quad -.65x$$
$$.25x + 8 = 10.4$$
$$-8 \quad -8$$
$$\frac{.25x}{.25} = \frac{2.4}{.25}$$
$$x = 9.6\ lbs$$

15) Solution A is 50% acid and solution B is 80% acid. How much of each should be used to make 100cc. of a solution that is 68% acid?

A	P	T
A	.5	.5A
B	.8	.8B
100	.68	68

$$-.5(A + B) = (100)(-.5)$$
$$.5A + .8B = 68$$
$$-.5A - .5B = -50$$
$$\frac{.3B}{.3} = \frac{18}{.3}$$
$$B = 60$$

$$A + 60 = 100$$
$$-60 \quad -60$$
$$A = 40$$

$60\ cc\ of\ 80\%$

$40\ cc\ of\ 50\%$

17) A farmer has some cream which is 21% butterfat and some which is 15% butter fat. How many gallons of each must be mixed to produce 60 gallons of cream which is 19% butterfat?

A	P	T
A	.21	.21A
B	.15	.15B
60	.19	11.4

$-.15(A+B)=(60)(-.15)$

$.21A+.15B=11.4$

$-.15A-.15B=-9$

$\frac{.06A}{.06}=\frac{2.4}{.06}$

$A=40$

$40+B=60$

$-40\quad -40$

$B=20$

$40\ gal\ 21\%$

$20\ gal\ 15\%$

19) A chemist wants to make 50ml of a 16% acid solution by mixing a 13% acid solution and an 18% acid solution. How many milliliters of each solution should the chemist use?

A	P	T
x	.13	.13x
y	.18	.18y
50	.16	8

$-.13(x+y)=(50)(-.13)$

$.13x+.18y=8$

$-.13x-.13y=-6.5$

$\frac{.05y}{.05}=\frac{1.5}{.05}$

$y=30$

$x+30=50$

$-30\quad -30$

$x=20$

$20\ mL\ 13\%$

$30\ mL\ 18\%$

21) A paint that contains 21% green dye is mixed with a paint that contains 15% green dye. How many gallons of each must be used to make 60 gal of paint that is 19% green dye?

A	P	T
x	.21	.21x
y	.15	.15y
60	.19	11.4

$-.15(x+y)=(60)(-.15)$

$.21x+.15y=11.4$

$-.15x-.15y=-9$

$\frac{.06x}{.06}=\frac{2.5}{.06}$

$x=40$

$40+y=60$

$-40\quad -40$

$y=20$

$40\ gal\ 21\%$

$20\ gal\ 15\%$

23) To make a weed and feed mixture, the Green Thumb Garden Shop mixes fertilizer worth $4.00/lb. with a weed killer worth $8.00/lb. The mixture will cost $6.00/lb. How much of each should be used to prepare 500 lb. of the mixture?

A	P	T
x	4	4x
y	8	8y
500	6	3000

$-4(x+y)=(500)(-4)$

$4x+8y=3000$

$-4x-4y=-2000$

$\frac{4y}{4}=\frac{1000}{4}$

$y=250$

$x+250=500$

$-250\quad -250$

$x=250$

$250\ lbs$ @ \$4

$250\ lbs$ @ \$8

25) A grocer wishes to mix sugar at 9 cents per pound with sugar at 6 cents per pound to make 60 pounds at 7 cents per pound. What quantity of each must he take?

A	P	T
x	9	9x
y	6	6y
60	7	420

$-6(x+y) = (60)(-6)$
$9x + 6y = 420$
$-6x - 6y = -360$

$\frac{3x}{3} = \frac{60}{3}$

$x = 20$

$20 + y = 60$
$-20 \quad -20$
$y = 40$

$20\ lbs$ @ 9¢
$40\ lbs$ @ 6¢

27) A goldsmith combined an alloy that costs S4.30 per ounce with an alloy that costs $1.80 per ounce. How many ounces of each were used to make a mixture of 200 oz costing $2.50 per ounce?

A	P	T
x	4.30	4.3x
y	1.80	1.80y
200	2.50	500

$-1.8(x+y) = (200)(-1.8)$
$4.3x + 1.8y = 500$
$-1.8x - 1.8y = -360$

$\frac{2.5x}{2.5} = \frac{140}{2.5}$

$x = 56$

$56 + y = 200$
$-56 \quad -56$
$y = 144$

$56\ oz.$ @ $4.30
$144\ oz.$ @ $1.80

29) The manager of a garden shop mixes grass seed that is 60% rye grass with 70 lb of grass seed that is 80% rye grass to make a mixture that is 74% rye grass. How much of the 60% mixture is used?

A	P	T
x	.6	.6x
70	.8	56
x+70	.74	.74x+51.8

$.6x + 56 = .74x + 51.8$
$-.6x \quad -.6x$
$56 = .45x + 51.8$
$-51.8 \quad -51.8$

$\frac{4.2}{.14} = \frac{.14x}{.14}$

$30\ lbs = x$

31) A caterer made an ice cream punch by combining fruit juice that cost $2.25 per gallon with ice cream that costs $3.25 per gallon. How many gallons of each were used to make 100 gal of punch costing $2.50 per pound?

A	P	T
x	2.25	2.25x
y	3.25	3.25y
100	2.5	250

$-2.25(x+y) = (100)(-2.25)$
$2.25x + 3.25y = 250$
$-2.25x - 2.25y = -225$

$y = 25$

$x + 25 = 100$
$-25 \quad -25$
$x = 75$

$75\ gal$ @ $2.25
$25\ gal$ @ $3.25

33) A carpet manufacturer blends two fibers, one 20% wool and the second 50% wool. How many pounds of each fiber should be woven together to produce 600 lb of a fabric that is 28% wool?

A	P	T
x	.2	.2x
y	.5	.5y
600	.28	168

$-.2(x+y) = (600)(-.2)$

$.2x + .5y = 168$

$-2.x - .2y = -120$

$\frac{.3y}{.3} = \frac{48}{.3}$

$y = 160$

$x + 160 = 600$

$-160 - 160$

$x = 440$

$440\ lbs$ @ 20%

$160\ lbs$ @ 50%

35) The manager of a specialty food store combined almonds that cost $4.50 per pound with walnuts that cost S2.50 per pound. How many pounds of each were used to make a 100 lb mixture that cost $3.24 per pound?

A	P	T
x	4.50	4.5x
y	2.50	2.5y
100	3.24	324

$-2.5(x+y) = (100)(-2.5)$

$4.5x + 2.5y = 324$

$-2.5x - 2.5y = -250$

$\frac{2x}{2} = \frac{74}{2}$

$x = 37$

$37 + y = 100$

$-37 \quad -37$

$y = 63$

$37\ lbs$ @ \$4.50

$63\ lbs$ @ \$2.50

37) How many ounces of dried apricots must be added to 18 oz of a snack mix that contains 20% dried apricots to make a mixture that is 25% dried apricots?

A	P	T
x	1	x
18	.2	3.6
x+18	.25	.25x+4.5

$x + 3.6 = .25x + 4.5$

$-.25x \quad -.25x$

$.75x + 3.6 = 4.5$

$-3.6 \quad -3.6$

$\frac{.75x}{.75} = \frac{0.9}{.75}$

$x = 1.2\ oz$

39) How many ounces of pure bran flakes must be added to 50 oz. of cereal that is 40% bran flakes to produce a mixture that is 50% bran flakes?

A	P	T
x	1	x
50	.4	20
x+50	.5	.5x+25

$x + 20 = .5x + 25$

$-.5x \quad -.5x$

$.5x + 20 = 25$

$-20 \quad -20$

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

$x = 10\ oz$

41) How many grams of pure water must be added to 50 g of pure acid to make a solution that is 40% acid?

A	P	T
w	0	0
50	1	50
w+50	.4	.4w+20

$$50 = .4w + 20$$
$$-20 \qquad -20$$
$$\frac{30}{.4} = \frac{.4w}{.4}$$
$$75g = w$$

43) How many ounces of pure water must be added to 50 oz of a 15% saline solution to make a saline solution that is 10% salt?

A	P	T
x	0	0
50	.15	7.5
x+50	.10	.1x+5

$$7.5 = .1x + 5$$
$$-5 \qquad -5$$
$$\frac{2.5}{.1} = \frac{.1x}{.1}$$
$$25oz = x$$

Chapter 5: Polynomials

5.1

1) $4 \cdot 4^4 \cdot 4^4 = 4^9$

3) $4 \cdot 2^2 = 2^2 \cdot 2^2 = 2^4$

5) $3m \cdot 4mn = 12m^2n$

7) $2m^4n^2 \cdot 4nm^2 = 8m^6n^3$

9) $(3^3)^4 = 3^{12}$

11) $(4^4)^2 = 4^8$

13) $(2u^3v^2)^2 = 4u^6v^4$

15) $(2a^4)^4 = 2^4a^{16} = 16a^{16}$

17) $\frac{4^5}{4^3} = 4^2$

19) $\frac{3^2}{3} = 3$

21) $\frac{3nm^2}{3n} = m^2$

23) $\frac{4x^3y^4}{3xy^3} = \frac{4x^2y}{3}$

25) $(x^3y^4 \cdot 2x^2y^3)^2$
$(2x^5y^7)^2$
$2^2x^{10}y^{14}$
$4x^{10}y^{14}$

27) $2x(x^4y^4)^4$
$2x(x^{16}y^{16})$
$2x^{17}y^{16}$

29) $\frac{2x^7y^5}{3x^3y \cdot 4x^2y^3} = \frac{2x^7y^5}{12x^5y^4} = \frac{x^2y}{6}$

31) $\left(\frac{(2x)^3}{x^3}\right)^2 = \left(\frac{2^3x^3}{x^3}\right)^2 = \left(\frac{8x^3}{x^3}\right)^2 = 8^2 = 64$

33) $\left(\frac{2y^{17}}{(2x^2y^4)^4}\right)^3 = \left(\frac{2y^{17}}{2^4x^8y^{16}}\right)^3 = \left(\frac{2y^{17}}{16x^8y^{16}}\right)^3 = \left(\frac{y}{8x^8}\right)^3 = \frac{y^3}{8^3x^{24}} = \frac{y^3}{512x^{24}}$

35) $\left(\frac{2mn^4 \cdot 2m^4n^4}{mn^4}\right)^3 = \left(\frac{4m^5n^8}{mn^4}\right)^3 = (4m^4n^4)^3 = 4^3m^{12}n^{12} = 64m^{12}n^{12}$

37) $\frac{2xy^5 \cdot 2x^2y^3}{2xy^4 \cdot y^3} = \frac{4x^3y^8}{2xy^7} = 2x^2y$

39) $rr\frac{q^3r^2 \cdot (2p^2q^2r^3)^2}{2p^3} = \frac{q^3r^2(2^2p^4q^4r^2)}{2p^3} = \frac{q^3r^2 \cdot 4p^4p^4r^6}{2p^3} = \frac{4p^4q^7r^8}{2p^3} = 2pq^7r^8$

41) $\left(\frac{zy^3 \cdot z^3x^4y^4}{x^3y^3z^3}\right)^4 = \left(\frac{z^4y^7x^4}{x^3y^3z^3}\right)^4 = (xy^4z)^4 = x^4y^{16}z^4$

43) $\frac{2x^2y^2z^6 \cdot 2zx^2y^2}{(x^2z^3)^2} = \frac{4x^4y^4z^7}{x^4z^6} = 4y^4z$

5.2

1) $2x^4y^{-2}(2xy^3)^4 = 2x^4y^{-2}(2^4x^4y^{12}) = 2^5x^8y^{10} = 32x^8y^{10}$

3) $(a^4b^{-3})^3\ 2a^3b^{-2} = a^{12}b^9 \cdot 2a^3b^{-2} = 2a^{15}b^{-11} = \frac{2a^{15}}{b^{11}}$

5) $(2x^2y^2)^4x^{-4} = 2^4x^8y^8x^{-4} = 16x^4y^8$

7) $(x^3y^4)\&3\ x^{-4}y^4 = x^9y^{12}x^{04}y^4 = x^5y^{16}$

9) $\frac{2x^{-3}y^2}{3x^{-3}y^3 \cdot 3x^0} = \frac{2y^2x^3}{x^3 \cdot 3y^3 \cdot 3x^0} = \frac{2y^3x^3}{9x^3y^3} = \frac{2}{9y}$

11) $\frac{4xy^{-3} \cdot x^{-4}y^0}{4y^{-1}} = \frac{4xy^0y}{4y^3x^4} = \frac{4xy}{4y^3x^4} = \frac{1}{x^3y^2}$

13) $\frac{u^2v^{-1}}{2u^0v^4 \cdot 2uv} = \frac{u^2}{v \cdot 2u^0v^4 \cdot 2uv} = \frac{u^2}{4uv^6} = \frac{u}{4v^6}$

15) $\frac{u^2}{4u^0v^3 \cdot 3v^2} = \frac{u^2}{12v^5}$

17) $\frac{2y}{(x^0y^2)^4} = \frac{2y}{x^0y^8} = \frac{2}{y^7}$

19) $\left(\frac{2a^2b^3}{a^{-1}}\right)^4 = (2a^2a\ b^3)^4 = (2a^3b^3)^4 = 2^4a^{12}b^{12} = 16a^{12}b^{12}$

21) $\frac{2nm^4}{(2m^2n^2)^4} = \frac{2nm^4}{2^4m^8n^8} = \frac{1}{2^3m^4n^7} = \frac{1}{8m^4n^7}$

23) $\frac{(2mn)^4}{m^0n^{-2}} = \frac{2^4m^4n^4}{m^0n^{-2}} = 2^4m^4n^4n^2 = 16m^4n^6$

25) $\frac{y^3 \cdot x^{-3}y^2}{(x^4y^2)^3} = \frac{y^3x^{-3}y^2}{x^{12}y^6} = \frac{y^3y^2}{x^3x^{12}y^6} = \frac{y^5}{x^{15}y^6} = \frac{1}{x^{15}y}$

27) $\frac{2u^{-2}v^3(2uv^4)^{-1}}{2u^{-4}v^0} = \frac{2u^{-2}v^3 \cdot 2^{-1}u^{-1}v^{-4}}{2u^{-4}v^0} = \frac{2v^3 \cdot u^4}{u^2 2uv^4 \cdot 2v^0} = \frac{2v^3u^4}{4u^3v^4} = \frac{u}{2v}$

29) $\left(\frac{2x^0y^4}{y^4}\right)^3 = (2)^3 = 8$

31) $\frac{y(2x^4y^2)^2}{2x^4y^0} = \frac{y(2^2x^8y^4)}{2x^4y^0} = \frac{4x^8y^5}{2x^4y^0} = 2x^4y^5$

33) $\frac{2yzx^2}{2x^4y^4z^{-2}(zy^2)^4} = \frac{2yzx^2}{2x^4y^4z^{-2}z^4y^8} = \frac{2yz^3x^2}{2x^4y^{12}z^4} = \frac{1}{x^2y^{11}z}$

35) $\frac{2kh^0 \cdot 2h^{-3}k^0}{(2kj^3)^2} = \frac{2kh^0 \cdot 2h^{-3}k^0}{2^2k^2j^6} = \frac{2k \cdot 2}{h^3 \cdot 4k^2j^6} = \frac{4k}{4k^2h^3j^6} = \frac{1}{kh^3j^6}$

37) $\frac{(cb^3)^2 \cdot 2a^{-3}b^2}{(a^3b^{-2}c^3)^3} = \frac{c^2b^6 \cdot 2a^{-3}b^2}{a^9b^{-6}c^9} = \frac{c^2b^6 2b^2b^6}{a^3a^9c^9} = \frac{2b^{14}c^2}{a^{12}c^9} = \frac{2b^{14}}{a^{12}c^7}$

39) $\frac{(yx^{-4}z^2)^{-1}}{z^3x^2y^3z^{-1}} = \frac{y^{-1}x^4z^{-2}}{x^3x^2y^3z^{-1}} = \frac{x^4z}{yz^2x^3x^2y^3} = \frac{x^4z}{x^2y^4z^5} = \frac{x^2}{y^4z^4}$

5.3

1) 885
$8.85\ x\ 10^2$

3) 0.081
$8.1\ x\ 10^{-2}$

5) 0.039
$3.9\ x\ 10^{-2}$

7) $8.7\ x\ 10^5$
870,000

9) $9\ x\ 10^{-4}$
0.0009

11) $2\ x\ 10^0$
2

13) $(7\ x\ 10^{-1})(2\ x\ 10^{-3})$
$14\ x\ 10^{-4}$
$1.4\ x\ 10^1 x\ 10^{-4}$
$1.4\ x\ 10^{-3}$

15) $(5.26\ x\ 10^{-5})(3.16\ x\ 10^{-2})$
$16.6216\ x\ 10^{-7}$
$1.66216\ x\ 10^{1}\ x\ 10^{-7}$
$1.66216\ x\ 10^{-6}$

17) $(2.6\ x\ 10^{-2})(6\ x\ 10^{-2})$
$15.6\ x\ 10^{-4}$
$1.56\ x\ 10^{1} x\ 10^{-4}$
$1.56\ x\ 10^{-3}$

19) $\frac{4.9\ x\ 10^{1}}{2.7\ x\ 10^{-3}} = 1.81\ x\ 10^{4}$

21) $\frac{5.33\ x\ 10^{-6}}{9.62\ x\ 10^{-2}} = 0.554\ x\ 10^{-4} =$
$5.54\ x\ 10^{-1}\ x\ 10^{-4} = 5.54\ x\ 10^{-5}$

23) $(5.5\ x\ 10^{-5})^{2}$
$30.25\ x\ 10^{-10}$
$3.025\ x\ 10^{1} x\ 10^{-10}$
$3.025\ x\ 10\text{^} - 9$

25) $(7.8\ x\ 10^{-2})^{5}$
$28.872\ x\ 10^{-10}$
$2.8872\ x\ 10^{1}\ x\ 10^{-10}$
$2.8872\ x\ 10^{-9}$

27) $(8.03\ x\ 10^{4})^{-4}$
$0.000241\ x\ 10^{-16}$
$2.41\ x\ 10^{-4} x\ 10^{-16}$
$2.41\ x\ 10^{-20}$

29) $\frac{6.1\ x\ 10^{-6}}{5.1\ x\ 10^{-4}} = 1.196\ x\ 10^{-2}$

31) $(3.6\ x\ 10^{0})(6.1\ x\ 10^{-3})$
$21.96\ x\ 10^{-3}$
$2.196\ x\ 10^{1} x\ 10^{-3}$
$2.196\ x\ 10^{-2}$

33) $(1.8\ x\ 10^{-5})^{-3}$
$0.1715\ x\ 10^{15}$
$1.715\ x\ 10^{-1}\ x\ 10^{15}$
$1.715\ x\ 10^{14}$

35) $\frac{9\ x\ 10^{4}}{7.83\ x\ 10^{-2}} = 1.149\ x\ 10^{6}$

37) $\frac{3.22\ x\ 10^{-3}}{7\ x\ 10^{-6}} = 0.46\ x\ 10^{3} =$
$4.6\ x\ 10^{-1} x\ 10^{3} = 4.6\ x\ 10^{2}$

39) $\frac{2.4\ x\ 106-6}{6.5\ x\ 10^{0}} = 0.3692\ x\ 10^{-6} =$
$3.692\ x\ 10^{-1}\ x\ 10^{-6} = 3.692\ x\ 10^{-7}$

41) $\frac{6\ x\ 10^{3}}{5.8\ x\ 10^{-3}} = 1.034\ x\ 10^{6}$

5.4

1) $-a^{3}a^{2} + 6a - 21\ at\ a = -4$
$-(-4)^{3} - (-4)^{2} + 6(-4) - 21$
$-(-64) - (16) + 6(-4) - 21$
$64 - 16 - 24 - 21$
3

3) $n^{3} - 7n^{2} + 15n - 20\ when\ n = 2$
$(2)^{3} - 7(2)^{2} + 15(2) - 20$
$8 - 7(4) + 15(2) - 20$
$8 - 28 + 30 - 20$
-10

5) $-5n^{4} - 11n^{3} - 9n^{2} - n - 5\ when\ n = -1$
$-5(-1)^{4} - 11(-1)^{3} - 9(-1)^{2} - (-1) - 5$
$-5(1) - 11(-1) - 9(1) - 1(-1) - 5$
$-5 + 11 - 9 + 1 - 5$
-7

7) $x^{2} + 9x + 23\ \ when\ x = -3$
$(-3)^{2} + 9(-3) + 23$
$9 + 9(-3) + 23$
$9 - 27 + 23$
5

9) $x^4 - 6x^3 + x^2 - 24 \; when \; x = 6$

$(6)^4 - 6(6)^3 + (6)^2 - 24$

$1296 - 6(216 + 36 - 24$

$1296 - 1296 + 36 - 24$

12

11) $(5p - 5p^4) - (8p - 8p^4)$

$5p - 5p^5 - 8p + 8p^4$

$3p^4 - 3p$

13) $(3n^2 + n^3) - (2n^3 - 7n^2)$

$3n^2 + n^3 - 2n^3 - 7n^2$

$-n^3 + 10n^2$

15) $(8n + n^4) - (3n - 4n^4)$

$8n + n^4 - 3n + 4n^4$

$5n^4 + 5n$

17) $(1 + 5p^3) - (1 - 8p^3)$

$1 + 5p^3 - 1 + 8p^3$

$13p^3$

19) $(5n^4 + 6n^3) + (8 - 3n^3 - 5n^4)$

$3n^3 + 8$

21) $(3 + b^4) + (7 + 2b + b^4)$

$2b^4 + 2b + 10$

23) $(8x^3 + 1) - (5x^4 - 6x^3 + 2)$

$8x^3 + 1 - 5x^4 + 6x^3 - 2$

$-5x^4 + 14x^3 - 1$

25) $(2a + 2a^4) - (3a^2 - 5a^4 + 4a)$

$2a + 2a^4 - 3a^2 + 5a^4 - 4a$

$7a^4 - 3a^2 - 2a$

27) $(4p^2 - 3 - 2p) - (3p^2 - 6p + 3)$

$4p^2 - 3 - 2p - 3p^2 + 6p - 3$

$p^2 + 4p - 6$

29) $(4b^3 + 7b^2 - 3) + (8 + 5b^2 + b^3)$

$5b^3 + 12b^2 + 5$

31) $(3 + 2n^2 + 4n^4) + (n^3 - 7n^2 - 4n^4)$

$n^3 - 5n^2 + 3$

33) $(n - 5n^4 + 7) + (n^2 - 7n^4 - n)$

$-12n^4 + n^2 + 7$

35) $(8r^4 - 5r^3 + 5r^2) + (2r^2 + 2r^3 - 7r^4 + 1)$

$r^4 - 3r^3 + 7r^2 + 1$

37) $(2n^2 + 7n^4 - 2) + (2 + 2n^3 + 4n^2 + 2n^4)$

$9n^4 + 2n^3 + 6n^2$

39) $(8 - b + 7b^3) - (3b^4 + 7b - 8 - 7b^2) + (3 - 3b + 6b^3)$

$8 - b + 7b^3 - 3b^4 - 7b + 8 + 7b^2 + 3 - 3b + 6b^3$

$-3b^4 + 13b^3 - 7b^2 - 11b + 19$

41) $(8x^4 + 2x^3 + 2x) + (2x + 2 - 2x^3 - x^4) - (x^3 + 5x^4 + 8x)$

$8x^4 + 2x^3 + 2x + 2x + 2 - 2x^3 - x^4 - x^3 - 5x^4 - 8x$

$2x^4 - x^3 - 4x + 2$

5.5

1) $6(p-7)$
$6p-42$

3) $2(6x+3)$
$12x+6$

5) $5m^4(4m+4)$
$20m^5+20m^4$

7) $(4n+6)(8n+8)$
$32n^2+32n+48n+48$
$32n^2+80n+48$

9) $(8b+3)(7b-5)$
$56b^2-40b+21b-15$
$56b^2-19b-15$

11) $(4x+5)(2x+3)$
$8x^2+12x+10x+15$
$8x^2+22x+15$

13) $(3v-4)(5v-2)$
$15v^2-6v-20v+8$
$15v^2-26v+8$

15) $(6x-7)(4x+1)$
$24x^2+6x-28x-7$
$24x^2-22x-7$

17) $(5x+y)(6x-4y)$
$30x^2-20xy+6xy-4y^2$
$30x^2-14xy-4y^2$

19) $(x+3y)(3x+4y)$
$3x^2-4xy+9xy+12y^2$
$3x^2+13xy+12y^2$

21) $(7x+5y)(8x+3y)$
$56x^2+21xy+40xy+15y^2$
$56x^2+61xy+15y^2$

23) $(r-7)(6r^2-4+5)$
$6r^3-r^2+5r-42r^2+7r-35$
$6r^3-43r^2+12r-35$

25) $(6n-4)(2n^2-2n+5)$
$12n^3-12n^2+30n-8n^2+8n-20$
$12n^3-20n^2+38n-20$

27) $(6x+3y)(6x^2-7xy+4y^2)$
$36x^3-42x^2y+24xy^2+18x^2y-21xy^2+12y^3$
$36x^3-24x^2y+3xy^2+12y^3$

29) $(8n^2+4n+6)(6n^2-6n+6)$
$48n^4-40n^3+48n^2+24n^3-20n^2+24n+36n^2-30n+36$
$48n^4-16n^3+64n^2-6n+36$

31) $(5k^2+3k+3)(3k^2+3k+6)$
$15k^4+15k^3+30k^2+9k^3+9k^2+18k+9k^2+9k+18$
$15k^4+24k^3+48k^2+27k+18$

33) $3(3x-4)(2x+1)$
$3(6x^2+3x-8x-4)$
$3(6x^2-5x-5)$
$18x^2-15x-12$

35) $3(2x+1)(4x-5)$
$3(8x^2-10x+4x-5)$
$3(8x^2-6x-5)$
$24x^2-18x-15$

37) $7(x-5)(x-2)$
$7(x^2-2x-5x+10)$
$7(x^2-7x+10)$
$7x^2-49x+70$

39) $6(4x-1)(4x+1)$
$6(16x^2+4x-4x-1)$
$6(16x^2-1)$
$96x^2-6$

5.6

1) $(x+8)(x-8)$
x^2-64

3) $(1+3p)(1-3p)$
$1-9p^2$

5) $(1-7n)(1+7n)$
$1-49n^2$

7) $(5n-8)(5n+8)$
$25n^2-64$

9) $(4x+8)(4x-8)$
$16x^2-64$

11) $(4y-x)(4y+x)$
$16y^2-x^2$

13) $(4m-8n)(4m+8n)$
$16n^2-64n^2$

15) $(6x-2y)(6x+2y)$
$36x^2-4y^2$

17) $(a+5)^2$
$2(5a)=10a$
$a^2+10a+25$

19) $(x-8)^2$
$2(-8x)=-16x$
$x^2-16x+64$

21) $(p+7)^2$
$2(7p)=14p$
$p^2+14p+49$

23) $(7-5n)^2$
$2(-35n)=-70n$
$49-70n+25n^2$

25) $(5m-8)^2$
$2(-40m)=-80m$
$25m^2-80m+64$

27) $(5x+7y)^2$
$2(35xy)=70xy$
$25x^2+70xy+49y^2$

29) $(2x+2y)^2$
$2(4xy)=8xy$
$4x^2+8xy+4x=y^2$

31) $(5+2r)^2$
$2(10r)=20r$
$25+20r+4r^2$

33) $(2+5x)^2$
$2(10x)=20x$
$4+20x+25x^2$

35) $(4v-7)(4v+7)$
$16v^2-49$

37) $(n-5)(n+5)$
n^2-25

39) $(4k+2)^2$
$2(8k)=16k$
$16k^2+16k+4$

5.7

1) $\frac{20x^4+x^3+2x^2}{4x^3}=\frac{20x^4}{4x^3}+\frac{x^3}{4x^3}+\frac{2x^2}{4x^3}=5x+\frac{1}{4}+\frac{1}{2x}$

3) $\frac{20n^4+n^3+40n^2}{10n}=\frac{20n^4}{10n}+\frac{n^3}{10n}+\frac{40n^2}{10n}=2n^3+\frac{n^2}{10}+4n$

5) $\frac{12x^4+24x^3+3x^2}{6x}=\frac{12x^4}{6x}+\frac{24x^3}{6x}+\frac{3x^2}{6x}=2x^3+4x^2+\frac{x}{2}$

7) $\frac{10n^4+50n^3+2n^2}{10n^2} = \frac{10n^4}{10n^2} + \frac{50n^3}{10n^2} + \frac{2n^2}{10n^2} = n^2 + 5n + \frac{1}{5}$

9) $\frac{x^2-2x-71}{x+8}$

$$\begin{array}{r} x - 10 + \frac{9}{x+8} \\ x + 8 \overline{\left| x^2 - 2x - 71 \right.} \\ \underline{-x^2 + (-8x)} \\ -10x - 71 \\ \underline{+10x + 80} \\ 9 \end{array}$$

11) $\frac{n^2+13n+32}{n+5}$

$$\begin{array}{r} n + 8 - \frac{8}{n+5} \\ n + 5 \overline{\left| n^2 + 13n + 32 \right.} \\ \underline{-n^2 - 5n} \\ 8n + 32 \\ \underline{-8n - 40} \\ -8 \end{array}$$

13) $\frac{v^2-2v-89}{v-10}$

$$\begin{array}{r} v + 8 - \frac{9}{v-10} \\ v - 10 \overline{\left| v^2 - 2v - 89 \right.} \\ \underline{-v^2 + 10v} \\ 8v - 89 \\ \underline{-8v + 80} \\ 9 \end{array}$$

15) $\frac{a^2-4a-38}{a-8}$

$$\begin{array}{r} a + 4 - \frac{6}{a-8} \\ a - 8 \overline{\left| a^2 - 4a - 38 \right.} \\ \underline{-a^2 + 8a} \\ 4a - 38 \\ \underline{-4a + 32} \\ -6 \end{array}$$

17) $\frac{45p^2+56p+19}{9p+4}$

$$\begin{array}{r} 5p + 4 + \frac{3}{9p+4} \\ 9p + 4 \overline{\left| 45p^2 + 56p + 19 \right.} \\ \underline{-45p^2 - 20p} \\ 36p + 19 \\ \underline{-36p - 16} \\ 3 \end{array}$$

19) $\frac{10x^2-32x+9}{10x-2}$

$$x-3+\frac{3}{10x-2}$$
$$10x-2\overline{)10x^2-32x+9}$$
$$\underline{-10x^2+2x}$$
$$-30x+9$$
$$\underline{+30x-6}$$
$$3$$

21) $\frac{4r^2-r-1}{4r+3}$

$$r-1+\frac{2}{4r+3}$$
$$4r+3\overline{)4r^2-r-1}$$
$$\underline{-4r^2-3r}$$
$$-4r-1$$
$$\underline{+4r+3}$$
$$2$$

23) $\frac{n^2-4}{n-2}$

$$n+2$$
$$n-2\overline{)n^2-0n-4}$$
$$\underline{-n^2-2n}$$
$$-2n-4$$
$$\underline{+2n+4}$$
$$0$$

25) $\frac{27b^2+87b+35}{3b+8}$

$$9b+5-\frac{5}{3b+8}$$
$$3b+8\overline{)27b^2+87b+35}$$
$$\underline{-27b^2-72b}$$
$$15b+35$$
$$\underline{-15b-40}$$
$$-5$$

27) $\frac{4x^2-33x+28}{4x-5}$

$$x-7-\frac{7}{4x-5}$$
$$4x-5\overline{)4x^2-33x+28}$$
$$\underline{-4x^2+5x}$$
$$28x+28$$
$$\underline{-28x-35}$$
$$-7$$

29) $\frac{a^3+15a^2+49a-55}{a+7}$

$$a^2 + 8a - 7 - \frac{6}{a+7}$$
$$a + 7 \overline{)\, a^3 + 15a^2 + 49a - 55}$$
$$-a^3 - 7a^2$$
$$8a^2 + 49a$$
$$-8a^2 - 56a$$
$$-7a - 55$$
$$+7a + 55$$
$$0$$

31) $\frac{x^3-26x-41}{x+4}$

$$x^2 - 4x - 10 - \frac{1}{x+4}$$
$$x + 4 \overline{)\, x^3 - 0x^2 - 26x - 41}$$
$$-x^3 - 4x^2$$
$$-4x^2 - 26x$$
$$+4x^2 + 16x$$
$$-10x - 41$$
$$+10x + 40$$
$$1$$

33) $\frac{3n^3+9n^2-64n-68}{n+6}$

$$3n^2 - 9n - 10 - \frac{8}{n+6}$$
$$n + 6 \overline{)\, 3n^3 + 9n^2 - 64n - 68}$$
$$-3n^3 - 18n^2$$
$$-9n^2 - 64n$$
$$+9n^2 + 54n$$
$$-10n - 68$$
$$+10n + 60$$
$$-8$$

35) $\frac{x^3-46x+22}{x+7}$

$$x^2 - 7x + 3 + \frac{1}{x+7}$$
$$x + 7 \overline{)\, x^3 + 0x^2 - 46x + 22}$$
$$-x^3 - 7x$$
$$-7x - 46x$$
$$+7x + 49x$$
$$3x + 22$$
$$-3x - 21$$
$$1$$

37) $\frac{9p^3+45p^2+27p-5}{9p+9}$

$$p^2 + 4p - 1 + \frac{4}{9p+9}$$
$$9p + 9 \overline{)9p^3 + 45p^2 + 27p - 5}$$
$$\underline{-9p^3 - 9p}$$
$$36p^2 + 27p$$
$$\underline{-36p^2 - 36p}$$
$$-9p - 5$$
$$\underline{+9p + 9}$$
$$4$$

39) $\frac{r^3-r^2-16r+8}{r-4}$

$$r^2 + 3r - 4 - \frac{8}{r-4}$$
$$r - 4 \overline{)r^3 - r^2 - 16r + 8}$$
$$\underline{-r^3 + 4r^2}$$
$$3r^2 - 16r$$
$$\underline{-3r^2 + 12r}$$
$$-4r + 8$$
$$\underline{+4r - 16}$$
$$-8$$

41) $\frac{12n^3+12n^2-15n-4}{2n+3}$

$$6n^2 - 3n - 3 + \frac{5}{2n+3}$$
$$2n + 3 \overline{)12n^3 + 12n^2 - 15n - 4}$$
$$\underline{-12n^3 - 18n^2}$$
$$-6n^2 - 15n$$
$$\underline{+6n^2 + 9n}$$
$$-6n - 4$$
$$\underline{+6n + 9}$$
$$5$$

43) $\frac{4v^3-21v^2+6v+19}{4v+3}$

$$v^2 - 6v + 6 + \frac{1}{4v+3}$$
$$4v + 3 \overline{)4v^3 - 21v^2 + 6v + 19}$$
$$\underline{-4v^3 - 3v^2}$$
$$-24v^2 + 6v$$
$$\underline{+24v^2 + 18v}$$
$$24v + 19$$
$$\underline{-24v - 18}$$
$$1$$

Chapter 6: Factoring

6.1

1) $9 + 8x$
   $1(9 + 8x)$

3) $45x^2 - 25$
   $5(9x^2 - 5)$

5) $56 - 35p$
   $7(8 - 5p)$

7) $7ab - 36a^2b$
   $7ab(1 - 5a)$

9) $-3a^2b + 6a^3b^2$
   $-3a^2b(1 - 2ab)$

11) $-5x^2 - 5x^3 - 15x^4$
    $-5x^2(1 + x + 3x^2)$

13) $20x^4 - 30x + 30$
    $10(2x^4 - 3x + 3)$

15) $28m^4 + 40m^3 + 8$
    $4(7m^4 + 10m^3 + 2)$

17) $30b^9 + 5ab - 15a^2$
    $5(6b^9 + ab - 3a^2)$

19) $-48a^2b^2 - 56a^3b - 56a^5b$
    $-8a^2b(6b + 7a + 7a^3)$

21) $20x^8y^2z^2 + 15x^5y^2z + 35x^3y^3z$
    $5x^3y^2z(4x^5z + 3x^2 + 7y)$

23) $50x^2y + 10y^2 + 70xz^2$
    $10(5x^2y + y^2 + 7xz^2)$

25) $30qpr - 5qp + 5q$
    $5q(6pr - p + 1)$

27) $-18n^5 + 3n^3 - 21n + 3$
    $-3(6n^5 - n^3 + 7n - 1)$

29) $-40x^{11} - 20x^{12} + 50x^{13} - 50x^{14}$
    $-10x^{11}(4 + 22x - 5x^2 + 5x^3)$

31) $-32mn^8 + 4m^6n + 12mn^4 + 16mn$
    $-4mn(8n^7 - m^5 - 3n^3 - 4)$

6.2

1) $40r^3 - 8r^2 - 25r + 5$
   $8r^2(5r - 1) - 5(5r - 1)$
   $(5r - 1)(8r^2 - 5)$

3) $3n^2 - 2n^2 - 9n + 6$
   $n^2(3n - 2) - 3(3n - 2)$
   $(3n - 2)(n^2 - 3)$

5) $15b^3 + 21b^2 - 35b - 49$
   $3b^2(5b + 7) - 7(5b + 7)$
   $(5b + 7)(3b^2 - 7)$

7) $3x^3 + 15x^2 + 2x + 10$
   $3x^2(x + 5) + 2(x + 5)$
   $(x + 5)(3x^2 + 2)$

9) $35x^3 - 28x^2 - 20x + 16$
   $7x^2(5x - 4) - 4(5x - 4)$
   $(5x - 4)(7x^2 - 4)$

11) $7xy - 49x + 5y - 35$
    $7x(y - 7) + 5(y - 7)$
    $(y - 7)(7x + 5)$

13) $32xy + 40x^2 + 12y + 15x$
$8x(4y + 5x) + 3(4y + 5x)$
$(4y + 5x)(8x + 3)$

15) $16xy - 56x + 2y - 7$
$8x(2y - 7) + 1(2y - 7)$
$(2y - 7)(8x + 1)$

17) $2xy - 8x^2 + 7y^3 - 28y^2x$
$2x(y - 4x) + 7y^2(y - 4x)$
$(y - 4x)(2x + 7y^2)$

19) $40xy + 35x - 8y^2 - 7y$
$5x(8y + 7) - y(8y + 7)$
$(8y + 7)(5x - y)$

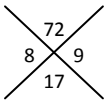
21) $32uv - 20u + 24v - 15$
$4u(8v - 5) + 3(8v - 5)$
$(8v - 5)(4u + 3)$

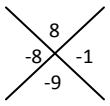
23) $10xy + 30 + 25x + 12y$
$10(xy + 3) + 1(25x + 12y)$
$No!$
$10xy + 25x + 12y + 30$
$5x(2y + 5) + 6(2y + 5)$
$(2y + 5)(5x + 6)$

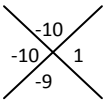
25) $3uv + 14u - 6u^2 - 7v$
$u(3v + 14) - 1(6u^2 + 7v)$
$No!$
$3uv - 6u^2 - 7v + 14u$
$3u(v - 2u) - 7(v - 2u)$
$(v - 2u)(3u - 7)$

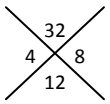
27) $16xy - 3x - 6x^2 + 8y$
$x(16y - 3) - 1(6x^2 - 8y)$
$No!$
$16xy - 6x^2 + 8y - 3x$
$2x(8y - 3x) + 1(8y - 3x)$
$(8y - 3x)(2x + 1)$

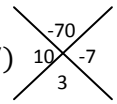
6.3

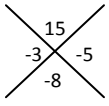
1) $p^2 + 17p + 72$
$(p + 8)(p + 9)$


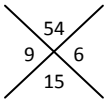
3) $n^2 - 9n + 8$
$(n - 8)(n - 1)$


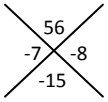
5) $x^2 - 9x - 10$
$(x - 10)(x + 1)$


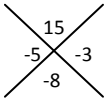
7) $b^2 + 12b + 32$
$(b + 4)(b + 8)$


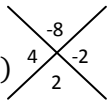
9) $x^2 + 3x - 70$
$(x + 10)(x - 7)$


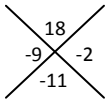
11) $n^2 - 8n + 15$
$(n - 3)(n - 5)$


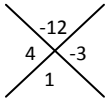
13) $p^2 + 15p + 54$
$(p + 9)(p + 6)$


15) $n^2 - 15n + 56$
$(n - 7)(n - 8)$


17) $u^2 - 8uv + 15v^2$
$(u - 5v)(u - 3v)$


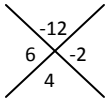
19) $m^2 - 2mn - 8n^2$
$(m + 4n)(m - 2n)$


21) $x^2 - 11xy - 12y^2$
$(x - 9y)(x - 2y)$


24) $x^2 + xy - 12y^2$
$(x + 4y)(x - 3y)$


26) $x^2 + 4xy - 12y^2$

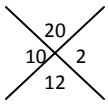
$(x + 6y)(x - 2y)$



27) $5a^2 + 60a + 100$

$5(a^2 + 12a + 20)$

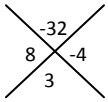
$5(a + 10)(a + 2)$



29) $6a^2 + 24a - 192$

$6(a^2 + 4a - 32)$

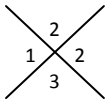
$6(a + 8)(a - 4)$



31) $6x^2 + 18xy + 12y^2$

$6(x^2 + 3xy + 2y^2)$

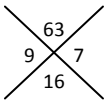
$6(x + y)(x + 2y)$



35) $6x^2 + 96xy + 378y^2$

$6(x^2 + 16xy + 63y^2)$

$6(x + 9y)(x + 7y)$



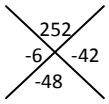
6.4

1) $7x^2 - 48x + 36$

$7x^2 - 6x - 42x + 36$

$x(7x - 6) - 6(7x - 6)$

$(7x - 6)(x - 6)$

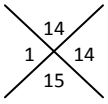


3) $7b^2 + 15b + 2$

$7b^2 + b + 14b + 2$

$b(7b + 1) + 2(7b + 1)$

$(7b + 1)(b + 2)$

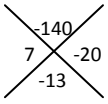


5) $5a^2 - 13a - 28$

$5a^2 + 7a - 20a - 28$

$a(5a + 7) - 4(5a + 7)$

$(5a + 7)(a - 4)$

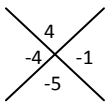


7) $2x^2 - 5x + 2$

$2x^2 - 4x - x + 2$

$2x(x - 2) - 1(x - 2)$

$(x - 2)(2x - 1)$

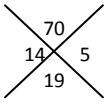


9) $2x^2 + 19x + 35$

$2x^2 + 14x + 5x + 35$

$2x(x + 7) + 5(x + 7)$

$(x + 7)(2x + 5)$

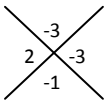


11) $2b^2 - b - 3$

$2b^2 + 2b - 3b - 3$

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

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

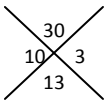


13) $5k^2 + 13k + 6$

$5k^2 + 10k + 3k + 6$

$5k(k + 2) + 3(k + 2)$

$(k + 2)(5k + 3)$

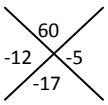


15) $3x^2 - 17x + 20$

$3x^2 - 12x - 5x + 20$

$3x(x - 4) - 5(x - 4)$

$(x - 4)(3x - 5)$

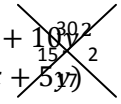


17) $3x^2 + 17xy + 10y^2$

$3x^2 + 15xy + 2xy + 10y^2$

$3x(x + 5y) + 2y(x + 5y)$

$(x + 5y)(3x + 2y)$

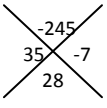


19) $5x^2 + 28xy - 49y^2$

$5x^2 + 35xy - 7xy - 49y^2$

$5x(x + 7y) - 7y(x + 7y)$

$(x + 7y)(5x - 7y)$



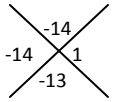
21) $6x^2 - 39x - 21$

$3(2x^2 - 13x - 7)$

$3(2x^2 - 14x + x - 7)$

$3(2x(x-7) + 1(x-7))$

$3(x-7)(2x+1)$



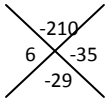
23) $21k^2 - 87k - 90$

$3(7k^2 - 29k - 30)$

$3(7k^2 + 6k - 35k - 30)$

$3(k(7k+6) - 5(7k+6))$

$3(7k+6)(k-5)$



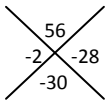
25) $14x^2 - 60x + 16$

$2(7x^2 - 30x + 8)$

$2(7x^2 - 2x - 28x + 8)$

$2\big(x(7x-2) - 4(7x-2)\big)$

$2(7x-2)(x-4)$

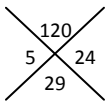


28) $6x^2 + 29x + 20$

$6x^2 + 5x + 24x + 20$

$x(6x+5) + 4(6x+5)$

$(6x+5)(x+4)$

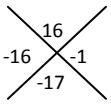


30) $4k^2 - 17k + 4$

$4k^2 - 16k - k + 4$

$4k(k-4) - 1(k-4)$

$(k-4)(4k-1)$

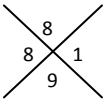


33) $4x^2 + 9xy + 2y^2$

$4x^2 + 8xy + xy + 2y^2$

$4x(x+2y) + y(x+2y)$

$(x+2y)(4+y)$

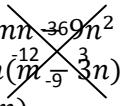


33) $4m^2 - 9mn - 9n^2$

$4m^2 - 12mn + 3mn - 9n^2$

$4m(m-3n) + 3n(m-3n)$

$(m-3n)(4m+3n)$

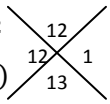


37) $4x^2 + 13xy + 3y^2$

$4x^2 + 12xy + xy + 3y^2$

$4x(x+3y) + y(x+3y)$

$(x+3y)(4x+y)$



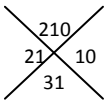
39) $12x^2 + 62xy + 70y^2$

$2(6x^2 + 31xy + 35y^2)$

$2(6x^2 + 21xy + 10xy + 35y^2)$

$2\big(3x(2x+7y) + 5y(2x+7y)\big)$

$2(2x+7y)(3x+5y)$



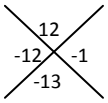
40) $24x^2 - 52xy + 8y^2$

$4(6x^2 - 13xy + 2y^2)$

$4(6x^2 - 12xy - xy + 2y^2)$

$4\big(6x(x-2y) - y(x-2y)\big)$

$4(x-2y)(6x-y)$



6.5

1) $r^2 - 16$

$(r)\quad(4)$

$(r+4)(r-4)$

3) $v^2 - 25$

$(v)\quad(5)$

$(v+5)(v-5)$

5) $p^2 - 4$

$(p)\quad(2)$

$(p+2)(p-2)$

7) $9k^2 - 4$

$(3k)\quad(2)$

$(3k+2)(3k-2)$

9) $3x^2 - 27$

$3(x^2 - 9)$

$(x)\ (3)$

$3(x+3)(x-3)$

11) $16x^2 - 36$

$4(4x^2 - 9)$

$(2x)\ (3)$

$4(2x+3)(2x-3)$

13) $18a^2 - 50b^2$

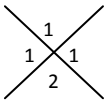
$2(9a^2 - 25b^2)$

$(3a) \quad (5b)$

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

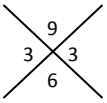
15) $a^2 - 2a + 1$

$(a - 1)^2$



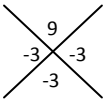
17) $x^2 + 6x + 9$

$(x + 3)^2$



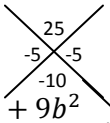
19) $x^2 - 6x + 9$

$(x + 3)^2$



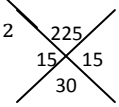
21) $25p^2 - 10p + 1$

$(5p - 1)^2$



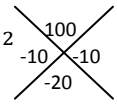
23) $25a^2 + 30ab + 9b^2$

$(5a + 3b)^2$



25) $4a^2 - 20ab + 25b^2$

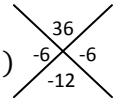
$(2a - 5b)^2$



27) $8x^2 - 24xy + 18y^2$

$2(4x^2 - 12xy + 9y^2)$

$2(2x - 3y)^2$



29) $8 - m^3$

$(2) \ (m)$

$(2 - m)(4 + 2m + m^2)$

31) $x^3 - 64$

$(x) \quad (4)$

$(x - 4)(x^2 + 4x + 16)$

33) $216 - u^3$

$(6) \quad (u)$

$(6 - u)(36 + 6u + u^2$

35) $125a^3 - 64$

$(5a) \quad (4)$

$(5a - 4)(25a^2 + 20a + 16)$

37) $64x^3 + 27y^3$

$(4x) \quad (3y)$

$(4x + 3y)(16x^2 - 12xy + 9y^2)$

39) $54x^3 + 250y^3$

$2(27x^3 + 125y^3)$

$(3x) \quad (5y)$

$2(3x + 5y)(9x^2 - 15xy + 25y^2$

41) $a^4 - 81$

$(a^2) \ (9)$

$(a^2 + 9)(a^2 - 9)$

$(a) \ (3)$

$(a^2 + 9)(a + 3)(a - 3)$

43) $16 - z^4$

$(4) \ (z^2)$

$(4 + z^2)(4 - z^2)$

$(2) \ (z)$

$(4 + z^2)(2 + z)(2 - z)$

45) $x^4 - y^4$

$(x^2) \ (y^2)$

$(x^2 + y^2)(x^2 - y^2)$

$(x) \ (y)$

$(x^2 + y^2)(x + y)(x - y)$

47) $m^4 - 81b^4$

$(m^2) \ (9b^2)$

$(m^2 + 9b^2)(m^2 - 9b^2)$

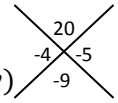
$(m) \quad (3b)$

$(m^2 + 9b^2)(m + 3b)(m - 3b)$

6.6

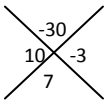
1) $24az - 18ah + 60yz - 45yh$
$3(8az - 6ah + 20yz - 15yh)$
$3(2a(4z - 3h) + 5y(4z - 3h)$
$3(4z - 3h)(2a + 5y)$

3) $5u^2 - 9uv + 4v^2$
$5u^2 - 4uv - 5uv + 4v^2$
$u(5u - 4v) - v(5u - 4v)$
$(5u - 4v)(u - v)$



5) $-2x^3 + 128y^3$
$-2(x^3 - 64y^3)$
$(x) \quad (4y)$
$-2(x - 4y)(x^2 + 4xy + 16y^2)$

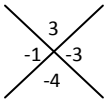
7) $5n^3 + 7n^2 - 6n$
$n(5n^2 + 7n - 6)$
$n(5n^2 + 10n - 3n - 6)$
$n\big(5n(n + 2) - 3(n + 2)\big)$
$n(n + 2)(5n - 3)$



9) $54u^3 - 16$
$2(27u^3 - 8)$
$(3u) \quad (2)$
$2(3u - 2)(9u^2 + 6u + 4)$

11) $n^2 - n$
$n(n - 1)$

13) $x^2 - 4xy + 3y^2$
$x^2 - xy - 3xy + 3y^2$
$x(x - y) - 3y(x - y)$
$(x - y)(x - 3y)$



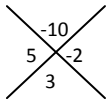
15) $9x^2 - 25y^2$
$(3x) \quad (5y)$
$(3x + 5y)(3x - 5y)$

17) $m^2 - 4n^2$
$(m) \; (2n)$
$(m + 2n)(m - 2n)$

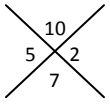
19) $36b^2c - 16xd - 24b^2d + 24xc$
$4(9b^2c - 4xd - 6b^2d + 6xc)$
~~$4(1(9b^2c - 4xd) - 6(b^2d + xc)$~~
$4(9b^2c - 6b^2d + 6xc - 4xd)$
$4(3b^2(3c - 2d) + 2x(3c - 2d)$
$4(3c - sd)(3b^2 + 2x)$

21) $128 + 54x^3$
$2(64 + 27x^3)$
$(4) \quad (3x)$
$2(4 + 3x)(16 - 12x + 9x^2)$

23) $2x^3 + 6x^2y - 20y^2x$
$2x(x^2 + 3xy - 10y^2)$
$2x(x + 5y)(x - 2y)$



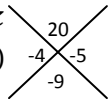
25) $n^3 + 7n^2 + 10n$
$n(n^2 + 7n + 10)$
$n(n + 5)(n + 2)$



27) $27x^3 - 64$
$(3x) \quad (4)$
$(3x - 4)(9x^2 + 12x + 16)$

29) $5x^2 + 2x$
$x(5x + 2)$

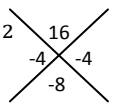
31) $3k^3 - 27k^2 + 60k$
$3k(k^2 - 9k + 20)$
$3k(k - 4)(k - 5)$



33) $mn - 12x + 3m - 4xn$

~~$1(mn - 12x) + 1(3m - 4xn)$~~
$mn + 3m - 4xn - 12x$
$m(n + 3) - 4x(n + 3)$
$(n + 3)(m - 4x)$

35) $16x^2 - 8xy + y^2$
$(4x - y)^2$



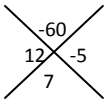
37) $27m^2 - 48n^2$

$3(9m^2 - 16n^2)$

$(3m)\ \ (4n)$

$3(3m + 4n)(3m - 4n)$

39) $9x^3 + 21x^2y - 60y^2x$



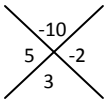
$3x(3x^2 + 7xy - 20y^2)$

$3x(3x^2 + 12xy - 5xy - 20y^2)$

$3x\big(3x(x + 4y) - 5y(x + 4y)\big)$

$3x(x + 4y)(3x - 5y)$

41) $2m^2 + 6mn - 20n^2$



$2(m^2 + 3mn - 10n^2)$

$2(m + 5n)(m - 2n)$

6.7

1) $(k - 7)(k + 2) = 0$

$k - 7 = 0 \quad k + 2 = 0$

$+7 \quad +7 \qquad -2 \quad -2$

$k = 7 \qquad k = -2$

3) $(x - 1)(x + 4) = 0$

$x - 1 = 0 \quad x + 4 = 0$

$+1 \quad +1 \qquad -4 \quad -4$

$x = 1 \qquad x = -4$

5) $6x^2 - 150 = 0$

$6(x^2 - 25) = 0$

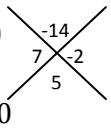
$6(x + 5)(x - 5) = 0$

$x + 5 = 0 \quad x - 5 = 0$

$-5 \quad -5 \qquad +5 \quad +5$

$x = -5 \qquad x = 5$

7) $2n^2 + 10n - 28 = 0$



$2(n^2 + 5n - 14) = 0$

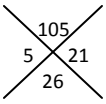
$2(n + 7)(n - 2) = 0$

$n + 7 = 0 \quad n - 2 = 0$

$-7 \quad -7 \qquad +2 \quad +2$

$n = -7 \qquad n = 2$

9) $7x^2 + 26x + 15 = 0$



$7x^2 + 5x + 21x + 15 = 0$

$x(7x + 5) + 3(7x + 5) = 0$

$(7x + 5)(x + 3) = 0$

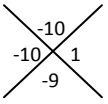
$7x + 5 = 0 \quad x + 3 = 0$

$-5 \quad -5 \qquad -3 \quad -3$

$\frac{7x}{7} = \frac{-5}{7} \qquad x = -3$

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

11) $5n^2 - 9n - 2 = 0$



$5n^2 - 10n + n - 2 = 0$

$5n(n - 2) + 1(n - 2) = 0$

$(n - 2)(5n + 1) = 0$

$n - 2 = 0 \quad 5n + 1 = 0$

$+2 \quad +2 \qquad -1 \quad -1$

$n = 2 \qquad \frac{5n}{5} = \frac{-1}{5}$

$n = -\frac{1}{5}$

13) $x^2 - 4x - 8 = -8$

$+8 \quad +8$

$x^2 - 4x = 0$

$x(x - 4) = 0$

$x = 0 \quad x - 4 = 0$

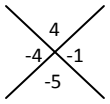
$+4 \quad +4$

$x = 4$

15) $x^2 - 4x - 1 = -5$

$+5 \quad +5$

$x^2 - 4x + 4 = 0$



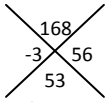
$(x-4)(x-1) = 0$

$x - 4 = 0 \quad x - 1 = 0$

$+4 \ +4 \quad +1 \ +1$

$x = 4 \quad x = 1$

17) $49p^2 + 371p - 241 = 0$



$7(7p^2 + 53p - 24) = 0$

$7(7p^2 - 3p + 56p - 24) = 0$

$7(p(7p-3) + 8(7p-3) = 0$

$7(7p-3)(p+8) = 0$

$7p - 3 = 0 \quad p + 8 = 0$

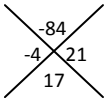
$+3 \ +3 \quad -8 \ -8$

$\frac{7p}{7} = \frac{3}{7} \quad p = -8$

$p = \frac{3}{7}$

19) $7x^2 + 17x - 20 = -8$

$+8 \quad +8$



$7x^2 + 17x - 12 = 0$

$7x^2 - 4x + 21x - 12 = 0$

$x(7x-4) + 3(7x-4) = 0$

$(7x-4)(x+3) = 0$

$7x - 4 = 0 \quad x + 3 = 0$

$+4 \ +4 \quad -3 \ -3$

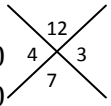
$\frac{7x}{7} = \frac{4}{7} \quad x = -3$

$x = \frac{4}{7}$

21) $7r^2 + 84 = -49r$

$+49r \quad +49r$

$7r^2 + 49r + 84 = 0$



$7(r^2 + 7r + 12) = 0$

$7(r^2 + 7r + 12) = 0$

$7(r+4)(r+3) = 0$

$r + 4 = 0 \quad r + 3 = 0$

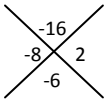
$-4 \ -4 \quad -3 \ -3$

$r = -4 \quad r = -3$

23) $x^2 - 6x = 16$

$-16 \ -16$

$x^2 - 6x - 16 = 0$



$(x-8)(x+2) = 0$

$x - 8 = 0 \quad x + 2 = 0$

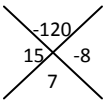
$+8 \ +8 \quad -2 \ -2$

$x = 8 \quad x = -2$

25) $3v^2 + 7v = 40$

$-40 \ -40$

$3v^2 + 7v - 40 = 0$



$3v^2 + 15v - 8v - 40 = 0$

$3v(v+5) - 8(v+5) = 0$

$(v+5)(3v-8) = 0$

$v + 5 = 0 \quad 3v - 8 = 0$

$-5 \ -5 \quad +8 \ +8$

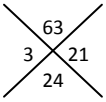
$v = -5 \quad \frac{3v}{3} = \frac{8}{3}$

$v = \frac{8}{3}$

27) $35x^2 + 120x = -45$

$+45 \quad +45$

$35x^2 + 120x + 45 = 0$



$5(7x^2 + 24x + 9) = 0$

$5(7x^2 + 3x + 21x + 9) = 0$

$5\big(x(7x+3) + 3(7x+3)\big) = 0$

$5(7x+3)(x+3) = 0$

$7x + 3 = 0 \quad x + 3 = 0$

$-3 \ -3 \quad -3 \ -3$

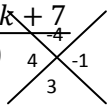
$\frac{7x}{7} = \frac{-3}{7} \quad x = -3$

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

29) $4k^2 + 18k - 23 = 6k - 7$

$-6k + 7 \quad -6k + 7$

$4k^2 + 12k - 16 = 0$



$4(k^2 + 3k - 4) = 0$

$4(k+4)(k-1) = 0$

$k + 4 = 0 \quad k - 1 = 0$

$-4 \ -4 \quad +1 \ +1$

$k = -4 \quad k = 1$

31) $9x^2 - 46 + 7x = 7x + 8x^2 + 3$

$-8x^2 - 3 \quad -7x \quad -7x - 8x^2 - 3$

$x^2 - 49 = 0$

$(x + 7)(x - 7) = 0$

$x + 7 = 0 \quad x - 7 = 0$

$-7 \quad -7 \qquad +7 \quad +7$

$x = -7 \qquad x = 7$

33) $2m^2 + 19m + 40 = -2m$

$+2m \qquad\qquad +2m$

$2m^2 + 21m + 40 = 0$

$2m^2 + 4m + 16m + 40 = 0$

$m(2m + 5 + 8(2m + 5) = 0$

$(2m + 5)(m + 8) = 0$

80, 5, 16, 21

$2m + 5 = 0 \quad m + 8 = 0$

$-5 \quad -5 \qquad -8 \quad -8$

$\frac{2m}{2} = \frac{-5}{2} \qquad m = -8$

$m = -\frac{5}{2}$

35) $40p^2 + 183p - 168 = p + 5p^2$

$-5p^2 \qquad -p \qquad\qquad -p - 5p^2$

$35p^2 + 182p - 168 = 0$

-120, -4, 30, 26

$7(5p^2 + 26p - 24) = 0$

$7(5p^2 - 4p + 30p - 24) = 0$

$7\big(p(5p - 4) + 6(5p - 4)\big) = 0$

$7(5p - 4)(p + 6) = 0$

$5p - 4 = 0 \quad p + 6 = 0$

$+4 \quad +4 \qquad -6 \quad -6$

$\frac{5p}{5} = \frac{4}{5} \qquad p = -6$

$p = \frac{4}{5}$

Chapter 7: Rational Expressions

7.1

1) $\frac{3k^2+30k}{k+10}$

$k+10 \neq 0$

$-10 \quad -10$

$k \neq -10$

3) $\frac{15n^2}{10n+25}$

$10n+25 \neq 0$

$-25 \quad -25$

$\frac{10n}{10} \neq -\frac{25}{10}$

$n \neq -\frac{5}{2}$

5) $\frac{10m^2+8m}{10m}$

$\frac{10m}{10} \neq \frac{0}{10}$

$m \neq 0$

7) $\frac{r^2+3r+12}{5r+10}$

$5r+10 \neq 0$

$-10 \quad -10$

$\frac{5r}{5} \neq -\frac{10}{5}$

$r \neq -2$

9) $\frac{b^2+12b+32}{b^2+4b-32}$

$b^2+4b-32 \neq 0$

$(b+8)(b-4) \neq 0$

$b+8 \neq 0 \quad b-4 \neq 0$

$-8 \quad -8 \quad +4 \quad +4$

$b \neq -8 \quad b \neq 4$

11) $\frac{21x^2}{18x} = \frac{7x}{6}$

13) $\frac{24a}{40a^2} = \frac{3}{5a}$

15) $\frac{32x^3}{8x^4} = \frac{4}{x}$

17) $\frac{18m-24}{60} = \frac{6(3m-4)}{60} = \frac{3m-4}{10}$

19) $\frac{20}{4+2p} = \frac{20}{2(2+p)} = \frac{10}{2+p}$

21) $\frac{x+1}{x^2+8x+7} = \frac{x+1}{(x+7)(x+1)} = \frac{1}{x+7}$

23) $\frac{32x^2}{28x^2+28x} = \frac{32x^2}{28x(x+1)} = \frac{8x}{7(x+1)}$

25) $\frac{n^2+4n-12}{n^2-7n+10} = \frac{(n+6)(n-2)}{(n-5)(n-2)} = \frac{n+6}{n-5}$

27) $\frac{9v+54}{v^2-4v-60} = \frac{9(v+6)}{(v-10)(v+6)} = \frac{9}{v-10}$

29) $\frac{12x^2-42x}{30x^2-42x} = \frac{6x(2x-7)}{6x(5x-7)} = \frac{2x-7}{5x-7}$

31) $\frac{6a-10}{10a+4} = \frac{2(3a-5)}{2(5a+2)} = \frac{3a-5}{5a+2}$

33) $\frac{2n^2+19n-10}{9n+90} = \frac{(2n-1)(n+10)}{9(n+10)} = \frac{2n-1}{9}$

35) $\frac{8m+16}{20m-12} = \frac{8(m+2)}{4(5m-3)} = \frac{2(m+2)}{5m-3}$

37) $\frac{2x^2-10x+8}{3x^2-7x+4} = \frac{2(x-4)(x-1)}{(3x-4)(x-1)} = \frac{2(x-4)}{3x-4}$

39) $\frac{7n^2-32n+16}{4n-16} = \frac{(7n-4)(n-4)}{4(n-4)} = \frac{7n-4}{4}$

41) $\frac{n^2-2n+1}{6n+6} = \frac{(n-1)^2}{6(n+1)}$

43) $\frac{7a^2-26a-45}{6a^2-34a+20} = \frac{(7a+9)(a-5)}{2(3a-2)(a-5)} = \frac{7a+9}{2(3a-2)}$

7.2

1) $\frac{\cancel{8}^{4}x^2}{\cancel{9}} \cdot \frac{\cancel{9}}{\cancel{2}} = 4x^2$

3) $\frac{\cancel{9}n}{\cancel{2}n} \cdot \frac{7}{5n} = \frac{63}{10n}$

5) $\frac{5x^2}{\cancel{4}_{2}} \cdot \frac{\cancel{6}^{3}}{\cancel{5}} = \frac{3x^2}{2}$

7) $\frac{\cancel{7(m-6)}}{\cancel{m-6}} \cdot \frac{5m\cancel{(7m-5)}}{\cancel{7(7m-5)}} = 5m$

9) $\frac{7r}{7r(r+10)} \div \frac{r-6}{(r-6)^2} = \frac{\cancel{7r}}{\cancel{7r}(r+10)} \cdot \frac{(r-6)^{\cancel{2}}}{\cancel{r-6}} = \frac{r-6}{r+10}$

11) $\frac{25n+25}{5} \cdot \frac{4}{30n+30} = \frac{\cancel{25(n+1)}}{\cancel{5}} \cdot \frac{\cancel{4}^{2}}{3\cancel{30(n+1)}} = \frac{2}{3}$

13) $\frac{x-10}{35x+21} \div \frac{7}{3x+21} = \frac{x-10}{35x+21} \cdot \frac{35x+21}{7} = \frac{x-10}{\cancel{7(5x+3)}} \cdot \frac{\cancel{7(5x+3)}}{7} = \frac{x-10}{7}$

15) $\frac{x^2-6x-7}{x+5} \cdot \frac{x+5}{x-7} = \frac{\cancel{(x-7)}(x+1)}{\cancel{x+5}} \cdot \frac{\cancel{x+5}}{\cancel{x-7}} = x+1$

17) $\frac{8k}{24k^2-40k} \div \frac{1}{15k-25} = \frac{8k}{24k^2-40k} \cdot \frac{15k-25}{1} = \frac{\cancel{8k}}{\cancel{8k}(3k-5)} \cdot \frac{5\cancel{(3k-5)}}{1} = 5$

19) $(n-8) \cdot \frac{6}{10n-80} = \frac{\cancel{n-8}}{1} \cdot \frac{\cancel{6}^{3}}{5\cancel{10(n-8)}} = \frac{3}{5}$

21) $\frac{4m+36}{m+9} \cdot \frac{m-5}{5m^2} = \frac{4\cancel{(m+9)}}{\cancel{m+9}} \cdot \frac{m-5}{5m^2} = \frac{4(m-5)}{5m^2}$

23) $\frac{3x-6}{12x-24} \cdot (x+3) = \frac{\cancel{3(x-2)}}{4\cancel{12(x-2)}} \cdot \frac{x+3}{1} = \frac{x+3}{4}$

25) $\frac{b+2}{40b^2-24b} \cdot (5b-3) = \frac{b+2}{8b\cancel{(5b-3)}} \cdot \frac{\cancel{5b-3}}{1} = \frac{b+2}{8b}$

27) $\frac{n-7}{6n-12} \cdot \frac{12-6n}{n^2+13n+42} = \frac{\cancel{n-7}}{\cancel{6(n-2)}} \cdot \frac{\cancel{-6(n-2)}}{\cancel{(n-7)}(n-6)} = \frac{-1}{n-6}$

29) $\frac{27a+36}{9a+63} \div \frac{6a+8}{2} = \frac{27a+36}{9a+63} \cdot \frac{2}{6a+8} = \frac{\cancel{9(3a+4)}}{\cancel{9}(a+7)} \cdot \frac{\cancel{2}}{\cancel{2}(3a+4)} = \frac{1}{a+7}$

31) $\frac{x^2-12x+32}{x^2-6x-16} \cdot \frac{7x^2+14x}{7x^2+21x} = \frac{\cancel{(x-8)}(x-4)}{\cancel{(x-8)}(x+2)} \cdot \frac{\cancel{7x(x+2)}}{\cancel{7x}(x+3)} = \frac{x-4}{x+3}$

33) $(10m^2+100m)\cdot\frac{18m^3-36m^2}{20m^2-40m}=\frac{10m(m+10)}{1}\cdot\frac{18m^2(m-2)}{20m(m-2)}=9m^2(m+10)$

35) $\frac{7p^2+25p+12}{6p+48}\cdot\frac{3p-8}{21p^2-44p-32}=\frac{(7p+4)(p+3)}{6(p+8)}\cdot\frac{3p-8}{(7p+4)(3p-8)}=\frac{p+3}{6(p+8)}$

37) $\frac{10b^2}{30b+20}\cdot\frac{30b+20}{2b^2+10b}=\frac{10b^2}{10(3b+2)}\cdot\frac{10(3b+2)}{2b(b+5)}=\frac{5b}{b+5}$

39) $\frac{7r^2-53r-24}{7r+2}\div\frac{49r+21}{49r+14}=\frac{7r^2-53r-24}{7r+2}\cdot\frac{49r+14}{49r+21}=\frac{(7r+3)(r-8)}{7r+2}\cdot\frac{7(7r+2)}{7(7r+3)}=r-8$

41) $\frac{x^2-1}{2x-4}\cdot\frac{x^2-4}{x^2-x-2}\div\frac{x^2+x-2}{3x-6}=\frac{x^2-1}{2x-4}\cdot\frac{x^2-4}{x^2-x-2}\cdot\frac{3x-6}{x^2+x-2}=\frac{(x+1)(x-1)}{2(x-2)}\cdot\frac{(x+2)(x-2)}{(x-2)(x+1)}\cdot\frac{3(x-2)}{(x+2)(x-1)}=\frac{3}{2}$

43) $\frac{x^2+3x+9}{x^2+x-12}\cdot\frac{x^2+2x-8}{x^3-27}\div\frac{x^2-4}{x^2-6x+9}=\frac{x^2+3x+9}{x^2+x-12}\cdot\frac{x^2+2x-8}{x^3-27}\cdot\frac{x^2-6x+9}{x^2-4}=$

$\frac{x^2+3x+9}{(x+4)(x-3)}\cdot\frac{(x+4)(x-2)}{(x-3)(x^2+3x+9)}\cdot\frac{(x-3)^2}{(x-2)(x+2)}=\frac{1}{x+2}$

7.3

1) $\frac{(6)}{(6)}\frac{3}{8}=\frac{?}{48}$

$\frac{18}{48}$

3) $\frac{(y)}{(y)}\frac{a}{x}=\frac{?}{xy}$

$\frac{ay}{xy}$

5) $\frac{(3a^2c^3)}{(3a^2c^3)}\frac{2}{3a^3b^2c}=\frac{?}{9a^3b^2c^4}$

$\frac{6a^2c^3}{9a^3b^2c^4}$

7) $\frac{(x-4)}{(x-4)}\frac{2}{x+4}=\frac{?}{x^2-16}$

$(x+4)(x-4)$

$\frac{2x-8}{(x+4)(x-4)}$

9) $\frac{(x+3)}{(x+3)}\frac{(x-4)}{(x+2)}=\frac{?}{x^2+5x+6}$

$(x+2)(x+3)$

$\frac{x^2-4x+3x-12}{(x+2)(x+3)}=\frac{x^2-x-12}{(x+2)(x+3)}$

11) $2a^3, 6a^4b^2, 4a^3b^5$

$12a^4b^5$

13) $x^3-3x, \quad x-3, x$

$x(x^2-3)$

$x(x-3)$

15) $x+2,\ x-4$

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

17) $x^2-25, \qquad x+5$

$(x+5)(x-5)$

$(x+5)(x-5)$

19) $x^2+3x+2, \quad x^2+5x+6$

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

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

21) $\frac{(2a^3)}{(2a^3)}\frac{3a}{5b^2}\ ,\ \frac{2}{10a^3b}\frac{(b)}{(b)}$

$LCD=10a^3b^2$

$\frac{6a^4}{10a^3b^2}\ ,\ \frac{2b}{10a^3b^2}$

23) $\frac{(x+2)}{(x+2)}\frac{x+2}{x-3}, \frac{(x-3)}{(x+2)}\frac{(x-3)}{(x-3)}$

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

$\frac{x^2+4x+4}{(x-3)(x+2)}, \frac{x^2-6x+9}{(x-3)(x+2)}$

25) $\frac{(x-4)}{(x-4)}\frac{x}{x^2-16}, \frac{3x}{x^2-8x+16}\frac{(x+4)}{(x+4)}$

$(x-4)(x+4)\quad (x-4)(x-4)$

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

27) $\frac{4x}{x^2-x-6}, \quad \frac{x+2}{x-3}\frac{(x+2)}{(x+2)}$

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

$LCD: (x-3)(x+2)$

$\frac{4x}{(x-3)(x+2)}, \frac{x^2+4x+4}{(x-3)(x+2)}$

7.4

1) $\frac{2}{a+3}+\frac{4}{a+3}=\frac{6}{a+3}$

3) $\frac{t^2+4t}{t-1}+\frac{2t-7}{t-1}=\frac{t^2+6t-7}{t-1}=\frac{(t+7)(t-1)}{t-1}=t+7$

5) $\frac{2x^2+3}{x^2-6x+5}+\frac{-x^2+5x+(-9)}{x^2-6x+5}=\frac{x^2+5x-6}{x^2-6x+5}=$
$\frac{(x+6)(x-1)}{(x+5)(x-1)}=\frac{x+6}{x+5}$

7) $\frac{(4)}{(4)}\frac{5}{6r}+\frac{-5}{8r}\frac{(3)}{(3)}$

$LCD: 24r$

$\frac{20}{24r}+\frac{-15}{24r}=\frac{5}{24r}$

9) $\frac{(2)}{(2)}\frac{8}{9t^3}+\frac{5}{6t^2}\frac{(3t)}{(3t)}$

$LCD: 18t^3$

$\frac{16}{18t^3}+\frac{15t}{18t^3}=\frac{16+15t}{18t^3}$

11) $\frac{(2)}{(2)}\frac{a+2}{2}+\frac{-a+4}{4}$

$LCD: 4$

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

13) $\frac{x-1}{4x}+\frac{-2x-3}{x}\frac{(4)}{(4)}$

$LCD: 4x$

$\frac{x-1}{4x}+\frac{-8x-12}{4x}=\frac{-7x-13}{4x}$

15) $\frac{(y)}{(y)}\frac{5x+3y}{2x^2y}+\frac{-3x-4y}{xy^2}\frac{(2x)}{(2x)}$

$LCD: 2x^2y^2$

$\frac{5xy+3y^2}{2x^2y^2}+\frac{-6x^2-8xy}{2x^2y^2}=\frac{-6x^2-3xy+3y^2}{2x^2y^2}$

17) $\frac{(z+1)}{(z+1)}\frac{2z}{z-1}+\frac{-3z}{z+1}\frac{(z-1)}{(z-1)}$

$LCD: (z-1)(z+1)$

$\frac{2z^2+2z}{(z-1)(z+1)}+\frac{-3z^2+3z}{(z-1)(z+1)}=\frac{-a^2+5z}{(z-1)(z+1)}$

19) $\frac{8}{x^2-4}+\frac{-3}{x+2}\frac{(x-2)}{(x-2)}$

$LCD: (x+2)(x-2)$

$\frac{8}{(x+2)(x-2)}+\frac{-3x+6}{(x+2)(x-2)}=\frac{-3x+14}{(x+2)(x-2)}$

21) $\frac{(4)}{(4)}\frac{t}{t-3}+\frac{-5}{4t-12}$

$LCD: 4(t-3)$

$\frac{4t}{4(t-3)}+\frac{-5}{4(t-3)}=\frac{4t-5}{4(t-3)}$

23) $\frac{(3)}{(3)}\frac{2}{5x^2+5x}+\frac{-4}{3x+3}\frac{(5x)}{(5x)}$

$5x(x+1)\quad 3(x+1)$

$LCD: 15x(x+1)$

$\frac{6}{15x(x+1)}+\frac{-20x}{15x(x+1)}=\frac{6-20x}{15x(x+1)}$

25) $\frac{(y+t)}{(y+t)}\frac{t}{y-t}+\frac{-y}{y+t}\frac{(y-t)}{(y-t)}$

$LCD: (y+t)(y-t)$

$\frac{yt+t^2}{(y+t)(y-t)}+\frac{-y^2+yt}{(y+t)(y-t)}=\frac{t^2+2yt-y^2}{(y+t)(y-t)}$

27) $\frac{(x+1)}{(x+1)}\frac{x}{x^2+5x+6}+\frac{-2}{x^2+3x+2}\frac{(x+3)}{(x+3)}$

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

$LCD: (x+1)(x+2)(x+3)$

$\frac{x^2+x}{(x+1)(x+2)(x+3)}+\frac{-2x-6}{(x+1)(x+2)(x+3)}=\frac{x^2-x-6}{(x+1)(x+2)(x+3)}=\frac{(x-3)(x+2)}{(x+1)(x+2)(x+3)}=\frac{x-3}{(x+1)(x+3)}$

29) $\frac{(x+6)}{(x+6)}\frac{x}{x^2+15x+56}+\frac{-7}{x^2+13x+42}\frac{(x+8)}{(x+8)}$

$(x+7)(x+8)\quad (x+7)(x+6)$

$LCD: (x+6)(x+7)(x+8)$

$\frac{x^2+6x}{(x+6)(x+7)(x+8)}+\frac{-7x-56}{(x+6)(x+7)(x+8)}=\frac{x^2-x-56}{(x+6)(x+7)(x+8)}=\frac{(x-8)(x+7)}{(x+6)(x+7)(x+8)}=\frac{x-8}{(x+6)(x+8)}$

31) $\frac{(x+3)}{(x+3)}\frac{5x}{x^2-x-6}+\frac{-18}{x^2-9}\frac{(x+2)}{(x+2)}$

$(x-3)(x+2)\quad (x+3)(x-3)$

$LCD: (x+2)(x-3)(x+3)$

$\frac{5x^2+15x}{(x+2)(x-3)(x+3)}+\frac{-18x-36}{(x+2)(x-3)(x+3)}=\frac{5x^2-3x-36}{(x+2)(x-3)(x+3)}=\frac{(5x+12)(x-3)}{(x+2)(x-3)(x+3)}=\frac{5x+12}{(x+2)(x+3)}$

33) $\frac{(x+3)}{(x+3)}\frac{2x}{x^2-1}+\frac{-4}{x^2+2x-3}\frac{(x+1)}{(x+1)}$

$(x+1)(x-1)\ (x+3)(x-1)$

$LCD: (x+3)(x+1)(x-1)$

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

35) $\frac{(x+2)}{(x+2)}\frac{x+1}{x^2-2x-35}+\frac{x+6}{x^2+7x+10}\frac{(x-7)}{(x-7)}$

$(x-7)(x+5)\quad (x+5)(x+2)$

$LCD: (x+2)(x+5)(x-7)$

$\frac{x^2+x+2x+2}{(x+2)(x+5)(x-7)}+\frac{x^2-7x+6x-42}{(x+2)(x+5)(x-7)}=\frac{2x^2+2x-40}{(x+2)(x+5)(x-7)}=\frac{2(x+5)(x-4)}{(x+2)(x+5)(x-7)}=\frac{2(x-4)}{(x-7)(x+2)}$

37) $\frac{(-1)}{(-1)}\frac{4-a^2}{a^2-9}+\frac{-a+2}{3-a}\frac{(a+3)}{(a+3)}$

$(a+3)(a-3)\ (-1)(a-3)$

$LCD: (-1)(a+3)(a-3)$

$\frac{a^2-4}{(-1)(a+3)(a-3)}+\frac{-a^2-3a+2a+6}{(-1)(a+3)(a-3)}=\frac{-a+2}{(-1)(a+3)(a-3)}$

39) $\frac{(2z+1)}{(2z+1)}\frac{2z}{1-2z}+\frac{(-1)(2z-1)}{(-1)(2z-1)}\frac{3z}{2z+1}+\frac{-3}{4z^2-1}\frac{(-1)}{(-1)}$

$(-1)(2z-1)\qquad (2z+1)(2z-1)$

$LCD: (-1)(2z-1)(2z+1)$

$\frac{4z^2+2z}{(-1)(2z-1)(2z+1)}+\frac{-6z^2+3z}{(-1)(2z-1)(2z+1)}+\frac{3}{(-1)(2z-1)(2z+1)}=\frac{-2z^2+5z+3}{(-1)(2z-1)(2z+1)}=\frac{(-1)(2z+1)(z-3)}{(-1)(2z-1)(2z+1)}=\frac{z-3}{2z-1}$

41) $\frac{(x+3)}{x+3}\frac{2x-3}{x^2+3x+2}+\frac{3x-1}{x^2+5x+6}\frac{(x+1)}{(x+1)}$

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

$LCD: (x+1)(x+2)(x+3)$

$\frac{2x^2-3x+6x-9}{(x+1)(x+2)(x+3)}+\frac{3x^2+3x-x-1}{(x+1)(x+2)(x+3)}=\frac{(5x^2+5x-10)}{(x+1)(x+2)(x+3)}=\frac{5(x+2)(x-1)}{(x+1)(x+2)(x+3)}=\frac{5(x-1)}{(x+1)(x+3)}$

43) $\frac{(x+5)}{(x+5)}\frac{(2x+7)}{(x^2-2x-3)}+\frac{-3x+2}{x^2+6x+5}\frac{(x-3)}{(x-3)}$

$(x-3)(x+1)\quad (x+5)(x+1)$

$LCD: (x+1)(x-3)(x+5)$

$\frac{2x^2+7x+10x+35}{(x+1)(x-3)(x+5)}+\frac{(-3x^2+9x+2x-6)}{(x+1)(x-3)(x+5)}=\frac{-x^2+28x+29}{(x+1)(x-3)(x+5)}=\frac{-1(x-29)(x+1)}{(x+1)(x-3)(x+5)}=\frac{(-1)(x-29)}{(x-3)(x+5)}$

7.5

1) $\frac{(x^2)1+\frac{1}{x}(x^2)}{(x^2)1-\frac{1}{x^2}(x^2)}=\frac{x^2+x}{x^2-1}=\frac{x(x+1)}{(x+1)(x-1)}=\frac{x}{x-1}$

3) $\frac{(a)a-2(a)}{(a)\frac{4}{a}-a(a)}=\frac{a^2-2a}{4-a^2}=\frac{a(a-2)(-1)}{(2+a)(2-a)}=\frac{-a}{a+2}$

5) $\frac{(a^2)\frac{1}{a^2}-\frac{1}{a}(a^2)}{(a^2)\frac{1}{a^2}+\frac{1}{a}(a^2)}=\frac{1-a}{1+a}$

7) $\frac{(x+2)\ 2-\frac{4}{x+2}(x+2)}{(x+2)\ 5-\frac{10}{x+2}(x+2)}=\frac{2x+4-4}{5x+10-10}=\frac{2x}{5x}=\frac{2}{5}$

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

11) $\frac{x(x+1)\ \frac{x}{x+1}-\frac{1}{x}\ x(x+1)}{x(x+1)\ \frac{x}{x+1}+\frac{1}{x}\ x(x+1)}=\frac{x^2-x-1}{x^2+x+1}$

13) $\frac{(x^2)\frac{3}{x}}{(x^2)\frac{9}{x^2}}=\frac{3x}{9}=\frac{x}{3}$

15) $\frac{(16a^2b^2)\frac{a^2-b^2}{4a^2b}}{(16a^2b^2)\frac{a+b}{16ab^2}} = \frac{4b(a^2-b^2)}{a(a+b)} = \frac{4b(a+b)(a-b)}{a(a+b)} = \frac{4b(a-b)}{a}$

17) $\frac{(x^2)\,1-\frac{3}{x}(x^2)-\frac{10}{x^2}(x^2)}{(x^2)1+\frac{11}{x}(x^2)+\frac{18}{x^2}(x^2)} = \frac{x^2-3x-10}{x^2+11x+18} = \frac{(x-5)(x+2)}{(x+9)(x+2)} = \frac{x-5}{x+9}$

19) $\frac{(3x-4)1-\frac{2x}{(3x-4)}(3x-4)}{(3x-4)x-\frac{32}{(3x-4)}(3x-4)} = \frac{3x-4-2x}{3x^2-4x-32} = \frac{x-4}{(3x+8)(x-4)} = \frac{1}{3x+8}$

21) $\frac{(x-4)x-(x-4)1+\frac{2}{(x-4)}(x-4)}{(x-4)\,x+(x-4)3+\frac{6}{(x-4)}(x-4)} = \frac{x^2-4x-x+4+2}{x^2-4x+3x-12+6} = \frac{x^2-5x+6}{x^2-x-6} = \frac{(x-2)(x+3)}{(x-3)(x+2)} = \frac{(x-2)}{x+2}$

23) $\frac{(2x+3)\,x-(2x+3)4+\frac{9}{(2x+3)}(2x+3)}{(2x+3)x+(2x+3)3-\frac{5}{(2x+3)}(2x+3)} = \frac{2x^2+3x-8x-12+9}{2x^2+3x+6x+9-5} = \frac{(2x+1)(x-3)}{(2x+1)(x+4)} = \frac{x-3}{x+4}$

25) $\frac{b(b+3)\frac{2}{b}-\frac{5}{b+3}b(b+3)}{b(b+3)\frac{3}{b}+\frac{3}{b+3}b(b+3)} = \frac{2b+6-5b}{3b+9+3b} = \frac{-3b+6}{6b+9} = \frac{(-3)(b-2)}{3(2b+3)} = \frac{(-1)(b-2)}{2b+3}$

27) $\frac{(a^2b^2)\frac{2}{b^2}-(a^2b^2)\frac{5}{ab}-\frac{3}{a^2}(a^2b^2)}{(a^2b^2)\frac{2}{b^2}-(a^2b^2)\frac{7}{ab}+\frac{3}{a^2}(a^2b^2)} = \frac{2a^2-5ab-3b^2}{2a^2+7ab+3b^2} = \frac{(2a+b)(a-3b)}{(2a+b)(a+3b)} = \frac{a-3b}{a+3b}$

29) $\frac{(y+2)(y-2)\frac{y}{y+2}-\frac{y}{y-2}(y+2)(y-2)}{(y+2)(y-2)\frac{y}{y+2}+\frac{y}{y-2}(y+2)(y-2)} = \frac{y^2-2y-y^2-2y}{y^2-2y+y^2+2y} = \frac{-4y}{2y^2} = -\frac{2}{y}$

31) $\frac{x^{-2}-y^{-2}}{x^{-1}+y^{-1}} = \frac{(x^2y^2)\frac{1}{x^2}+\frac{1}{y^2}(x^2y^2)}{(x^2y^2)\frac{1}{x}+\frac{1}{y}(x^2y^2)} = \frac{y^2-x^2}{xy^2+x^2y} = \frac{(y+x)(y-x)}{xy(y+x)} = \frac{y-x}{xy}$

33) $\frac{x^{-3}y-xy^{-3}}{x^{-2}-y^{-2}} = \frac{(x^3y^3)\frac{y}{x^3}-\frac{x}{y^3}(x^3y^3)}{(x^3y^3)\frac{1}{x^2}-\frac{1}{y^2}(x^3y^3)} = \frac{y^4-x^4}{xy^3-x^3y} = \frac{(y^2+x^2)(y^2-x^2)}{xy(y^2-x^2)} = \frac{y^2+x^2}{xy}$

35) $\frac{x^{-2}-6x^{-1}+9}{x^2-9} = \frac{(x^2)\frac{1}{x^2}-(x^2)\frac{6}{x}+9(x^2)}{(x^2)\,x^2-9} = \frac{1-6x+9x^2}{x^2(x^2-9)} = \frac{(1-3x)^2}{(x^2)(x+3)(x-3)}$

7.6

1) $\frac{10}{a}=\frac{6}{8}$

$\frac{80}{6}=\frac{6a}{6}$

$13.3=a$

3) $\frac{7}{6}=\frac{2}{k}$

$\frac{7k}{7}=\frac{12}{7}$

$k=1.71$

5) $\frac{6}{x}=\frac{8}{2}$

$\frac{12}{8}=\frac{8x}{8}$

$1.5=x$

7) $\frac{m-1}{5}=\frac{8}{2}$

$2(m-1)=40$

$2m-2=40$

$+2 \quad +2$

$\frac{2m}{2}=\frac{42}{2}$

$m=21$

9) $\frac{2}{9}=\frac{10}{p-4}$

$2(p-4)=90$

$2p-8=90$

$+8 \quad +8$

$\frac{2p}{2}=\frac{98}{2}$

$p=49$

11) $\frac{b-10}{7}=\frac{b}{4}$

$4(b-10)=7b$

$4b-40=7b$

$-4b \qquad -4b$

$\frac{-40}{3}=\frac{3b}{3}$

$-13.3=b$

13) $\frac{x}{5}=\frac{x+2}{9}$

$9x=5(x+2)$

$9x=5x+10$

$-5x \ -5x$

$\frac{4x}{4}=\frac{10}{4}$

$x=2.5$

15) $\frac{3}{10}=\frac{a}{a+2}$

$3(a+2)=10a$

$3a+6=10a$

$-3a \qquad -3a$

$\frac{6}{7}=\frac{7a}{7}$

$0.86=a$

17) $\frac{v-5}{v+6}=\frac{4}{9}$

$9(v-5)=4(v+6)$

$9v-45=4v+24$

$-4v \qquad -4v$

$5v-45=24$

$+45 \ +45$

$\frac{5v}{5}=\frac{69}{5}$

$v=13.8$

19) $\frac{7}{x-1}=\frac{4}{x-6}$

$7(x-6)=4(x-1)$

$7x-42=4x-4$

$-4x \qquad -4x$

$3x-42=-4$

$+42 \quad +42$

$\frac{3x}{3}=\frac{38}{3}$

$x=12.67$

21) $\frac{x+5}{5} = \frac{6}{x-2}$

$(x+5)(x-2) = 30$

$x^2 + 5x - 2x - 10 = 30$

$x^2 + 3x - 10 = 30$

$-30 \quad -30$

$x^2 + 3x - 40 = 0$

$(x+8)(x-5) = 0$

$x+8=0 \quad x-5=0$

$-8 \quad -8 \qquad +5 \quad +5$

$x = -8 \qquad x = 5$

23) $\frac{m+3}{4} = \frac{11}{m-4}$

$(m+3)(m-4) = 44$

$m^2 - 4m + 3m - 12 = 44$

$m^2 - m - 12 = 44$

$-44 \quad -44$

$m^2 - m - 56 = 0$

$(m-8)(m+7) = 0$

$m-8=0 \quad m+7=0$

$+8 \quad +8 \qquad -7 \quad -7$

$m = 8 \qquad m = -7$

25) $\frac{2}{p+4} = \frac{p+5}{3}$

$6 = (p+4)(p+5)$

$6 = p^2 + 5p + 4p + 20$

$6 = p^2 + 9p + 20$

$-6 \qquad\qquad -6$

$0 = p^2 + 9p + 14$

$0 = (p+7)(p+2)$

$p+7=0 \quad p+2=0$

$-7 \quad -7 \qquad -2 \quad -2$

$p = -7, -2$

27) $\frac{n+4}{3} = \frac{-3}{n-2}$

$(n+4)(n-2) = -9$

$n^2 - 2n + 4n - 8 = -9$

$n^2 + 2n - 8 = -9$

$+9 \quad +9$

$n^2 + 2n + 1 = 0$

$(n+1)^2 = 0$

$n+1=0$

$-1 \quad -1$

$n = -1$

29) $\frac{3}{x+4} = \frac{x+2}{5}$

$15 = (x+4)(x+2)$

$15 = x^2 + 2x + 4x + 8$

$15 = x^2 + 6x + 8$

$-15 \qquad\qquad -15$

$0 = x^2 + 6x - 7$

$0 = (x+7)(x-1)$

$x+7=0 \quad x-1=0$

$-7 \quad -7 \qquad +1 \quad +1$

$x = -7 \qquad x = 1$

31) The currency in Western Samoa is the Tala. The exchange rate is approximately S0.70 to 1 Tala. At this rate, how many dollars would you get if you exchanged 13.3 Tala?

$\frac{T}{\$} = \frac{1}{0.70} = \frac{13.3}{x}$

$x = \$\,9.31$

39) Kali reduced the size of a painting to a height of 1.3 in. What is the new width if it was originally 5.2 in. tall and 10 in. wide?

$\frac{h}{w} = \frac{5.2}{10} = \frac{1.3}{x}$

$x = 2.5\ in$

41) A bird bath that is 5.3 ft tall casts a shadow that is 25.4 ft long. Find the length of the shadow that a 8.2 ft adult elephant casts.

$\frac{h}{s} = \frac{5.3}{25.4} = \frac{8.2}{x}$

$x = 39.3\ ft$

43) The Vikings led the Timberwolves by 19 points at the half. If the Vikings scored 3 points for every 2 points the Timberwolves scored, what was the half time score?

$\frac{V}{T} = \frac{(x+19)}{x} = \frac{3}{2}$

$2(x + 19) = 3x$

$2x + 38 = 3x$

$-2x \quad -2x$

$38 = x$

$Timberwolves: 38$

$Vikings: 57$

45) Computer Services Inc. charges S8 more for a repair than Low Cost Computer Repair. If the ratio of the costs is 3 : 6, what will it cost for the repair at Low Cost Computer Repair?

$\frac{CSI}{LCCR} = \frac{x+8}{x} = \frac{6}{3}$

$3(x + 8) = 6x$

$3x + 24 = 6x$

$-3x \quad -3x$

$\frac{24}{3} = \frac{3x}{3}$

$\$8 = x$

7.7

1) $(2x)\,3x-(2x)\frac{1}{2}-(2x)\frac{1}{x}=0(2x)$

$LCD: 2x$

$\frac{2x}{2}\neq\frac{0}{2}$

$*\,x\neq 0\,*$

$6x^2-x-2=0$

$(2x+1)(3x-2)=0$

$2x+1=0 \quad 3x-2=0$

$\underline{-1\ \ -1} \qquad \underline{+2\ \ +2}$

$\frac{2x}{2}=\frac{-1}{2} \qquad \frac{3x}{3}=\frac{2}{3}$

$x=-\frac{1}{2} \qquad x=\frac{2}{3}$

3) $x(x-4)+\frac{20}{(x-4)}\,(x-4)=\frac{5x}{(x-4)}\,(x-4)-2\,(x-4)$

$LCD: (x-4)$

$x-4\neq 0$

$\underline{+4\ \ +4}$

$*\,x\neq 4\,*$

$x^2-4x+20=5x-2x+8$

$x^2-4x+20=3x+8$

$\underline{-3x-8\ \ -3x-8}$

$x^2-7x+12=0$

$(x-4)(x-3)=0$

$x-4=0 \quad x-3=0$

$\underline{+4\ \ +4} \qquad \underline{+3\ \ +3}$

~~$x=4$~~ $\qquad x=3$

5) $x(x-3)+\frac{6}{(x-3)}(x-3)=\frac{2x}{(x-3)}\,(x-3)$

$LCD=x-3$

$x-3\neq 0$

$\underline{+3\ \ +3}$

$*\,x\neq 3\,*$

$x^2-3x+6=2x$

$\underline{-2x\qquad -2x}$

$x^2-5x+6=0$

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

$x-2=0 \quad x-3=0$

$\underline{+2\ \ +2} \qquad \underline{+3\ \ +3}$

$x=2 \qquad$ ~~$x=3$~~

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

$LCD:(6x-1)(3x-4)$

$6x-1\neq 0 \quad 3x-4\neq 0$

$\frac{+1 \quad +1}{\frac{6x}{6}\neq\frac{1}{6}} \qquad \frac{+4 \quad +4}{\frac{3x}{3}\neq\frac{4}{3}}$

$*x\neq\frac{1}{6}**x\neq\frac{4}{3}*$

$12x^2-2x=12x^2-16x+15x-20-18x+3$

$12x^2-2x=12x^2-19x-17$

$\underline{-12x^2 \qquad -12x^2}$

$-2x=-19x-17$

$\underline{+19x \quad +19x}$

$\frac{17x}{17}=-\frac{17}{17}$

$x=-1$

9) $\frac{3m}{2m-5}(2)(2m-5)(3m+1)-\frac{7}{3m+1}(2)(2m-5)(3m+1)=\frac{3}{2}(2)(2m-5)(3m+1)$

$LCD:(2)(2m-5)(3m+1)$

$2m-5\neq 0 \quad 3m+1\neq 0$

$\frac{+5 \quad +5}{\frac{2m}{2}\neq\frac{5}{2}} \qquad \frac{-1 \quad -1}{\frac{3m}{3}\neq-\frac{1}{3}}$

$*x\neq\frac{5}{2}**x\neq-\frac{1}{3}*$

$18m^2+6m-28m+70=18m^2-39m-15$

$18m^2-22m+70=18m^2-39m-15$

$\underline{-18m^2 \qquad -18m^2}$

$-22m+70=-39m-15$

$\underline{+39m \qquad +39m}$

$17m+70=-15$

$\frac{-70 \quad -70}{\frac{17m}{17}=\frac{-85}{17}}$

$m=-5$

11) $\frac{4-x}{1-x}(1-x)(3-x) = \frac{12}{3-x}(1-x)(3-x)$

$LCD: (1-x)(3-x)$

$1-x \neq 0 \quad 3-x \neq 0$

$\underline{+x \quad +x} \quad \underline{+x \quad +x}$

$*1 \neq x* \quad *3 \neq x*$

$12-4x-3x+x^2 = 12-12x$

$x^2-7x+12 = 12-12x$

$\underline{+12x-12 \quad -12+12x}$

$x^2+5x = 0$

$x(x+5) = 0$

$x = 0 \quad x+5 = 0$

$\underline{-5 \quad -5}$

$x = -5$

13) $\frac{7}{y-3}(2)(y-3)(y-4) - \frac{1}{2}(2)(y-3)(y-4) = \frac{y-2}{y-4}(2)(y-3)(y-4)$

$LCD: (2)(y-3)(y-4)$

$y-3 \neq 0 \quad y-4 \neq 0$

$\underline{+3 \quad +3} \quad \underline{+4 \quad +4}$

$*y \neq 3* \quad *y \neq 4*$

$14y-56-y^2+3y+4y-12 = 2y^2-6y-4y+12$

$-y^2+21y-68 = 2y^2-10y+12$

$\underline{+y^2-21y+68 \quad +y^2-21y+68}$

$0 = 3y^2-31y+80$

$0 = (3y-16)(y-5)$

$3y-16 = 0 \quad y-5 = 0$

$\underline{+16 \quad +16} \quad \underline{+5 \quad +5}$

$\frac{3y}{3} = \frac{16}{3} \quad y = 5$

15) $\frac{1}{x+2}(x+2)(x-2) + \underset{x-2}{\frac{1}{2-x}}(x+2)(x-2) = \underset{(x-2)(x+2)}{\frac{3x+8}{x^2-4}}(x+2)(x-2)$

$LCD: (x+2)(x-2)$

$x+2 \neq 0 \quad x-2 \neq 0$

$\underline{-2 \quad -2} \quad \underline{+2 \quad +2}$

$x \neq -2 \quad x \neq 2$

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

$2x = 3x+8$

$\underline{-3x \quad -3x}$

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

$x = -8$

17) $\frac{(x+1)}{x-1}(6)(x-1)(x+1)+\frac{-x+1}{x+1}(6)(x-1)(x+1)=\frac{5}{6}(6)(x-1)(x+1)$

LCD: $(6)(x-1)(x+1)$

$x-1\neq 0 \quad x+1\neq 0$

$+1 \quad +1 \quad -1 \quad -1$

$*x\neq 1 * * x\neq -1 *$

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

$24x=5x^2-5$

$-24x \quad -24x$

$0=5x^2-24x-5$

$0=(5x+1)(x-5)$

$5x+1=0 \quad x-5=0$

$-1 \quad -1 \quad +5 \quad +5$

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

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

19) $\frac{3}{2x+1}\frac{(2x+1)(2x-1)}{1}+\frac{-2x-1}{2x-1}\frac{(2x+1)(2x-1)}{1}=1\frac{(2x+1)(2x-1)}{1}-\frac{8x^2}{4x^2-1}\frac{(2x+1)(2x-1)}{1}$

$LCD:(2x+1)(2x-1)$

$2x+1\neq 0 \quad 2x-1\neq 0$

$-1 \quad -1 \quad +1 \quad +1$

$\frac{2x}{2}\neq\frac{-1}{2} \quad \frac{2x}{2}\neq\frac{1}{2}$

$*x\neq -\frac{1}{2}* \quad *x\neq\frac{1}{2}*$

$6x-3-4x^2-2x-2x-1=4x^2-1-8x^2$

$-4x^2+2x-4=-4x^2-1$

$+4x^2 \quad +4x^2$

$2x-4=-1$

$+4 \quad +4$

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

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

21) $\frac{x-2}{x+3}(x+3)(x-2) - \frac{1}{x-2}(x+3)(x-2) = \frac{1}{x^2+x-6}(x+3)(x-2)$

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

$LCD: (x+3)(x-2)$

$x+3 \neq 0 \quad x-2 \neq 0$

$-3 \quad -3 \quad +2 \quad +2$

$*x \neq -3 * * x \neq 2 *$

$x^2 - 4x + 4 - x - 3 = 1$

$x^2 - 5x + 1 = 1$

$-1 \quad -1$

$x^2 - 5x = 0$

$x(x-5) = 0$

$x = 0 \quad x - 5 = 0$

$+5 \quad +5$

$x = 5$

23) $\frac{3}{x+2} + \frac{x-1}{x+5} = \frac{5x+20}{6x+24}$

$5(x+4)$

$6(x+4)$

$\frac{3}{x+2}(6)(x+2)(x+5) + \frac{x-1}{x+5}(6)(x+2)(x+5) = \frac{5}{6}(6)(x+2)(x+5)$

$LCD: (6)(x+2)(x+5)$

$x+2 \neq 0 \quad x+5 \neq 0$

$-2 \quad -2 \quad -5 \quad -5$

$*x \neq -2 * * x \neq -5 *$

$18x + 90 + 6x^2 + 12x - 6x - 12 = 5x^2 + 25x + 10x + 50$

$6x^2 + 24x + 78 = 5x^2 + 35x + 50$

$-5x^2 - 35x - 50 \quad -5x^2 - 35x - 50$

$x^2 - 11x + 28 = 0$

$(x-7)(x-4) = 0$

$x - 7 = 0 \quad x - 4 = 0$

$+7 \quad +7 \quad +4 \quad +4$

$x = 7 \quad x = 4$

25) $\frac{x}{x-1}(x+1)(x-1) - \frac{2}{x+1}(x+1)(x-1) = \frac{4x^2}{x^2-1}(x+1)(x-1)$
$(x+1)(x-1)$

$LCD: (x+1)(x-1)$

$x+1 \neq 0 \quad x-1 \neq 0$

$\underline{-1 \quad -1 \quad +1 \quad +1}$

$*x \neq -1* \quad *x \neq 1*$

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

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

$\underline{-x^2 + x - 2 \quad -x^2 + x - 2}$

$0 = 3x^2 + x - x$

$0 = (3x-2)(x+1)$

$3x - 2 = 0 \quad x + 1 = 0$

$\underline{+2 \quad +2} \qquad \underline{-1 \quad -1}$

$\frac{3x}{3} = \frac{2}{3} \qquad x = -1$

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

27) $\frac{2x}{x+1}(x+1)(x+5) - \frac{3}{x+5}(x+1)(x+5) = \frac{-8x^2}{x^2+6x+5}(x+1)(x+5)$
$(x+1)(x+5)$

$LCD: (x+1)(x+5)$

$x+1 \neq 0 \quad x+5 \neq 0$

$\underline{-1 \quad -1} \qquad \underline{-5 \quad -5}$

$*x \neq -1* \quad *x \neq -5*$

$2x^2 + 10x - 3x - 3 = -8x^2$

$2x^2 + 7x - 3 = -8x^2$

$\underline{+8x^2 \qquad\qquad +8x^2}$

$10x^2 + 7x - 3 = 0$

$(10x-3)(x+1) = 0$

$10x - 3 = 0 \quad x + 1 = 0$

$\underline{+3 \quad +3} \qquad \underline{-1 \quad -1}$

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

$x = \frac{3}{10}$

29) $\frac{x-5}{x-9}(x-9)(x-3)+\frac{x+3}{x-3}(x-9)(x-3)=\frac{-4x^2}{x^2-12x+27}(x-9)(x-3)$
$(x-9)(x-3)$

$LCD:\ (x-9)(x-3)$

$x-9\ \neq 0 \quad x-3\neq 0$

$+9\ \ +9 \qquad +3\ \ \ +3$

$*x\neq 9* \quad *x\neq 3*$

$x^2-3x-5x+15+x^2-9x+3x-27=-4x^2$

$2x^2-14x-12=-4x^2$

$+4x^2 \qquad\qquad +4x^2$

$6x^2-14x-12=0$

$2(3x^2-7x-6)=0$

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

$3x+2=0 \quad x-3=0$

$-2\ \ -2 \qquad +3\ \ +3$

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

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

31) $\frac{x-3}{x-6}(x-6)(x+3)+\frac{x+5}{x+3}(x-6)(x+3)=\frac{-2x^2}{x^2-3x-18}(x-6)(x+3)$
$(x-6)(x+3)$

$LCD:\ (x-6)(x+3)$

$x-6\ \neq 0 \quad x+3\ \neq 0$

$+6\ \ +6 \qquad -3\ \ \ -3$

$*x\neq 6* \quad *x\neq -3*$

$x^2-9+x^2-6x+5x-30=-2x^2$

$2x^2-x-90=-2x^2$

$+2x^2 \qquad\qquad +2x^2$

$4x^2-x-90=0$

$(4x-13)(x+3)=0$

$4x-13=0 \quad x+3=0$

$+13\ \ +13 \qquad -3\ \ -3$

$\frac{4x}{4}=\frac{13}{4} \qquad x=-3$

$x=\frac{13}{4}$

33) $\frac{4x+1}{x+3}(x+3)(x-1)+\frac{5x-3}{x-1}(x+3)(x-1)=\frac{8x^2}{x^2+2x-3}(x+3)(x-1)$

$(x+3)(x-1)$

$LCD:\ (x+3)(x-1)$

$x+3\neq 0 \quad x-1\neq 0$

$-3\ \ -3 \quad +1\ \ +1$

$*x\neq -3 * * x\neq 1 *$

$4x^2-4x+x-1+5x^2+15x-3x-9=8x^2$

$9x^2+9x-10=8x^2$

$-8x^2 \quad -8x^2$

$x^2+9x-10=0$

$(x+10)(x-1)=0$

$x+10=0 \quad x-1=0$

$-10\ \ -10 \quad +1\ \ +1$

$x=-10 \quad \cancel{x=1}$

7.8

1) $7\ mi\ to\ yd$

$\left(\frac{7\cancel{mi}}{1}\right)\left(\frac{5280\cancel{ft}}{1\cancel{mi}}\right)\left(\frac{1\ yd}{(3\cancel{ft})}\right)=\frac{36960yd}{3}=12{,}320\ yd$

3) $11.2\ mg\ to\ g$

$\left(\frac{11.2\ \cancel{mg}}{1}\right)\left(\frac{1\ g}{1000\ \cancel{mg}}\right)=\frac{11.29}{1000}=0.0112\ g$

5) $9{,}800{,}000\ mm\ to\ mi$

$\left(\frac{9{,}800{,}000\ \cancel{mm}}{1}\right)\left(\frac{1\ \cancel{m}}{1000\ \cancel{mm}}\right)\left(\frac{3.29\ \cancel{ft}}{1\ \cancel{m}}\right)\left(\frac{1\ mi}{5280\ \cancel{ft}}\right)=\frac{32{,}144{,}000\ mi}{5280000}=6.088\ mi$

7) $435{,}000\ m^2\ to\ km^2$

$\left(\frac{435{,}000m^2}{1}\right)\left(\frac{1km}{1{,}000\ m}\right)^2$

$\left(\frac{435{,}000\cancel{m^2}}{1}\right)\left(\frac{1km^2}{1{,}000{,}000\cancel{m^2}}\right)=\frac{435{,}000\ km^2}{1{,}000{,}000}=0.435\ km^2$

9) $0.0065\ km^3 to\ m^3$

$\left(\frac{0.0065km^3}{1}\right)\left(\frac{1000m}{km}\right)^3$

$\left(\frac{0.0065\cancel{km^3}}{1}\right)\left(\frac{(1{,}000{,}000{,}000m^3)}{\cancel{km^3}}\right)=6{,}500{,}000\ m^3$

11) $5{,}500\ cm^3 to\ yd^3$

$\left(\frac{5{,}500cm^3}{1}\right)\left(\frac{1in}{2.54cm}\right)^3\left(\frac{1yd}{36in}\right)^3$

$\left(\frac{5{,}500\cancel{cm^3}}{1}\right)\left(\frac{1\cancel{in^3}}{16.387064\cancel{cm^3}}\right)\left(\frac{1yd^3}{46656\cancel{in^3}}\right)=\frac{5{,}500\ yd^3}{764554.858}=0.00719\ yd^3$

13) $185\ yd/\min\ to\ min/hr$

$\left(\frac{185yd}{\min}\right)\left(\frac{3ft}{1yd}\right)\left(\frac{1mi}{5280ft}\right)\left(\frac{60min}{1hr}\right) = \frac{33300mi}{5280hr} = 6.307\ mi/hr$

15) $248\ mi/hr\ to\ m/sec$

$\left(\frac{248mi}{hr}\right)\left(\frac{1.61km}{1mi}\right)\left(\frac{1000m}{1km}\right)\left(\frac{1hr}{3600\ \sec}\right) = \frac{399.280m}{3600\ \sec} = 110.9\ m/sec$

17) $7.5\frac{T}{yd^2}\ to\ lbs/in^2$

$\left(\frac{7.5T}{yd^2}\right)\left(\frac{2000lbs}{1T}\right)\left(\frac{1yd}{36in}\right)^2$

$\left(\frac{7.5T}{yd^2}\right)\left(\frac{2000lbs}{1T}\right)\left(\frac{1yd^2}{1296in^2}\right) = \frac{15000lbs}{1296in^2} = 11.57\ lbs/in^2$

19) On a recent trip, Jan traveled 260 miles using 8 gallons of gas. How many miles per 1-gallon did she travel? How many yards per 1-ounce?

$\frac{260mi}{8gal} = 32.5\ mi/gal$

$\left(\frac{32.5mi}{gal}\right)\left(\frac{5280ft}{1mi}\right)\left(\frac{1yd}{3ft}\right)\left(\frac{1gal}{4qt}\right)\left(\frac{1qt}{2pt}\right)\left(\frac{1pt}{2c}\right)\left(\frac{1c}{8oz}\right) = \frac{171{,}600yd}{384oz} = 446.875\ yd/oz$

21) A certain laser printer can print 12 pages per minute. Determine this printer's output in pages per day, and reams per month. (1 ream = 5000 pages)

$\left(\frac{12pg}{1\ \min}\right)\left(\frac{60min}{1hr}\right)\left(\frac{24hr}{1day}\right) = 17280\ pg/day$

$\left(\frac{17280pg}{day}\right)\left(\frac{30day}{mon}\right)\left(\frac{1ream}{5000pg}\right) = \frac{5184000reams}{5000months} = 103.68\ reams/month$

23) Blood sugar levels are measured in miligrams of gluclose per deciliter of blood volume. If a person's blood sugar level measured 128 mg/dL, how much is this in grams per liter?

$\left(\frac{128mg}{dL}\right)\left(\frac{1g}{100mg}\right)\left(\frac{10dL}{1L}\right) = \frac{1280g}{1000L} = 1.28\ g/L$

25) A car travels 14 miles in 15 minutes. How fast is it going in miles per hour? in meters per second?

$\left(\frac{14mi}{15\ \min}\right)\left(\frac{60min}{1hr}\right) = \frac{840mi}{15hr} = 56\ mi/hr$

$\left(\frac{14mi}{15\ \min}\right)\left(\frac{1.61km}{1mi}\right)\left(\frac{1000m}{1km}\right)\left(\frac{1min}{60\ \sec}\right) = \frac{22540m}{900\ sec} = 25.04\ m/sec$

27) A local zoning ordinance says that a house's "footprint" (area of its ground floor) cannot occupy more than $\frac{1}{4}$ of the lot it is built on. Suppose you own a $\frac{1}{3}$ acre lot, what is the maximum allowed footprint for your house in square feet? in square inches? (1 acre = 43560 ft^2)

$\left(\frac{1\cancel{acre}}{3}\right)\left(\frac{43560ft^2}{1\cancel{acre}}\right)\left(\frac{1}{4}\right) = \frac{43560ft^2}{12} = 3{,}630\ ft^2$

$\left(\frac{3630ft^2}{1}\right)\left(\frac{12in}{1ft}\right)^2$

$\left(\frac{3630\cancel{ft^2}}{1}\right)\left(\frac{144in^2}{1\cancel{ft^2}}\right) = 522{,}720\ in^2$

29) In April 1996, the Department of the Interior released a "spike flood" from the Glen Canyon Dam on the Colorado River. Its purpose was to restore the river and the habitants along its bank. The release from the dam lasted a week at a rate of 25,800 cubic feet of water per second. About how much water was released during the 1-week flood

$\left(\frac{25{,}800ft^3}{1\cancel{sec}}\right)\left(\frac{3600\cancel{sec}}{1\cancel{hr}}\right)\left(\frac{24\cancel{hr}}{1\cancel{day}}\right)\left(\frac{7\cancel{day}}{1\cancel{wk}}\right) = 15{,}603{,}840{,}000\ ft^3/week$

Chapter 8: Radicals

8.1

1) $r\sqrt{245}$
$\sqrt{5 \cdot 7^2}$
$7\sqrt{5}$

4) $\sqrt{36}$
$\sqrt{2^2 \cdot 3^2}$
$2 \cdot 3$
6

5) $\sqrt{12}$
$\sqrt{2^2 \cdot 3}$
$2\sqrt{3}$

7) $3\sqrt{12}$
$3\sqrt{2^2 \cdot 3}$
$3 \cdot 2\sqrt{3}$
$6\sqrt{3}$

9) $6\sqrt{128}$
$6\sqrt{2^7}$
$6 \cdot 2^3\sqrt{2}$
$6 \cdot 8\sqrt{2}$
$48\sqrt{2}$

11) $-8\sqrt{392}$
$-8\sqrt{7^2 \cdot 2^3}$
$-8 \cdot 7 \cdot 2\sqrt{2}$
$-112\sqrt{2}$

13) $\sqrt{192n}$
$\sqrt{2^6 \cdot 3n}$
$2^3\sqrt{3n}$
$8\sqrt{3n}$

15) $\sqrt{196v^2}$
$\sqrt{2^2 \cdot 7^2 v^2}$
$2 \cdot 7 \cdot v$
$14v$

17) $\sqrt{252x^2}$
$\sqrt{2^2 \cdot 3^2 \cdot 7x^2}$
$2 \cdot 3x\sqrt{7}$
$6x\sqrt{7}$

19) $-\sqrt{100k^4}$
$-\sqrt{2^2 \cdot 5^2 k^4}$
$-2 \cdot 5 \cdot k^2$
$-10k^2$

21) $-7\sqrt{64x^4}$
$-7\sqrt{2^6 x^4}$
$-7 \cdot 2^3 x^2$
$-7 \cdot 8x^2$
$-56x^2$

23) $-5\sqrt{36m}$
$-5\sqrt{2^2 \cdot 3^2 m}$
$-5 \cdot 2 \cdot 3\sqrt{m}$
$-30\sqrt{m}$

25) $\sqrt{45x^2y^2}$
$\sqrt{3^2 \cdot 5 \cdot x^2y^2}$
$3xy\sqrt{5}$

27) $\sqrt{16x^3y^3}$
$\sqrt{2^4 x^3y^3}$
$2^2xy\sqrt{xy}$
$4xy\sqrt{xy}$

29) $\sqrt{320x^4y^4}$
$\sqrt{2^6 \cdot 5x^4y^4}$
$2^3x^2y^2\sqrt{5}$
$8x^2y^2\sqrt{5}$

31) $6\sqrt{80xy^2}$
$6\sqrt{2^4 \cdot 5xy^2}$
$6 \cdot 2^2y\sqrt{5x}$
$6 \cdot 4y\sqrt{5x}$
$24y\sqrt{5x}$

33) $5\sqrt{245x^2y^3}$
$5\sqrt{5 \cdot 7^2x^2y^3}$
$5 \cdot 7xy\sqrt{5y}$
$35xy\sqrt{5y}$

35) $-2\sqrt{180u^3v}$
$-2\sqrt{2^2 \cdot 3^2 \cdot 5u^3v}$
$-2 \cdot 2 \cdot 3u\sqrt{5uv}$
$-12u\sqrt{5uv}$

37) $-8\sqrt{180x^4y^2z^4}$

$-8\sqrt{2^2 \cdot 3^2 \cdot 5x^4y^2z^4}$
$-8 \cdot 2 \cdot 3x^2yz^2\sqrt{5}$
$-48x^2yz^2\sqrt{5}$

39) $2\sqrt{80hj^4k}$
$2\sqrt{2^4 \cdot 5hj^4k}$
$2 \cdot 2^2j^2\sqrt{5hk}$
$2 \cdot 4j^2\sqrt{5hk}$
$8j^2\sqrt{5hk}$

41) $-4\sqrt{54mnp^2}$
$-4\sqrt{2 \cdot 3^2mnp^2}$
$-4 \cdot 3p\sqrt{2 \cdot 3mn}$
$-12p\sqrt{60n}$

8.2

1) $\sqrt[3]{625}$
$\sqrt[3]{5^4}$
$5\sqrt[3]{5}$

3) $r\sqrt[3]{750}$
$\sqrt[3]{2 \cdot 3 \cdot 5^3}$
$5\sqrt[3]{2 \cdot 3}$
$5\sqrt[3]{6}$

5) $\sqrt[3]{875}$
$\sqrt[3]{5^3 \cdot 7}$
$5\sqrt[3]{7}$

7) $-4\sqrt[4]{96}$
$-4\sqrt[4]{2^5 \cdot 3}$
$-4 \cdot 2\sqrt[4]{2 \cdot 3}$
$-8\sqrt[4]{6}$

9) $6\sqrt[4]{112}$
$6\sqrt[4]{2^4 \cdot 7}$
$6 \cdot 2\sqrt[4]{7}$
$12\sqrt[4]{7}$

11) $-\sqrt[4]{112}$
$-\sqrt[4]{2^4 \cdot 7}$
$-2\sqrt[4]{7}$

13) $r\sqrt[4]{648a^2}$
$\sqrt[4]{2^3 \cdot 3^4 a^2}$
$3\sqrt[4]{2^3 a^2}$
$3\sqrt[4]{8a^2}$

15) $\sqrt[5]{224n^3}$
$\sqrt[5]{2^5 \cdot 7n^3}$
$2\sqrt[5]{7n^3}$

17) $r\sqrt[5]{224p^5}$
$\sqrt[5]{2^5 \cdot 7p^5}$
$2p\sqrt[5]{7}$

19) $-3\sqrt[7]{896r}$
$-3\sqrt[7]{2^7 \cdot 7r}$
$-3 \cdot 2\sqrt[7]{7r}$
$-6\sqrt[7]{7r}$

21) $r - 2\sqrt[3]{-48v^7}$
$-2\sqrt[3]{-1^3 \cdot 2^4 \cdot 3v^7}$
$-2 \cdot -1 \cdot 2v^2\sqrt[3]{2 \cdot 3v}$
$4v^2\sqrt[3]{6v}$

23) $-7\sqrt[3]{320n^6}$
$-7\sqrt[3]{2^6 \cdot 5n^6}$
$-7 \cdot 2^2 n^2\sqrt[3]{5}$
$-7 \cdot 4n^2\sqrt[3]{5}$
$-28n^2\sqrt[3]{5}$

25) $\sqrt[3]{-135x^5y^3}$
$\sqrt[3]{-1^3 \cdot 3^3 \cdot 5x^5y^3}$
$-1 \cdot 3xy\sqrt[3]{5x^2}$
$-3xy\sqrt[3]{5x^2}$

27) $\sqrt[3]{-32x^4y^4}$
$\sqrt[3]{-1^3 \cdot 2^5 x^4y^4}$
$-1 \cdot 2xy\sqrt[3]{2^2xy}$
$-2xy\sqrt[3]{4xy}$

29) $r\sqrt[3]{256x^4y^6}$
$\sqrt[3]{2^8x^4y^6}$
$2^2xy^2\sqrt[3]{2^2x}$
$4xy^2\sqrt[3]{4x}$

31) $7\sqrt[3]{-81x^3y^7}$
$7\sqrt[3]{-1^3 \cdot 3^4x^3y^7}$
$7 \cdot -1 \cdot 3xy^2\sqrt[3]{3y}$
$-21xy^2\sqrt[3]{3y}$

33) $2\sqrt[3]{375u^2v^8}$
$2\sqrt[3]{3 \cdot 5^3u^2v^8}$
$2 \cdot 5v^2\sqrt[3]{3u^2v^2}$
$10v^2\sqrt[3]{3u^2v^2}$

35) $-3\sqrt[3]{192ab^2}$
$-3\sqrt[3]{2^6 \cdot 3ab^2}$
$-3 \cdot 2^2\sqrt[3]{3ab^2}$
$-3 \cdot 4\sqrt[3]{3ab^2}$
$-12\sqrt[3]{3ab^2}$

37) $6\sqrt[3]{-54m^8n^3p^7}$

$6\sqrt[3]{-1^3 \cdot 2 \cdot 3^3m^8n^3p^7}$

$6 \cdot -1 \cdot$
$3m^2np^2\sqrt[3]{2m^2p}$
$-18m^2np^2\sqrt[3]{2m^2p}$

39) $6\sqrt[4]{648x^5y^7z^2}$
$6\sqrt[4]{2^3 \cdot 3^4x^5y^7z^2}$
$6 \cdot 3xy\sqrt[4]{2^3xy^3z^2}$
$18xy\sqrt[4]{8xy^3z^2}$

41) $7\sqrt[4]{128h^6j^8k^8}$
$7\sqrt[4]{2^7h^6j^8k^8}$
$7 \cdot 2hj^2k^2\sqrt[4]{2^3h^2}$
$14hj^2k^2\sqrt[4]{8h^2}$

8.3

1) $2\sqrt{5}+2\sqrt{5}+2\sqrt{5}$
$6\sqrt{5}$

3) $-3\sqrt{2}+3\sqrt{5}+3\sqrt{5}$
$-3\sqrt{2}+6\sqrt{5}$

6) $-2\sqrt{6}-2\sqrt{6}-\sqrt{6}$
$-5\sqrt{6}$

8) $3\sqrt{6}+3\sqrt{5}+2\sqrt{5}$
$3\sqrt{6}+5\sqrt{5}$

10) $2\sqrt{2}-3\sqrt{18}-\sqrt{2}$
$2\sqrt{2}-3\sqrt{3^2\cdot 2}-\sqrt{2}$
$2\sqrt{2}-3\cdot 3\sqrt{2}-\sqrt{2}$
$2\sqrt{2}-9\sqrt{2}-\sqrt{2}$
$-8\sqrt{2}$

12) $-3\sqrt{6}-\sqrt{12}+3\sqrt{3}$
$-3\sqrt{6}-\sqrt{2^2\cdot 3}+3\sqrt{3}$
$-3\sqrt{6}-2\sqrt{3}+3\sqrt{3}$
$-3\sqrt{6}+\sqrt{3}$

14) $3\sqrt{2}+2\sqrt{8}-3\sqrt{18}$
$3\sqrt{2}+2\sqrt{2^3}-3\sqrt{2\cdot 3^2}$
$3\sqrt{2}+2\cdot 2\sqrt{2}-3\cdot 3\sqrt{2}$
$3\sqrt{2}+4\sqrt{2}-9\sqrt{2}$
$-2\sqrt{2}$

16) $3\sqrt{18}-\sqrt{2}-3\sqrt{2}$
$3\sqrt{2\cdot 3^2}-\sqrt{2}-3\sqrt{2}$
$3\cdot 3\sqrt{2}-\sqrt{2}-3\sqrt{2}$
$9\sqrt{2}-2\sqrt{2}-3\sqrt{2}$
$5\sqrt{2}$

19) $-3\sqrt{6}-3\sqrt{6}-\sqrt{3}+3\sqrt{6}$
$-3\sqrt{6}-\sqrt{3}$

20) $-2\sqrt{18}-3\sqrt{8}-\sqrt{20}+2\sqrt{20}$
$-2\sqrt{2\cdot 3^2}-3\sqrt{2^3}-\sqrt{2^2\cdot 5}+2\sqrt{2^2\cdot 5}$
$-2\cdot 3\sqrt{2}-3\cdot 2\sqrt{2}-2\sqrt{5}+2\cdot 2\sqrt{5}$
$-6\sqrt{2}-6\sqrt{2}-2\sqrt{5}+4\sqrt{5}$
$-12\sqrt{2}-2\sqrt{5}$

21) $-2\sqrt{24}-2\sqrt{6}+2\sqrt{6}+2\sqrt{20}$
$-2\sqrt{2^3\cdot 3}-2\sqrt{6}+2\sqrt{6}+2\sqrt{2^2\cdot 5}$
$-2\cdot 2\sqrt{2\cdot 3}-2\sqrt{6}+2\sqrt{6}+2\cdot 2\sqrt{5}$
$-4\sqrt{6}-2\sqrt{6}+2\sqrt{6}+4\sqrt{5}$
$-4\sqrt{6}+4\sqrt{5}$

23) $3\sqrt{24}-3\sqrt{27}+2\sqrt{6}+2\sqrt{8}$
$3\sqrt{2^3\cdot 3}-3\sqrt{3^3}+2\sqrt{6}+2\sqrt{2^3}$
$3\cdot 2\sqrt{2\cdot 3}-3\cdot 3\sqrt{3}+2\sqrt{6}+2\cdot 2\sqrt{2}$
$6\sqrt{6}-9\sqrt{3}+2\sqrt{6}+4\sqrt{2}$
$8\sqrt{6}-9\sqrt{3}+4\sqrt{2}$

25) $-2\sqrt[3]{16}+2\sqrt[3]{16}+2\sqrt[3]{2}$
$-2\sqrt[3]{2^4}+2\sqrt[3]{2^4}+2\sqrt[3]{2}$
$-2\cdot 2\sqrt[3]{2}+2\cdot 2\sqrt[3]{2}+2\sqrt[3]{2}$
$-4\sqrt[3]{2}+4\sqrt[3]{2}+2\sqrt[3]{2}$
$2\sqrt[3]{2}$

27) $2\sqrt[4]{243}-2\sqrt[4]{253}-\sqrt[4]{3}$
$2\sqrt[4]{3^5}-2\sqrt[4]{3^5}-\sqrt[4]{3}$
$2\cdot 3\sqrt[4]{3}-2\cdot 3\sqrt[4]{3}-\sqrt[4]{3}$
$6\sqrt[4]{3}-6\sqrt[4]{3}-\sqrt[4]{3}$
$-\sqrt[4]{3}$

29) $3\sqrt[4]{2}-2\sqrt[4]{2}-\sqrt[4]{243}$
$3\sqrt[4]{2}-2\sqrt[4]{2}-\sqrt[4]{3^5}$
$3\sqrt[4]{2}-2\sqrt[4]{2}-3\sqrt[4]{3}$
$\sqrt[4]{2}-3\sqrt[4]{3}$

31) $-\sqrt[4]{324}+3\sqrt[4]{324}-3\sqrt[4]{4}$

$-\sqrt[4]{3^5}+3\sqrt[4]{3^5}-3\sqrt[4]{4}$

$-3\sqrt[4]{3}+3\cdot 3\sqrt[4]{3}-3\sqrt[4]{4}$

$-3\sqrt[4]{3}+9\sqrt[4]{3}-3\sqrt[4]{4}$

$6\sqrt[4]{3}-3\sqrt[4]{4}$

33) $2\sqrt[4]{2}+2\sqrt[4]{3}+3\sqrt[4]{64}-\sqrt[4]{3}$

$2\sqrt[4]{2}+2\sqrt[4]{3}+3\sqrt[4]{2^6}-\sqrt[4]{3}$

$2\sqrt[4]{2}+2\sqrt[4]{3}+3\cdot 2\sqrt[4]{2^2}-\sqrt[4]{3}$

$2\sqrt[4]{2}+2\sqrt[4]{3}+6\sqrt[4]{4}-\sqrt[4]{3}$

$2\sqrt[4]{2}+\sqrt[4]{3}+6\sqrt[4]{4}$

35) $-3\sqrt[5]{6}-\sqrt[5]{64}+2\sqrt[5]{192}-2\sqrt[5]{64}$

$-3\sqrt[5]{6}-\sqrt[5]{2^6}+2\sqrt[5]{2^6\cdot 3}-2\sqrt[5]{2^6}$

$-3\sqrt[5]{6}-2\sqrt[5]{2}+2\cdot 2\sqrt[5]{2\cdot 3}-2\cdot 2\sqrt[5]{2}$

$-3\sqrt[5]{6}-2\sqrt[5]{2}+4\sqrt[5]{6}-4\sqrt[5]{2}$

$\sqrt[5]{6}-6\sqrt[5]{2}$

37) $2\sqrt[5]{160}-2\sqrt[5]{192}-\sqrt[5]{160}-\sqrt[5]{-160}$

$2\sqrt[5]{2^5\cdot 5}-2\sqrt[5]{2^6\cdot 3}-\sqrt[5]{2^5\cdot 5}-\sqrt[5]{-1^5\cdot 2^5\cdot 5}$

$2\cdot 2\sqrt[5]{5}-2\cdot 2\sqrt[5]{2\cdot 3}-2\sqrt[5]{5}-(-1)\cdot 2\sqrt[5]{5}$

$4\sqrt[5]{5}-4\sqrt[5]{6}-2\sqrt[5]{5}+2\sqrt[5]{5}$

$4\sqrt[5]{5}-4\sqrt[5]{6}$

39) $-\sqrt[6]{256}-2\sqrt[6]{4}-3\sqrt[6]{320}-2\sqrt[6]{128}$

$-\sqrt[6]{2^8}-2\sqrt[6]{4}-3\sqrt[6]{2^6\cdot 5}-2\sqrt[6]{2^7}$

$-2\sqrt[6]{2^2}-2\sqrt[6]{4}-3\cdot 2\sqrt[6]{5}-2\cdot 2\sqrt[6]{2}$

$-2\sqrt[6]{4}-2\sqrt[6]{4}-6\sqrt[6]{5}-4\sqrt[6]{2}$

$-4\sqrt[6]{4}-6\sqrt[6]{5}-4\sqrt[6]{2}$

8.4

2) $3\sqrt{5} \cdot -4\sqrt{16}$
$-12\sqrt{80}$
$-12\sqrt{2^4 \cdot 5}$
$-12 \cdot 2^2\sqrt{5}$
$-12 \cdot 4\sqrt{5}$
$-48\sqrt{5}$

5) $\sqrt{12m}\sqrt{15m}$
$\sqrt{180m^2}$
$\sqrt{2^2 \cdot 3^2 \cdot 5m^2}$
$2 \cdot 3m\sqrt{5}$
$6m\sqrt{5}$

7) $\sqrt[3]{4x^3}\sqrt[3]{2x^4}$
$\sqrt[3]{8x^7}$
$\sqrt[3]{2^3x^7}$
$2x^2\sqrt[3]{x}$

9) $\sqrt{6}(\sqrt{2}+2)$
$\sqrt{12}+2\sqrt{6}$
$\sqrt{2^2 \cdot 3}+2\sqrt{6}$
$2\sqrt{3}+2\sqrt{6}$

11) $-5\sqrt{15}(3\sqrt{3}+2)$
$-15\sqrt{45}-10\sqrt{15}$
$-15\sqrt{3^2 \cdot 5}-10\sqrt{15}$
$-15 \cdot 3\sqrt{5}-10\sqrt{15}$
$-45\sqrt{5}-10\sqrt{15}$

13) $5\sqrt{10}(5n+\sqrt{2})$
$25n\sqrt{10}+5\sqrt{20}$
$25n\sqrt{10}+5\sqrt{2^2+5}$
$25n\sqrt{10}+5 \cdot 2\sqrt{5}$
$25n\sqrt{10}+10\sqrt{5}$

15) $(2+2\sqrt{2})(-3+\sqrt{2})$
$-6+2\sqrt{2}-6\sqrt{2}+2\sqrt{4}$
$-6+2\sqrt{2}-6\sqrt{2}+2\sqrt{2^2}$
$-6+2\sqrt{2}-6\sqrt{2}+2 \cdot 2$
$-6+2\sqrt{2}-6\sqrt{2}+4$
$-2-4\sqrt{2}$

17) $(\sqrt{5}-5)(2\sqrt{5}-1)$
$2\sqrt{25}-\sqrt{5}-10\sqrt{5}+5$
$2\sqrt{5^2}-\sqrt{5}-10\sqrt{5}+5$
$2 \cdot 5-\sqrt{5}-10\sqrt{5}+5$
$10-\sqrt{5}-10\sqrt{5}+5$
$15-11\sqrt{5}$

20) $(\sqrt{2a}+2\sqrt{3a})(3\sqrt{2a}+\sqrt{5a})$
$3\sqrt{4a^2}+\sqrt{10a^2}+6\sqrt{6a^2}+2\sqrt{15a^2}$
$3\sqrt{2^2a^2}+\sqrt{10a^2}+6\sqrt{6a^2}+2\sqrt{15a^2}$
$3 \cdot 2a+a\sqrt{10}+6a\sqrt{6}+2a\sqrt{15}$
$6a+a\sqrt{10}+6a\sqrt{6}+2a\sqrt{15}$

21) $(-5-4\sqrt{3})(-3-4\sqrt{3})$
$15+20\sqrt{3}+12\sqrt{3}+16\sqrt{9}$
$15+20\sqrt{3}+12\sqrt{3}+16\sqrt{3^2}$
$15+20\sqrt{3}+12\sqrt{3}+16 \cdot 3$
$15+20\sqrt{3}+12\sqrt{3}+48$
$63+32\sqrt{3}$

21) $\frac{\sqrt{12}}{5\sqrt{100}}=\frac{\sqrt{3}}{5\sqrt{25}}=\frac{\sqrt{3}}{5\sqrt{5^2}}=\frac{\sqrt{3}}{5 \cdot 5}=\frac{\sqrt{3}}{25}$

23) $\frac{\sqrt{5}}{4\sqrt{125}}=\frac{1}{4\sqrt{25}}=\frac{1}{4\sqrt{5^2}}=\frac{1}{4 \cdot 5}=\frac{1}{20}$

25) $\frac{\sqrt{10}}{\sqrt{6}}=\frac{\sqrt{5}}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)=\frac{\sqrt{15}}{3}$

27) $\frac{2\sqrt{4}}{3\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)=\frac{2\sqrt{12}}{3 \cdot 3}=\frac{2\sqrt{2^2 \cdot 3}}{9}=\frac{2 \cdot 2\sqrt{3}}{9}=\frac{4\sqrt{3}}{9}$

29) $\frac{5x^2}{4\sqrt{3x^3y^3}} = \frac{5x^2}{4xy\sqrt{3xy}} = \frac{5x}{4y\sqrt{3xy}}\left(\frac{\sqrt{3xy}}{\sqrt{3xy}}\right) = \frac{5x\sqrt{3xy}}{4y\cdot 3xy} = \frac{5x\sqrt{3xy}}{12xy^2}$

31) $\frac{\sqrt{2p^2}}{\sqrt{3p}} = \frac{\sqrt{2p}}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{6p}}{3}$

33) $\frac{3\sqrt[3]{10}}{5\sqrt[3]{27}} = \frac{3\sqrt[3]{10}}{5\sqrt[3]{3^2}} = \frac{3\sqrt[3]{10}}{5\cdot 3} = \frac{3\sqrt[3]{10}}{15} = \frac{\sqrt[3]{10}}{5}$

35) $\frac{\sqrt[3]{5}}{4\sqrt[3]{4}} = \frac{\sqrt[3]{5}}{4\sqrt[3]{2^2}}\left(\frac{\sqrt[3]{2}}{\sqrt[3]{2}}\right) = \frac{3\sqrt[3]{10}}{4\cdot 2} = \frac{3\sqrt[3]{10}}{8}$

37) $\frac{5\sqrt[4]{5r^4}}{\sqrt[4]{8r^2}} = \frac{5\sqrt[4]{5r^2}}{\sqrt[4]{8}} = \frac{5\sqrt[4]{5r^2}}{\sqrt[4]{2^3}}\left(\frac{\sqrt[4]{2}}{\sqrt[4]{2}}\right) = \frac{5\sqrt[4]{10r}}{2}$

8.5

1) $\frac{4+2\sqrt{3}}{\sqrt{9}} = \frac{4+2\sqrt{3}}{3}$

3) $\frac{4+2\sqrt{3}}{5\sqrt{4}} = \frac{4+2\sqrt{3}}{5\cdot 2} = \frac{4+2\sqrt{3}}{10} = \frac{2(2+\sqrt{3})}{10} = \frac{2+\sqrt{3}}{5}$

5) $\frac{2-5\sqrt{5}}{4\sqrt{13}}\left(\frac{\sqrt{13}}{\sqrt{13}}\right) = \frac{2\sqrt{13}-5\sqrt{65}}{4\cdot 13} = \frac{2\sqrt{13}-5\sqrt{65}}{52}$

7) $\frac{\sqrt{2}-3\sqrt{3}}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{6}-3\sqrt{9}}{3} = \frac{\sqrt{6}-3\cdot 3}{3} = \frac{\sqrt{6}-9}{3}$

9) $\frac{2p+3\sqrt{5p^4}}{5\sqrt{20p^2}} = \frac{2p+3\sqrt{5p^4}}{5\sqrt{2^2\cdot 5p^2}} = \frac{2p+3p^2\sqrt{5}}{5\cdot 2p\sqrt{5}} = \frac{2p+3p^2\sqrt{5}}{10p\sqrt{5}}\left(\frac{\sqrt{5}}{\sqrt{5}}\right) = \frac{2p\sqrt{5}+3p^2\sqrt{25}}{10p(5)} = \frac{2p\sqrt{5}+3p^2\cdot 5}{50p} = \frac{2p\sqrt{5}+15p^2}{50p} = \frac{p(2\sqrt{5}+15p)}{50p} = \frac{2\sqrt{5}+15p}{50}$

11) $\frac{\sqrt{3m^2}-4\sqrt{2m^4}}{5\sqrt{12m^4}} = \frac{\sqrt{3m^2}-4\sqrt{2m^4}}{5\sqrt{2^2\cdot 3m^4}} = \frac{m\sqrt{3}-4m^2\sqrt{2}}{2\cdot 5m^2\sqrt{3}} = \frac{m\sqrt{3}-4m^2\sqrt{2}}{10m^2\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{m\sqrt{9}-4m^2\sqrt{6}}{10m^2\cdot 3} = \frac{3m-4m^2\sqrt{6}}{30m^2} = \frac{m(3-4m\sqrt{6})}{30m^2} = \frac{3-4m\sqrt{6}}{30m}$

13) $\frac{5}{3\sqrt{5}+\sqrt{2}}\left(\frac{3\sqrt{5}+2}{3\sqrt{5}+2}\right) = \frac{15\sqrt{5}-5\sqrt{2}}{9\cdot 5-2} = \frac{15\sqrt{5}-5\sqrt{2}}{45-2} = \frac{15\sqrt{5}-5\sqrt{2}}{43}$

15) $\frac{2}{5+\sqrt{2}}\left(\frac{5-\sqrt{2}}{5-\sqrt{2}}\right)=\frac{10-2\sqrt{2}}{25-2}=\frac{10-2\sqrt{2}}{23}$

17) $\frac{3}{4-3\sqrt{3}}\left(\frac{4+3\sqrt{3}}{4+3\sqrt{3}}\right)=\frac{12+9\sqrt{3}}{16-9\cdot 3}=\frac{12+9\sqrt{3}}{16-27}=\frac{12+9\sqrt{3}}{-11}$

19) $\frac{4}{3+\sqrt{5}}\left(\frac{3-\sqrt{5}}{3-\sqrt{5}}\right)=\frac{12-4\sqrt{5}}{9-5}=\frac{12-4\sqrt{5}}{4}=\frac{4(3-\sqrt{5})}{4}=3-\sqrt{5}$

21) $\frac{-4}{4-4\sqrt{2}}\left(\frac{4+4\sqrt{2}}{4+4\sqrt{2}}\right)=\frac{-16-16\sqrt{2}}{16-16\cdot 2}=\frac{-16-16\sqrt{2}}{16-32}=\frac{-16-16\sqrt{2}}{-16}=\frac{-16(1+\sqrt{2})}{-16}=1+\sqrt{2}$

23) $\frac{5}{\sqrt{n^4-5}}=\frac{5}{n^2-5}$

25) $\frac{4p}{3-5\sqrt{p^4}}=\frac{4p}{3-5p^2}$

27) $\frac{4}{5+\sqrt{5x^2}}=\frac{4}{5+x\sqrt{5}}\left(\frac{5-x\sqrt{5}}{5-x\sqrt{5}}\right)=\frac{20-4x\sqrt{5}}{25+5x^2}$

29) $\frac{5}{2+\sqrt{5r^3}}=\frac{5}{2+r\sqrt{5r}}\left(\frac{2-r\sqrt{5r}}{2-r\sqrt{5r}}\right)=\frac{10-5r\sqrt{5r}}{4-r^2(5r)}=\frac{10-5r\sqrt{5r}}{4-5r^3}$

31) $\frac{5}{-5v-3\sqrt{v}}\left(\frac{-5v+3\sqrt{v}}{-5v+3\sqrt{v}}\right)=\frac{-25v+15\sqrt{v}}{25v^2-9v}$

33) $\frac{4\sqrt{2}+3}{3\sqrt{2}+\sqrt{3}}\left(\frac{3\sqrt{2}-\sqrt{3}}{3\sqrt{2}-\sqrt{3}}\right)=\frac{12\sqrt{4}-4\sqrt{6}+9\sqrt{2}-3\sqrt{3}}{9\cdot 2-3}=\frac{12\cdot 2-4\sqrt{6}+9\sqrt{2}-3\sqrt{3}}{18-3}=\frac{24-4\sqrt{6}+9\sqrt{2}-3\sqrt{3}}{15}$

35) $\frac{2-\sqrt{5}}{-3+\sqrt{5}}\left(\frac{-3-\sqrt{5}}{-3-\sqrt{5}}\right)=\frac{-6-2\sqrt{5}+3\sqrt{5}+\sqrt{25}}{9-5}=\frac{-6-2\sqrt{5}+3\sqrt{5}+5}{4}=\frac{-1+\sqrt{5}}{4}$

37) $\frac{5\sqrt{2}+\sqrt{3}}{5+5\sqrt{2}}\left(\frac{5-5\sqrt{2}}{5-5\sqrt{2}}\right)=\frac{25\sqrt{2}-25\sqrt{4}+5\sqrt{3}-5\sqrt{6}}{25-25\cdot 2}=\frac{25\sqrt{2}-25\cdot 2+5\sqrt{3}-5\sqrt{6}}{25-50}=$
$\frac{25\sqrt{2}-50+5\sqrt{3}-5\sqrt{6}}{-25}=\frac{5(5\sqrt{2}-10+\sqrt{3}-\sqrt{6})}{-25}=\frac{5\sqrt{2}-10+\sqrt{3}-\sqrt{6}}{-5}$

39) $\frac{\sqrt{3}+\sqrt{2}}{2\sqrt{3}-\sqrt{2}}\left(\frac{2\sqrt{3}+\sqrt{2}}{2\sqrt{3}+\sqrt{2}}\right)=\frac{2\sqrt{9}+\sqrt{6}+2\sqrt{6}+\sqrt{4}}{4\cdot 3-2}=\frac{2\cdot 3+\sqrt{6}+2\sqrt{6}+2}{12-2}=\frac{6+\sqrt{6}+2\sqrt{6}+2}{10}=\frac{8+3\sqrt{6}}{10}$

41) $\frac{\sqrt{3}-\sqrt{2}}{4+\sqrt{5}}\left(\frac{4-\sqrt{5}}{4-\sqrt{5}}\right)=\frac{4\sqrt{3}-\sqrt{15}-4\sqrt{2}+\sqrt{10}}{16-5}=\frac{4\sqrt{3}-\sqrt{15}-4\sqrt{2}+\sqrt{10}}{11}$

43) $\frac{4+2\sqrt{2x^2}}{5+2\sqrt{5x^3}}=\frac{4+2x\sqrt{2}}{5+2x\sqrt{5x}}\left(\frac{5-2x\sqrt{5x}}{5-2x\sqrt{5x}}\right)=\frac{20+8x\sqrt{5x}+10x\sqrt{2}-4x^2\sqrt{10x}}{25-4x^2(5x)}=$
$\frac{20+8x\sqrt{5x}+10x\sqrt{2}-4x^2\sqrt{10x}}{25-20x^3}$

45) $\frac{\left(2\sqrt{3m^2}-\sqrt{2m^4}\right)}{5-\sqrt{3m^2}}=\frac{\left(2m\sqrt{3}-m^2\sqrt{2}\right)}{5-m\sqrt{3}}\left(\frac{5+m\sqrt{3}}{5+m\sqrt{3}}\right)=\frac{10m\sqrt{3}+2m^2\sqrt{9}-5m^2\sqrt{2}-m^3\sqrt{6}}{25-3m^2}=$
$\frac{10m\sqrt{3}+2m^2(3)-5m^2\sqrt{2}-m^3\sqrt{6}}{25-3m^2}=\frac{10m\sqrt{3}+6m^2-5m^2\sqrt{2}-m^3\sqrt{6}}{25-3m^2}$

47) $\frac{2b-5\sqrt{2b}}{-1+\sqrt{2b^4}}=\frac{2b-5\sqrt{2b}}{-1+b^2\sqrt{2}}\left(\frac{-1-\sqrt{2}}{-1-\sqrt{2}}\right)=\frac{-2b-2b^3\sqrt{2}+5\sqrt{2b}-5b^2\sqrt{4b}}{1-2b^4}=$
$\frac{-2b-2b^3\sqrt{2}+5\sqrt{2b}-2\cdot5b^2\sqrt{b}}{1-2b^4}=\frac{-2b-2b^3\sqrt{2}+5\sqrt{2b}-10b^2\sqrt{b}}{1-2b^4}$

49) $\frac{2-\sqrt{2x}}{4x-5\sqrt{3x^3}}=\frac{2-\sqrt{2x}}{4x-5x\sqrt{3x}}\left(\frac{4x+5x\sqrt{3x}}{4x+5x\sqrt{3x}}\right)=\frac{8x+10x\sqrt{3x}-4x\sqrt{2x}-5x\sqrt{6x^2}}{16x^2+25x^2(3x)}=$
$\frac{8x+10x\sqrt{3x}-4x\sqrt{2x}-5x^2\sqrt{6}}{16x^2+75x^2}=\frac{x(8+10\sqrt{3x}-4\sqrt{2x}-5x\sqrt{6})}{x(16x+75x)}=\frac{8+10\sqrt{3x}-4\sqrt{2x}-5x\sqrt{6}}{16x+75x}$

51) $\frac{-4p-\sqrt{p}}{-p-\sqrt{p^3}}=\frac{-4p-\sqrt{p}}{-p-p\sqrt{p}}\left(\frac{-p+p\sqrt{p}}{-p+p\sqrt{p}}\right)=\frac{4p^2-4p^2\sqrt{p}+p\sqrt{p}-p\sqrt{p^2}}{p^2-p^2\cdot p}=\frac{4p^2-4p^2\sqrt{p}+p\sqrt{p}-p^2}{p^2-p^3}=$
$\frac{3p^2-4p^2\sqrt{p}+p\sqrt{p}}{p^2-p^3}=\frac{p(3p-4p\sqrt{p}+\sqrt{p})}{p(p-p^2)}=\frac{3p-4p\sqrt{p}+\sqrt{p}}{p-p^2}$

8.6

1) $m^{\frac{3}{5}}=\left(\sqrt[5]{m}\right)^3$

3) $r(7x)^{\frac{3}{2}}=\left(\sqrt{7x}\right)^3$

5) $\frac{1}{\left(\sqrt{6x}\right)^3}=(6x)^{-\frac{3}{2}}$

7) $\frac{1}{\left(\sqrt[4]{n}\right)^7}=n^{-\frac{7}{4}}$

9) $8^{\frac{2}{3}} = \left(\sqrt[3]{8}\right)^2 = 2^2 = 4$

11) $4^{\frac{3}{2}} = \left(\sqrt{4}\right)^3 = 2^3 = 8$

13) $yx^{\frac{1}{3}} \cdot xy^{\frac{3}{2}}$

$y^{\frac{2}{2}}x^{\frac{1}{3}}x^{\frac{3}{3}}y^{\frac{3}{2}}$

$x^{\frac{4}{3}}y^{\frac{5}{2}}$

15) $\left(a^{\frac{1}{2}}b^{\frac{1}{2}}\right)^{-1}$

$a^{-\frac{1}{2}}b^{-\frac{1}{2}}$

$\frac{1}{a^{\frac{1}{2}}b^{\frac{1}{2}}}$

17) $\frac{a^2b^0}{3a^4} = \frac{1}{3a^2}$

19) $uv \cdot u\left(v^{\frac{3}{2}}\right)^3$

$uv \cdot uv^{\frac{9}{2}}$

$uv^{\frac{2}{2}}uv^{\frac{9}{2}}$

$u^2v^{\frac{11}{2}}$

21) $\left(x^0y^{\frac{1}{3}}\right)^{\frac{3}{2}} x^0$

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

23) $\frac{a^{\frac{3}{4}}b^{-1}b^{\frac{7}{4}}}{3b^{-1}} = \frac{a^{\frac{3}{4}}b^{\frac{7}{4}}}{3}$

25) $\frac{3y^{-\frac{5}{4}}}{y^{-1}2y^{-\frac{1}{3}}} = \frac{3yy^{\frac{1}{3}}}{2y^{\frac{5}{4}}} = \frac{3y^{\frac{3}{3}}y^{\frac{1}{3}}}{2y^{\frac{5}{4}}} = \frac{3y^{\frac{4}{3}}}{2y^{\frac{5}{4}}} = \frac{3y^{\frac{16}{12}}}{2y^{\frac{15}{12}}} = \frac{3y^{\frac{1}{12}}}{2}$

27) $\left(\frac{m^{\frac{3}{2}}n^{-2}}{\left(mn^{\frac{4}{3}}\right)^{-1}}\right)^{\frac{7}{4}} = \left(\frac{m^{\frac{3}{2}}n^{-2}}{m^{-1}n^{-\frac{4}{3}}}\right)^{\frac{7}{4}} = \left(\frac{m^{\frac{3}{2}}mn^{\frac{4}{3}}}{n^2}\right)^{\frac{7}{4}} = \left(\frac{m^{\frac{3}{2}}m^{\frac{2}{2}}n^{\frac{4}{3}}}{n^{\frac{6}{3}}}\right)^{\frac{7}{4}} = \left(\frac{m^{\frac{5}{2}}}{n^{\frac{2}{3}}}\right)^{\frac{7}{4}} = \frac{m^{\frac{35}{8}}}{n^{\frac{7}{6}}}$

29) $r\dfrac{\left(m^2n^{\frac{1}{2}}\right)^0}{n^{\frac{3}{4}}}=\dfrac{1}{n^{\frac{3}{4}}}$

31) $r\dfrac{\left(x^{-\frac{4}{3}}y^{-\frac{1}{3}}y\right)^{-1}}{x^{\frac{1}{3}}y^{-2}}=\dfrac{\left(x^{-\frac{4}{3}}y^{-\frac{1}{3}}y^{\frac{3}{3}}\right)^{-1}}{x^{\frac{1}{3}}y^{-2}}=\dfrac{\left(x^{-\frac{4}{3}}y^{\frac{2}{3}}\right)^{-1}}{x^{\frac{1}{3}}y^{-2}}=\dfrac{x^{\frac{4}{3}}y^{-\frac{2}{3}}}{x^{\frac{1}{3}}y^{-2}}=\dfrac{x^{\frac{4}{3}}y^{2}}{x^{\frac{1}{3}}y^{\frac{2}{3}}}=\dfrac{x^{\frac{4}{3}}y^{\frac{6}{3}}}{x^{\frac{1}{3}}y^{\frac{2}{3}}}=xy^{\frac{4}{3}}$

33) $\dfrac{(uv^2)^{\frac{1}{2}}}{v^{-\frac{1}{4}}v^2}=\dfrac{u^{\frac{1}{2}}v}{v^{-\frac{1}{4}}v^2}=\dfrac{u^{\frac{1}{2}}v^{\frac{1}{4}}v}{v^2}=\dfrac{u^{\frac{1}{2}}v^{\frac{1}{4}}v^{\frac{4}{4}}}{v^2}=\dfrac{u^{\frac{1}{2}}v^{\frac{5}{4}}}{v^2}=\dfrac{u^{\frac{1}{2}}v^{\frac{5}{4}}}{v^{\frac{8}{4}}}=\dfrac{u^{\frac{1}{2}}}{v^{\frac{3}{4}}}$

8.7

1) $\sqrt[8]{16x^4y^6}$
$\sqrt[8]{2^4x^4y^6}$
$\sqrt[4]{2^2x^2y^3}$
$\sqrt[4]{4x^2y^3}$

3) $\sqrt[12]{64\,x^4y^6z^8}$
$\sqrt[12]{2^6x^4y^6z^8}$
$\sqrt[6]{2^3x^2y^3z^4}$
$\sqrt[6]{8x^2y^3z^4}$

5) $\sqrt[6]{\dfrac{16x^2}{9y^4}}=\sqrt[6]{\dfrac{2^4x^2}{3^2y^4}}=\sqrt[3]{\dfrac{2^2x}{3y^2}}\left(\dfrac{\sqrt[3]{3^2y}}{\sqrt[3]{3^2y}}\right)=$
$\dfrac{\sqrt[3]{36xy}}{3y}$

7) $\sqrt[12]{x^6y^9}$
$\sqrt[4]{x^2y^3}$

9) $\sqrt[8]{x^6y^4z^2}$
$\sqrt[4]{x^3y^2z}$

11) $\sqrt[9]{8x^3y^6}$
$\sqrt[9]{2^3x^3y^6}$
$\sqrt[3]{2xy^2}$

13) $\sqrt[3]{5}\sqrt{6}$
$\sqrt[6]{5^2\cdot 6^3}$
$\sqrt[6]{25\ \cdot 216}$
$\sqrt[6]{5400}$

15) $\sqrt{x}\sqrt[3]{7y}$
$\sqrt[6]{x^3\cdot 7^2y^2}$
$\sqrt[6]{49x^3y^2}$

17) $\sqrt{x}\ \sqrt[3]{x-2}$
$\sqrt[6]{x^3(x-2)^2}$

19) $\sqrt[5]{x^2y}\ \sqrt{xy}$
$\sqrt[10]{x^4y^2\cdot x^5y^5}$
$\sqrt[10]{x^9y^7}$

21) $\sqrt[4]{xy^2}\ \sqrt[3]{x^2y}$
$\sqrt[12]{x^3y^6\cdot x^8y^4}$
$\sqrt[12]{x^{11}y^{10}}$

23) $\sqrt[4]{a^2bc^2}\ \sqrt[5]{a^2b^3c}$

$\sqrt[20]{a^{10}b^5c^{10} \cdot a^8b^{12}c^4}$

$\sqrt[20]{a^{18}b^{17}c^{14}}$

25) $\sqrt{a}\ \sqrt[4]{a^3}$

$\sqrt[4]{a^2 \cdot a^3}$

$\sqrt[4]{a^5}$

$a\sqrt[4]{a}$

27) $\sqrt[5]{b^2}\ \sqrt{b^3}$

$\sqrt[10]{b^4 \cdot b^{15}}$

$\sqrt[10]{b^{19}}$

$b\sqrt[10]{b^9}$

29) $\sqrt{xy^3}\ \sqrt[3]{x^2y}$

$\sqrt[6]{x^3y^9x^4y^2}$

$\sqrt[6]{x^7y^{11}}$

$xy\sqrt[6]{xy^5}$

31) $\sqrt[4]{9ab^3}\ \sqrt{3a^4b}$

$\sqrt[4]{3^2ab^3}\ \sqrt{3a^4b}$

$\sqrt[4]{3^2ab^3 \cdot 3^2a^8b^2}$

$\sqrt[4]{3^4a^9b^5}$

$3a^2b\sqrt[4]{ab}$

33) $\sqrt[3]{3xy^2z}\ \sqrt[4]{9x^3yz^2}$

$\sqrt[3]{3xy^2z}\ \sqrt[4]{3^2x^3yz^2}$

$\sqrt[12]{3^4x^4y^8z^4 \cdot 3^6x^9y^3z^6}$

$\sqrt[12]{3^{10}x^{13}y^{11}z^{10}}$

$x\sqrt[12]{59049xy^{11}z^{10}}$

35) $\sqrt{27a^5(b+1)}\ \sqrt[3]{81a(b+1)^4}$

$\sqrt{3^3a^5(b+1)}\ \sqrt[3]{3^4a(b+1)^4}$

$\sqrt[6]{3^9a^{15}(b+1)^3 \cdot 3^8a^2(b+1)^8}$

$\sqrt[6]{3^{17}a^{17}(b+1)^{11}}$

$3^2a^2(b+1)\sqrt[6]{3^5a^5(b+1)^5}$

$9a^2(b+1)\sqrt[6]{243a^5(b+1)^5}$

37) $\frac{\sqrt[3]{a^2}}{\sqrt[4]{a}} = \sqrt[12]{\frac{a^8}{a^3}} = \sqrt[2]{a^5}$

39) $\frac{\sqrt[4]{x^2y^3}}{\sqrt[3]{xy}} = \sqrt[12]{\frac{x^6y^9}{x^4y^4}} = \sqrt[12]{x^2y^5}$

41) $\frac{\sqrt{ab^3c}}{\sqrt[5]{a^2b^3c^{-1}}} = \sqrt[10]{\frac{a^5b^{15}c^5}{a^4b^6c^{-2}}} = \sqrt[10]{ab^9c^7}$

43) $\frac{\sqrt[4]{(3x-1)^3}}{\sqrt[5]{(3x-1)^3}} = \sqrt[20]{\frac{(3x-1)^{15}}{(3x-1)^{12}}} = \sqrt[20]{(3x-1)^3}$

45) $\frac{\sqrt[3]{(2x+1)^2}}{\sqrt[5]{(2x+1)^2}} = \sqrt[15]{\frac{(2x+1)^{10}}{(2x+1)^6}} = \sqrt[15]{(2x+1)^4}$

8.8

1) $3-(-8+4i)$
$3+8-4i$
$11-4i$

3) $r7i-(3-2i)$
$7i-3+2i$
$-3+9i$

5) $-6i-(3+7i)$
$-6i-3-7i$
$-3-13i$

7) $(3-3i)+(-7-8i)$
$3-3i-7-8i$
$-4-11i$

9) $i-(2+3i)-6$
$i-2-3i-6$
$-8-2i$

11) $(6i)(-8i)$
$-48i^2$
$-48(-1)$
48

13) $(-5i)(8i)$
$-40i^2$
$-40(-1)$
40

15) $(-7i)^2$
$49i^2$
$49(-1)$
-49

17) $(6+5i)^2$
$36+60i+25i^2$
$36+60i+25(-1)$
$36+60i-25$
$11+60i$

19) $(-7-4i)(-8+6i)$
$56-42i+32i-24i^2$
$56-42i+32i-24(-1)$
$56-42i+32i+24$
$80-10i$

21) $(-4+5i)(2-7i)$
$-8+28i+10i-35i^2$
$-8+28i+10i-35(-1)$
$-8+28i+10i+35$
$27+38i$

23) $(-8-6i)(-4+2i)$
$32-16i+24i-12i^2$
$32-16i+24i-12(-1)$
$32-16i+24i+12$
$44+8i$

25) $(1+5i)(2+i)$
$2+i+10i+5i^2$
$2+i+10i+5(-1)$
$2+i+10i-5$
$-3+11i$

27) $\frac{(-9+5i)}{i}\frac{(i)}{(i)}=\frac{-9i+5i^2}{i^2}=\frac{-9i+5(-1)}{-1}=\frac{-9i-5}{-1}=$
$9i+5$

29) $\frac{(-10-9i)}{6i}\frac{(i)}{(i)}=\frac{-10i-9i^2}{6i^2}=\frac{-10i-9(-1)}{6(-1)}=\frac{-10i+9}{-6}$

31) $\frac{(-3-6i)}{4i}\frac{(i)}{(i)}=\frac{-3i-6i^2}{4i^2}=\frac{-3i-6(-1)}{4(-1)}=\frac{-3i+6}{-4}$

33) $\frac{(10-i)}{-i}\frac{(i)}{(i)} = \frac{10i-i^2}{-i^2} = \frac{10i-(-1)}{-(-1)} = \frac{10i+1}{1} = 10i+1$

35) $\frac{4i}{-10+i}\frac{(-10-i)}{(-10-i)} = \frac{-40i-4i^2}{100-i^2} = \frac{-40i-4(-1)}{100-(-1)} = \frac{-40i+4}{100+1} = \frac{-40i+4}{101}$

37) $\frac{8}{7-6i}\frac{(7+6i)}{(7+6i)} = \frac{56+48i}{49-36i^2} = \frac{56+48i}{49-36(-1)} = \frac{56+48i}{49+36} = \frac{56+48i}{85}$

39) $\frac{7}{10-7i}\frac{(10+7i)}{(10+7i)} = \frac{70+49i}{100-49i^2} = \frac{70+49i}{100-49(-1)} = \frac{70+49i}{100+49} = \frac{70+49i}{149}$

41) $\frac{5i}{-6-i}\frac{(-6+i)}{(-6+i)} = \frac{-30i+5i^2}{36-i^2} = \frac{-30i+5(-1)}{36-1(-1)} = \frac{-30i+5(-1)}{36-1(-1)} = \frac{-30i-5}{36+1} = \frac{-30i-5}{37}$

43) $\sqrt{-81}$
$\sqrt{-1\cdot 3^2}$
$3^2 i$
$9i$

45) $\sqrt{-10}\sqrt{-2}$
$\sqrt{-1\cdot 10}\sqrt{-1\cdot 2}$
$i\sqrt{10}\cdot i\sqrt{2}$
$i^2\sqrt{20}$
$-1\sqrt{2^2\cdot 5}$
$-1\cdot 2\sqrt{5}$
$-2\sqrt{5}$

47) $\frac{3+\sqrt{-27}}{6} = \frac{3+\sqrt{-1\cdot 3^3}}{6} = \frac{3+3i\sqrt{3}}{6} = \frac{3\left(1+i\sqrt{3}\right)}{6} = \frac{1+\sqrt{3}}{2}$

49) $\frac{8-\sqrt{-16}}{4} = \frac{8-\sqrt{-1\cdot 2^4}}{4} = \frac{8-2^2 i}{4} = \frac{8-4i}{4} = \frac{4(2-i)}{4} = 2-i$

51) $i^{73} = i^1 = i$

53) $i^{48} = i^0 = 1$

55) $i^{62} = i^2 = -1$

57) $i^{154} = i^2 = -1$

Chapter 9: Quadratics

9.1

1) $\sqrt{2x+3}-3=0$

$+3 \quad +3$

$\left(\sqrt{2x+3}\right)^2=3^2$

$2x+3=9$

$-3 \quad -3$

$\frac{2x}{2}=\frac{6}{2}$

$x=3$

Check: $\sqrt{2(3)+3}-3=0$

$\sqrt{6+3}-3=0$

$\sqrt{9}-3=0$

$3-3=0$

$0=0\,\surd$

$x=3$

3) $\sqrt{6x-5}-x=0$

$+x \quad +x$

$\left(\sqrt{6x-5}\right)^2=x^2$

$6x-5=x^2$

$-6x+5 \quad -6x+5$

$0=x^2-6x+5$

$0=(x-1)(x-5)$

$x-1=0 \quad x-5=0$

$+1 \quad +1 \qquad +5 \quad +5$

$x=1 \qquad x=5$

Check: $\sqrt{6(5)-5}-5=0$

$\sqrt{30-5}-5=0$

$\sqrt{25}-5=0$

$5-5=0$

$0=0$ ∨

Check: $\sqrt{6(1)-5}-1=0$

$\sqrt{6-5}-1=0$

$\sqrt{1}-1=0$

$1-1=0$

$0=0$∨

$x=5,1$

5) $(3+x)^2=\left(\sqrt{6x+13}\right)^2$

$9+6x+x^2=6x+13$

$-13-6x \quad -6x-13$

$x^2-4=0$

$(x+2)(x-2)=0$

$x+2=0 \quad x-2=0$

$-2 \quad -2 \qquad +2 \quad +2$

$x=-2 \qquad x=2$

Check: $3+(-2)=\sqrt{6(-2)+13}$

$1=\sqrt{-12+13}$

$1=\sqrt{1}$

$1=1$ ∨

Check: $3+(2)=\sqrt{6(2)+13}$

$5=\sqrt{12+13}$

$5=\sqrt{25}$

$5=5$ ∨

$x=-2,2$

7) $\sqrt{3-3x}-1=2x$

$+1 \quad +1$

$\left(\sqrt{3-3x}\right)^2=(2x+1)^2$

$3-3x=4x^2+4x+1$

$-3+3x \qquad +3x-3$

$0=4x^2+7x-2$

$0=(4x-1)(x+2)$

$4x-1=0 \quad x+2=0$

$+1 \quad +1 \qquad -2 \quad -2$

$\frac{4x}{4}=\frac{1}{4} \qquad x=-2$

$x=\frac{1}{4}$

Check: $\sqrt{3-3(\frac{1}{4})}-1=2\left(\frac{1}{4}\right)$

$\sqrt{3-\frac{3}{4}}-1=\frac{1}{2}$

$\sqrt{\frac{9}{4}}-1=\frac{1}{2}$

$\frac{3}{2}-1=\frac{1}{2}$

$\frac{1}{2}=\frac{1}{2}$ ∨

Check: $\sqrt{3-3(-2)}-1=2(-2)$

$\sqrt{3+6}-1=-4$

$\sqrt{9}-1=-4$

$3-1=-4$

$2=-4 \quad No!$

$x=\frac{1}{4}$

9) $\sqrt{4x+5}-\sqrt{x+4}=2$

$+\sqrt{x+4} \quad +\sqrt{x+4}$

$\left(\sqrt{4x+5}\right)^2=\left(2+\sqrt{x+4}\right)^2$

$4x+5=4+4\sqrt{x+4}+x+4$

$4x+5=8+x+4\sqrt{x+4}$

$-x-8 \quad -8-x$

$(3x-3)^2=\left(4\sqrt{x+4}\right)^2$

$9x^2-18x+9=16(x+4)$

$9x^2-18x+9=16x+64$

$-16x-64 \quad -16x-64$

$9x^2-34x-55=0$

$(9x+11)(x-5)=0$

$9x+11=0 \quad x-5=0$

$-11 \quad -11 \quad +5 \quad +5$

$\frac{9x}{9}=\frac{(-11)}{9} \qquad x=5$

$x=-\frac{11}{9}$

Check: $\sqrt{4\left(-\frac{11}{9}\right)+5}-\sqrt{-\frac{11}{9}+4}=2$

$\sqrt{-\frac{44}{9}+5}-\sqrt{\frac{25}{9}}=2$

$\sqrt{\frac{1}{9}}-\frac{5}{3}=2$

$\frac{1}{3}-\frac{5}{3}=2$

$-2=2 \quad No!$

Check: $\sqrt{4(5)+5}-\sqrt{(5)+4}=2$

$\sqrt{20+5}-\sqrt{9}=2$

$\sqrt{25}-3=2$

$5-3=2$

$2=2$ √

$x=5$

11) $\sqrt{2x+4}-\sqrt{x+3}=1$

$+\sqrt{x+3} \quad +\sqrt{x+3}$

$\left(\sqrt{2x+4}\right)^2=\left(1+\sqrt{x+3}\right)^2$

$2x+4=1+2\sqrt{x+3}+x+3$

$2x+4=4+x+2\sqrt{x+3}$

$-x-4 \quad -4-x$

$(x)^2=\left(2\sqrt{x+3}\right)^2$

$x^2=4(x+3)$

$x^2=4x+12$

$-4x-12 \quad -4x-12$

$x^2-4x-12=0$

$(x-6)(x+2)=0$

$x-6=0 \quad x+2=0$

$+6 \quad +6 \quad -2 \quad -2$

$x=6 \qquad x=-2$

Check: $\sqrt{2(6)+4}-\sqrt{(6)+3}=1$

$\sqrt{12+4}-\sqrt{9}=1$

$\sqrt{16}-3=1$

$4-3=1$

$1=1$ √

Check: $\sqrt{2(-2)+4}-\sqrt{(-2)+3}=1$

$\sqrt{-4+4}-\sqrt{1}=1$

$\sqrt{0}-1=1$

$0-1=1$

$-1=1 \quad No!$

$x=6$

13) $\sqrt{2x+6}-\sqrt{x+4}=1$

$\underline{+\sqrt{x+4}\quad+\sqrt{x+4}}$

$\left(\sqrt{2x+6}\right)^2=\left(1+\sqrt{x+4}\right)^2$

$2x+6=1+2\sqrt{x+4}+x+4$

$2x+6=5+x+2\sqrt{x+4}$

$\underline{-x-5\quad-5-x}$

$(x+1)^2=\left(2\sqrt{x+4}\right)^2$

$x^2+2x+1=4(x+4)$

$x^2+2x+1=4x+16$

$\underline{-4x-16\quad-4x-16}$

$x^2-2x-15=0$

$(x-5)(x+3)=0$

$x-5=0\quad x+3=0$

$\underline{+5\quad+5}\qquad\underline{-3\quad-3}$

$x=5\qquad x=-3$

Check: $\sqrt{2(5)+6}-\sqrt{(5)+4}=1$

$\sqrt{10+6}-\sqrt{9}=1$

$\sqrt{16}-3=1$

$4-3=1$

$1=1$ ∨

Check: $\sqrt{2(-3)+6}-\sqrt{(-3)+4}=1$

$\sqrt{-6+6}-\sqrt{1}=1$

$\sqrt{0}-1=1$

$0-1=1$

$-1=1\quad No!$

$x=5$

15) $\sqrt{6-2x}-\sqrt{2x+3}=3$

$\underline{+\sqrt{2x+3}\quad+\sqrt{2x+3}}$

$\left(\sqrt{6-2x}\right)^2=\left(3+\sqrt{2x+3}\right)^2$

$6-2x=9+6\sqrt{2x+3}+2x+3$

$6-2x=2x+12+6\sqrt{2x+3}$

$\underline{-12-2x\quad-2x-12}$

$(-6-4x)^2=\left(6\sqrt{2x+3}\right)^2$

$36+48x+16x^2=36(2x+3)$

$16x^2+48x+36=72x+108$

$\underline{-72x-108\quad-72x-108}$

$16x^2-24x-72=0$

$8(2x^2-3x-9)=0$

$8(2x+3)(x-3)=0$

$2x+3=0\quad x-3=0$

$\underline{-3\quad-3}\qquad\underline{+3\quad+3}$

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

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

Check: $\sqrt{6-2(-\frac{3}{2})}-\sqrt{2\left(-\frac{3}{2}\right)+3}=3$

$\sqrt{6+3}-\sqrt{-3+3}=3$

$\sqrt{9}-\sqrt{0}=3$

$3-0=3$

$3=3$ ∨

Check: $\sqrt{6-2(3)}-\sqrt{2(3)+3}=3$

$\sqrt{6-6}-\sqrt{6+3}=3$

$\sqrt{0}-\sqrt{9}=3$

$0-3=3$

$-3=3\quad No!$

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

9.2

1) $\sqrt{x^2}=\sqrt{75}$

$x=\pm\sqrt{75}$

$x=\pm\sqrt{5^2\cdot 3}$

$x=\pm 5\sqrt{3}$

3) $x^2+5=13$

$\underline{-5\quad-5}$

$\sqrt{x^2}=\sqrt{8}$

$x=\pm\sqrt{2^3}$

$x=\pm 2\sqrt{2}$

5) $3x^2 + 1 = 73$

$\underline{-1 \quad -1}$

$\frac{3x^2}{3} = \frac{72}{3}$

$\sqrt{x^2} = \sqrt{24}$

$x = \pm\sqrt{24}$

$x = \pm\sqrt{2^3 \cdot 3}$

$x = \pm 2\sqrt{2 \cdot 3}$

$x = \pm 2\sqrt{6}$

7) $\sqrt[5]{(x+2)^5} = \sqrt[5]{-243}$

$x + 2 = -3$

$\underline{-2 \quad -2}$

$x = -5$

9) $(2x+5)^3 - 6 = 21$

$+6 \quad +6$

$\sqrt[3]{(2x+5)^3} = \sqrt[3]{27}$

$2x + 5 = 3$

$\underline{-5 \quad -5}$

$\frac{2x}{2} = \frac{(-2)}{2}$

$x = -1$

11) $(x-1)^{\frac{2}{3}} = 16$ `

$\sqrt{\left(\sqrt[3]{x-1}\right)^2} = \sqrt{16}$

$\left(\sqrt[3]{x-1}\right)^3 = (\pm 4)^3$

$x - 1 = \pm 64$

$\underline{+1 \quad +1}$

$x = 1 \pm 64$

$x = 65. -63$

13) $(2-x)^{\frac{3}{2}} = 27$

$\sqrt[3]{\left(\sqrt{2-x}\right)^3} = \sqrt[3]{27}$

$\left(\sqrt{2-x}\right)^2 = 3^2$

$2 - x = 9$

$\underline{-2 \quad -2}$

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

$x = -7$

Check: $\left(2-(-7)\right)^{\frac{3}{2}} = 27$

$9^{\frac{3}{2}} = 27$

$\left(\sqrt{9}\right)^3 = 27$

$3^3 = 27$

$27 = 27$ √

15) $(2x-3)^{\frac{2}{3}} = 4$

$\sqrt{\left(\sqrt[3]{2x-3}\right)^2} = \sqrt{4}$

$\left(\sqrt[3]{2x-3}\right)^3 = (\pm 2)^3$

$2x - 3 = \pm 8$

$\underline{+3 \quad +3}$

$\frac{2x}{2} = \frac{3 \pm 8}{2}$

$x = \frac{11}{2}, -\frac{5}{2}$

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

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

$\left(\sqrt{\frac{1}{x+\frac{1}{2}}}\right)^3 = (\pm 2)^3$

$\frac{1}{x+\frac{1}{2}} = \pm 8$

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

$\pm 8\left(x + \frac{1}{2}\right)$

$\frac{1}{\pm 8} = \frac{\pm 8\left(x+\frac{1}{2}\right)}{\pm 8}$

$\pm\frac{1}{8} = x + \frac{1}{2}$

$\underline{-\frac{1}{2} \quad -\frac{1}{2}}$

$-\frac{1}{2} \pm \frac{1}{8} = x$

$x = -\frac{3}{8}, -\frac{5}{8}$

19) $r(x-1)^{-\frac{5}{2}} = 32$

$\left(\frac{1}{x-1}\right)^{\frac{5}{2}} = 32$

$\sqrt[5]{\left(\sqrt{\frac{1}{x-1}}\right)^5} = \sqrt[5]{32}$

$\left(\sqrt{\frac{1}{x-1}}\right)^2 = (2)^2$

$(x-1)\frac{1}{x-1} = 4(x-1)$

$1 = 4x - 4$

$\underline{+4 \quad +4}$

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

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

Check: $\left(\frac{5}{4} - 1\right)^{-\frac{5}{2}} = 32$

$\left(\frac{1}{4}\right)^{-\frac{5}{2}} = 32$

$4^{\frac{5}{2}} = 32$

$\left(\sqrt{4}\right)^5 = 32$

$2^5 = 32$

$32 = 32$ √

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

21) $(3x-2)^{\frac{4}{5}} = 16$

$\sqrt[4]{\left(\sqrt[5]{3x-2}\right)^4} = \sqrt[4]{16}$

$\left(\sqrt[5]{3x-2}\right)^5 = +2^5$

$3x - 2 = \pm 32$

$\underline{+2 \quad +2}$

$\frac{3x}{3} = \frac{2 \pm 32}{3}$

$x = \frac{34}{3}, -10$

23) $(4x+2)^{\frac{3}{5}} = -8$

$$\sqrt[3]{\left(\sqrt[5]{4x+2}\right)^3} = \sqrt[3]{-8}$$

$$\left(\sqrt[5]{4x+2}\right)^5 = (-2)^5$$

$$4x+2 = -32$$

$$\underline{\quad -2 \quad -2}$$

$$\frac{4x}{4} = \frac{-34}{4}$$

$$x = -\frac{17}{2}$$

9.3

1) $x^2 - 30x + \_\_\_$

$$\left(-30 \cdot \frac{1}{2}\right)^2$$

$$(-15)^2 = 225$$

$$x^2 - 30x + 225$$

$$(x-15)^2$$

3) $m^2 - 36m + \_\_\_$

$$\left(-36 \cdot \frac{1}{2}\right)^2$$

$$(-18)^2 = 324$$

$$m^2 - 36m + 324$$

$$(m-18)^2$$

5) $x^2 - 15x + \_\_$

$$\left(-15 \cdot \frac{1}{2}\right)^2$$

$$\left(-\frac{15}{2}\right)^2 = \frac{225}{4}$$

$$x^2 - 15x + \frac{225}{4}$$

$$\left(x - \frac{15}{2}\right)^2$$

7) $y^2 - y + \_\_$

$$\left(-1 \cdot \frac{1}{2}\right)^2$$

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

$$y^2 - y + \frac{1}{4}$$

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

9) $x^2 - 16x + 55 = 0$

$$\underline{\quad -55 \quad -55}$$

$$x^2 - 16x \qquad = -55$$

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

$$(-8)^2 = 64$$

$$x^2 - 16x + 64 = -55 + 64f$$

$$\sqrt{(x-8)^2} = \sqrt{9}$$

$$x - 8 = \pm 3$$

$$\underline{\quad +8 \quad +8}$$

$$x = 8 \pm 3$$

$$x = 11, 5$$

11) $v^2 - 8v + 45 = 0$

$$\underline{\quad -45 \quad -45}$$

$$v^2 - 8v \qquad = -45$$

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

$$(-4)^2 = 16$$

$$v^2 - 8v + 16 = -45 + 16$$

$$\sqrt{(v-4)^2} = \sqrt{-29}$$

$$v - 4 = \pm i\sqrt{29}$$

$$\underline{\quad +4 \quad +4}$$

$$v = 4 \pm i\sqrt{29}$$

13) $6x^2 + 12x + 63 = 0$

$$-63 \quad -63$$
$$\frac{6x^2}{6} + \frac{12x}{6} = -\frac{63}{6}$$
$$x^2 + 2x = -\frac{21}{2}$$
$$\left(2 \cdot \frac{1}{2}\right)^2$$
$$(1)^2 = 1$$
$$x^2 + 2x + 1 = -\frac{21}{2} + 1$$
$$\sqrt{(x+1)^2} = \sqrt{-\frac{19}{2}}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$$
$$x + 1 = \pm\frac{i\sqrt{38}}{2}$$
$$-1 \quad -1$$
$$x = \frac{-2 \pm i\sqrt{38}}{2}$$

15) $5k^2 - 10k + 48 = 0$

$$-48 \quad -48$$
$$\frac{5k^2}{5} - \frac{10k}{5} = \frac{-48}{5}$$
$$k^2 - 2k = \frac{-48}{5}$$
$$\left(-2 \cdot \frac{1}{2}\right)^2$$
$$(-1)^2 = 1$$
$$k^2 - 2k + 1 = -\frac{48}{5} + 1$$
$$\sqrt{(k-1)^2} = \sqrt{-\frac{48}{5}}\left(\frac{\sqrt{5}}{\sqrt{5}}\right)$$
$$k - 1 = \pm\frac{i\sqrt{215}}{5}$$
$$+1 \quad +1$$
$$k = \frac{5 \pm i\sqrt{215}}{5}$$

17) $x^2 + 10x - 57 = 4$

$$+57 \quad +57$$
$$x^2 + 10x = 61$$
$$\left(10 \cdot \frac{1}{2}\right)^2$$
$$(5)^2 = 25$$
$$x^2 + 10x + 25 = 61 + 25$$
$$\sqrt{(x+5)^2} = \sqrt{86}$$
$$x + 5 = \pm\sqrt{86}$$
$$-5 \quad -5$$
$$x = -5 \pm \sqrt{86}$$

19) $n^2 - 16n + 67 = 4$

$$-67 \quad -67$$
$$n^2 - 16n = -63$$
$$\left(-16 \cdot \frac{1}{2}\right)^2 = (-8)^2 = 64$$
$$n^2 - 16n + 64 = 63 + 64$$
$$\sqrt{(n-8)^2} = \sqrt{1}$$
$$n - 8 = \pm 1$$
$$+8 \quad +8$$
$$n = 9, 7$$

21) $2x^2 + 4x + 38 = -6$

$$-38 \quad -38$$
$$\frac{2x^2}{2} + \frac{4x}{2} = \frac{-44}{2}$$
$$x^2 + 2x = -22$$
$$\left(2 \cdot \frac{1}{2}\right)^2 = 1^1 = 1$$
$$x^2 + 2x + 1 = -22 + 1$$
$$\sqrt{(x+1)^2} = \sqrt{-21}$$
$$x + 1 = \pm i\sqrt{21}$$
$$-1 \quad -1$$
$$x = -1 \pm i\sqrt{21}$$

23) $8b^2 + 16b - 37 = 5$

$$+37 \quad +37$$
$$\frac{8b^2}{8} + \frac{16b}{8} = \frac{42}{8}$$
$$b^2 + 2b = \frac{21}{4}$$
$$\left(2 \cdot \frac{1}{2}\right)^2 = 1^1 = 1$$
$$b^2 + 2b + 1 = \frac{21}{4} + 1$$
$$\sqrt{(b+1)^2} = \sqrt{\frac{25}{4}}$$
$$b + 1 = \pm\frac{5}{2}$$
$$-1 \quad -1$$
$$b = -1 \pm \frac{5}{2}$$
$$b = \frac{3}{2}, -\frac{7}{2}$$

25) $r \quad x^2 = -10x - 29$

$+10x \quad +10x$

$x^2 + 10x \quad = -29$

$\left(10 \cdot \frac{1}{2}\right)^2 = (5)^2 = 25$

$x^2 + 10x + 25 = -29 + 25$

$\sqrt{(x+5)^2} = \sqrt{-4}$

$x + 5 = \pm 2i$

$-5 \quad -5$

$x = -5 \pm 2i$

27) $n^2 = -21 + 10n$

$-10n \quad -10n$

$n^2 - 10n \quad = -21$

$\left(-10 \cdot \frac{1}{2}\right)^2 = (-5)^2 = 25$

$n^2 - 10n + 25 = -21 + 25$

$\sqrt{(n-5)^2} = \sqrt{4}$

$n - 5 = \pm 2$

$+5 \quad +5$

$n = 5 \pm 2$

$n = 7, 3$

29) $3k^2 + 9 = 6k$

$-6k - 9 \quad -6k - 9$

$\frac{3k^2}{3} - \frac{6k}{3} \quad = \frac{-9}{3}$

$k^2 - 2k \quad = -3$

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

$k^2 - 2k + 1 = -3 + 1$

$\sqrt{(k-1)^2} = \sqrt{-2}$

$k - 1 = \pm i\sqrt{2}$

$+1 \quad +1$

$k = 1 \pm i\sqrt{2}$

31) $2x^2 + 63 = 8x$

$-8x - 63 \quad -8x - 63$

$\frac{2x^2}{2} - \frac{8x}{2} \quad = -\frac{63}{2}$

$x^2 - 4x \quad = -\frac{63}{2}$

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

$x^2 - 4x + 4 = -\frac{63}{2} + 4$

$\sqrt{(x-2)^2} = \sqrt{-\frac{55}{2}} \left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$x - 2 = \pm \frac{i\sqrt{110}}{2}$

$+2 \quad +2$

$x = \frac{4 \pm i\sqrt{110}}{2}$

33) $p^2 - 8p \quad = -55$

$\left(-8 \cdot \frac{1}{2}\right)^2 = (-4)^2 = 16$

$p^2 - 8p + 16 = -55 + 16$

$\sqrt{(p-4)^2} = \sqrt{-39}$

$p - 4 = \pm i\sqrt{39}$

$+4 \quad +4$

$p = 4 \pm i\sqrt{39}$

35) $7n^2 - n + 7 \quad = \quad 7n + 6n^2$

$-6n^2 - 7n - 7 \quad -6n^2 - 7n - 7$

$n^2 - 8n \quad = -7$

$\left(-8 \cdot \frac{1}{2}\right)^2 = (-4)^2 = 16$

$n^2 - 8n + 16 = -7 + 16$

$\sqrt{(n-4)^2} = \sqrt{9}$

$n - 4 = \pm 3$

$+4 \quad +4$

$n = 4 \pm 3$

$n = 7, 1$

37) $13b^2 + 15b + 44 = -5 + 7b^2 + 3b$

$-7b^2 - 3b - 44 \quad -44 - 7b^2 - 3b$

$\frac{6b^2}{6} + \frac{12b}{6} = -\frac{49}{6}$

$b^2 + 2b = -\frac{49}{6}$

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

$b^2 + 2b + 1 = -\frac{49}{6} + 1$

$\sqrt{(b+1)^2} = \sqrt{-\frac{43}{6}}\left(\frac{\sqrt{6}}{\sqrt{6}}\right)$

$b + 1 = \pm\frac{i\sqrt{256}}{6}$

$-1 \quad -1$

$b = \frac{-6 \pm i\sqrt{256}}{6}$

39) $5x^2 + 5x = -31 - 5x$

$+5x \qquad +5x$

$\frac{5x^2}{5} + \frac{10x}{5} = -\frac{31}{5}$

$x^2 + 2x = -\frac{31}{5}$

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

$x^2 + 2x + 1 = -\frac{31}{5} + 1$

$\sqrt{(x+1)^2} = \sqrt{-\frac{26}{5}}\left(\frac{\sqrt{5}}{\sqrt{5}}\right)$

$x + 1 = \pm\frac{i\sqrt{130}}{5}$

$-1 \quad -1$

$x = \frac{-5 \pm i\sqrt{130}}{5}$

41) $v^2 + 5v + 28 = 0$

$-28 \quad -28$

$v^2 + 5v = -28$

$\left(5 \cdot \frac{1}{2}\right)^2 = \left(\frac{5}{2}\right)^2 = \frac{25}{4}$

$v^2 + 5v + \frac{25}{4} = -28 + \frac{25}{4}$

$\sqrt{\left(v + \frac{5}{2}\right)^2} = \sqrt{-\frac{87}{4}}$

$v + \frac{5}{2} = \pm\frac{i\sqrt{87}}{2}$

$-\frac{5}{2} \quad -\frac{5}{2}$

$v = \frac{-5 \pm i\sqrt{87}}{2}$

43) $7x^2 - 6x + 40 = 0$

$-40 \quad -40$

$\frac{7x^2}{7} - \frac{6x}{7} = -\frac{40}{7}$

$x^2 - \frac{6}{7}x = -\frac{40}{7}$

$\left(-\frac{6}{7} \cdot \frac{1}{2}\right)^2 = \left(-\frac{3}{7}\right)^2 = \frac{9}{49}$

$x^2 - \frac{6}{7}x + \frac{9}{49} = -\frac{40}{7} + \frac{9}{49}$

$\sqrt{\left(x - \frac{3}{7}\right)^2} = \sqrt{-\frac{271}{49}}$

$x - \frac{3}{7} = \pm\frac{i\sqrt{271}}{7}$

$+\frac{3}{7} \quad +\frac{3}{7}$

$x = \frac{3 \pm i\sqrt{271}}{7}$

45) $k^2 - 7k + 50 = 3$

$-50 \quad -50$

$k^2 - 7k = -47$

$\left(-7 \cdot \frac{1}{2}\right)^2 = \left(-\frac{7}{2}\right)^2 = \frac{49}{4}$

$k^2 - 7k + \frac{49}{4} = -47 + \frac{49}{4}$

$\sqrt{\left(k - \frac{7}{2}\right)^2} = \sqrt{-\frac{139}{4}}$

$k - \frac{7}{2} = \pm\frac{i\sqrt{139}}{2}$

$+\frac{7}{2} \quad +\frac{7}{2}$

$k = \frac{7 \pm i\sqrt{139}}{2}$

47) $5x^2 + 8x - 40 = 8$

$+40 \quad +40$

$\frac{5x^2}{5} + \frac{8x}{5} = \frac{48}{5}$

$x^2 + \frac{8}{5}x = \frac{48}{5}$

$\left(\frac{8}{5} \cdot \frac{1}{2}\right)^2 = \left(\frac{4}{5}\right)^2 = \frac{16}{25}$

$x^2 + \frac{8}{5}x + \frac{16}{25} = \frac{48}{5} + \frac{16}{25}$

$\sqrt{\left(x + \frac{4}{5}\right)^2} = \sqrt{\frac{256}{25}}$

$x + \frac{4}{5} = \pm\frac{16}{5}$

$-\frac{4}{5} \quad -\frac{4}{5}$

$x = \frac{-4 \pm 16}{5}$

49) $m^2 = -15 + 9m$

$-9m \quad -9m$

$m^2 - 9m = -15$

$\left(-9 \cdot \frac{1}{2}\right)^2 = \left(-\frac{9}{2}\right)^2 = \frac{81}{4}$

$m^2 - 9m + \frac{81}{4} = -15 + \frac{81}{4}$

$\sqrt{\left(m - \frac{9}{2}\right)^2} = \sqrt{\frac{21}{4}}$

$m - \frac{9}{2} = \pm\frac{\sqrt{21}}{2}$

$+\frac{9}{2} \quad +\frac{9}{2}$

$m = \frac{9 \pm \sqrt{21}}{2}$

51) $\frac{8r^2}{8} + \frac{10r}{8} = -\frac{55}{8}$

$r^2 + \frac{5}{4}r = -\frac{55}{8}$

$\left(\frac{5}{4} \cdot \frac{1}{2}\right)^2 = \left(\frac{5}{8}\right)^2 = \frac{25}{64}$

$r^2 + \frac{5}{4}r + \frac{25}{64} = -\frac{55}{8} + \frac{25}{64}$

$\sqrt{\left(r + \frac{5}{8}\right)^2} = \sqrt{\frac{-415}{64}}$

$r + \frac{5}{8} = \pm\frac{i\sqrt{416}}{8}$

$-\frac{5}{8} \quad -\frac{5}{8}$

$r = \frac{-5 \pm i\sqrt{415}}{8}$

53) $5n^2 - 8n + 60 = -3n - 6 + 4n^2$

$-4n^2 + 3n - 60 \quad +3n - 60 - 4n^2$

$n^2 + 5n = -54$

$\left(5 \cdot \frac{1}{2}\right)^2 = \left(\frac{5}{2}\right)^2 = \frac{25}{4}$

$n^2 + 5n + \frac{25}{4} = -54 + \frac{25}{4}$

$\sqrt{\left(n + \frac{5}{2}\right)^2} = \sqrt{-\frac{191}{4}}$

$n + \frac{5}{2} = \pm\frac{i\sqrt{191}}{2}$

$-\frac{5}{2} \quad -\frac{5}{2}$

$n = \frac{-5 \pm i\sqrt{191}}{2}$

55) $2x^2 + 3x - 5 = -4x^2$

$+4x^2 \quad +5 \quad +4x^2 + 5$

$\frac{6x^2}{6} + \frac{3x}{6} = \frac{5}{6}$

$x^2 + \frac{1}{2}x = \frac{5}{6}$

$\left(\frac{1}{2} \cdot \frac{1}{2}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$

$x^2 + \frac{1}{2}x + \frac{1}{16} = \frac{5}{6} + \frac{1}{16}$

$\sqrt{\left(x + \frac{1}{4}\right)^2} = \sqrt{\frac{43}{48}} = \frac{\sqrt{43}}{4\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)$

$x + \frac{1}{4} = \pm\frac{\sqrt{129}}{12}$

$-\frac{1}{4} \quad -\frac{1}{4}$

$x = \frac{(-3 \pm \sqrt{129})}{12}$

57) $-2x^2 + 3x - 5 = -4x^2$

$+4x^2 \quad +5 \quad +4x^2 + 5$

$\frac{2x^2}{2} + \frac{3x}{2} = \frac{5}{2}$

$x^2 + \frac{3}{2}x = \frac{5}{2}$

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

$x^2 + \frac{3}{2}x + \frac{9}{16} = \frac{5}{2} + \frac{9}{16}$

$\sqrt{\left(x + \frac{3}{4}\right)^2} = \sqrt{\frac{49}{16}}$

$x + \frac{3}{4} = \pm\frac{7}{4}$

$-\frac{3}{4} \quad -\frac{3}{4}$

$x = -\frac{3}{4} \pm \frac{7}{4}$

$x = 1, -\frac{5}{2}$

9.4

1) $4a^2 + 6 = 0$

$a = 4, b = 0, c = 6$

$\frac{-0 \pm \sqrt{0^2 - 4(4)(6)}}{2(4)} = \frac{\pm\sqrt{-96}}{8} = \frac{\pm\sqrt{-16 \cdot 6}}{8} = \frac{\pm 4i\sqrt{6}}{8} = \frac{\pm i\sqrt{6}}{2}$

3) $2x^2 - 8x - 2 = 0$

$a = 2, b = -8, c = -2$

$\frac{8 \pm \sqrt{(-8)^2 - 4(2)(-2)}}{2(2)} = \frac{8 \pm \sqrt{64+16}}{4} = \frac{8 \pm \sqrt{80}}{4} = \frac{8 \pm \sqrt{16 \cdot 5}}{4} = \frac{8 \pm 4\sqrt{5}}{4} = 2 \pm \sqrt{5}$

5) $2m^2 - 3 = 0$

$a = 2, b = 0, c = -3$

$\frac{-0 \pm \sqrt{(0)^2 - 4(2)(-3)}}{2(2)} = \frac{\pm\sqrt{24}}{4} = \frac{\pm\sqrt{4 \cdot 6}}{4} = \frac{(\pm 2\sqrt{6})}{4} = \frac{\pm\sqrt{6}}{2}$

7) $3r^2 - 2r - 1 = 0$

$a = 3, b = -2, c = -1$

$\frac{2 \pm \sqrt{(-2)^2 - 4(3)(-1)}}{2(3)} = \frac{2 \pm \sqrt{4+12}}{6} = \frac{2 \pm \sqrt{16}}{6} = \frac{2 \pm 4}{6} = 1, -\frac{1}{3}$

9) $4n^2 - 36 = 0$

$a = 4, b = 0, c = -36$

$\frac{-0 \pm \sqrt{0^2 - 4(4)(-36)}}{2(4)} = \frac{\pm\sqrt{576}}{8} = \frac{\pm 24}{8} = \pm 3$

11) $v^2 - 4v - 5 = -8$

$+8 \quad +8$

$v^2 - 4v + 3 = 0$

$a = 1, b = -4, c = 3$

$\frac{4 \pm \sqrt{(-4)^2 - 4(1)(3)}}{2(1)} = \frac{4 \pm \sqrt{16-12}}{2} = \frac{4 \pm \sqrt{4}}{2} = \frac{4 \pm 2}{2} = 3,1$

13) $2a^2 + 3a + 14 = 6$

$-14 \quad -14$

$2a^2 + 3a + 8 = 0$

$a = 2, b = 3, c = 8$

$\frac{-3 \pm \sqrt{(3^2 - 4(2)(8)}}{2(2)} = \frac{-3 \pm \sqrt{9-64}}{4} = \frac{-3 \pm \sqrt{-55}}{4} = \frac{-3 \pm i\sqrt{55}}{4}$

15) $3k^2 + 3k - 4 = 7$

$\underline{\quad -7 \quad -7}$

$3k^2 + 3k - 11 = 0$

$a = 3, b = 3, c = -11$

$\frac{-3 \pm \sqrt{3^2 - 4(3)(-11)}}{2(3)} = \frac{-3 \pm \sqrt{9 + 132}}{6} = \frac{-3 \pm \sqrt{141}}{6}$

17) $7x^2 + 3x - 16 = -2$

$\underline{\quad +2 \quad +2}$

$7x^2 + 3x - 14 = 0$

$a = 7, b = 3, c = -14$

$\frac{-3 \pm \sqrt{3^2 - 4(7)(-14)}}{2(7)} = \frac{-3 \pm \sqrt{9 + 392}}{14} = \frac{-3 \pm \sqrt{401}}{14}$

19) $2p^2 + 6p - 16 = 4$

$\underline{\quad -4 \quad -4}$

$2p^2 + 6p - 20 = 0$

$a = 2, b = 6, c = -20$

$\frac{-6 \pm \sqrt{6^2 - 4(2)(-20)}}{2(2)} = \frac{-6 \pm \sqrt{36 + 160}}{4} = \frac{-6 \pm \sqrt{196}}{4} = \frac{-6 \pm 14}{4} = 2, -5$

21) $3n^2 + 3n = -3$

$\underline{\quad +3 \quad +3}$

$3n^2 + 3n + 3 = 0$

$a = 3, b = 3, c = 3$

$\frac{-3 \pm \sqrt{(3)^2 - 4(3)(3)}}{2(3)} = \frac{-3 \pm \sqrt{9 - 36}}{6} = \frac{-3 \pm \sqrt{-9 \cdot 3}}{6} = \frac{-3 \pm 3i\sqrt{3}}{6} = \frac{-1 \pm i\sqrt{3}}{6}$

23) $2x^2 \quad = -7x + 49$

$\underline{+7x - 49 + 7x - 49}$

$2x^2 + 7x - 49 = 0$

$a = 2, b = 7, c = -49$

$\frac{-7 \pm \sqrt{(7)^2 - 4(2)(-49)}}{2(2)} = \frac{-7 \pm \sqrt{49 + 392}}{4} = \frac{-7 \pm \sqrt{441}}{4}$

25) $5x^2 \qquad = 7x + 7$

$\underline{-7x - 7 \ -7x - 7}$

$5x^2 - 7x - 7 = 0$

$a = 5, b = -7, c = -7$

$\frac{7 \pm \sqrt{(-7)^2 - 4(5)(-7)}}{2(5)} = \frac{7 \pm \sqrt{49 + 140)}}{10} = \frac{7 \pm \sqrt{189}}{10} = \frac{7 \pm \sqrt{9 \cdot 21}}{10} = \frac{7 \pm 3\sqrt{21}}{10}$

27) $8n^2 \quad = -3n - 8$

$\underline{+3n + 8 \quad + 3n + 8}$

$8n^2 + 3n + 8 = 0$

$a = 8, b = 3, c = 8$

$\frac{-3 \pm \sqrt{3^2 - 4(8)(8)}}{2(8)} = \frac{-3 \pm \sqrt{9 - 256}}{16} = \frac{-3 \pm \sqrt{-247}}{16} = \frac{-3 \pm i\sqrt{247}}{16}$

29) $2x^2 + 5x = -3$

$\underline{\quad +3 \quad + 3}$

$2x^2 + 5x + 3 = 0$

$a = 2, b = 5, c = 3$

$\frac{-5 \pm \sqrt{5^2 - 4(2)(3)}}{2(2)} = \frac{-5 \pm \sqrt{25 - 24}}{4} = \frac{-5 \pm \sqrt{1}}{4} = \frac{-5 \pm 1}{4} = -1, -\frac{3}{2}$

31) $4a^2 - 64 = 0$

$a = 4, b = 0, c = -64$

$\frac{-0 \pm \sqrt{o^2 - 4(4)(-64)}}{2(4)} = \frac{\pm\sqrt{1024}}{8} = \frac{\pm 32}{8} = \pm 4$

33) $4p^2 + 5p - 36 = 3p^2$

$\underline{-3p^2 \quad\quad - 3p^2}$

$p^2 + 5p - 36 = 0$

$a = 1, b = 5, c = -36$

$\frac{-5 \pm \sqrt{5^2 - 4(1)(-36)}}{2(1)} = \frac{-5 \pm \sqrt{25 + 144}}{2} = \frac{-5 \pm \sqrt{169}}{2} = \frac{-5 \pm 13}{2} = 4, -9$

35) $-5n^2 - 3n - 52 = 2 - 7n^2$

$\underline{+7n^2 \quad - 2 \quad - 2 + 7n^2}$

$2n^2 - 3n - 54 = 0$

$a = 2, b = -3, c = -54$

$\frac{3 \pm \sqrt{(-3)^2 - 4(2)(-54)}}{2(2)} = \frac{3 \pm \sqrt{9 + 432}}{4} = \frac{3 \pm \sqrt{441}}{4} = \frac{3 \pm 21}{4} = 6, -\frac{9}{2}$

37) $7r^2 - 12 = -3r$

$\underline{\quad +3r \quad\quad + 3r}$

$7r^2 + 3r - 12 = 0$

$a = 7, b = 3, c = -12$

$\frac{-3 \pm \sqrt{3^2 - 4(7)(-12)}}{2(7)} = \frac{-3 \pm \sqrt{9 + 336}}{14} = \frac{-3 \pm \sqrt{345}}{14}$

39) $2n^2 - 9 = 4$

$\underline{\quad -4 \quad -4}$

$2n^2 - 13 = 0$

$a = 2, b = 0, c = -13$

$\frac{-0 \pm \sqrt{0^2 - 4(2)(-13)}}{2(2)} = \frac{\pm\sqrt{104}}{4} = \frac{\pm\sqrt{4 \cdot 26}}{4} = \frac{\pm 2\sqrt{26}}{4} = \frac{\pm\sqrt{26}}{2}$

9.5

1) $2, 5$

$x = 2, \quad x = 5$

$\underline{-2 \ -2 - 5 \ -5}$

$x - 2 = 0 \ x - 5 = 0$

$(x - 2)(x - 5) = 0$

$x^2 - 5x - 2x + 10 = 0$

$x^2 - 7x + 10 = 0$

3) $20, 2$

$x = 20 \quad x = 2$

$\underline{-20 - 20 - 2 \ -2}$

$x - 20 = 0 \ x - 2 = 0$

$(x - 20)(x - 2) = 0$

$x^2 - 20x - 2x + 40 = 0$

$x^2 - 22x + 40 = 0$

5) $4, 4$

$x = 4 \quad x = 4$

$\underline{-4 - 4 \ -4 - 4}$

$x - 4 = 0 \ x - 4 = 0$

$(x - 4)(x - 4) = 0$

$x^2 - 4x - 4x + 16 = 0$

$x^2 - 8x + 16 = 0$

7) $0, 0$

$x = 0, x = 0$

$xx = 0$

$x^2 = 0$

9) $-4, 11$

$x = -4 \quad x = 11$

$\underline{+4 \ +4 \quad -11 - 11}$

$x + 4 = 0 \ x - 11 = 0$

$(x + 4)(x - 11) = 0$

$x^2 + 4x - 11x - 44 = 0$

$x^2 - 7x - 44 = 0$

11) $\frac{3}{4}, \frac{1}{4}$

$4(x) = \left(\frac{3}{4}\right)4 \ , 4(x) = \left(\frac{1}{4}\right)4$

$4x = 3 \quad 4x = 1$

$\underline{-3 \ -3 \quad -1 \ -1}$

$4x - 3 = 0 \ 4x - 1 = 0$

$(4x - 3)(4x - 1) = 0$

$16x^2 - 12x - 4x + 3 = 0$

$16x^2 - 8x + 3 = 0$

13) $\frac{1}{2}$, $\frac{1}{3}$

$(2)x = \frac{1}{2}(2) \quad (3)x = \frac{1}{3}(3)$

$2x = 1 \quad 3x = 1$

$\underline{-1 \ -1} \quad \underline{-1 \ -1}$

$2x - 1 = 0 \ 3x - 1 = 0$

$(2x - 1)(3x - 1) = 0$

$6x^2 - 3x - 2x + 1 = 0$

$6x^2 - 5x + 1 = 0$

15) $\frac{3}{7}$, 4

$(7)x = \frac{3}{7}(x) \quad x = 4$

$7x = 3 \quad \underline{-4 \ -4}$

$\underline{-3 \ -3} \quad x - 4 = 0$

$7x - 3 = 0$

$(7x - 3)(x - 4) = 0$

$7x^2 - 3x - 28x + 12 = 0$

$7x^2 - 31x + 12 = 0$

17) $-\frac{1}{3}, \frac{5}{6}$

$(3)x = -\frac{1}{3}(3) \ 6(x) = \frac{5}{6}(6)$

$3x = -1 \quad 6x = 5$

$\underline{+1 \ +1} \quad \underline{-5 \ -5}$

$3x + 1 = 0 \quad 6x - 5 = 0$

$(3x + 1)(6x - 5) = 0$

$18x^2 + 6x - 15x - 5 = 0$

$18x^2 - 9x - 5 = 0$

19) $-6, \quad \frac{1}{9}$

$x = -6 \quad (9)x = \frac{1}{9}(9)$

$\underline{+6 \ +6} \quad 9x = 1$

$x + 6 = 0 \ \underline{-1 \ -1}$

$9x - 1 = 0$

$(x + 6)(9x - 1) = 0$

$9x^2 + 54x - x - 6 = 0$

$9x^2 - 53x - 6 = 0$

21) ± 5

$x^2 = (\pm 5)^2$

$x^2 = 25$

$\underline{-25 - 25}$

$x^2 - 25 = 0$

23) $\pm\frac{1}{5}$

$x^2 = \left(\pm\frac{1}{5}\right)^2$

$(25)x^2 = \frac{1}{25}(25)$

$25x^2 = 1$

$\underline{-1 \quad -1}$

$25x^2 - 1 = 0$

25) $\pm\sqrt{11}$

$x^2 = \left(\pm\sqrt{11}\right)^2$

$x^2 = 11$

$\underline{-11 \ -11}$

$x^2 - 11 = 0$

27) $\pm\frac{\sqrt{3}}{4}$

$4x = \pm\frac{\sqrt{3}}{4}(4)$

$(4x)^2 = \left(\pm\sqrt{3}\right)^2$

$16x^2 = 3$

$\underline{-3 \quad -3}$

$16x^2 - 3 = 0$

29) $\pm i\sqrt{13}$

$x^2 = \left(\pm i\sqrt{13}\right)^2$

$x^2 = -13$

$\underline{+13 \ +13}$

$x^2 + 13 = 0$

31) $2 \pm \sqrt{6}$

$x = 2 \pm \sqrt{6}$

$\underline{-2 \quad -2}$

$(x-2)^2 = \left(\pm\sqrt{6}\right)^2$

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

$\underline{\qquad -6 \ -6}$

$x^2 - 4x - 2 = 0$

33) $1 \pm 3i$

$x = 1 \pm 3i$

$\underline{-1 \quad -1}$

$(x-1)^2 = (\pm 3i)^2$

$x^2 - 2x + 1 = -9$

$\underline{\qquad +9 \ +9}$

$x^2 - 2x + 10 = 0$

35) $6 \pm i\sqrt{3}$

$x = 6 \pm i\sqrt{3}$

$\underline{-6 \quad -6}$

$(x-6)^2 = \left(\pm i\sqrt{3}\right)^2$

$x^2 - 12x + 36 = -3$

$\underline{\qquad +3 \ +3}$

$x^2 - 12x + 39 = 0$

37) $\frac{-1\pm\sqrt{6}}{2}$

$(2)x = \frac{-1\pm\sqrt{6}}{2}(2)$

$2x = -1 \pm \sqrt{6}$

$\underline{+1 \quad +1}$

$(2x+1)^2 = \left(\pm\sqrt{6}\right)^2$

$4x^2 + 4x + 1 = 6$

$\underline{\qquad -6 \ -6}$

$4x^2 + 4x - 5 = 0$

39) $\frac{6\pm i\sqrt{2}}{8}$

$(8)x = \frac{6\pm i\sqrt{2}}{8}(8)$

$8x = 6 \pm i\sqrt{2}$

$\underline{-6 \quad -6}$

$(8x-6)^2 = \left(\pm i\sqrt{2}\right)^2$

$64x^2 - 96x + 36 = -2$

$\underline{\qquad +2 \quad +2}$

$64x^2 - 96x + 38 = 0$

9.6

1) $x^4 - 5x^2 + 4 = 0$
$y = x^2, y^2 = x^4$
$y^2 - 5y + 4 = 0$
$(y-4)(y-1) = 0$
$y - 4 = 0 \quad y - 1 = 0$
$+4 \;\; +4 \qquad +1 \;\; +1$
$y = 4 \quad y = 1$
$\sqrt{x^2} = \sqrt{4} \quad x^2 = \sqrt{1}$
$x = \pm 2, \pm 1$

3) $m^4 - 7m^2 - 8 = 0$
$y = m^2 \;\; y^2 = m^2$
$y^2 - 7y - 8 = 0$
$(y-8)(y+1) = 0$
$y - 8 = 0 \quad y + 1 = 0$
$+8 \quad +8 \qquad -1 \quad -1$
$y = 8 \quad y = -1$
$\sqrt{m^2} = \sqrt{8} \;\; \sqrt{m^2} = \sqrt{(-1)^2}$
$m = \pm 2\sqrt{2}, \pm i$

5) $a^4 - 50a^2 + 49 = 0$
$y = a^2 \quad y^2 = a^4$
$y^2 - 50y + 49 = 0$
$(y-49)(y-1) = 0$
$y - 49 = 0 \quad y - 1 = 0$
$+49 \quad +49 \qquad +1 \quad +1$
$y = 49 \quad y = 1$
$\sqrt{a^2} = \sqrt{49} \;\; \sqrt{a^2} = \sqrt{1}$
$a = \pm 7, \pm 1$

7) $x^4 - 25x^2 + 144 = 0$
$y = x^2, \;\; y^2 = x^4$
$y^2 - 25y + 144 = 0$
$(y-9)(y-16) = 0$
$y - 9 = 0 \;\; y - 16 = 0$
$+9 \;\; +9 \qquad +16 \quad +16$
$y = 9 \qquad y = 16$
$\sqrt{x^2} = \sqrt{9} \quad \sqrt{x^2} = \sqrt{16}$
$x = \pm 3, \pm 4$

9) $m^4 - 20m^2 + 64 = 0$
$y = m^2 \;\; y^2 = m^4$
$y^2 - 20y + 64 = 0$
$(y-4)(y-16) = 0$
$y - 4 = 0 \quad y - 16 = 0$
$+4 \quad +4 \qquad +16 \quad +16$
$y = 4 \qquad y = 16$
$\sqrt{m^2} = \sqrt{4} \;\; \sqrt{m^2} = \sqrt{16}$
$m = \pm 2, \pm 4$

11) $z^6 - 216 = 19z^3$

$y = z^3 \; y^2 = z^6$

$y^2 - 216 = 19y$

$-19y \quad -19y$

$y^2 - 19y - 216 = 0$

$(y - 27)(y + 8) = 0$

$y - 27 = 0 \quad y + 8 = 0$

$+27 \quad +27 \quad -8 \quad -8$

$y = 27 \qquad y = -8$

$z^3 = 27 \qquad z^3 = -8$

$-27 \quad -27 \quad +8 \quad +8$

$z^3 - 27 = 0 \quad z^3 - 8 = 0$

$(z - 3)(z^2 + 3z + 9) = 0$

$z - 3 = 0 \quad z^2 + 3z + 9 = 0$

$+3 \quad +3 \quad \frac{-3 \pm \sqrt{3^2 - 4(1)(9)}}{2(1)} = \frac{2 \pm \sqrt{-27}}{2} = \frac{-3 \pm 3i\sqrt{3}}{2}$

$z = 3$

$(z + 2)(z^2 - 2z + 4) = 0$

$z + 2 = 0 \quad z^2 - 2x + 4 = 0$

$-2 \quad -2 \quad \frac{2 \pm \sqrt{(-2)^2 - 4(1)(4)}}{2} = \frac{2 \pm \sqrt{-12}}{2} = \frac{2 \pm 2i\sqrt{3}}{2} = 1 \pm i\sqrt{3}$

$z = -2$

$z = 3, \frac{-3 \pm 3i\sqrt{3}}{2}, -2, 1 \pm i\sqrt{3}$

13) $6z^4 - z^2 = 12$

$y = z^2, y^2 = z^4$

$6y^2 - y = 12$

$-12 \quad -12$

$6y^2 - y - 12 = 0$

$(3y + 4)(2y - 3) = 0$

$3y + 4 = 0 \quad 2y - 3 = 0$

$-4 \quad -4 \qquad +3 \quad +3$

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

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

$\sqrt{z^2} = \sqrt{-\frac{4}{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) \quad \sqrt{z^2} = \sqrt{\frac{3}{2}}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$z = \frac{\pm 2i\sqrt{3}}{3}, \frac{\pm\sqrt{6}}{2}$

15) $x^{\frac{2}{3}} - 35 = 2x^{\frac{1}{3}}$

$y = x^{\frac{1}{3}}, \; y^2 = x^{\frac{2}{3}}$

$y^2 - 35 = 2y$

$-2y \quad -2y$

$y^2 - 2y - 35 = 0$

$(y - 7)(y + 5) = 0$

$y - 7 = 0 \quad y + 5 = 0$

$+7 \quad +7 \quad -5 \quad -5$

$y = 7, \quad y = -5$

$x^{\frac{1}{3}} = -5 \qquad x^{\frac{1}{3}} = 7$

$\left(\sqrt[3]{x}\right)^3 = (-5)^3 \; \left(\sqrt[3]{x}\right)^3 = 7^3$

$x = -125, 343$

17) $y^{-6} + 7y^{-3} = 8$

$z = y^{-3}\ z^2 = y^{-6}$

$z^2 + 7z = 8$

$\underline{-8 \quad -8}$

$z^2 + 7z - 8 = 0$

$(z+8)(z-1) = 0$

$z + 8 = 0 \quad z - 1 = 0$

$\underline{-8\ -8} \quad \underline{+1\ +1}$

$z = -8, \quad z = 1$

$y^{-3} = -8, y^{-3} = 1$

$(y^3)\left(\frac{1}{y^3}\right) = -8(y^3) \quad (y^3)\frac{1}{y^3} = 1(y^3)$

$1 = -8y^3 \qquad 1 = y^3$

$\underline{+8y^3 \quad +8y^3} \qquad \underline{-1 \quad -1}$

$8y^3 + 1 = 0 \qquad 0 = y^3 - 1$

$(2y+1)(4y^2 - 2y + 1) = 0 \qquad 0 = (y-1)(y^2 + y + 1)$

$2y + 1 = 0 \quad 4y^2 - 2y + 1 = 0 \qquad y - 1 = 0 \quad y^2 + y + 1 = 0$

$\underline{-1 \quad -1} \quad \frac{2 \pm \sqrt{(-2)^2 - 4(4)(1)}}{2(4)} \qquad \underline{+1 \quad +1} \quad \frac{-1 \pm \sqrt{1^1 - 4(1)(1)}}{2(1)}$

$\frac{2y}{2} = \frac{-1}{2} \quad \frac{2 \pm \sqrt{-12}}{8} \qquad y = 1 \quad \frac{-1 \pm \sqrt{-3}}{2} = \frac{-1 \pm i\sqrt{3}}{2}$

$y = -\frac{1}{2} \quad \frac{2 \pm 2i\sqrt{3}}{8} = \frac{1 \pm i\sqrt{3}}{4}$

$y = -\frac{1}{2}, \frac{1 \pm i\sqrt{3}}{4}, 1, \frac{-1 \pm i\sqrt{3}}{2}$

19) $x^4 - 2x^2 - 3 = 0$

$y = x^2 \quad y^2 = x^4$

$y^2 - 2y - 3 = 0$

$(y-3)(y+1) = 0$

$y - 3 = 0 \quad y + 1 = 0$

$\underline{+3 \quad +3} \qquad \underline{-1 \quad -1}$

$y = 3 \qquad y = -1$

$\sqrt{x^2} = \sqrt{3} \qquad \sqrt{x^2} = \sqrt{-1}$

$x = \pm\sqrt{3}, \pm i$

21) $2x^4 - 5x^2 + 2 = 0$

$y = x^2, y^2 = x^4$

$2y^2 - 5y + 2 = 0$

$(2y - 1)(y - 2) = 0$

$2y - 1 = 0 \quad y - 2 = 0$

$+1 \quad +1 \qquad +2 \quad +2$

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

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

$\sqrt{x^2} = \sqrt{\frac{1}{2}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)} \quad \sqrt{x^2} = \sqrt{2}$

$x = \pm\frac{\sqrt{2}}{2}, \pm\sqrt{2}$

23) $x^4 - 9x^2 + 8 = 0$

$y = x^2, \ y^2 = x^4$

$y^2 - 9y + 8 = 0$

$(y - 8)(y - 1) = 0$

$y - 8 = 0 \quad y - 1 = 0$

$+8 \quad +8 \qquad +1 \quad +1$

$y = 8 \qquad y = 1$

$\sqrt{x^2} = \sqrt{8} \quad \sqrt{x^2} = \sqrt{1}$

$x = \pm 2\sqrt{2}, \pm 1$

25) $8x^6 - x^3 + 1 = 0$

$y = x^3, y^2 = x^6$

$8y^2 - y + 1 = 0$

$(8y - 1)(y - 1) = 0$

$8y - 1 = 0 \quad y - 1 = 0$

$+1 \quad +1 \qquad +1 \quad +1$

$\frac{8y}{8} = \frac{1}{8} \qquad y = 1$

$y = \frac{1}{8}$

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

$8x^3 = 1$

$-1 \quad -1$

$8x^3 - 1 = 0$

$(2x - 1)(4x^2 + 2x + 1 = 0$

$2x - 1 = 0 \quad 4x^2 + 2x + 1 = 0$

$+1 \quad +1 \qquad \frac{-2 \pm \sqrt{2^2 - 4(4)(1)}}{2(4)}$

$\frac{2x}{2} = \frac{1}{2} \qquad \frac{-2 \pm \sqrt{-12}}{8}$

$x^3 = 1$

$-1 \quad -1$

$x^3 - 1 = 0$

$(x - 1)(x^2 + x + 1) = 0$

$x - 1 = 0 \quad x^2 + x + 1 = 0$

$+1 \quad +1 \qquad \frac{-1 \pm \sqrt{1^1 - 4(1)(1)}}{2(1)}$

$x = 1 \qquad \frac{-1 \pm \sqrt{-3}}{2} = \frac{-1 \pm i\sqrt{3}}{2}$

$$x = \frac{1}{2} \quad \frac{-2 \pm 2i\sqrt{3}}{8} = \frac{-1 \pm i\sqrt{3}}{4}$$

$$x = \frac{1}{2}, \frac{-1 \pm i\sqrt{3}}{4}, 1, \frac{-1 \pm i\sqrt{3}}{2}$$

27) $x^8 - 17x^4 + 16 = 0$

$y = x^4, y^2 = x^8$

$y^2 - 17y + 16 = 0$

$(y - 16)(y - 1) = 0$

$y - 16 = 0 \quad y - 1 = 0$

$+16 + 16 \quad +1 \quad +1$

$y = 16 \quad y = 1$

$x^4 = 16$ | $x^4 = 1$

$-16 \quad -16$ | $-1 \quad -1$

$x^4 - 16 = 0$ | $x^4 - 1 = 0$

$(x^2 + 4)(x^2 - 4) = 0$ | $(x^2 - 1)(x^2 + 1) = 0$

$x^2 + 4 = 0 \quad x^2 - 4 = 0$ | $x^2 - 1 = 0 \quad x^2 + 1 = 0$

$-4 \quad -4 \quad +4 \quad +4$ | $+1 \quad +1 \quad -1 \quad -1$

$\sqrt{x^2} = \sqrt{-4} \quad \sqrt{x^2} = \sqrt{4}$ | $\sqrt{x^2} = \sqrt{1} \quad \sqrt{x^2} = \sqrt{-1}$

$x = \pm 2i \quad x = \pm 2$ | $x = \pm 1 \quad x = \pm i$

$x = \pm 2i, \pm 2, \pm i, \pm 1$

29) $(y + b)^2 - 4(y + b) = 21$

$z = (y + b), \; z^2 = (y + b)^2$

$z^2 - 4z = 21$

$-21 \quad -21$

$z^2 - 4z - 21 = 0$

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

$z - 7 = 0 \quad z + 3 = 0$

$+7 \quad +7 \quad -3 \quad -3$

$z = 7 \quad z = -3$

$y + b = 7 \quad y + b = -3$

$-b \quad -b \quad -b \quad -b$

$y = 7 - b \quad y = -3 - b$

31) $(y+2)^2 - 6(y+2) = 16$

$z = y+2, \quad z^2 = (y+2)^2$

$z^2 - 6z = 16$

$-16 \quad -16$

$z^2 - 6z - 16 = 0$

$(z-8)(z+2) = 0$

$z-8=0 \quad z+2=0$

$+8 \quad +8 \quad -2 \quad -2$

$z = 8 \qquad z = -2$

$y+2=8 \qquad y+2=-2$

$-2 \quad -2 \qquad -2 \quad -2$

$y = 6 \qquad y = -4$

33) $(x-3)^2 - 2(x-3) = 35$

$y = (x-3), \quad y^2 = (x-3)^2$

$y^2 - 2y = 35$

$-35 \quad -35$

$y^2 - 2y - 35 = 0$

$(y-7)(y+5) = 0$

$y-7=0 \quad y+5=0$

$+7 \quad +7 \qquad -5 \quad -5$

$y = 7 \qquad y = -5$

$x-3=7 \quad x-3=-5$

$+3 \quad +3 \qquad +3 \quad +3$

$x = 10, -2$

35) $(r-1)^2 - 8(r-1) = 20$

$y = (r-1), \quad y^2 = (r-1)^2$

$y^2 - 8y = 20$

$-20 \quad -20$

$y^2 - 8y - 20 = 0$

$(y-10)(y+2) = 0$

$y-10=0 \quad y+2=0$

$+10 \quad +10 \qquad -2 \quad -2$

$y = 10 \qquad y = -2$

$r-1=10 \quad r-1=-2$

$+1 \quad +1 \qquad +1 \quad +1$

$r = 11, -1$

37) $3(y+1)^2 - 14(y+1) = 5$

$z = (y+1), z^2 = (y+1)^2$

$3z^2 - 14z = 5$

$-5 \quad -5$

$3z^2 - 14z - 5 = 0$

$(3z+1)(z-5) = 0$

$3z+1=0 \quad z-5=0$

$-1 \quad -1 \qquad +5 \quad +5$

$\frac{3z}{3} = \frac{-1}{3} \qquad z = 5$

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

$y+1 = -\frac{1}{3} \qquad y+1=5$

$-1 \quad -1 \qquad -1 \quad -1$

$y = -\frac{4}{3}, \ 4$

39) $(3x^2 - 2x)^2 + 5 = 6(3x^2 - 2x)$

$y = (3x^2 - 2x), \quad y^2 = (3x^2 - 2x)^2$

$y^2 + 5 = 6y$

$-6y \quad -6y$

$y^2 - 6y + 5 = 0$

$(y-1)(y-5) = 0$

$y - 1 = 0 \quad y - 5 = 0$

$+1 \quad +1 \qquad +5 \quad +5$

$y = 1 \qquad y = 5$

$3x^2 - 2x = 1 \qquad 3x^2 - 2x = 5$

$-1 \quad -1 \qquad -5 \quad -5$

$3x^2 - 2x - 1 = 0 \qquad 3x^2 - 2x - 5 = 0$

$(3x-5)(x+1) = 0 \quad (3x+1)(x-1) = 0$

$3x - 5 = 0 \quad x + 1 = 0 \quad 3x + 1 = 0 \quad x - 1 = 0$

$+5 \quad +5 \qquad -1 \quad -1 \qquad -1 \quad -1 \qquad +1 \quad +1$

$\frac{3x}{3} = \frac{5}{3} \qquad x = -1 \qquad \frac{3x}{3} = \frac{-1}{3} \qquad x = 1$

$x = \frac{5}{3}, -1, -\frac{1}{3}, 1$

41) $2(3x+1)^{\frac{2}{3}} - 5(3x+1)^{\frac{1}{3}} = 88$

$y = (3x+1)^{\frac{1}{3}}, y^2 = (3x+1)^{\frac{2}{3}}$

$2y^2 - 5y = 88$

$-88 \quad -88$

$2y^2 - 5y - 88 = 0$

$(2y+11)(y-8) = 0$

$2y + 11 = 0 \quad y - 8 = 0$

$-11 \quad -11 \qquad +8 \quad +8$

$\frac{2y}{2} = \frac{-11}{2} \qquad y = 8$

$y = -\frac{11}{2}$

$(3x+1)^{\frac{1}{3}} = -\frac{11}{2} \qquad (3x+1)^{\frac{1}{3}} = 8$

$\left(\sqrt[3]{3x+1}\right)^3 = \left(-\frac{11}{2}\right)^3 \qquad \left(\sqrt[3]{3x+1}\right)^3 = 8^3$

$3x + 1 = -\frac{1331}{8} \qquad 3x + 1 = 512$

$-1 \quad -1 \qquad -1 \quad -1$

$$\frac{3x}{3} = \left(-\frac{\frac{1329}{8}}{3}\right) \qquad \frac{3x}{3} = \frac{511}{3}$$

$$x = \frac{1329}{24}, \frac{511}{3}$$

43) $(x^2 + 2x)^2 - 2(x^2 + 2x) = 3$

$y = (x^2 + 2x),\ y^2 = (x^2 + 2x)^2$

$y^2 - 2y = 3$

$\underline{-3 \quad -3}$

$y^2 - 2y - 3 = 0$

$(y - 3)(y + 1) = 0$

$y - 3 = 0 \quad y + 1 = 0$

$\underline{+3 \quad +3} \qquad \underline{-1 \quad -1}$

$y = 3 \qquad y = -1$

$x^2 + 2x = 3 \qquad x^2 + 2x = -1$

$\underline{-3 \ -3} \qquad \underline{+1 \quad +1}$

$x^2 + 2x - 3 = 0 \qquad x^2 + 2x + 1 = 0$

$(x + 3)(x - 1) = 0 \qquad (\sqrt{(x+1)^2} = \sqrt{0}$

$x + 3 = 0 \quad x - 1 = 0 \qquad x + 1 = 0$

$\underline{-3 \ -3} \quad \underline{+1 \quad +1} \qquad \underline{-1 \quad -1}$

$x = -3, 1, -1$

45) $(2x^2 - x)^2 - 4(2x^2 - x) + 3 = 0$

$y = (2x^2 - x),\ y^2 = (2x^2 - x)^2$

$y^2 - 4y + 3 = 0$

$(y - 3)(y - 1) = 0$

$y - 3 = 0 \quad y - 1 = 0$

$\underline{+3 \quad +3} \quad \underline{+1 \quad +1}$

$y = 3 \qquad y = 1$

$2x^2 - x = 3 \qquad 2x^2 - x = 1$

$\underline{-3 \quad -3} \qquad \underline{-1 \quad -1}$

$2x^2 - x - 3 = 0 \qquad 2x^2 - x - 1 = 0$

$(2x - 3)(x + 1) = 0 \qquad (2x + 1)(x - 1) = 0$

$2x - 3 = 0 \quad x + 1 = 0 \qquad 2x + 1 = 0 \quad x - 1 = 0$

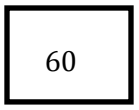
$\underline{+3 \quad +3} \quad \underline{-1 \quad -1} \qquad \underline{-1 \quad -1} \quad \underline{+1 \quad +1}$

$\frac{2x}{2} = \frac{3}{2} \qquad x = -1 \qquad \frac{2x}{2} = \frac{-1}{2} \qquad x = 1$

$x = \frac{3}{2}, -1, -\frac{1}{2}, 1$

9.7

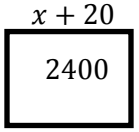
1) In a landscape plan, a rectangular flowerbed is designed to be 4 meters longer than it is wide. If 60 square meters are needed for the plants in the bed, what should the dimensions of the rectangular bed be?



$$x(x+4)=60$$
$$x^2+4x=60$$
$$-60\ \ -60$$
$$x^2+4x-60=0$$
$$(x-6)(x+10)=0$$
$$x-6=0 \quad x+10=0$$
$$+6\ \ +6 \qquad -10\ \ -10$$
$$x=6 \qquad \cancel{x=-10}$$

$6m\ by\ 10m$

3) A rectangular lot is 20 yards longer than it is wide and its area is 2400 square yards. Find the dimensions of the lot



$$x(x+20)=2400$$
$$x^2+20x=2400$$
$$\left(20\cdot\tfrac{1}{2}\right)^2=10^2=100$$
$$x^2+20x+100=2400+100$$
$$\sqrt{(x+10)^2}=\sqrt{2500}$$
$$x+10=\pm 50$$
$$-10\ \ -10$$
$$x=-10\pm 50$$
$$x=40,\cancel{-60}$$

$40yds\ x\ 60\ yds$

5) The length of a rectangular lot is 4 rods greater than its width, and its area is 60 square rods. Find the dimensions of the lot.

$$x(x+4)=60$$
$$x^2+4x=60$$
$$-60\ \ -60$$

60 x

$x^2 + 4x - 60 = 0$

$(x + 10)(x - 6) = 0$

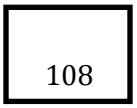
$x + 10 = 0 \quad x - 6 = 0$

$-10 - 10 \quad +6 \quad +6$

~~$x = -10$~~ $\quad x = 6$

$6\ rods\ x\ 10\ rods$

7) A rectangular piece of paper is twice as long as a square piece and 3 inches wider. The area of the rectangular piece is 108 in^2. Find the dimensions of the square piece.



$2x(x + 3) = 108$

$2x^2 + 6x = 108$

$-108 - 108$

$\frac{2x^2}{2} + \frac{6x}{2} - \frac{108}{2} = \frac{0}{2}$

$x^2 + 3x - 54 = 0$

$(x + 9)(x - 6) = 0$

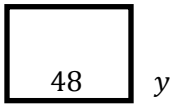
$x + 9 = 0 \quad x - 6 = 0$

$-9 - 9 \quad +6 \quad +6$

~~$x = -9$~~ $\quad x = 6$

$6in\ x\ 6in$

9) The area of a rectangle is 48 ft^2 and its perimeter is 32 ft. Find its length and width.



$p = 32$

$2x + 2y = 32$

$-2x \quad -2x$

$\frac{2y}{2} = \frac{32}{2} - \frac{2x}{2}$

$y = 16 - x$

$xy = 48$

$x(16 - x) = 48$

$16x - x^2 = 48$

$-16x + x^2 - 16x + x^2$

$0 = x^2 - 16x + 48$

$0 = (x - 12)(x - 4)$

$x - 12 = 0 \quad x - 4 = 0$

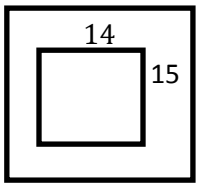
$+12 \quad +12 \quad +4 \quad +4$

$x = 12 \quad x = 4$

$12ft\ x\ 4\ ft$ $\quad y = 16 - 12 = 4 \quad y = 16 - 4 = 12$

11) A mirror 14 inches by 15 inches has a frame of uniform width. If the area of the frame equals that of the mirror, what is the width of the frame?

$(15 + 2x)(14 + 2x) = 420$



$A = 2(14 \cdot 15) = 420$

$3\ in$

$210 + 30x + 28 + 4x^2 = 420$

$4x^2 + 58x + 210 = 420$

$-420 \quad -420$

$\frac{4x^2}{2} + \frac{58x}{2} - - \frac{210}{2} = \frac{0}{2}$

$2x^2 + 29x - 105 = 0$

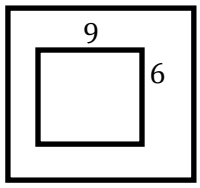
$(2x + 35)(x - 3) = 0$

$2x + 35 = 0 \qquad x - 3 = 0$

$-35 \quad -35 \qquad +3 \quad +3$

$\frac{2x}{2} = \frac{-35}{2} = \cancel{x = -\frac{35}{2}} \qquad x = 3$

13) A grass plot 9 yards long and 6 yards wide has a path of uniform width around it. If the area of the path is equal to the area of the plot, determine the width of the path.



$A = 2(9 \cdot 6) = 108$

$1.5\ yds$

$(6 + 2x)(9 + 2x) = 108$

$54 + 12x + 18x + 4x^2 = 108$

$4x^2 + 30x + 54 = 108$

$-108 \quad -108$

$\frac{4x^2}{2} + \frac{30x}{2} - \frac{54}{2} = \frac{0}{2}$

$2x^2 + 15x - 27 = 0$

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

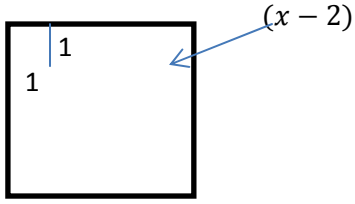
$2x - 3 = 0 \quad x + 9 = 0$

$+3 \quad +3 \qquad -9 \quad -9$

$\frac{2x}{2} = \frac{3}{2} \qquad \cancel{x = -9}$

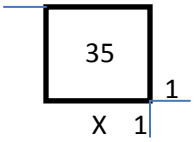
$x = \frac{3}{2} = 1.5$

15) A page is to have a margin of 1 inch, and is to contain 35 in^2 of painting. How large must the page be if the length is to exceed the width by 2 inches?



$x(x - 2) = 35$

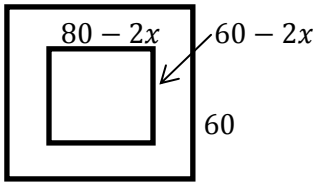
$x^2 - 2x = 35$



$7in\ x\ 9in$

$$\underline{\quad -35 \quad -35}$$
$$x^2 - 2x - 35 = 0$$
$$(x-7)(x+5) = 0$$
$$x - 7 = 0 \quad x + 5 = 0$$
$$\underline{+7 \quad +7} \qquad \underline{-5 \quad -5}$$
$$x = 7 \qquad \cancel{x = -5}$$

17) A rectangular wheat field is 80 rods long by 60 rods wide. A strip of uniform width is cut around the field, so that half the grain is left standing in the form of a rectangular plot. How wide is the strip that is cut?

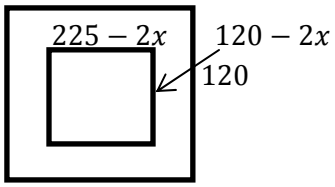


$$A = \frac{1}{2}(60 \cdot 80) = 2400$$

$10\ rods$

$$(80-2x)(60-2x) = 2400$$
$$48000 - 160x - 120x + 4x^2 = 2400$$
$$4x^2 - 280x + 4800 = 2400$$
$$\underline{\quad -2400 \quad -2400}$$
$$\frac{4x^2}{4} - \frac{280x}{4} + \frac{2400}{4} = \frac{0}{4}$$
$$x^2 - 70x + 600 = 0$$
$$(x-10)(x-60) = 0$$
$$x - 10 = 0 \quad x - 60 = 0$$
$$\underline{+10 \quad +10} \qquad \underline{+60 \quad +60}$$
$$x = 10 \qquad \cancel{x = 60}$$

19) A rectangular field 225 ft by 120 ft has a ring of uniform width cut around the outside edge. The ring leaves 65% of the field uncut in the center. What is the width of the ring?

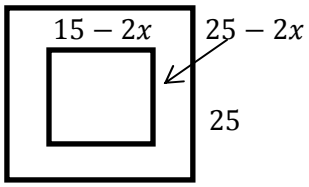


$$A = 0.65(120 \cdot 225)17500$$

$$(225-2x)(120-2x) = 17500$$
$$27000 - 450x - 240x + 4x^2 = 17500$$
$$4x^2 - 690x + 27000 = 17500$$
$$\underline{\quad -17500 \quad -17500}$$
$$\frac{4x^2}{2} - \frac{690x}{2} + \frac{9450}{2} = \frac{0}{2}$$
$$2x^2 - 345x + 4725 = 0$$
$$\frac{345 \pm \sqrt{345^2 - 4(2)(4725)}}{2(2)} = \frac{345 \pm \sqrt{81225}}{4} = \frac{345 \pm 285}{4} = \cancel{\frac{315}{2}} \ \&\ 15$$

$15ft$

21) A frame is 15 in by 25 in and is of uniform width. The inside of the frame leaves 75% of the total area available for the picture. What is the width of the frame?



$$(15-2x)(25-2x) = 281.25$$
$$375 - 30x - 50x + 4x^2 = 281.25$$
$$4x^2 - 80x + 375 = 281.25$$
$$\underline{\quad -281.25 \quad -281.25}$$
$$\frac{4x^2}{4} - \frac{80x}{4} + \frac{93.75}{4} = \frac{0}{4}$$

15

$A = .75(25 \cdot 15) = 281.25$

$x^2 - 20x + 23.4375 = 0$

$-23.4375 \quad -23.4375$

$x^2 - 20x \quad = -23.4375$

$\left(-20 \cdot \frac{1}{2}\right)^2 = (-10)^2 = 100$

$x^2 - 20x + 100 = -23.4375 + 100$

$\sqrt{(x-10)^2} = \sqrt{(76.5625)}$

$x - 10 = \pm 8.75$

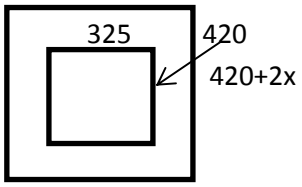
$+10 \quad +10$

$x = 10 \pm 8.75$

$x = 18.75,\ 1.25$

$1.25\ in$

23) The farmer in the previous problem has a neighbor who has a field 325 ft by 420 ft. His neighbor wants to increase the size of his field by 20% by cultivating a band of uniform width around the outside of his lot. How wide a band should his neighbor cultivate?



$325 + 2x$

$A = 1.2(325)(420) = 163800$

$(420 + 2x)(325 + 2x) = 163800$

$136500 + 840x + 650x + 4x^2 = 163800$

$4x^2 + 1490x + 136500 = 163800$

$-163800 \quad -163800$

$\frac{4x^2}{4} + \frac{1490x}{4} - \frac{27300}{4} = \frac{0}{4}$

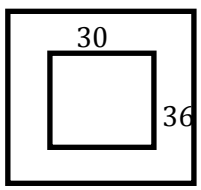
$x^2 + 745x - 13650 = 0$

$\frac{-745 \pm \sqrt{(745^2 - 4(2)(-13650)}}{2(2)} = \frac{-745 \pm \sqrt{664225}}{4} =$

$\frac{-745 \pm 815}{4} = 17.5, -390$

$17.5\ ft$

25) Donna has a garden that is 30 ft by 36 ft. She wants to increase the size of the garden by 40%. How wide a ring around the outside should she cultivate?



$36 + 2x$

$(36 + 2x)(30 + 2x) = 1512$

$1080 + 72x + 60x + 4x^2 = 1512$

$4x^2 + 132x + 1080 = 1512$

$-1512 \quad -1512$

$$\frac{4x^2}{4}+\frac{132x}{4}-\frac{432}{4}=\frac{0}{4}$$

$30+2x$

$$x^2+33x-108=0$$

$A=1.4(30\cdot 36)=1512$

$$\frac{-33\pm\sqrt{33^2-4(1)(-108)}}{2(1)}=\frac{-33\pm\sqrt{1521}}{2}=\frac{-33\pm39}{2}=3,\cancel{-36}$$

$3\ ft.$

9.8

1) Bills father can paint a room in two hours less than Bill can paint it. Working together they can complete the job in two hours and 24 minutes. How much time would each require working alone?

$Father: x-2$

$Bill: x$

$Team: 2\frac{24}{60}=2\frac{2}{5}=\frac{12}{5}$

$$\frac{1}{x-2}\ 12x(x-2)+\frac{1}{x}\ 12x(x-2)=\frac{5}{12}\ 12x(x-2)$$

$LCD: 12x(x-2)$

$$12x+12(x-2)=5x(x-2)$$

$$12x+12x-24=5x^2-10x$$

$$24x-24=5x^2-10$$

$$-24x+24\ \ -24x+24$$

$$0=5x^2-34x+24$$

$$0=(5x-4)(x-6)$$

$$5x-4=0\quad x-6=0$$

$$+4\quad +4\qquad +6\quad +6$$

$$\frac{5x}{5}=\frac{4}{5}\qquad x=6$$

$\cancel{x=.8}$

$Bill: 6hr, Father: 4$

3) Jack can wash and wax the family car in one hour less than Bob can. The two working together can complete the job in $1\frac{1}{5}$ hours. How much time would each require if they worked alone?

$Jack: x-1$

$Bob: x$

$Team: 1\frac{1}{5}=\frac{6}{5}$

$\frac{1}{x-1}\left(6x(x-1)\right)+\frac{1}{x}\left(6x(x-1)\right)=\frac{5}{6}\left(6x(x-1)\right)$

$LCD: 6x(x-1)$

$6x+6(x-1)=5x(x-1)$

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

$12x-6=5x^2-5x$

$-12x+6 \quad -12x+6$

$0=5x^2-17x+6$

$0=(5x-2)(x-3)$

$5x-2=0 \quad x-3=0$

$+2 \quad +2 \qquad +3 \quad +3$

$\frac{5x}{5}=\frac{2}{5} \qquad x=3$

~~$x=.4$~~

$Bob: 3hr, Jack: 2hr$

5) Working alone it takes John 8 hours longer than Carlos to do a job. Working together they can do the job in 3 hours. How long will it take each to do the job working alone

$John: x+8$

$Carlos: x$

$Team: 3$

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

$LCD: 3x(x+8)$

$3x+3(x+8)=x(x+8)$

$3x+3x+24=x^2+8x$

$6x+24=x^2+8x$

$-6x-24 \qquad -6x-24$

$0=x^2+2x-24$

$0=(x+6)(x-4)$

$x+6=0 \quad x-4=0$

$-6 \quad -6 \qquad +4 \quad +4$

~~$x=-6$~~ $\qquad x=4$

$Carlos: 4hr, John: 12hr$

7) A can do a piece of work in 4 days and B can do it in half the time. How long will it take them to do the work together?

$A: 4$

$B: 2$

$Team: x$

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

$LCD: 4x$

$x+2x=4$

$$\frac{3x}{3} = \frac{4}{3}$$
$$x = .133$$
$$\boxed{(1\ hr., 20\ \text{min.})}$$

9) If A can do a piece of work in 24 days and A and B together can do it in 6 days, how long would it take B to do the work alone?

$A: 24$
$B: x$
$Team: 6$

$$\frac{1}{24}(24x) + \frac{1}{x}(24x) = \frac{1}{6}(24x)$$
$$LCD: 24x$$
$$x + 24 = 4x$$
$$-x \qquad\qquad -x$$
$$\frac{24}{3} = \frac{3x}{3}$$
$$8 = x \qquad \boxed{8\ days}$$

11) If Sam can do a certain job in 3 days, while it takes Fred 6 days to do the same job, how long will it take them, working together, to complete the job?

$Sam: 3$
$Fred: 6$
$Team: x$

$$\frac{1}{3}(6x) + \frac{1}{6}(6x) = \frac{1}{x}(6x)$$
$$LCD: 6x$$
$$2x + x = 6$$
$$\frac{3x}{3} = \frac{6}{3}$$
$$x = \boxed{2\ days}$$

13) Two people working together can complete a job in 6 hours. If one of them works twice as fast as the other, how long would it take the faster person, working alone, to do the job?

$A = x$
$B = 2x$
$Team: 6$

$$\frac{1}{x}(6x) + \frac{1}{2x}(6x) = \frac{1}{6}(6x)$$
$$6 + 3 = x$$
$$9 = x$$
$$\boxed{A = 9hr},\ B = 18hr$$

15) A water tank can be filled by an inlet pipe in 8 hours. It takes twice that long for the outlet pipe to empty the tank. How long will it take to fill the tank if both pipes are open?

$In: 8$
$Out: -16$
$Team: x$

$$\frac{1}{8}(16x) - \frac{1}{16}(16x) = \frac{1}{x}(16x)$$
$$2x - x = 16$$
$$x = \boxed{16hr}$$

17) It takes 10 hours to fill a pool with the inlet pipe. It can be emptied in 15 hrs. with the outlet pipe. If the pool is half full to begin with, how long will it take to fill it from there if both pipes are open?

$In: 10$
$Out: -15$
$Team: x$

$$\frac{1}{10}(30x) - \frac{1}{15}(30x) = \frac{1}{x}(30x)$$
$$3x - 2x = 30$$
$$x = 30$$
$$\frac{1}{2}(30) = \boxed{15\ hr}$$

19) A sink has two faucets, one for hot water and one for cold water. The sink can be filled by a cold-water faucet in 3.5 minutes. If both faucets are open, the sink is filled in 2.1 minutes. How long does it take to fill the sink with just the hot-water faucet open?

$Hot: x$

$Cold: 3.5 = \frac{35}{10} = \frac{7}{2}$

$Team: 2.1 = \frac{21}{10}$

$\frac{1}{x}(21x) + \frac{2}{7}(21x) = \frac{10}{21}(21x)$

$LCD: 21x$

$21 + 6x = 10x$

$-6x \quad -6x$

$\frac{21}{4} = \frac{4x}{4}$

$\boxed{5.25\ hr} = x$

21) A tank can be emptied by any one of three caps. The first can empty the tank in 20 minutes while the second takes 32 minutes. If all three working together could empty the tank in $8\frac{8}{59}$ minutes, how long would the third take to empty the tank?

$First: 20$

$Second: 32$

$Third: x$

$Team: 8\frac{8}{59} = \frac{480}{59}$

$\frac{1}{20}(480x) + \frac{1}{32}(480x) + \frac{1}{x}(480x) = \frac{59}{480}\ (480x)$

$LCD: 480x$

$24x + 15x + 480 = 59x$

$39x + 480 = 59x$

$-39x \qquad -39x$

$\frac{480}{20} = \frac{20x}{20}$

$24 = x$ $\boxed{24\ min.}$

23) Sam takes 6 hours longer than Susan to wax a floor. Working together they can wax the floor in 4 hours. How long will it take each of them working alone to wax the floor?

$Sam: x + 6$

$Susan: x$

$Team: 4$

$\frac{1}{x+6}\big(4x(x+6)\big) + \frac{1}{x}\big(4x(x+6)\big) = \frac{1}{4}\big(4x(x+6)\big)$

$LCD: \big(4x(x+6)\big)$

$4x + 4(x+6) = x(x+6)$

$4x + 4x + 24 = x^2 + 6x$

$8x + 24 = x^2 + 6x$

$-8x - 24 \qquad -8x - 24$

$$0 = x^2 - 2x - 24$$
$$0 = (x-6)(x+4)$$
$$x-6=0 \quad x+4=0$$
$$+6 \quad +6 \qquad -4 \quad -4$$
$$\cancel{x=6} \qquad x=-4$$

$\boxed{Susan = 6hr, Sam = 12hr}$

25) It takes Sally $10\frac{1}{2}$ minutes longer than Patricia to clean up their dorm room. If they work together they can clean it in 5 minutes. How long will it take each of them if they work alone?

$Sally: x + 10.5 = x + \frac{21}{2} = \frac{2x+21}{2}$

$Patricia: x$

$Team: 5$

$\frac{2}{2x+21}\left(5x(2x+21)\right) + \frac{1}{x}\left(5x(2x+21)\right) = \frac{1}{5}\left(5x(2x+21)\right)$

$LCD: \left(5x(2x+21)\right)$

$$10x + 5(2x+21) = x(2x+21)$$
$$10x + 10x + 105 = 2x^2 + 21x$$
$$20x + 105 = 2x^2 + 21x$$
$$-20x - 105 \qquad -20x - 105$$
$$0 = 2x^2 + x - 105$$
$$0 = (2x+15)(x-7)$$
$$2x + 15 = 0 \quad x - 7 = 0$$
$$-15 \quad -15 \qquad +7 \quad +7$$
$$\frac{2x}{2} = -\frac{15}{2} \qquad x = 7$$
$$\cancel{x = -\frac{15}{2}}$$

$\boxed{Patricia = 7min., Sally = 17.5\ min.}$

27) Secretary A takes 6 minutes longer than Secretary B to type 10 pages of manuscript. If they divide the job and work together it will take them $8\frac{3}{4}$ minutes to type 10 pages. How long will it take each working alone to type the 10 pages?

$A: x + 6$

$B: x$

$Team: 8\frac{3}{4} = \frac{35}{4}$

$\frac{1}{x+6}\left(35x(x+6)\right) + \frac{1}{x}\left(35x(x+6)\right) = \frac{4}{35}\left(35x(x+6)\right)$

$LCD: \left(35x(x+6)\right)$

$$35x + 35(x+6) = 4x(x+6)$$
$$35x + 35x + 210 = 4x^2 + 24x$$
$$70x + 210 = 4x^2 + 24x$$
$$-70x - 210 \qquad -70x - 210$$
$$\frac{0}{2} = \frac{4x^2}{2} - \frac{46x}{2} - \frac{210}{2}$$
$$0 = 2x^2 - 23x - 105$$
$$0 = (2x+7)(x-15)$$
$$2x + 7 = 0 \quad x - 15 = 0$$
$$-7 \quad -7 \qquad +15 \quad +15$$
$$\frac{2x}{2} = -\frac{7}{2} \qquad x = 15$$
$$\cancel{x = -\frac{7}{2}}$$

$\boxed{B: 15hr,\ A: 21hr}$

9.9

1) $\frac{xy}{y}=\frac{72}{y}$ $x=\frac{72}{y}$

$\frac{(x+2)(y-4)}{y-4}=\frac{128}{y-4}$

$x+2=\frac{128}{y-4}$

$y(y-4)\frac{72}{y}+2\,y(y-4)=\frac{128}{y-4}y(y-4)$

$LCD: y(y-4)$

$72(y-4)+2y(y-4)=128y$

$72y-288+2y^2-8y=128y$

$2y^2+64y-288=128y$

$-128y \qquad -128y$

$\frac{2y^2}{2}-\frac{64y}{2}-\frac{288}{2}=0$

$y^2-32y-144=0$

$+144 \quad +144$

$y^2-32y \qquad =144$

$\left(32\cdot\frac{1}{2}\right)^2=16^2=256$

$y^2-32y+256=144+256$

$\sqrt{(y-16)^2}=\sqrt{400}$

$y-16=\pm 20$

$+16 \quad +16$

$y=36,-4$

$x=\frac{72}{36}=2 \quad x=\frac{72}{-4}=-18$

$(2,36),(48,-4)$

3) $\frac{xy}{y}=\frac{150}{y}$ $x=\frac{150}{y}$

$\frac{(x-6)(y+1)}{y+1}=\frac{64}{y+1}$

$x-6=\frac{64}{y+1}$

$\frac{150y}{y}\ \big(y(y+1)\big)-6\big(y(y+1)\big)=\frac{64}{y+1}\big(y(y+1)\big)$

$LCD: \big(y(y+1)\big)$

$150(y+1)-6y(y+1)=64y$

$150y+150-6y^2+6y=64y$

$-6y^2+156y+150=64y$

$+6y^2-156y-150 \quad +6y^2-156y-150$

$\frac{0}{2}=\frac{6y^2}{2}-\frac{80y}{2}-\frac{150}{2}$

$0=3y^2-40y-75$

$0=(3y+5)(y-15)$

$3y+5=0 \quad y-15=0$

$-5 \quad -5 \qquad +15 \quad +15$

$\frac{3y}{3}=-\frac{5}{3} \qquad y=15$

$y=-\frac{5}{3} \quad x=\frac{150}{15}=10$

$x=\frac{150}{-\frac{5}{3}}=150\left(-\frac{3}{5}\right)=-90$

$\left(-90,-\frac{5}{3}\right),\ (10,15)$

5) $\frac{xy}{y}=\frac{45}{y}\quad x=\frac{45}{y}$

$\frac{(x+2)(y+1)}{y+1}=\frac{70}{y+1}$

$x+2=\frac{70}{y+1}$

$\frac{45}{y}\left(y(y+1)\right)+2\left(y(y+1)\right)=\frac{70}{y+1}\left(y(y+1)\right)$

$LCD:\left(y(y+1)\right)$

$45(y+1)+2y(y+1)=70y$

$45y+45+2y^2+2y=70y$

$2y^2+47y+2y=70y$

$-70y\qquad -70y$

$2y^2-23y+45=0$

$(2y-5)(y-9)=0$

$2y-5=0\quad y-9=0$

$+5\quad +5\qquad +9\quad +9$

$\frac{2y}{2}=\frac{5}{2}\qquad y=9$

$y=\frac{5}{2}\qquad x=\frac{45}{9}=5$

$x=\frac{45}{\frac{5}{2}}=45\cdot\frac{2}{5}=18$

$\left(18,\frac{5}{2}\right),\ (5,9)$

7) $\frac{xy}{y}=\frac{90}{y}\quad x=\frac{90}{y}$

$\frac{(x-5)(y+1)}{y+1}=\frac{120}{y+1}$

$x-5=\frac{120}{y+1}$

$\frac{90}{y}\left(y(y+1)\right)-5\left(y(y+1)\right)=\frac{120}{y+1}\left(y(y+1)\right)$

$LCD:\left(y(y+1)\right)$

$90(y+1)-5y(y+1)=120y$

$90y+90-5y^2-5y=120y$

$-5y^2+85y+90=120y$

$+5y^2-85y-90\quad +5y^2-85y-90$

$0=\frac{5y^2}{5}+\frac{35y}{5}-\frac{90}{5}$

$0=y^2+7y-18$

$0=(y+9)(y-2)$

$y+9=0\quad y-2=0$

$-9\ -9\qquad +2\ \ +2$

$y=-9\qquad y=2$

$x=\frac{90}{-9}=-10\quad x=\frac{90}{2}=45$

9) $\frac{xy}{y}=\frac{12}{y}\quad x=\frac{12}{y}$

$\frac{(x+1)(y-4)}{y-4}=\frac{16}{y-4}$

$x+1=\frac{16}{y-4}$

$\frac{12}{y}\left(y(y-4)\right)+1\left(y(y-4)\right)=\frac{16}{y-4}\left(y(y-4)\right)$

$LCD:\left(y(y-4)\right)$

$12(y-4)+\left(y(y-4)\right)=16y$

$12y-48+y^2-4y=16y$

$y^2+8y-48=16y$

$-16y\qquad -16y$

$y^2-8y-48=0$

$(y-12)(y+4)=0$

$y-12=0\ \ y+4=0$

$+12\ \ +12\ \ -4\quad -4$

$y=12\quad y=-4$

$x=\frac{12}{12}=1\quad x=\frac{12}{-4}=-3$

$(1,12),(-3,-4)$

11) $\frac{xy}{y}=\frac{45}{y}\quad x=\frac{45}{y}$

$\frac{(x-5)(y+3)}{y+3}=\frac{160}{y+3}$

$x-5=\frac{160}{y+3}$

$\frac{45}{y}\left(y(y+3)\right)-5\left(y(y+3)\right)=\frac{160}{y+3}\left(y(y+3)\right)$

$45(y+3)-5y(y+3)=160y$

$45y+135-5y^2-15y=160y$

$-5y^2+30y+135=160y$

$+5y^2-30y-135\quad +5y^2-30y-135$

$0=\frac{5y^2}{5}+\frac{130y}{5}-\frac{135}{5}$

$0=y^2+26y-27$

$0=(y+27)(y-1)$

$y+27=0\quad y-1=0$

$-27\ -27\qquad +1\quad +1$

$y=-27\quad y=1$

$x=\frac{45}{-27}=-\frac{5}{3}\quad x=\frac{45}{1}$

$\left(-\frac{5}{3},-27\right),\ (45,\ 1)$

9.10

1) A merchant bought some pieces of silk for \$900. Had he bought 3 pieces more for the same money, he would have paid \$15 less for each piece. Find the number of pieces purchased.

N	P	T
N	P	900
$n+3$	$p-15$	900

$\frac{np}{n} = \frac{900}{n} \quad p = 900n$

$\frac{(n+3)(p-15)}{n+3} = \frac{900}{n+3}$

$n + 3 = \frac{900}{n+3}$

$\frac{900}{n}\big(n(n+3)\big) - 15\big(n(n+3)\big) = \frac{900}{n+3}n(n+3)$

$LCD: n(n+3)$

$900(n+3) - 15n(n+3) = 900n$

$900n + 2700 - 15n^2 - 45n = 900n$

$-15n^2 + 855n + 2700 = 900n$

$+15n^2 - 855n - 2700 \quad +15n^2 - 855n - 2700$

$0 = \frac{15n^2}{15} + \frac{45n}{15} - \frac{2700}{15}$

$0 = n^2 + 3n - 180$

$0 = (n+15)(n-12)$

$n + 15 = 0 \quad n - 12 = 0$

$-15 \quad -15 \quad +12 \quad +12$

~~$n = -15$~~ $\quad n = 12$

3) A merchant bought a number of barrels of apples for S120. He kept two barrels and sold the remainder at a profit of \$2 per barrel making a total profit of \$34. How many barrels did he originally buy?

N	P	T
N	P	120
$n-2$	$p+2$	900

$\frac{np}{n} = \frac{120}{n} \quad p = \frac{120}{n}$

$\frac{(n-2)(p+2)}{n-2} = \frac{154}{n-2}$

$p + 2 = \frac{154}{n-2}$

$\frac{120}{n}\big(n(n-2)\big) + 2\big(n(n-2)\big) = \frac{154}{n-2}\big(n(n-2)\big)$

$LCD: \big(n(n-2)\big)$

$120(n-2) + 2n(n-2) = 154n$

$120n - 240 + 2n^2 - 4n = 154n$

$2n^2 + 116n - 240 = 154n$

$-154n \qquad -154n$

$\frac{2n^2}{2} - \frac{38n}{2} - \frac{240}{2} = \frac{0}{2}$

$n^2 - 17n - 120 = 0$

$(n-24)(n+5) = 0$

$n - 24 = 0 \quad n + 5 = 0$

$+24 \quad +24 \quad -5 \quad -5$

$n = 24 \quad$ ~~$n = -5$~~

5) A man bought a number of articles at equal cost for $500. He sold all but two for $540 at a profit of S5 for each item. How many articles did he buy?

N	P	T
N	P	500
$n-2$	$p+5$	540

$\frac{np}{n} = \frac{500}{n} \quad p = \frac{500}{n}$

$\frac{(n-2)(p+5)}{n-2} = \frac{540}{n-2}$

$p + 5 = \frac{540}{n-2}$

$\frac{500}{n}\big(n(n+2)\big) + 5\big(n(n+2)\big) = \frac{540}{n-2}\big(n(n+2)\big)$

$LCD: \big(n(n+2)\big)$

$500(n-2) + 5n(n-2) = 540n$

$500n - 1000 + 5n^2 - 10n = 540n$

$5n^2 + 490n - 1000 = 540n$

$-540n \qquad\qquad -540n$

$\frac{5n^2}{5} - \frac{50n}{5} - \frac{1000}{5} = \frac{0}{5}$

$n^2 - 10n - 200 = 0$

$(n-20)(n+40) = 0$

$n - 20 = 0 \quad n + 40 = 0$

$+20 \;\; +20 \quad -40 \;\; -40$

$n = 20 \qquad \cancel{n = -40}$

7) A group of boys bought a boat for $450. Five boys failed to pay their share, hence each remaining boys were compelled to pay $4.50 more. How many boys were in the original group and how much had each agreed to pay?

N	P	T
N	P	450
$n-5$	$p+4.5$	450

$\frac{np}{n} = \frac{450}{n} \quad p = \frac{450}{n}$

$\frac{(n-5)(p+4.5)}{n-5} = \frac{450}{n-5}$

$p + 4.5 = \frac{450}{n-5}$

$\frac{450}{n}\big(2n(n-5)\big) + \frac{9}{2}\big(2n(n-5)\big) = \frac{450}{n-5}\big(2n(n-5)\big)$

$LCD: \big(2n(n-5)\big)$

$900(n-5) + 9n(n-5) = 900n$

$900n - 4500 + 9n^2 - 45n = 900n$

$9n^2 + 855n - 4500 = 900n$

$-900n \qquad\qquad -900n$

$\frac{9n^2}{9} - \frac{45n}{9} - \frac{4500}{9} = \frac{0}{9}$

$n^2 - 5n - 500 = 0$

$(n-25)(n+20) = 0$

$n - 25 = 0 \quad n + 20 = 0$

$+25 \;\; +25 \quad -20 \;\; -20$

$n = 25 \qquad \cancel{n = -20}$

9) A factory tests the road performance of new model cars by driving them at two different rates of speed for at least 100 kilometers at each rate. The speed rates range from 50 to 70 km/hr in the lower range and from 70 to 90 km/hr in the higher range. A driver plans to test a car on an available speedway by driving it for 120 kilometers at a speed in the lower range and then driving 120 kilometers at a rate that is 20 km/hr faster. At what rates should he drive if he plans to complete the test in $3\frac{1}{2}$ hours?

r	t	d
r	t	120
$r+20$	$35-t$	120

$\frac{rt}{r}=\frac{120}{r}\quad t=\frac{120}{r}$

$\frac{(r+20)(3.5-t)}{r+20}=\frac{120}{r+20}$

$\frac{7}{2}\left(2r(r+20)\right)-\frac{120}{r}\left(2r(r+20)\right)=\frac{120}{r+20}\left(2r(r+20)\right)$

$LCD:\left(2r(r+20)\right)$

$7r(r+20)-240(r+20)=240r$

$7r^2+140r-240r-480=240r$

$7r^2-100r-480=240r$

$-240r\qquad -240r$

$7r^2-340r-4800=0$

$\frac{340\pm\sqrt{(340)^2-4(7)(-4800)}}{2(7)}=\frac{340\pm\sqrt{25000}}{14}=\frac{340\pm500}{14}=60,\cancel{-\frac{80}{7}}$

$60mph\ \&\ 80mph$

11) The rate of the current in a stream is 3 km/hr. A man rowed upstream for 3 kilometers and then returned. The round trip required 1 hour and 20 minutes. How fast was he rowing?

$1\frac{1}{3}=\frac{4}{3}$

r	t	d
r	t	3
$r-3$	$\frac{4}{3}-t$	3

$\frac{(r+3)t}{r+3}=\frac{3}{r+3}\quad t=\frac{3}{r+3}$

$\frac{(r-3)\left(\frac{4}{3}-t\right)}{r-3}=\frac{3}{r-3}$

$\frac{4}{3}-t=\frac{3}{r-3}$

$\frac{4}{3}\,3(r+3)(r-3)-\frac{3}{r+3}3(r+3)(r-3)=\frac{3}{r-3}3(r+3)(r-3)$

$LCD:3(r+3)(r-3)$

$4(r^2-9)-9(r-3)=9(r+3)$

$4r^2-36-9r+27=9r+27$

$4r^2-9r-9=9r+27$

$-9r-27\quad -9r-27$

$\frac{4r^2}{2}-\frac{18r}{2}-\frac{36}{2}=0$

$2r^2-9r-18=0$

$(2r+3)(r-6)=0$

$2r+3=0\quad r-6=0$

$-3\ \ -3\quad +6\ \ +6$

$\frac{2r}{2}=-\frac{3}{2}\qquad r=6$

$\cancel{r=-\frac{3}{2}}$

13) Two drivers are testing the same model car at speeds that differ by 20 km/hr. The one driving at the slower rate drives 70 kilometers down a speedway and returns by the same route. The one driving at the faster rate drives 76 kilometers down the speedway and returns by the same route. Both drivers leave at the same time, and the faster car returns $\frac{1}{2}$ hour earlier than the slower car. At what rates were the cars driven?

r	t	d
$r+20$	$t-\frac{1}{2}$	152
r	t	140

$\frac{rt}{r}=\frac{140}{r}\quad t=\frac{140}{r}$

$\frac{(r+20)\left(t-\frac{1}{2}\right)}{r+20}=\frac{152}{r+20}$

$t-\frac{1}{2}=\frac{152}{r+20}$

$\frac{140}{r}\left(2r(r+20)\right)-\frac{1}{2}\left(2r(r+20)\right)=\frac{152}{r+20}\left(2r(r+20)\right)$

$LCD:\left(2r(r+20)\right)$

$280(r+20)-r(r+20)=304r$

$280r+560-r^2-20r=304r$

$-r^2+260r+5600=304r$

$+r^2-260r-5600 \quad +r^2-260r-5600$

$0=r^2+44r-5600$

$0=(r-56)(r+100)$

$r-56=0 \quad r+100=0$

$+56 \;\; +56 \quad -100 \;\; -100$

$r=56 \qquad \cancel{r=-100}$

$56km/hr \;\&\; 76km/hr$

15) An automobile goes to a place 72 miles away and then returns, the round trip occupying 9 hours. His speed in returning is 12 miles per hour faster than his speed in going. Find the rate of speed in both going and returning.

r	t	d
r	t	72
$r+12$	$9-t$	72

$\frac{rt}{r}=\frac{72}{r}\quad t=\frac{72}{r}$

$\frac{(r+12)(9-t)}{r+12}=\frac{72}{r+12}$

$9-t=\frac{72}{r+12}$

$9\left(r(r+12)\right)-\frac{72}{r}\left(r(r+12)\right)=\frac{72}{r+12}\left(r(r+12)\right)$

$LCD: r(r+12)$

$9r(r+12)-72(r+12)=72r$

$9r^2+108r-72r-864=72r$

$9r^2+36r-864=72r$

$-72r \qquad -72r$

$\frac{9r^2}{9}-\frac{36r}{9}-\frac{864}{9}=\frac{0}{9}$

$r^2-4r-96=0$

$(r-12)(r+8)=0$

$r-12=0 \quad r+8=0$

$+12 \;\; +12 \quad -8 \;\; -8$

$r=12 \qquad \cancel{r=-8}$

$12\ mph \;\&\; 24mph$

17) The rate of a stream is 3 miles an hour. If a crew rows downstream for a distance of 8 miles and then back again, the round trip occupying 5 hours, what is the rate of the crew in still water?

r	t	d
$r+3$	t	8
$r-3$	$5-t$	8

$\frac{(r+3)t}{r+3}=\frac{8}{r+3}\quad t=\frac{8}{r+3}$

$\frac{(r-3)(5-t)}{r-3}=\frac{8}{r-3}$

$5-t=\frac{8}{r-3}$

$5\,(r+3)(r-3)-\frac{8}{r+3}(r+3)(r-3)=\frac{8}{r-3}(r+3)(r-3)$

$5(r^2-9)-8(r-3)=8(r+3)$

$5r^2-45-8r+24=8r+24$

$5r^2-8r-21=8r+24$

$-8r-24\ \ -8r-24$

$5r^2-16r-46=0$

$(5r+9)(r-5)=0$

$5r+9=0\quad r-5=0$

$-9\ \ -9\quad +5\ \ +5$

$\frac{5r}{5}=-\frac{9}{5}\quad r=5mph$

~~$r=-\frac{9}{5}$~~

19) By going 15 miles per hour faster, a train would have required 1 hour less to travel 180 miles. How fast did it travel?

r	t	d
r	t	180
$r+15$	$t-1$	180

$\frac{rt}{r}=\frac{180}{r}\ t=\frac{180}{r}$

$\frac{(r+15)(t-1)}{r+15}=\frac{180}{r+15}$

$t-1=\frac{180}{r+15}$

$\frac{180}{r}\big(r(r+15)\big)-1\big(r(r+15)\big)=\frac{180}{r+15}\big(r(r+15)\big)$

$LCD: r(r+15)$

$180(r+15)-r(r+15)=180r$

$180r+2700-r^2-15r=180r$

$-r^2+165r+2700=180r$

$+r^2-165-2700\quad +r^2-165-2700$

$0=r^2+15r-2700$

$0=(r+60)(r-45)$

$r+60=0\quad r-45=0$

$-60\ \ -60\quad +45\ \ +45$

~~$r=-60$~~ $\quad r=45mph$

21) If a train had traveled 5 miles an hour faster, it would have needed $1\frac{1}{2}$ hours less time to travel 150 miles. Find the rate of the train.

r	t	d
r	t	150
$r+5$	$t-\frac{3}{2}$	150

$\frac{rt}{r}=\frac{150}{r}\ t=\frac{150}{r}$

$\frac{(r+5)\left(t-\frac{3}{2}\right)}{r+5}=\frac{150}{r+5}$

$t-\frac{3}{2}=\frac{150}{r+5}$

$\frac{150}{r}\left(2r(r+5)\right)-\frac{3}{2}\left(2r(r+5)\right)=\frac{150}{r+5}\left(2r(r+5)\right)$

$LCD:\left(2r(r+5)\right)$

$300(r+5)-3r(r+5)=300r$

$300r+1500-3r^2-15r=300r$

$-3r^2+285r+1500=300r$

$+3r^2-285-1500 \qquad +3r^2-285r-1500$

$0=\frac{3r^2}{3}+\frac{15r}{3}-\frac{1500}{3}$

$0=(r+25)(r-20)$

$r+25=0 \quad r-20=0$

$-25\ -25 \quad +20\ +20$

~~$r=-25$~~ $\qquad r=20mph$

9.11

1) $y=x^2-2x-8$

$y-inter:(0,-8)$

$x-inter:0=x^2-2x-8$

$0=(x-4)(x+2)$

$x-4=0 \quad x+2=0$

$+4\ +4 \quad -2\ -2$

$x=4 \qquad x=-2$

$(4,0),\ (-2,0)$

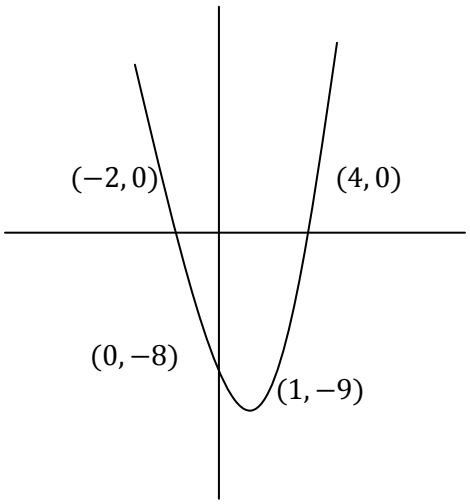
$vertex:x=\frac{2}{2(1)}=\frac{2}{2}=1$

$y=(1)^2-2(1)-8$

$y=1-2-8$

$y=-9$

$(1,-9)$



3) $y = 2x^2 - 12x + 10$

$y - inter: (0, 10)$

$x - inter: 0 = 2x^2 - 12x + 10$

$0 = 2(x^2 - 6x + 5)$

$0 = 2(x - 5)(x - 1)$

$x - 5 = 0 \quad x - 1 = 0$

$+5 \quad +5 \quad +1 \quad +1$

$x = 5 \qquad x = 1$

$(5, 0) \ (1, 0)$

$vertex: x = \frac{12}{2(2)} = \frac{12}{4} = 3$

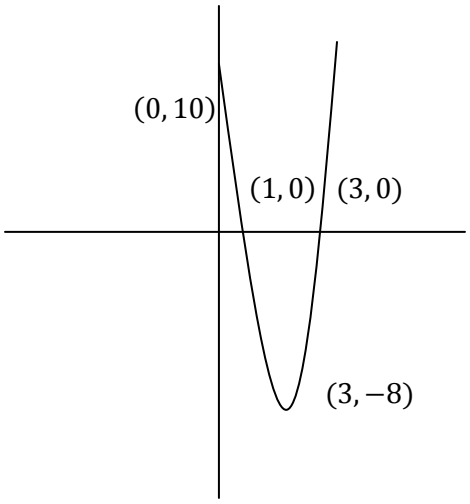
$y = 2(3)^2 - 12(3) + 10$

$y = 2(9) - 36 + 10$

$y = 18 - 36 + 10$

$y = -8$

$(3, -8)$



5) $y = -2x^2 + 12x - 18$

$y - inter: (0, 10)$

$x - inter: 0 = -2x^2 + 12x - 18$

$0 = -2(x^2 - 6x + 9)$

$0 = -2(x - 3)^2$

$x - 3 = 0$

$+3 \quad +3$

$x = 3$

$(3, 0)$

$vertex: x = \frac{-12}{2(-2)} = \frac{-12}{-4} = 3$

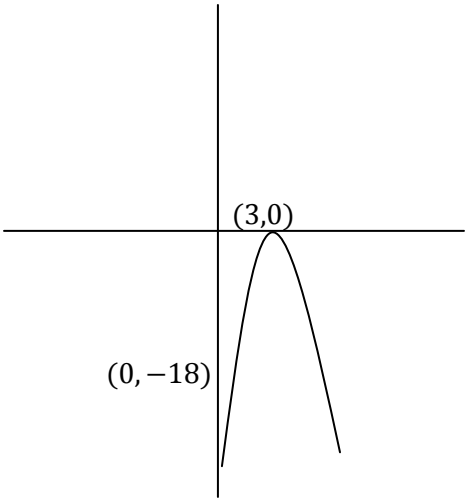
$y = -2(3)^2 + 12(3) - 18$

$y = -2(9) + 36 - 18$

$y = -18 + 36 - 18$

$y = 0$

$(3, 0)$



7) $y = -3x^2 + 24x - 45$

$y - inter: (0, -45)$

$x - inter: 0 = -3x^2 + 24x - 45$

$0 = -3(x^2 - 8x + 15)$

$0 = -3(x - 5)(x - 3)$

$x - 5 = 0 \quad x - 3 = 0$

$+5 \quad +5 \quad +3 \quad +3$

$x = 5 \qquad x = 3$

$(5, 0) \ (3,0)$

$vertex: x = \frac{-24}{2(-3)} = \frac{-24}{-6} = 4$

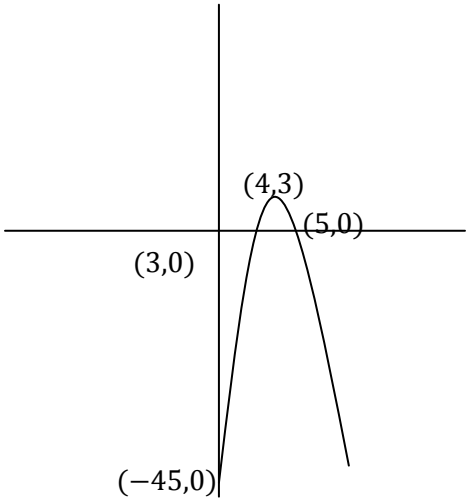
$y = -3(4)^2 + 24(4) - 45$

$y = -3(16) + 96 - 45$

$y = -48 + 96 - 45$

$y = 3$

$(4, 3)$



9) $y = -x^2 + 4x + 5$

$y - inter: (0, 9)$

$x - inter: 0 = -x^2 + 4x + 5$

$0 = -1(x^2 - 4x - 5)$

$0 = -1(x - 5)(x + 1)$

$x - 5 = 0 \quad x + 1 = 0$

$+5 \quad +5 \quad -1 \quad -1$

$x = 5 \qquad x = -1$

$(5, 0) \qquad (-1, 0)$

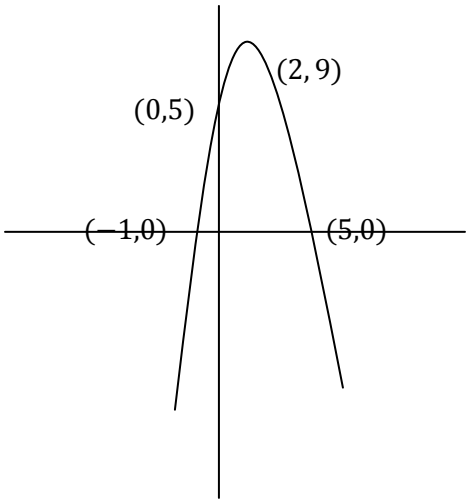
$vertex: x = \frac{-4}{2(-1)} = \frac{-4}{-2} = 2$

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

$y = -4 + 8 + 5$

$y = 9$

$(2, 9)$



11) $y = -x^2 + 6x - 5$

$y - inter: (0, -5)$

$x - inter: 0 = -x^2 + 6x - 5$

$0 = -1(x^2 - 6x + 5)$

$0 = -1(x - 1)(x - 5)$

$x - 1 = 0 \quad x - 5 = 0$

$+1 \quad +1 \quad +5 \quad +5$

$x = 1 \qquad x = 5$

$(1, 0) \qquad (5,0)$

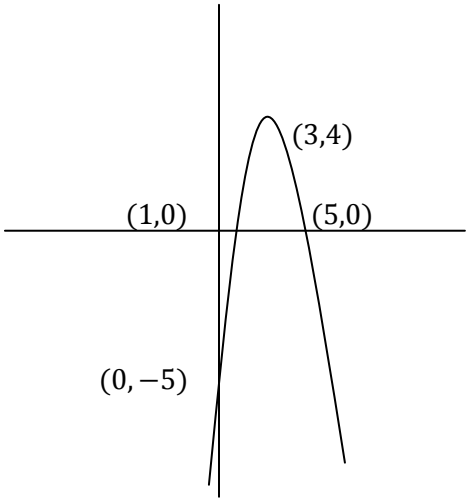
$vertex: x = \frac{-6}{2(-1)} = \frac{-6}{-2} = 3$

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

$y = -9 + 18 - 5$

$y = 4$

$(3, 4)$



13) $y = -2x^2 + 16x - 24$

$y - inter: (0, -24)$

$x - inter: 0 = -2x^2 + 16x - 24$

$0 = -2(x^2 - 8x + 12)$

$0 = -2(x - 2)(x - 6)$

$x - 2 = 0 \quad x - 6 = 0$

$+2 \quad +2 \quad +6 \quad +6$

$x = 2 \qquad x = 6$

$(2, 0) \qquad (6, 0)$

$vertex: x = \frac{-16}{2(-2)} = \frac{-16}{-4} = 4$

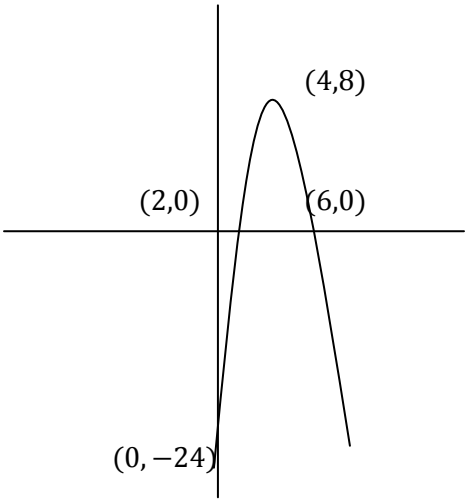
$y = -2(4)^2 + 16(4) - 24$

$y = -2(16) + 64 - 24$

$y = -32 + 64 - 24$

$y = 8$

$(4, 8)$



15) $y = 3x^2 + 12x + 9$

$y - inter: (0, 9)$

$x - inter: 0 = 3x^2 + 12x + 9$

$0 = 3(x^2 + 4x + 3)$

$0 = 3(x + 1)(x + 3)$

$x + 1 = 0 \quad x + 3 = 0$

$-1 \ \ -1 \quad -3 \ \ -3$

$x = -1 \quad x = -3$

$(-1, 0) \quad (-3, 0)$

$vertex: x = \frac{-12}{2(3)} = \frac{-12}{6} = -2$

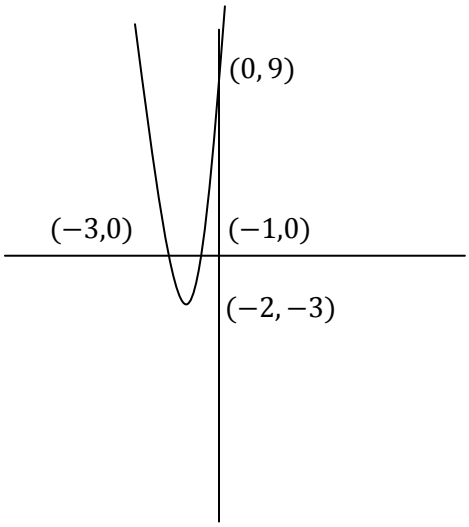
$y = 3(-2)^2 + 12(-2) + 9$

$y = 3(4) - 24 + 9$

$y = 12 - 24 + 9$

$y = -3$

$(-2, -3)$



17) $y = 5x^2 - 40x + 75$

$y - inter: (0, 75)$

$x - inter: 0 = 5x^2 - 40x + 75$

$0 = 5(x^2 - 8x + 15$

$0 = 5(x - 3)(x - 5)$

$x - 3 = 0 \ \ x - 5 = 0$

$+3 \ \ +3 \quad +5 \ \ +5$

$x = 3 \quad x = 5$

$vertex: \frac{40}{2(5)} = \frac{40}{10} = 4$

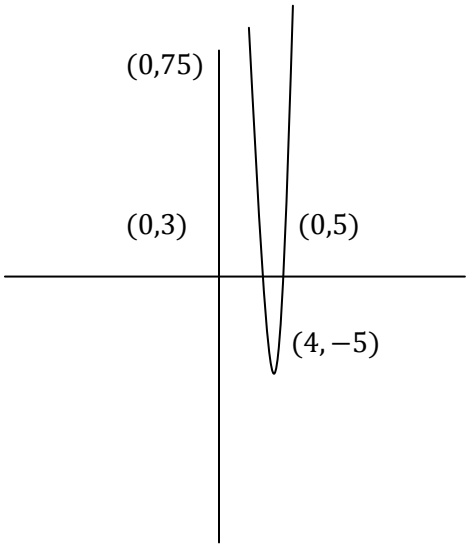
$y = 5(4)^2 - 40(4) + 75$

$y = 5(16) - 160 + 75$

$y = 80 - 160 + 75$

$y = -5$

$(4, -5)$



19) $y = -5x^2 - 60x - 175$

$y - inter: (0, -175)$

$x - inter: 0 = -5x^2 - 60x - 175$

$0 = -5(x^2 + 12x + 35)$

$0 = -5(x + 5)(x + 7)$

$x + 5 = 0 \quad x + 7 = 0$

$-5 \quad -5 \quad -7 \quad -7$

$x = -5 \quad x = -7$

$(-5, 0) \quad (-7, 0)$

$vertex: x = \frac{60}{2(-5)} = \frac{60}{-10} = -6$

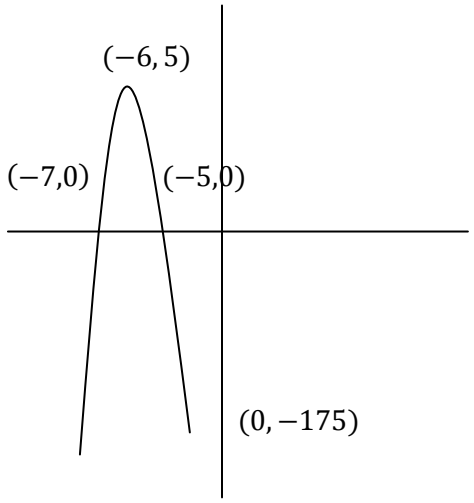
$y = -5(-6)^2 - 60(-6) - 175$

$y = -5(36) + 360 - 175$

$y = -180 + 360 - 175$

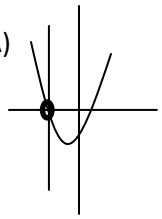
$y = 5$

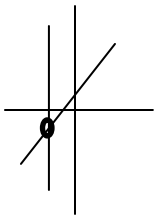
$(-6, 5)$

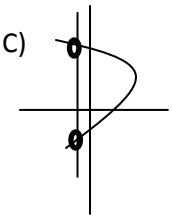


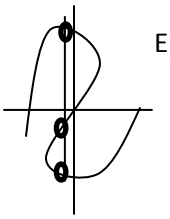
Chapter 10: Functions

10.1

1) A)  *Yes*

B)  *Yes*

C)  *No*

D)  *No*

E) $y = 3x - 7$

F) $y^2 - x^2 = 1$

$+x^2 \quad +x^2$

$\sqrt{y^2} = \sqrt{(x^2 + 1)}$

$y = \pm\sqrt{x^2 + 1}$

No

G) $\sqrt{y} + x = 2$

$-x \quad -x$

$(\sqrt{y})^2 = (2 - x)^2$

$y = (2 - x)^2$

Yes

H) $x^2 + y^2 = 1$

$-x^2 \quad -x^2$

$\sqrt{y^2} = \sqrt{(1 - x^2)}$

$y = \pm\sqrt{1 - x^2}$

No

3) $f(x) = \sqrt{5 - 4x}$

$5 - 4x \geq 0$

$-5 \quad -5$

$-\frac{4x}{-4} \geq \frac{-5}{-4}$

$x \leq \frac{5}{4}$

5) $f(x) = x^2 - 3x - 4$

All Real Numbers $\mathbb{R}$

7) $f(x) = \sqrt{x - 16}$

$x - 16 \geq 0$

$+16 \quad +16$

$x \geq 16$

9) $h(x) = \frac{\sqrt{3x-12}}{x^2-25}$

$x^2 - 25 \neq 0$

$(x - 5)(x + 5) \neq 0$

$x - 5 = 0 \quad x + 5 = 0$

$+5 \quad +5 \qquad -5 \quad -5$

$x = 5 \qquad x = -5$

$x \geq 4, x \neq 5$

$3x - 12 \geq 0$

$+12 \quad +12$

$\frac{3x}{3} \geq \frac{12}{3}$

$x \geq 4$

11) $g(x) = 4x - 4 \qquad g(0)$

$g(0) = 4(0) - 4$

$g(0) = 0 - 4$

$g(0) = -4$

13) $f(x) = |3x + 1| + 1 \quad f(0)$

$f(0) = |3(0) + 1| + 1$

$f(0) = |0 + 1| + 1$

$f(0) = |1| + 1$

$f(0) = 1 + 1$

$f(0) = 2$

15) $f(n) = -2|-n - 2| + 1 \quad f(-6)$

$f(-6) = -2|-(-6) - 2| + 1$

$f(-6) = -2|6 - 2| + 1$

$f(-6) = -2|4| + 1$

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

$f(-6) = -8 + 1$

$f(-6) = -7$

17) $f(rt) = 3^t - 2 \qquad f(-2)$

$f(-2) = 3^{-2} - 2$

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

$f(-2) = \frac{1}{9} - 2$

$f(-2) = \frac{1}{9} - \frac{18}{9}$

$f(-2) = -\frac{17}{9}$

19) $f(t) = |t + 3| \quad f(10)$
$f(10) = |10 + 3|$
$f(10) = |13|$
$f(10) = 13$

21) $w(n) = 4n + 3 \quad w(2)$
$w(2) = 4(2) + 3$
$w(2) = 8 + 3$
$w(2) = 11$

23) $w(n) = 2^{n+2} \quad w(-2)$
$w(-2) = 2^{-2+2}$
$w(-2) = 2^0$
$w(-2) = 1$

25) $p(n) = -3|n| \quad p(7)$
$p(7) = -3|7|$
$p(7) = -3(7)$
$p(7) = -21$

27) $p(t) = -t^3 + t \quad p(4)$
$p(4) = -4^3 + 4$
$p(4) = -64 + 4$
$p(4) = -60$

29) $k(n) = |n - 1| \quad k(3)$
$k(3) = |3 - 1|$
$k(3) = |2|$
$k(3) = 2$

31) $h(x) = x^3 + 2 \quad h(-4x)$
$h(-4x) = (-4x)^3 + 2$
$h(-4x) = -64x^3 + 2$

33) $h(x) = 3x + 2 \quad h(-1 + x)$
$h(-1 + x) = 3(-1 + x) + 2$
$h(-1 + x) = -3 + 3x + 2$
$h(-1 + x) = 3x - 1$

35) $h(t) = 2|-3t - 1| + 2 \quad h(n^2)$
$h(n^2) = 2|-3n^2 - 1| + 2$

37) $g(x) = x + 1 \quad g(3x)$
$g(3x) = 3x + 1$

39) $g(x) = 5^x \quad g(-3 - x)$
$g(-3 - x) = 5^{-3-x}$

10.2

1) $g(a) = a^3 + 5a^2$
$f(a) = 2a + 4$
$g(3) + f(3)$
$g(3) = 3^3 + 5(3)^2$
$g(3) = 27 + 5(9)$
$g(3) = 27 + 45$
$g(3) = 72$
$f(3) = 2(3) + 4$
$f(3) = 6 + 4$
$f(3) = 10$
$g(3) + f(3) = 72 + 10 = 82$

3) $g(a) = 3a + 3$
$f(a) = 2a - 2$
$(g + f)(a) = g(9) + f(9)$
$g(9) = 3(9) + 3$
$g(9) = 27 + 3$
$g(9) = 30$
$f(9) = 2(9) - 2$
$f(9) = 18 - 2$
$f(9) = 16$
$g(9) + f(9) = 30 + 16 = 46$

5) $g(x) = x + 3$
$f(x) = -x + 4$
$(g - f)(3) = g(3) - f(3)$
$g(3) = 3 + 3$
$g(3) = 6$
$f(3) = -3 + 4$
$f(3) = -1$
$g(3) + f(3) = 6 - 1 = 5$

7) $g(x) = x^2 + 2$
$f(x) = 2x + 5$
$(g - f)(0) = g(0) - f(0)$
$g(0) = 0^2 + 2$
$g(0) = 0 + 2$
$g(0) = 2$
$f(0) = 2(0) + 5$
$f(0) = 0 + 5$
$f(0) = 5$
$g(0) - f(0) = 2 - 5 = -3$

9) $g(t) = t - 3$
$h(t) = -3t^3 + 6t$
$g(1) + h(1)$
$g(1) = 1 - 3$
$g(1) = -2$
$h(1) = -3(1)^3 + 6(1)$
$h(1) = -3(1) + 6$
$h(1) = -3 + 6$
$h(1) = 3$
$g(1) + h(1) = -2 + 3 = 1$

11) $h(t) = t + 5$
$g(t) = 3t - 5$
$(h \cdot g)(5) = h(5) \cdot g(5)$
$h(5) = 5 + 5$
$h(5) = 10$
$g(5) = 3(5) - 5$
$g(5) = 15 - 5$
$g(5) = 10$
$h(5) \cdot g(5) = 10 \cdot 10 = 100$

13) $h(n) = 2n - 1$
$g(n) = 3n - 5$
$h(0) \div g(0)$
$h(0) = 2(0) - 1$
$h(0) = 0 - 1$
$h(0) = -1$
$g(0) = 3(0) - 5$
$g(0) = 0 - 5$
$g(0) = -5$
$h(0) \div g(0) = -1 \div -5 = -\frac{1}{5}$

15) $f(a) = -2a - 4$
$g(a) = a^2 + 3$
$\left(\frac{f}{g}\right)(7) = \frac{f(7)}{g(7)}$
$f(7) = -2(7) - 4$
$f(7) = -14 - 4$
$f(7) = -18$
$g(7) = 7^2 + 3$
$g(7) = 49 + 3$
$g(7) = 52$
$\frac{f(7)}{g(7)} = \frac{-18}{52} = -\frac{9}{26}$

17) $g(x) = -x^3 - 2$
$h(x) = 4x$
$(g - h)(x) = g(x) - h(x)$
$g(x) - h(x) = (-x^3 - 2) - (4x)$
$g(x) - h(x) = -x^3 - 2 - 4x$

19) $f(x) = -3x + 2$
$g(x) = x^2 + 5x$
$(f - g)(x) = f(x) - g(x)$
$f(x) - g(x) = (-3x + 2) - (x^2 + 5x)$
$f(x) - g(x) = -3x + 2 - x^2 - 5x$
$f(x) - g(x) = -x^2 - 8x + 2$

21) $g(x) = 4x + 5$
$h(x) = x^2 + 5x$
$g(x) \cdot h(x)$
$g(x) \cdot h(x) = (4x + 5)(x^2 + 5)$
$g(x) \cdot h(x) = 4x^3 + 20x^2 + 5x^2 + 25x$
$g(x) \cdot h(x) = 4x^3 + 25x^2 + 25$

23) $f(x) = x^2 - 5x$
$g(x) = x + 5$
$(f + g)(x) = f(x) + g(x)$
$f(x) + g(x) = (x^2 - 5x) + (x + 5)$
$f(x) + g(x) = x^2 - 4x + 5$

25) $g(n) = n^2 + 5$
$f(n) = 3n + 5$
$g(n) \div f(n) = \frac{g(n)}{f(n)}$
$\frac{g(n)}{f(n)} = \frac{n^2+5}{3n+5}$

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

29) $h(n) = n^3 + 4n$
$g(n) = 4n + 5$
$h(n) + g(n)$
$h(n) + g(n) = (n^3 + 4n) + (4n + 5)$
$h(n) + g(n) = n^3 + 8n + 5$

31) $g(n) = n^2 - 4n$
$h(n) = n - 5$
$g(n^2) \cdot h(n^2)$
$g(n^2) \cdot h(n^2) = [(n^2)^2 - 4(n^2)][(n^2) - 5]$
$g(n^2) \cdot h(n^2) = (n^4 - 4n^2)(n^2 - 5)$
$g(n^2) \cdot h(n^2) = n^6 - 5n^4 - 4n^4 + 20n^2$
$g(n^2) \cdot h(n^2) = n^6 - 9n^4 + 20n^2$

33) $f(x) = 2x$
$g(x) = -3x - 1$
$(f + g)(-4 - x) = f(-4 - x) + g(-4 - x)$
$f(-4 - x) + g(-4 - x) = [2(-4 - x)] + [-3(-4 - x) - 1]$
$f(-4 - x) + g(-4 - x) = (-8 - 2x) + (12 + 3x - 1)$
$f(-4 - x) + g(-4 - x) = x + 3$

35) $f(t) = t^2 + 4t$
$g(t) = 4t + 2$
$f(t^2) + g(t^2)$
$f(t^2) + g(t^2) = [(t^4) + 4(t^2)] + [4(t^2) + 2]$
$f(t^2) + g(t^2) = t^4 + 8t^2 + 2$

37) $g(a) = a^3 + 2a$
$h(a) = 3a + 4$
$\left(\frac{g}{h}\right)(-x) = \frac{g(-x)}{h(-x)}$
$\frac{g(-x)}{h(-x)} = \frac{(-x)^3+2(x)}{3(x)+4} = \frac{-x^3-2x}{-3x+4}$

39) $f(n) = -3n^2 + 1$
$g(n) = 2n + 1$
$(f - g)\left(\frac{n}{3}\right) = f\left(\frac{n}{3}\right) - g\left(\frac{n}{3}\right)$
$f\left(\frac{n}{3}\right) - g\left(\frac{n}{3}\right) = \left[-3\left(\frac{n}{3}\right)^2 + 1\right] - \left[2\left(\frac{n}{3}\right) + 1\right]$
$f\left(\frac{n}{3}\right) - g\left(\frac{n}{3}\right) = \left[-3\left(\frac{n^2}{9}\right) + 1\right] - \left[\frac{2n}{3} + 1\right]$
$f\left(\frac{n}{3}\right) - g\left(\frac{n}{3}\right) = \left(-\frac{n^2}{3} + 1\right) - \frac{2n}{3} - 1$
$f\left(\frac{n}{3}\right) - g\left(\frac{n}{3}\right) = \frac{-n^2-2n}{3}$

43) $f(x) = -4x + 1$
$g(x) = 4x + 3$
$(f \circ g)(x) = f\big(g(9)\big)$
$g(9) = 4(9) + 3$
$g(9) = 36 + 3$
$g(9) = 39$
$f(39) = -4(39) + 1$
$f(39) = -156 + 1$
$f(39) = -155$

45) $h(a) = 3a + 3$
$g(a) = a + 1$
$(h \circ g)(5) = h\big(g(5)\big)$
$g(5) = 5 + 1$
$g(5) = 6$
$h(6) = 3(6) + 3$
$h(6) = 18 + 3$
$h(6) = 21$

45) $g(x) = x + 4$
$h(x) = x^2 - 1$
$(g \circ h)(10) = g\big(h(10)\big)$
$h(10) = 10^2 - 1$
$h(10) = 100 - 1$
$h(10) = 99$
$g(99) = 99 + 4$
$g(99) = 103$

47) $f(n) = -4n + 2$
$g(n) = n + 4$
$(f \circ g)(9) = f\big(g(9)\big)$
$g(9) = 9 + 4$
$g(9) = 13$
$f(13) = -4(13) + 2$
$f(13) = -52 + 2$
$f(13) = -50$

49) $g(x) = 2x - 4$
$h(x) = 2x^3 + 4x^2$
$(g \circ h)(3) = g\big(h(3)\big)$
$h(3) = 2(3^3) + 4(3^2)$
$h(3) = 2(27) + 4(9)$
$h(3) = 54 + 36$
$h(3) = 90$
$g(90) = 2(90) - 4$
$g(90) = 180 - 4$
$g(90) = 176$

51) $g(x) = x^2 - 5x$
$h(x) = 4x + 4$
$(g \circ h)(x) = g(h(x))$
$g(4x + 4) = (4x + 4)^2 - 5(4x + 4)$
$g(4x + 4) = 16x^2 + 32x + 16 - 20x - 20$
$g(4x + 4) = 16x^2 + 12x - 4$

53) $f(a) = -2a + 2$
$g(a) = 4a$
$(f \circ g)(a) = f\big(g(a)\big)$
$f(4a) = -2(4a) + 2$
$f(4a) = -8a + 2$

55) $g(x) = 4x + 4$
$f(x) = x^3 - 1$
$(g \circ f)(x) = g\big(f(x)\big)$
$g(x^3 - 1) = 4(x^3 - 1) + 4$
$g(x^3 - 1) = 4x^3 - 4 + 4$
$g(x^3 - 1) = 4x^3$

57) $g(x) = -x + 5$
$f(x) = 2x - 3$
$(g \circ f)(x) = g\big(f(x)\big)$
$g(2x - 3) = -(2x - 3) + 5$
$g(2x - 3) = -2x + 3 + 5$
$g(2x - 3) = -2x + 8$

59) $f(t) = 4t + 3$

$g(t) = -4t - 2$

$(f \circ g)(t) = f\big(g(t)\big)$

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

$f(-4t - 2) = -16t - 8 + 3$

$f(-4t - 2) = -16t - 5$

10.3

1) $g(x) = -x^5 - 3$

$f(x) = \sqrt[5]{-x - 3}$

$(g \circ f)(x) = g\big(f(x)\big)$

$g\big(\sqrt[5]{-x - 3}\big) = -\big(\sqrt[5]{-x - 3}\big)^5 - 3$

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

$= x + 3 - 3$

$= x$

yes

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

$g(x) = \frac{-2x+1}{-x-1}$

$(f \circ g)(x) = f\big(g(x)\big)$

$f\left(\frac{-2x+1}{-x-1}\right) = \frac{-\left(\frac{-2x+1}{-x-1}\right)-1}{\frac{-2x+1}{-x-1}-2}$

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

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

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

yes

5) $g(x) = -10x + 5$

$f(x) = \frac{x-5}{10}$

$(g \circ f)(x) = g\big(f(x)\big)$

$g\left(\frac{x-5}{10}\right) = -10\left(\frac{x-5}{10}\right) + 5$

$= -x + 5 + 5$

$= -x + 10$

No

7) $f(x) = -\frac{2}{x+3}$

$g(x) = \frac{3x+2}{x+2}$

$(f \circ g)(x) = f\big(g(x)\big)$

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

$= \frac{-2x-4}{3x+2+3x+6}$

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

No

9) $g(x) = \sqrt[5]{\frac{x-1}{2}}$

$f(x) = 2x^5 + 1$

$(g \circ f)(x) = g\big(f(x)\big)$

$g(2x^5 + 1) = \sqrt[5]{\frac{2x^5+1-1}{2}}$

$= \sqrt[5]{\frac{2x^5}{2}}$

$= \sqrt[5]{x^5}$

$= x$

yes

11) $f(x) = (x - 2)^5 + 3$

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

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

$-3 \qquad -3$

$\sqrt[5]{x - 3} = \sqrt[5]{y - 2}$

$\sqrt[5]{x - 3} = y - 2$

$+2 \qquad +2$

$\sqrt[5]{x - 3} + 2 = y$

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

13) $g(x) = \frac{4}{x+2}$

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

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

$(y+2)x = \frac{4}{y+2}(y+2)$

$\frac{x(y+2)}{x} = \frac{4}{x}$

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

$-2 \quad -2$

$y = 4x - 2$

$g^{-1}(x) = \frac{4}{x} - 2$

15) $f(x) = \frac{-2x-2}{x+2}$

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

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

$(y+2)x = \frac{-2y-2}{y+2}(y+2)$

$xy + 2x = -2y - 2$

$+2y - 2x \quad +2y - 2x$

$xy + 2y = -2 - 2x$

$\frac{y(x+2)}{x+2} = \frac{-2-2x}{x+2}$

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

$f^{-1}(x) = \frac{-2-2x}{x+2}$

17) $f(x) = \frac{10-x}{5}$

$y = \frac{10-x}{5}$

$5(x) = \frac{10-y}{5}(5)$

$5x = 10 - y$

$-10 \quad -10$

$\frac{5x}{-1} - \frac{10}{-1} = \frac{-y}{-1}$

$-5x + 10 = y$

$f^{-1}(x) = -5x + 10$

19) $g(x) = -(x-1)^3$

$y = -(x-1)^3$

$\frac{x}{-1} = \frac{-(y-1)^3}{-1}$

$\sqrt[3]{-x} = \sqrt[3]{(y-1)^3}$

$\sqrt[3]{-x} = y - 1$

$+1 \quad +1$

$\sqrt[3]{-x} + 1 = y$

$g^{-1}(x) = \sqrt[3]{-x} + 1$

21) $f(x) = (x-3)^3$

$y = (x-3)^3$

$\sqrt[3]{x} = \sqrt[3]{(y-3)^3}$

$\sqrt[3]{x} = y - 3$

$+3 \quad +3$

$\sqrt[3]{x} + 3 = y$

$f^{-1}(x) = \sqrt[3]{x} + 3$

23) $g(x) = \frac{x}{x-1}$

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

$(y-1)x = \frac{y}{y-1}(y-1)$

$xy - x = y$

$-xy \quad -xy$

$-x = y - xy$

$-\frac{x}{1-x} = \frac{y(1-x)}{1-x}$

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

$g^{-1}(x) = -\frac{x}{1-x}$

25) $f(x) = \frac{x-1}{x+1}$

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

$(y+1)x = \frac{y-1}{y+1}(y+1)$

$xy + x = y - 1$

$-y - x \quad -y - x$

$xy - y = -1 - x$

$\frac{y(x-1)}{x-1} = \frac{-1-x}{x-1}$

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

$f^{-1}(x) = \frac{-1-x}{x-1}$

27) $g(x) = \frac{8-5x}{4}$

$y = \frac{8-5x}{4}$

$4(x) = \frac{8-5y}{4}\ (4)$

$4x = 8 - 5y$

$\underline{-8 \quad -8}$

$\frac{4x-8}{-5} = -\frac{5y}{-5}$

$\frac{4x-8}{-5} = y$

$g^{-1}(x) = \frac{4x-8}{-5}$

29) $g(x) = -5x + 1$

$y = -5x + 1$

$x = -5y + 1$

$\underline{-1 \qquad -1}$

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

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

$g^{-1}(x) = \frac{x-1}{-5}$

31) $g(x) = -1 + x^3$

$y = -1 + x^3$

$x = -1 + y^3$

$\underline{+1 \ +1}$

$\sqrt[3]{x+1} = \sqrt[3]{y^3}$

$y = \sqrt[3]{x+1}$

$g^{-1}(x) = \sqrt[3]{x+1}$

33) $h(x) = \frac{4-\sqrt[3]{4x}}{2}$

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

$(2)x = \frac{4-\sqrt[3]{4y}}{2}(2)$

$2x = 4 - \sqrt[3]{4y}$

$\underline{-4 \ -4}$

$\frac{2x-4}{-1} = \frac{-\sqrt[3]{4y}}{-1}$

$(-2x+4)^3 = \left(\sqrt[3]{4y}\right)^3$

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

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

$h^{-1}(x) = \frac{(-2x+4)^3}{4}$

35) $f(x) = \frac{x+1}{x+2}$

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

$(y+2)x = \frac{y+1}{y+2}(y+2)$

$xy + 2x = y + 1$

$\underline{-y - 2x \ \ -y - 2x}$

$xy - y = 1 - 2x$

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

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

$f^{-1}(x) = \frac{1-2x}{x-1}$

37) $f(x) = \frac{7-3x}{x-2}$

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

$(y-2)x = \frac{7-3y}{y-2}(y-2)$

$xy - 2x = 7 - 3y$

$\underline{+3y + 2x \ \ + 2x + 3y}$

$xy + 3y = 7 + 2x$

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

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

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

39) $g(x) = -x$

$y = -x$

$\frac{x}{-1} = (-y)/-1$

$-x = y$

$g^{-1}(x) = -x$

10.4

1) $3^{1-2n} = 3^{1-3n}$

$1 - 2n = 1 - 3n$

$+3n \quad +3n$

$1 + n = 1$

$-1 \quad -1$

$n = 0$

3) $4^{2a} = 1$

$4^{2a} = 1^0$

$\frac{2a}{a} = \frac{0}{2}$

$a = 0$

5) $\left(\frac{1}{25}\right)^{-k} = 125^{-2k-2}$

$(5^{-2})^{-k} = (5^3)^{-2k-2}$

$5^{2k} = 5^{-6k-6}$

$2k = -6k - 6$

$+6k \quad +6k$

$\frac{8k}{8} = -\frac{6}{8}$

$k = -\frac{3}{4}$

7) $6^{2m+1} = \frac{1}{36}$

$6^{2m+1} = 6^{-2}$

$2m + 1 = -2$

$-1 \quad -1$

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

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

9) $6^{-3x} = 36$

$6^{-3x} = 6^2$

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

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

11) $64^b = 2^5$

$(2^6)^b = 2^5$

$2^{6b} = 2^5$

$\frac{6b}{6} = \frac{5}{6}$

$b = \frac{5}{6}$

13) $\left(\frac{1}{4}\right)^x = 16$

$(4^{-1})^x = 4^2$

$4^{-x} = 4^2$

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

$x = -2$

15) $4^{3a} = 4^3$

$\frac{3a}{3} = \frac{3}{3}$

$a = 1$

17) $36^{3x} = 216^{2x+1}$

$(6^2)^{3x} = (6^3)^{2x+1}$

$6^{6x} = 6^{6x+1}$

$6x = 6x + 1$

$-6x - 6x$

$0 = 1$

$false$

$No\ Solution$

19) $9^{2n+3} = 243$

$(3^2)^{2n+3} = 3^5$

$3^{4n+6} = 3^5$

$4n + 6 = 5$

$-6 \quad -6$

$\frac{4n}{4} = \frac{-1}{4}$

$n = -\frac{1}{4}$

21) $3^{3x-2} = 3^{3x+1}$

$3x - 2 = 3x + 1$

$-3x \quad -3x$

$-2 = 1$

$false$

$No\ Solution$

23) $3^{-2x} = 3^3$

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

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

25) $5^{m+2} + 5^{-m}$

$m + 2 = -m$

$-m \quad -m$

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

$-1 = m$

27) $\left(\frac{1}{36}\right)^{b-1} = 216$

$(6^{-2})^{b-1} = 6^3$

$6^{-2b+2} = 6^3$

$-2b + 2 = 3$

$-2 \quad -2$

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

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

29) $r6^{2-2x} = 6^2$

$2 - 2x = 2$

$-2 \quad -2$

$\frac{-2x}{-2} = \frac{0}{-2}$

$x = 0$

31) $4 \cdot 2^{(-3n-1)} = \frac{1}{4}$

$2^2 \cdot 2^{-3n-1} = 2^{-2}$

$2^{-3n+1} = 2^{-2}$

$-3n + 1 = -2$

$-1 \quad -1$

$-\frac{3n}{-3} = \frac{-3}{-3}$

$n = 1$

33) $4^{3k-3} \cdot 4^{2-2k} = 16^{-k}$

$4^{k-1} = (4^2)^{-k}$

$4^{k-1} = 4^{-2k}$

$k - 1 = -2k$

$-k \quad -k$

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

$\frac{1}{3} = k$

35) $9^{-2x}\left(\frac{1}{243}\right)^{3x} = 243^{-x}$

$(3^2)^{-2x}(3^{-5})^{3x} = (3^5)^{-x}$

$3^{-4x} \cdot 3^{-15x} = 3^{-5x}$

$3^{-19x} = 3\text{^} - 5x$

$-19x = -5x$

$+19x \quad +19x$

$\frac{0}{14} = \frac{14x}{14}$

$0 = x$

37) $64^{n-2} \cdot 16^{n+2} = \left(\frac{1}{4}\right)^{3n-1}$

$(4^3)^{n-2} \cdot (4^2)^{n+2} = (4^{-1})^{3n-1}$

$4^{3n-6} \cdot 4^{2n+4} = 4^{-3n+1}$

$4^{5n-2} = 4^{-3n+1}$

$5n - 2 = -3n + 1$

$+3n \quad +3n$

$8n - 2 = 1$

$+2 \quad +2$

$\frac{8n}{8} = \frac{3}{8}$

$n = \frac{3}{8}$

39) $5^{-3n-3} \cdot 5^{2n} = 1$

$5^{-n-3} = 5^0$

$-n - 3 = 0$

$+3 \quad +3$

$\frac{-n}{-1} = 3/-1$

$n = -3$

10.5

1) $\log_9 81 = 2$
$9^2 = 81$

3) $\log_7 \frac{1}{49} = -2$
$7^{-2} = \frac{1}{49}$

5) $\log_{13} 169 = 2$
$13^2 = 169$

7) $8^0 = 1$
$\log_8 1 = 0$

9) $15^2 = 225$
$\log_{15} 225 = 2$

11) $64^{\frac{1}{6}} = 2$
$\log_{64} 2 = \frac{1}{6}$

13) $\log_{125} 5 = x$
$125^x = 5$
$(5^3)^x = 5^1$
$5^{3x} = 5^1$
$\frac{3x}{3} = \frac{1}{3}$
$x = \frac{1}{3}$

15) $\log_{343} \frac{1}{7} = x$
$343^x = \frac{1}{7}$
$(7^3)^x = 7^{-1}$
$7^{3x} = 7^{-1}$
$\frac{3x}{3} = \frac{-1}{3}$
$x = -\frac{1}{3}$

17) $\log_4 16 = x$
$4^x = 16$
$4^x = 4^2$
$x = 2$

19) $\log_6 36 = x$
$6^x = 36$
$6^x = 6^2$
$x = 2$

21) $\log_2 64 = x$
$2^x = 64$
$2^x = 2^6$
$x = 6$

23) $\log_5 x = 1$
$5^1 = x$
$5 = x$

25) $\log_2 x = -2$
$2^{-2} = x$
$\frac{1}{2^2} = x$
$\frac{1}{4} = x$

27) $\log_{11} k = 2$
$11^2 = k$
$121 = k$

29) $\log_9(n + 9) = 4$
$9^4 = n + 9$
$6561 = n + 9$
$-9 \quad -9$
$6552 = n$

31) $\log_5(-3m) = 3$
$5^3 = -3m$
$\frac{125}{-3} = \frac{-3m}{-3}$
$-\frac{125}{3} = m$

33) $\log_{11}(x + 5) = -1$
$11^{-1} = x + 5$
$\frac{1}{11} = x + 5$
$-5 \quad -5$
$-\frac{54}{11} = x$

35) $\log_4(6b + 4) = 0$
$4^0 = 6b + 4$
$1 = 6b + 4$
$-4 \quad -4$
$\frac{-3}{6} = \frac{6b}{6}$
$-\frac{1}{2} = b$

37) $\log_5(-10x + 4) = 4$
$5^4 = -10x + 4$
$625 = -10x + 4$
$-4 \quad -4$
$\frac{621}{-10} = \frac{-10x}{-10}$
$-\frac{621}{10} = x$

39) $\log_2(10 - 5a) = 3$
$2^3 = 10 - 5a$
$8 = 10 - 5a$
$-10 \quad -10$
$\frac{-2}{-5} = \frac{-5a}{-5}$
$\frac{2}{5} = a$

10.6

1) Find each of the following:
   a. S500 invested at 4% compounded annually for 10 years.

$$A = 500\left(1 + \frac{.04}{1}\right)^{1\cdot 10}$$
$$A = 500(1.04)^{10}$$
$$A = 500(1.48)$$
$$A = \$740.12$$

   b. S600 invested at 6% compounded annually for 6 years.

$$A = 600\left(1 + \frac{.06}{1}\right)^{1\cdot 6}$$
$$A = 600(1.06)^{6}$$
$$A = 600(1.42)$$
$$A = \$851.11$$

   c. S750 invested at 3% compounded annually for 8 years.

$$A = 750\left(1 + \frac{.03}{1}\right)^{1\cdot 8}$$
$$A = 750(1.03)^{8}$$
$$A = 750(1.27)$$
$$A = \$950.08$$

   d. S1500 invested at 4% compounded semiannually for 7 years.

$$A = 1500\left(1 + \frac{.04}{2}\right)^{2\cdot 7}$$
$$A = 1500(1.02)^{14}$$
$$A = 1500(1.32)$$
$$A = \$1979.22$$

   e. S900 invested at 6% compounded semiannually for 5 years.

$$A = 900\left(1 + \frac{.06}{2}\right)^{2\cdot 5}$$
$$A = 900(1.03)^{10}$$
$$A = 900(1.34)$$
$$A = \$1209.52$$

   f. $950 invested at 4% compounded semiannually for 12 years.

$$A = 950\left(1 + \frac{.04}{2}\right)^{(2\cdot 12)}$$
$$A = 950(1.02)^{24}$$
$$A = 950(1.61)$$
$$A = \$1528.02$$

g. $2000 invested at 5% compounded quarterly for 6 years.

$A = 200\left(1 + \frac{.05}{2}\right)^{4 \cdot 6}$

$A = 200(1.0125)^{24}$

$A = 200(1.35)$

$A = \$2694.70$

h. $2250 invested at 4% compounded quarterly for 9 years.

$A = 2250\left(1 + \frac{.04}{4}\right)^{4 \cdot 9}$

$A = 2250(1.01)^{36}$

$A = 2250(1.43)$

$A = \$3219.23$

i. $3500 invested at 6% compounded quarterly for 12 years.

$A = 3500\left(1 + \frac{.06}{4}\right)^{4 \cdot 12}$

$A = 3500(1.015)^{48}$

$A = 3500(2.04)$

$A = \$7{,}152.17$

j. All of the above compounded continuously.

$A = 500e^{.04 \cdot 10}$

$A = 500e^{.4}$

$A = 500(1.49)$

$A =$\$745.91

$A = 600e^{.06 \cdot 6}$

$A = 600e^{.36}$

$A = 600(1.43)$

$A = \$860.00$

$A = 750e^{.03 \cdot 8}$

$A = 750e^{.24}$

$A = 750(1.27)$

$A = \$953.44$

$A = 1500e^{.04 \cdot 7}$

$A = 1500e^{.28}$

$A = 1500(1.32)$

$A = \$1984.69$

$A = 900e^{.06 \cdot 5}$

$A = 900e^{.30}$

$A = 900(1.35)$
$A = \$1214.87$

$A = 950e^{.04 \cdot 12}$
$A = 950e^{.48}$
$A = 950(1.62)$
$A = \$1535.27$

$A = 2000e^{.05 \cdot 6}$
$A = 2000e^{.3}$
$A = 2000(1.35)$
$A = \$2699.72$

$A = 2250e^{.04 \cdot 9}$
$A = 2250e^{.36}$
$A = 2250(1.43)$
$A = \$3224.99$

$A = 3500e^{.06 \cdot 12}$
$A = 3500e^{.72}$
$A = 3500(2.05)$
$A = \$7190.52$

3) What principal will amount to S3500 if invested at 4% interest compounded quarterly for 5 years?

$3500 = P\left(1 + \frac{.04}{4}\right)^{4 \cdot 5}$
$3500 = P(1.01)^{20}$
$\frac{3500}{1.22} = \frac{P(1.22)}{1.22}$
$\$2868.41 = P$

5) What principal will amount to S2500 if invested at 5% interest compounded semiannually for 7.5 years?

$2500 = P\left(1 + \frac{.05}{2}\right)^{2 \cdot 7.5}$
$2500 = P(1.025)^{1.5}$
$\frac{2500}{1.45} = \frac{P(1.45)}{1.45}$
$\$1726.16 = P$

7) A thousand dollars is left in a bank savings account drawing 7% interest, compounded quarterly for 10 years. What is the balance at the end of that time?

$$A = 1000\left(1 + \frac{.07}{4}\right)^{4\cdot 10}$$
$$A = 100(1.0175)^{40}$$
$$A = 1000(2.00)$$
$$A = \$2001.60$$

9) $1750 is invested in an account earning 13.5% interest compounded monthly for a 2 year period. What is the balance at the end of 9 years?

$$A = 1750\left(1 + \frac{.135}{12}\right)^{12\cdot 2}$$
$$A = 1750(1.01125)^{24}$$
$$A = 1750(1.31)$$
$$A = \$2288.98$$

11) A $10, 000 Treasury Bill earned 16% compounded monthly. If the bill matured in 2 years, what was it worth at maturity?

$$A = 10{,}000\left(1 + \frac{.16}{12}\right)^{12\cdot 2}$$
$$A = 10{,}000(1.01)^{24}$$
$$A = 10{,}000(1.37)$$
$$A = \$13{,}742.19$$

13) A savings institution advertises 7% annual interest, compounded daily, How much more interest would you earn over the bank savings account or credit union in problems 7 and 8?

$$A = 1000\left(1 + \frac{.07}{365}\right)^{365\cdot 10}$$
$$A = 1000(1.00019)^{3650}$$
$$A = 1000(2.01)$$
$$A = \$2013.62$$
$$\#7: 2001.60 - 2013.62 = \$12.02$$
$$\#8: 2009.66 - 2013.62 = \$ - 3{,}96$$

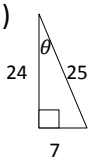
15) You lend $100 at 10% continuous interest. If you are repaid 2 months later, what is owed?

$$A = 100e^{.1\left(\frac{1}{6}\right)}$$
$$A = 100e^{.0167}$$
$$A = 100(1.02)$$
$$A = \$101.68$$

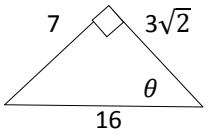
10. 7

1) $\cos 71 = 0.3256$

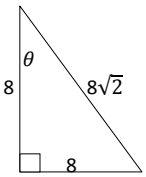
3) $\sin 75 = 0.9659$

5) 

$sin\theta = \frac{7}{25}$

7) 

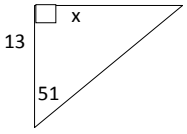
$\sin\theta = \frac{7}{16}$

9) 

$\sin\theta = \frac{8}{8\sqrt{2}}\left(\frac{\sqrt{2}}{\sqrt{2}}\right)$

$\sin\theta = \left(\frac{8\sqrt{2}}{8\cdot 2}\right)$

$\sin\theta = \frac{\sqrt{2}}{2}$

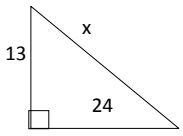
11) 

$(13)\tan 51 = \frac{x}{13}(13)$

$13\tan 51 = x$

$13(1.235) = x$

$16.05 = x$

13) 

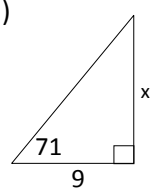
$(x)\sin 24 = \frac{13}{x}(x)$

$\frac{x\sin 24}{\sin 24} = \frac{13}{\sin 24}$

$x = \frac{13}{\sin 24}$

$x = \frac{13}{0.407}$

$x = 31.96$

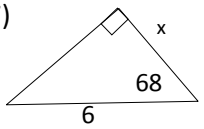
15) 

$(9)\tan 71 = \frac{x}{9}(9)$

$9\tan 71 = x$

$9(2.904) = x$

$26.14 = x$

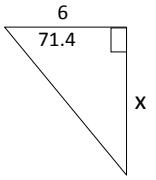
17) 

$(6)\cos 68 = \frac{x}{6}(6)$

$6\cos 68 = x$

$6(.3746) = x$

$2.25 = x$

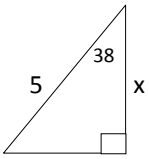
19) 

$(6)\tan 71.4 = \frac{x}{6}$

$6\tan 71.4 = x$

$6(2.9714) = x$

$17.83 = x$

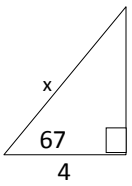
21) 

$(5)\cos 38 = \frac{x}{5}(5)$

$5\cos 38 = x$

$5(.7880) = x$

$3.94 = x$

23) 

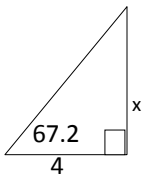
$(x)\cos 67 = \frac{4}{x}(x)$

$\frac{x\cos 67}{x\cos 67} = \frac{4}{\cos 67}$

$x = \frac{4}{\cos 67}$

$x = \frac{4}{.3907}$

$x = 10.24$

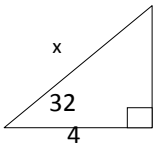
25) 

$(4)\tan 67.2 = \frac{x}{4}(4)$

$4\tan 67.2 = x$

$4(2.3789) = x$

$9.52 = x$

27) 

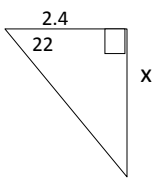
$(x)\cos 32 = \frac{4}{x}(x)$

$\frac{x\cos 32}{\cos 32} = \frac{4}{\cos 32}$

$x = \frac{4}{\cos 32}$

$x = \frac{4}{0.8480}$

$x = 4.72$

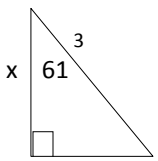
29) 

$(2.4)\tan 22 = \frac{x}{2.4}(2.4)$

$2.4\tan 22 = x$

$2.4(0.4040) = x$

$0.97 = x$

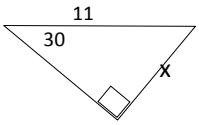
31) 

$(3)\cos 61 = \frac{x}{3}(3)$

$3\cos 61 = x$

$3(.4848) = x$

$1.45 = x$

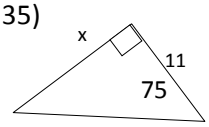
33) 

$(11)\sin 30 = \frac{x}{11}(11)$

$11\sin 30 = x$

$11(0.5) = x$

$5.5 = x$

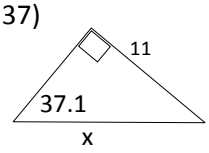
35) 

$(11)\tan 95 = \frac{x}{11}(11)$

$11\tan 95 = x$

$11(3.7321) = x$

$41.05 = x$

37) 

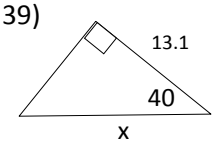
$(x)\sin 37.1 = \frac{11}{x}(x)$

$\frac{x\sin 37.1}{\sin 37.1} = \frac{11}{\sin 37.1}$

$x = \frac{11}{\sin 37.1}$

$x = \frac{11}{.6032}$

$x = 18.24$

39) 

$(x)\cos 40 = 13.1\ (x)$

$\frac{x\cos 40}{\cos 40} = \frac{13.1}{\cos 40}$

$x = \frac{13.1}{\cos 40}$

$x = \frac{13.1}{.7660}$

$x = 17.1$

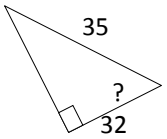
10.8

1) $\sin z = 0.4848$

$z = 29°$

3) $\sin y = 0.6561$

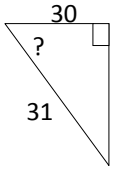
$y = 41°$

5) 

$\cos x = \frac{32}{35}$

$\cos x = .9143$

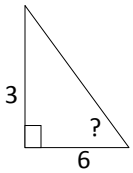
$x = 24°$

7) 

$\cos x = \frac{30}{31}$

$\cos x = .9677$

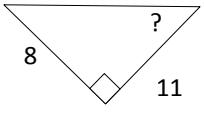
$x = 15°$

9) 

$\tan x = \frac{3}{6}$

$\tan x = .5$

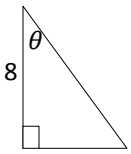
$x = 27°$

11) 

$\tan\theta = \frac{11}{8}$

$\tan\theta = .7273$

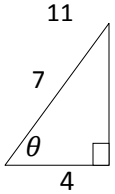
$\theta = 36°$

13) 

$\cos\theta = \frac{4}{7}$

$\cos\theta = 0.5714$

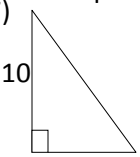
$\theta = 55.2°$

15) 

$\cos\theta = \frac{4}{7}$

$\cos\theta = 0.5714$

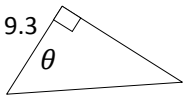
$\cos\theta = 55.2°$

17) 

$\tan\theta = \frac{16}{10}$

$\tan\theta = 1.6$

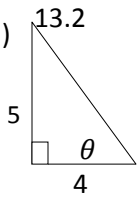
$\tan\theta = 58°$

19) 

$\cos\theta = \frac{9.3}{13.2}$

$\cos\theta = 0.7045$

$\cos\theta = 45.2°$

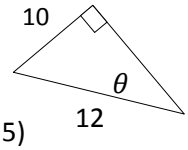
21) 

$\tan\theta = \frac{5}{4}$

$\tan\theta = 1.25$

$\tan\theta = 51.3°$

23)

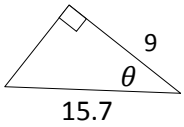


$\sin\theta = \frac{10}{12}$

$\sin\theta = 0.8333$

$\sin\theta = 56.4°$

25)

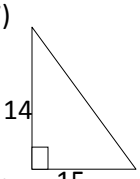


$\cos\theta = \frac{9}{15.7}$

$\cos\theta = 0.5732$

$\cos\theta = 55°$

27)

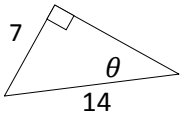


$\tan\theta = \frac{15}{14}$

$\tan\theta = 1.0714$

$\tan\theta = 47°$

29)

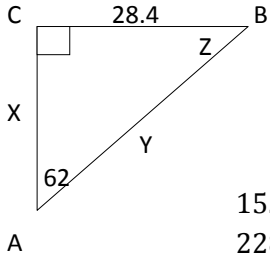


$sin\,\theta = \frac{7}{14}$

$\sin\theta = 0.5$

$\sin\theta = 30°$

31)



$(x)\tan 62 = \frac{28.4}{x}(x)$

$\frac{x\tan 62}{\tan 62} = \frac{28.4}{\tan 62}$

$x = \frac{28.4}{\tan 62}$

$x = \frac{28.4}{1.8507}$

$x = 15.1$

$15.1^2 + 28.4^2 = y^2$

$228.01 + 806.56 = y^2$

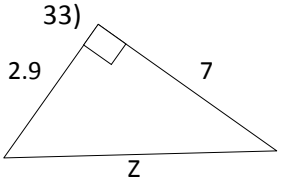
$\sqrt{1034.57} = \sqrt{y^2}$

$32.2 = y$

$z = 90 - 62$

$z = 28°$

33)



$\tan x = \frac{2.9}{7}$

$\tan x = .4143$

$x = 22.5°$

$y = 90 - 22.5$

$y = 67.5°$

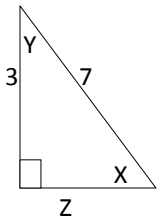
$2.9^2 + 7^2 = z^2$

$8.41 + 49 = z^2$

$\sqrt{57.41} = \sqrt{z^2}$

$7.6 = z$

35)



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

$\sin x = .4286$

$x = 25.4°$

$y = 90 - 25.4$

$y = 64.6°$

$3^2 + z^2 = 7^2$

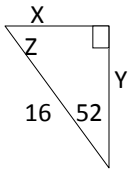
$9 + z^2 = 49$

$-9 \quad -9$

$\sqrt{z^2} = \sqrt{40}$

$z = 6.3$

37)



$(16)\sin 52 = \frac{x}{16}(16)$

$16\sin 52 = x$

$16(.7880) = x$

$12.6 = x$

$12.6^2 + y^2 = 16^2$

$158.76 + y^2 = 256$

$-158.76 \quad -158.76$

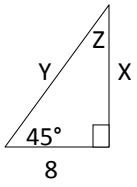
$\sqrt{y^2} = \sqrt{97.24}$

$y = 9.9$

$z = 90 - 52$

$z = 38°$

39)



$(8)\tan 45 = \frac{x}{8}(8)$

$8\tan 45 = x$

$8(1) = x$

$8 = x$

$8^2 + 8^2 = y^2$

$64 + 64 = y^2$

$\sqrt{128} = \sqrt{y^2}$

$11.3 = y$

$z = 90 - 45$

$z = 45°$