CHAPTER 1

Section 1.1 Solutions ----------

1.

$$5x = 35$$

$$\frac{1}{5}\cdot 5x = \frac{1}{5}\cdot 35$$

$$\boxed{x = 7}$$

2.

$$4t = 32$$

$$\frac{1}{4}\cdot 4t = \frac{1}{4}\cdot 32$$

$$\boxed{t = 8}$$

3.

$$-3 + n = 12$$

$$3 + -3 + n = 3 + 12$$

$$\boxed{n = 15}$$

4.

$$4 = -5 + y$$

$$5 + 4 = 5 + -5 + y$$

$$\boxed{9 = y}$$

5.

$$24 = -3x$$

$$-\frac{1}{3}\cdot 24 = -\frac{1}{3}\cdot(-3x)$$

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

6.

$$-50 = -5t$$

$$-\frac{1}{5}\cdot(-50) = -\frac{1}{5}\cdot(-5t)$$

$$\boxed{10 = t}$$

7.

$$\frac{1}{5}n = 3$$

$$5\cdot\frac{1}{5}n = 5\cdot 3$$

$$\boxed{n = 15}$$

8.

$$6 = \frac{1}{3}p$$

$$3\cdot 6 = 3\cdot\left(\frac{1}{3}p\right)$$

$$\boxed{18 = p}$$

9.

$$3x - 5 = 7$$

$$3x = 12$$

$$\boxed{x = 4}$$

10.

$$4p + 5 = 9$$

$$4p = 4$$

$$\boxed{p = 1}$$

11.

$$9m - 7 = 11$$

$$9m = 18$$

$$\boxed{m = 2}$$

12.

$$2x + 4 = 5$$

$$2x = 1$$

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

13.

$$5t + 11 = 18$$

$$5t = 7$$

$$\boxed{t = 7/5}$$

14.

$$7x + 4 = 21 + 24x$$

$$7x = 17 + 24x$$

$$-17x = 17$$

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

15.

$$3x - 5 = 25 + 6x$$

$$3x = 30 + 6x$$

$$-3x = 30$$

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

16.

$$5x + 10 = 25 + 2x$$

$$5x = 15 + 2x$$

$$3x = 15$$

$$\boxed{x = 5}$$

17. $20n-30=20-5n$

$20n=50-5n$

$25n=50$

$\boxed{n=2}$

18. $14c+15=43+7c$

$14c=28+7c$

$7c=28$

$\boxed{c=4}$

19. $4(x-3)=2(x+6)$

$4x-12=2x+12$

$2x=24$

$\boxed{x=12}$

20. $5(2y-1)=2(4y-3)$

$10y-5=8y-6$

$2y=-1$

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

21. $-3(4t-5)=5(6-2t)$

$-12t+15=30-10t$

$-15=2t$

$\boxed{-\frac{15}{2}=t}$

22. $2(3n+4)=-(n+2)$

$6n+8=-n-2$

$7n=-10$

$\boxed{n=-\frac{10}{7}}$

23. $2(x-1)+3=x-3(x+1)$

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

$2x+1=-2x-3$

$4x=-4$

$\boxed{x=-1}$

24. $4(y+6)-8=2y-4(y+2)$

$4y+24-8=2y-4y-8$

$4y+16=-2y-8$

$6y=-24$

$\boxed{y=-4}$

25. $5p+6(p+7)=3(p+2)$

$5p+6p+42=3p+6$

$11p+42=3p+6$

$8p=-36$

$\boxed{p=-\frac{36}{8}=-\frac{9}{2}}$

26. $3(z+5)-5=4z+7(z-2)$

$3z+15-5=4z+7z-14$

$3z+10=11z-14$

$-8z=-24$

$\boxed{z=3}$

27. $7x-(2x+3)=x-2$

$7x-2x-3=x-2$

$5x-3=x-2$

$4x=1$

$\boxed{x=\frac{1}{4}}$

28. $3x-(4x+2)=x-5$

$3x-4x-2=x-5$

$-x-2=x-5$

$3=2x$

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

29. $2-(4x+1)=3-(2x-1)$

$2-4x-1=3-2x+1$

$1-4x=4-2x$

$-3=2x$

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

30.

$$5-(2x-3)=7-(3x+5)$$
$$5-2x+3=7-3x-5$$
$$8-2x=2-3x$$
$$\boxed{x=-6}$$

31.

$$2a-9(a+6)=6(a+3)-4a$$
$$-7a-54=6a+18-4a$$
$$-7a-54=2a+18$$
$$-9a=72$$
$$\boxed{a=-8}$$

32.

$$25-\left[2+5y-3(y+2)\right]=-3(2y-5)-\left[5(y-1)-3y+3\right]$$
$$25-\left[2+5y-3y-6\right]=-6y+15-\left[5y-5-3y+3\right]$$
$$25-2-5y+3y+6=-6y+15-5y+5+3y-3$$
$$29-2y=-8y+17$$
$$6y=-12$$
$$\boxed{y=-2}$$

33.

$$32-\left[4+6x-5(x+4)\right]=4(3x+4)-\left[6(3x-4)+7-4x\right]$$
$$32-\left[4+6x-5x-20\right]=12x+16-\left[18x-24+7-4x\right]$$
$$32-4-6x+5x+20=12x+16-18x+24-7+4x$$
$$48-x=-2x+33$$
$$\boxed{x=-15}$$

34.

$$12-\left[3+4m-6(3m-2)\right]=-7(2m-8)-3\left[(m-2)+3m-5\right]$$
$$12-\left[3+4m-18m+12\right]=-14m+56-3\left[m-2+3m-5\right]$$
$$12-3-4m+18m-12=-14m+56-3m+6-9m+15$$
$$-3+14m=-26m+77$$
$$40m=80$$
$$\boxed{m=2}$$

35.

$$20-4\left[c-3-6(2c+3)\right]=5(3c-2)-\left[2(7c-8)-4c+7\right]$$
$$20-4\left[c-3-12c-18\right]=15c-10-\left[14c-16-4c+7\right]$$
$$20-4c+12+48c+72=15c-10-14c+16+4c-7$$
$$44c+104=5c-1$$
$$39c=-105$$
$$\boxed{c=\frac{-105}{39}=\frac{-35}{13}}$$

36.

$$46-\left[7-8y+9\left(6y-2\right)\right]=-7\left(4y-7\right)-2\left[6\left(2y-3\right)-4+6y\right]$$
$$46-\left[7-8y+54y-18\right]=-28y+49-2\left[12y-18-4+6y\right]$$
$$46-7+8y-54y+18=-28y+49-24y+36+8-12y$$
$$-46y+57=-64y+93$$
$$18y=36$$
$$\boxed{y=2}$$

37.

$$60\left(\frac{1}{5}m\right)=60\left(\frac{1}{60}m+1\right)$$
$$12m=m+60$$
$$11m=60$$
$$\boxed{m=\frac{60}{11}}$$

38.

$$24\left(\frac{1}{12}z\right)=24\left(\frac{1}{24}z+3\right)$$
$$2z=z+72$$
$$\boxed{z=72}$$

39.

$$63\left(\frac{x}{7}\right)=63\left(\frac{2x}{63}+4\right)$$
$$9x=2x+252$$
$$7x=252$$
$$\boxed{x=36}$$

40.

$$22\left(\frac{a}{11}\right)=22\left(\frac{a}{22}+9\right)$$
$$2a=a+198$$
$$\boxed{a=198}$$

41.

$$24\left(\frac{1}{3}p\right)=24\left(3-\frac{1}{24}p\right)$$
$$8p=72-p$$
$$9p=72$$
$$\boxed{p=8}$$

42.

$$10\left(\frac{3x}{5}-x\right)=10\left(\frac{x}{10}-\frac{5}{2}\right)$$
$$6x-10x=x-25$$
$$-5x=-25$$
$$\boxed{x=5}$$

43.

$$84\left(\frac{5y}{3}-2y\right)=84\left(\frac{2y}{84}+\frac{5}{7}\right)$$
$$140y-168y=2y+60$$
$$-30y=60$$
$$\boxed{y=\frac{60}{-30}=-2}$$

44.

$$72\left(2m-\frac{5m}{8}\right)=72\left(\frac{3m}{72}+\frac{4}{3}\right)$$
$$144m-45m=3m+96$$
$$96m=96$$
$$\boxed{m=1}$$

45.

$$8\left(p+\frac{p}{4}\right)=8\left(\frac{5}{2}\right)$$
$$8p+2p=20$$
$$10p=20$$
$$\boxed{p=2}$$

46.

$$4\left(\frac{c}{4}-2c\right)=4\left(\frac{5}{4}-\frac{c}{2}\right)$$
$$c-8c=5-2c$$
$$-5c=5$$
$$\boxed{c=-1}$$

47.

$$\frac{x-3}{3}-\frac{x-4}{2}=1-\frac{x-6}{6}$$
$$6\cdot\left[\frac{x-3}{3}-\frac{x-4}{2}\right]=6\cdot\left[1-\frac{x-6}{6}\right]$$
$$2(x-3)-3(x-4)=6-(x-6)$$
$$2x-6-3x+12=6-x+6$$
$$-x+6=-x+12$$
$6=12$, which is false.

Hence, no solution.

48.

$$1-\frac{x-5}{3}=\frac{x+2}{5}-\frac{6x-1}{15}$$
$$15\cdot\left[1-\frac{x-5}{3}\right]=15\cdot\left[\frac{x+2}{5}-\frac{6x-1}{15}\right]$$
$$15-5(x-5)=3(x+2)-(6x-1)$$
$$15-5x+25=3x+6-6x+1$$
$$40-5x=-3x+7$$
$$33=2x$$
$$\boxed{33/2=x}$$

49.

$$2y\left(\frac{4}{y}-5\right)=2y\left(\frac{5}{2y}\right)\qquad \boxed{y\neq 0}$$
$$8-10y=5$$
$$-10y=-3$$
$$\boxed{y=\frac{3}{10}}$$

50.

$$3x\left(\frac{4}{x}+10\right)=3x\left(\frac{2}{3x}\right)\qquad \boxed{x\neq 0}$$
$$12+30x=2$$
$$30x=-10$$
$$\boxed{x=-1/3}$$

51.

$$6x\left(7-\frac{1}{6x}\right)=6x\left(\frac{10}{3x}\right)\qquad \boxed{x\neq 0}$$
$$42x-1=20$$
$$42x=21$$
$$\boxed{x=\frac{1}{2}}$$

52.

$$6t\left(\frac{7}{6t}\right)=6t\left(2+\frac{5}{3t}\right)\qquad \boxed{t\neq 0}$$
$$7=12t+10$$
$$-12t=3$$
$$\boxed{t=\frac{3}{-12}=\frac{-1}{4}}$$

53.

$$3a\left(\frac{2}{a}-4\right)=3a\left(\frac{4}{3a}\right)\qquad \boxed{a\neq 0}$$
$$6-12a=4$$
$$-12a=-2$$
$$\boxed{a=\frac{1}{6}}$$

54.

$$x\left(\frac{4}{x}-2\right)=x\left(\frac{5}{2x}\right)\qquad \boxed{x\neq 0}$$
$$4-2x=5/2$$
$$2x=4-5/2=3/2$$
$$\boxed{x=3/4}$$

55. $(x-2)\left(\frac{x}{x-2}+5\right)=(x-2)\left(\frac{2}{x-2}\right)$ $\boxed{x\neq 2}$

$$x+5(x-2)=2$$
$$x+5x-10=2$$
$$6x=12$$
$$x=2$$

No solution since 2 was excluded from the solution set.

56. $(n-5)\left(\frac{n}{n-5}+2\right)=(n-5)\left(\frac{n}{n-5}\right)$ $\boxed{n\neq 5}$

$$n+2(n-5)=n$$
$$3n-10=n$$
$$2n=10$$
$$n=5$$

No solution since 5 was excluded from the solution set.

57. $(p-1)\left(\frac{2p}{p-1}\right)=(p-1)\left(3+\frac{2}{p-1}\right)$ $\boxed{p\neq 1}$

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

No solution since 1 was excluded from the solution set.

58. $(t+2)\left(\frac{4t}{t+2}\right)=(t+2)\left(3-\frac{8}{t+2}\right)$ $\boxed{t\neq -2}$

$$4t=3(t+2)-8$$
$$4t=3t+6-8$$
$$t=-2$$

No solution since -2 was excluded from the solution set.

59. $(x+2)\left(\frac{3x}{x+2}-4\right)=(x+2)\left(\frac{2}{x+2}\right)$ $\boxed{x\neq -2}$

$$3x-4(x+2)=2$$
$$-x-8=2$$
$$\boxed{x=-10}$$

60. $(2y-1)\left(\frac{5y}{2y-1}-3\right)=(2y-1)\left(\frac{12}{2y-1}\right)$ $\boxed{y\neq \frac{1}{2}}$

$$5y-3(2y-1)=12$$
$$5y-6y+3=12$$
$$-y+3=12$$
$$\boxed{y=-9}$$

61. $\frac{1}{n}+\frac{1}{n+1}=\frac{-1}{n(n+1)}$ $\boxed{n\neq -1,0}$

LCD is $n(n+1)$. So,

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

But since we have already stipulated that $n\neq -1$, there is no solution.

62. $x(x-1)\left(\frac{1}{x}+\frac{1}{x-1}\right)=x(x-1)\left(\frac{1}{x(x-1)}\right)$

First notice that $\boxed{x\neq 0,1}$

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

But since we have already stipulated that $x\neq 1$, there is no solution.

63. $\dfrac{3}{a}-\dfrac{2}{a+3}=\dfrac{9}{a(a+3)}$ $\boxed{a\neq 0,-3}$

LCD is $a(a+3)$. So,

$3(a+3)-2a=9$

$3a+9-2a=9$

$a=0$

But since we have already stipulated that $a\neq 0$, there is $\boxed{\text{no solution.}}$

64. $\dfrac{1}{c-2}+\dfrac{1}{c}=\dfrac{2}{c(c-2)}$ $\boxed{c\neq 0,2}$

LCD is $c(c-2)$. So,

$c+(c-2)=2$

$2c-2=2$

$2c=4$

$c=2$

But since we have already stipulated that $c\neq 2$, there is $\boxed{\text{no solution.}}$

65.

$$\frac{n-5}{6(n-1)}=\frac{1}{9}-\frac{n-3}{4(n-1)} \qquad \boxed{n\neq 1}$$

LCD is $36(n-1)$. So,

$$\frac{(n-5)(36)(n-1)}{6(n-1)}=\frac{36(n-1)}{9}-\frac{(n-3)(36)(n-1)}{4(n-1)}$$

$$6(n-5)=4(n-1)-9(n-3)$$

$$6n-30=4n-4-9n+27$$

$$6n-30=-5n+23$$

$$11n=53$$

So, the final solution is: $\boxed{n=\dfrac{53}{11}}$

66.

$$\frac{5}{m}+\frac{3}{m-2}=\frac{6}{m(m-2)} \qquad \boxed{m\neq 0,2}$$

LCD is $m(m-2)$. So,

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

$$5m-10+3m=6$$

$$8m-10=6$$

$$8m=16$$

$$m=2$$

Hence, $\boxed{\text{no solution}}$ since we have already stipulated that $m\neq 2$.

67.

$$\frac{2}{5x+1}=\frac{1}{2x-1} \qquad \boxed{x\neq -\tfrac{1}{5},\ \tfrac{1}{2}}$$

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

$$4x-2=5x+1$$

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

68.

$$\frac{3}{4n-1}=\frac{2}{2n-5} \qquad \boxed{n\neq \tfrac{1}{4},\ \tfrac{5}{2}}$$

$$3(2n-5)=2(4n-1)$$

$$6n-15=8n-2$$

$$-13=2n$$

$$\boxed{n=-\tfrac{13}{2}}$$

69.

$$\frac{t-1}{1-t}=\frac{3}{2} \qquad \boxed{t\neq 1}$$

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

$$3-3t=2t-2$$

$$-5t=-5$$

$$t=1$$

$\boxed{\text{No solution}}$ since 1 was excluded from the solution set.

70.

$$\frac{2-x}{x-2}=\frac{3}{4} \qquad \boxed{x\neq 2}$$

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

$$8-4x=3x-6$$

$$14=7x$$

$$x=2$$

$\boxed{\text{No solution}}$ since 2 is excluded from the solution set.

71.

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

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

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

$$\boxed{C=\frac{5}{9}F-\frac{160}{9}}$$

72.

$$P=2L+2W$$

$$P-2L=2W$$

$$\boxed{W=\frac{P-2L}{2}}$$

73. Let x = number of minutes you use the cell phone.

Solve:

$$25.08=15+0.12x$$

$$10.08=0.12x$$

$$84=\frac{10.08}{0.12}=x$$

So, you used your cell phone for $\boxed{84}$ min.

74. Let x = number of miles she drove the car.

Solve:

$$185=25(5)+0.10x$$

$$185=125+0.10x$$

$$60=0.10x$$

$$600=x$$

She drove the car $\boxed{600 \text{ miles.}}$

75. Let x = number of minutes logged on
Solve:

$$2+0.10x=3.70$$
$$0.10x=1.70$$
$$x=17$$

So, logged on for $\boxed{17 \text{ min.}}$

76. Let x = number of subscriptions sold.
Solve:

$$20(25)+1.00x=645$$
$$500+1.00x=645$$
$$x=145$$

So, sold $\boxed{145 \text{ subscriptions}}$.

77. **a.** $C(x)=15,000+2,500x$

b. Solve for x:

$$15,000+2,500x=5,515,000$$
$$2,500x=5,500,000$$
$$x=2,200$$

So, 2,200 days.

78. **a.** $R(x)=5,000+0.75x$

b. Solve for x:

$$5,000+0.75x=98,750$$
$$0.75x=93,750$$
$$x=125,000$$

So, 125,000 minutes.

79. Using $a=\dfrac{d}{c}$ with d = 600mg and c = 125mg/ 5mL = 25mg/mL, we see that

$$a=\frac{600mg}{25mg/mL}=24mL.$$

80. Using $a=\dfrac{d}{c}$ with d = 600mg and c = 100mg/ 5mL = 20mg/mL, we see that

$$a=\frac{600mg}{20mg/mL}=30mL.$$

81.

$$f=\frac{c}{\lambda}$$
$$\boxed{\lambda \neq 0}$$

82.

$$\frac{1}{f}=\frac{1}{d_0}+\frac{1}{d_i}$$

LCD is $d_0 d_i f$. So,

$$d_0 d_i = d_i f + d_0 f$$
$$d_0 d_i - d_0 f = d_i f$$
$$d_0\left(d_i - f\right)=d_i f$$
$$\boxed{d_0=\frac{d_i f}{d_i - f}}$$

83.
Should have subtracted $4x$ and added 7 to both sides. The correct answer is $x=5$.

84.
Forgot to distribute the negative sign through the parentheses.

85.
Cannot cross multiply- must multiply by LCD first. The correct answer is $p = \frac{6}{5}$.

86.
Should have eliminated $x = 0,\ x = 1$ from the domain first.

87. False $\boxed{x \neq 0}$

88. False $\boxed{x \neq 1, -2}$

89. True

90.
False $\boxed{x = 1 \text{ makes denominator} = 0}$

91.

$$ax + b = c \qquad \boxed{a \neq 0}$$
$$ax = c - b$$
$$\boxed{x = \frac{c-b}{a}}$$

92.

$$x \cdot \left(\frac{a}{x} - \frac{b}{x}\right) = x \cdot c \qquad \boxed{x \neq 0,\ c \neq 0}$$
$$a - b = cx$$
$$\boxed{x = \frac{a-b}{c}}$$

93.

$$\frac{b+c}{x+a} = \frac{b-c}{x-a} \quad \boxed{x \neq \pm a}$$
$$(b+c)(x-a) = (b-c)(x+a)$$
$$bx - ba + cx - ca = bx + ba - cx - ca$$
$$2cx = 2ba \qquad \boxed{x = \frac{ba}{c}}$$

94.

$$\frac{1}{y-a} + \frac{1}{y+a} = \frac{2}{y-1} \quad \boxed{y \neq -a, a, 1}$$

LCD is $(y-a)(y+a)(y-1)$. So,

$$(y+a)(y-1) + (y-a)(y-1) = 2(y-a)(y+a)$$
$$y^2 - y + ay - a + y^2 - y - ay + a = 2\left(y^2 + ay - ay - a^2\right)$$
$$y^2 - y + \cancel{ay} - \cancel{a} + y^2 - y - \cancel{ay} + \cancel{a} = 2y^2 + \cancel{2ay} - \cancel{2ay} - 2a^2$$
$$-2y = -2a^2$$
$$-y = -a^2$$
$$y = a^2 \quad \boxed{y \geq 0}$$

95.

$$\frac{1 - \frac{1}{x}}{1 + \frac{1}{x}} = 1 \qquad \boxed{x \neq -1, 0}$$

$$1 - \frac{1}{x} = 1 + \frac{1}{x} \quad \Rightarrow \quad \frac{2}{x} = 0$$

$\boxed{\text{no solution}}$

96.

$$\frac{t + \frac{1}{t}}{\frac{1}{t} - 1} = 1 \qquad \boxed{t \neq 0, 1}$$

$$\frac{1}{t} - 1 = t + \frac{1}{t} \quad \Rightarrow \quad \boxed{t = -1}$$

97.

$$y = \frac{a}{1+\frac{b}{x}+c} \qquad \boxed{x \neq 0, -\frac{b}{c+1}}$$

$$y = \frac{a}{\frac{x+b+cx}{x}}$$

$$y = \frac{ax}{b+x(c+1)}$$

$$y\left(b+x(c+1)\right) = ax$$

$$yb + xy(c+1) - ax = 0$$

$$x\left[y(c+1) - a\right] = -yb$$

$$\boxed{x = \frac{by}{a-y-cy}}$$

98.

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

$$2 - a = 7 - 6a$$

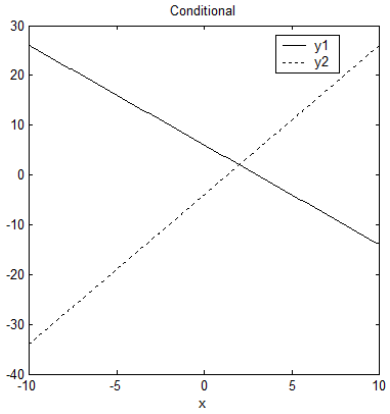
$$-5 = -5a$$

$$\boxed{a = 1}$$

99.

$y1 = 3(x+2) - 5x$

$y2 = 3x - 4$

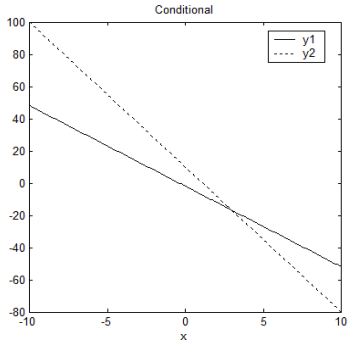


$\boxed{x = 2}$

100.

$y1 = -5(x-1) - 7$

$y2 = 10 - 9x$

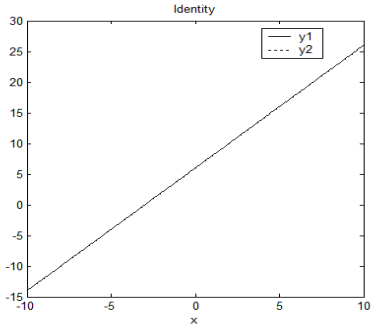


$\boxed{x = 3}$

101.

$y1 = 2x + 6$

$y2 = 4x - 2x + 8 - 2$

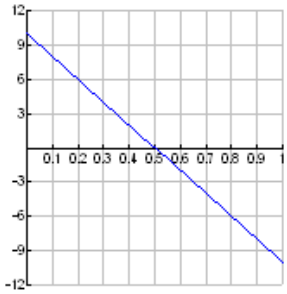


All real numbers

102.

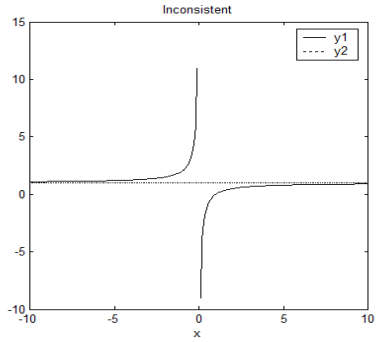
$y1 = 10 - 20x$

$y2 = 10x - 30x + 20 - 10$



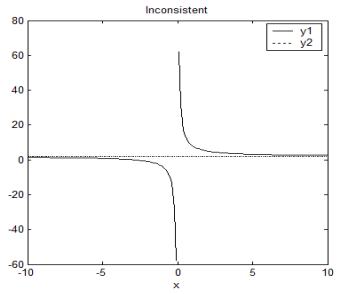
All real numbers

103. $y1 = \dfrac{x(x-1)}{x^2} \quad y2 = 1$



No solution

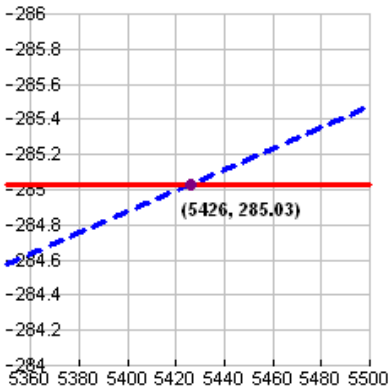
104. $y1 = \dfrac{2x(x+3)}{x^2} \quad y2 = 2$



No solution

105.

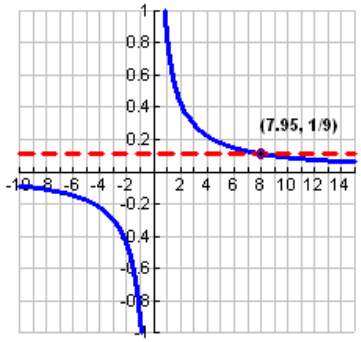
$y1 = 0.035x + 0.029(8706 - x) \quad y2 = 285.03$



$x = 5426$

106.

$y1 = \dfrac{1}{0.75x} - \dfrac{0.45}{x} \quad y2 = \dfrac{1}{9}$



$x = 7.95$

Section 1.2 Solutions ----------

1. Let x = price without coupon

$0.9x = 217.95$

$x = \$242.17$

2. Let x be the percentage of original price

$x = \dfrac{51.80}{74} = 0.7 = 70\%$

30% markdown

3. Let x = cost of pizza

Tom: 5.16

Chelsea: $1/8\ x$

Jeff: $1/2\ x$

$$5.16 + \frac{1}{8}x + \frac{1}{2}x = x$$

$$41.28 + x + 4x = 8x$$

$$3x = 41.28$$

$$\boxed{x = \$13.76}$$

4. Let x = take home pay

Bills = $0.5x$

Investments = $0.2x$

Groceries = 560

Miscellaneous = $0.23x$

$$0.5x + 0.2x + 560 + 0.23x = x$$

$$0.93x + 560 = x$$

$$0.07x = 560$$

$$\boxed{x = \$8{,}000}$$

5. Let x = original price

$$0.85x = 125{,}000$$

$$x = 147{,}058.82$$

$$\boxed{\text{Original price} \cong \$147{,}058.82}$$

Model price = \$125,000

$$\boxed{\text{Savings} = \$22{,}058.82}$$

6. Let x = price paid to publisher

$$1.25x = 79$$

$$x = \frac{79}{1.25} = 63.2$$

$$\boxed{\text{Bookstore paid } \$63.20}$$

7. Let x = distance from Angela's home to the restaurant.

Home $\rightarrow$ Train station = 1 mile

On train $\rightarrow \frac{3}{4}x$ In taxi $\rightarrow \frac{1}{6}x$

$$1 + \frac{3}{4}x + \frac{1}{6}x = x$$

LCD = 12

$$12 + 9x + 2x = 12x$$

$$12 + 11x = 12x$$

$$x = 12$$

Angela travels $\boxed{12 \text{ miles}}$ to the restaurant.

8. Let x = distance from her house to VAB

House $\rightarrow$ Park & Ride = 7 miles

Park & Ride $\rightarrow$ H.Q. $= \frac{5}{6}x$

H.Q. $\rightarrow$ VAB $= \frac{1}{20}x$

$$7 + \frac{5}{6}x + \frac{1}{20}x = x$$

LCD = 60

$$420 + 50x + 3x = 60x$$

$$420 = 7x$$

$$x = 60$$

She travels $\boxed{60 \text{ miles}}$ to the VAB.

9. x = hours awake

Class: $\frac{1}{3}x$

Eating: $\frac{1}{5}x$

Working out: $\frac{1}{10}x$

Studying: 3

Other things: 2.5

$$\frac{1}{3}x+\frac{1}{5}x+\frac{1}{10}x+3+2.5=x$$

$$10x+6x+3x+165=30x$$

$$19x+165=30x$$

$$11x=165$$

$$x=15 \text{ awake}$$

$\boxed{9 \text{ hours of sleep}}$

10. Let x = calories for breakfast

Dinner calories = $2x$

Lunch Calories = $x+100$

Snack 1 = 100

Snack 2 = 150

$$\underbrace{x}_{\text{breakfast}}+\overbrace{x+100}^{\text{lunch}}+\underbrace{2x}_{\text{dinner}}+\overbrace{100+150}^{\text{snacks}}=\underbrace{1550}_{\text{total}}$$

$$4x+350=1550$$

$$4x=1200$$

$$x=300$$

Breakfast: 300
Lunch: 400
Dinner: 600

11. Fixed costs = 15,000

Variable costs = $18.50x$

Total costs = 20,000

$$18.50x+15,000=20,000$$

$$18.50x=5000$$

$$x=270.27$$

Approximately $\boxed{270 \text{ units}}$ can be produced.

12. Let x = number of sets of napkins

Fixed monthly costs = 1329.50

Variable costs = $3.70x$

Total budget = 1870

$$1329.50+3.70x=1870$$

$$3.70x=540.5$$

$$x=146.08$$

She can afford approximately $\boxed{146}$ sets of napkins.

13.

$$\frac{2}{3}x-10=\frac{1}{4}x$$

$$\frac{5}{12}x=10$$

$$\boxed{x=10\left(\frac{12}{5}\right)=24}$$

14.

$$10x=2x+16$$

$$8x=16$$

$$\boxed{x=2}$$

15. Let the numbers be x, $x+2$

$4(x) = 2 + 3(x+2)$

$4x = 2 + 3x + 6$

$x = 8$

The numbers are $\boxed{8,10}$.

16. Let the numbers be $x, x+1, x+2$

$x + (x+1) + (x+2) = 2[x + (x+1)]$

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

$3x + 3 = 4x + 2$

$x = 1$

The numbers are $\boxed{1,2,3}$.

17. Let $p =$ perimeter.

First side = 11

Second side = $\frac{1}{5}p$

Third side = $\frac{1}{4}p$

$11 + \frac{1}{5}p + \frac{1}{4}p = p$

LCD = 20

$220 + 4p + 5p = 20p$

$220 = 11p$

$p = 20$

The perimeter is $\boxed{20 \text{ inches}}$.

18. $w =$ width

$l =$ length $= 2w + 1$

$p = 2l + 2w$

$20 = 2(2w+1) + 2w$

$20 = 4w + 2 + 2w$

$18 = 6w$

$w = 3$

$\boxed{\begin{array}{l}\text{width} = 3 \text{ feet} \\ \text{length} = 7 \text{ feet}\end{array}}$

19. $w =$ width

$l =$ length $= 2w + 40$

$p = 2l + 2w$

$260 = 2(2w + 40) + 2w$

$260 = 4w + 80 + 2w$

$180 = 6w$

$w = 30$

$\boxed{\begin{array}{l}\text{width} = 30 \text{ yards} \\ \text{length} = 100 \text{ yards}\end{array}}$

20. $w =$ width

$l =$ length $= 3w + 2$

$p = 2l + 2w$

$28 = 2(3w + 2) + 2w$

$28 = 6w + 4 + 2w$

$24 = 8w$

$w = 3$

$\boxed{\begin{array}{l}\text{width} = 3 \text{ inches} \\ \text{length} = 11 \text{ inches}\end{array}}$

21. $r_1 =$ radius of smaller circle

$r_2 =$ radius of larger circle

$r_2 = r_1 + 3$

Circumference of smaller circle $= 2\pi r_1$

Circumference of larger circle $= 2\pi r_2$

Ratio of circumferences $= \dfrac{2\pi r_2}{2\pi r_1} = \dfrac{r_2}{r_1} = \dfrac{2}{1}$

$r_2 = 2r_1$

$2r_1 = r_1 + 3$

$r_1 = 3$

$\boxed{r_1 = 3 \text{ feet } \ r_2 = 6 \text{ feet}}$

22. Perimeter of semicircle is half the circumference + twice the radius.

$P = \dfrac{1}{2}(2\pi r) + 2r$

$P = (\pi + 2)r$

When the radius is increased by one, the perimeter doubles, so

$2P = (\pi + 2)(r + 1)$

$2(\pi + 2)r = (\pi + 2)(r + 1)$

$2r = r + 1$

$\boxed{r = 1}$

23. $\dfrac{x}{225} = \dfrac{4}{3}$

$3x = 900$

$x = 300$

The tree is $\boxed{300 \text{ feet}}$ tall.

24. $\dfrac{x}{880} = \dfrac{4}{10}$

$10x = 3520$

$x = 352$

The oak tree is $\boxed{352 \text{ feet}}$ tall.

25. Let $x =$ length of alligator in feet.

Solve:

$\dfrac{3.5}{0.5} = \dfrac{x}{0.75}$

$0.5x = 2.625$

$x = 5.25$

The alligator is about $\boxed{5.25 \text{ feet}}$.

26. Let $x =$ length of snake in inches.

$\dfrac{\text{Fang}}{\text{Body}} = \dfrac{2}{36} = \dfrac{2.6}{x}$

Solve:

$2x = 93.6$

$x = 46.8$

The snake is about 3.9 feet

$= \boxed{46.8 \text{inches}}$.

27. Let x = amount invested at 4%.

$120{,}000 - x$ = amount invested at 7%

Solve:

$$0.04x + 0.07(120{,}000 - x) = 7{,}800$$
$$0.04x + 8400 - 0.07x = 7{,}800$$
$$-0.03x = -600$$
$$x = 20{,}000$$

$\boxed{\$20{,}000 \text{ at } 4\% \text{ and } \$100{,}000 \text{ at } 7\%}$

28. Let x = amount invested at 10%.

$13{,}000 - x$ = amount invested at 14%

Solve:

$$0.10x + 0.14(13{,}000 - x) = 1580$$
$$0.10x + 1820 - 0.14x = 1580$$
$$-0.04x = -240$$
$$x = 6000$$

$\boxed{\$6{,}000 \text{ at } 10\% \text{ and } \$7{,}000 \text{ at } 14\%}$

29. Let x = amount invested at 10%.

$\frac{14{,}000 - x}{2}$ = amount invested at 2%

$\frac{14{,}000 - x}{2}$ = amount invested at 40%

Interest earned $= 16{,}610 - 14{,}000 = 2{,}610$

Solve:

$$0.1x + 0.02\left(\frac{14{,}000 - x}{2}\right) + 0.4\left(\frac{14{,}000 - x}{2}\right) = 2610$$
$$0.1x + 140 - 0.01x + 2800 - 0.2x = 2610$$
$$-0.11x = -330$$
$$x = 3{,}000$$

$\boxed{\begin{array}{l}\$3{,}000 \text{ at } 10\% \\ \$5{,}500 \text{ at } 2\% \\ \$5{,}500 \text{ at } 40\%\end{array}}$

30. \$2500 in money market $(\text{rate} = x)$

\$2500 in stock market $(\text{rate} = 3x)$

Interest earned = \$150

Solve:

$$2500x + 2500(3x) = 150$$
$$2500x + 7500x = 150$$
$$10{,}000x = 150$$
$$x = 0.015$$

$\boxed{\begin{array}{l}\text{Money market: } 1.5\% \\ \text{Stock market: } 4.5\%\end{array}}$

31. Money for plants $= 4200 - 2400 - 1500 = 300$

Let x be the number of trees $(\$32 \text{ each})$.

Let $33 - x$ be the number of shrubs $(\$4 \text{ each})$.

Solve:

$$32x + 4(33 - x) = 300$$
$$32x + 132 - 4x = 300$$
$$28x = 168$$
$$x = 6$$

$\boxed{6 \text{ trees and } 27 \text{ shrubs}}$

32. Let x = lbs of turkey $(\$6.32 \text{ per lb})$

$3.2 - x$ = lbs of cheese $(\$4.27 \text{ per lb})$

Solve:

$$6.32x + 4.27(3.2 - x) = 17.56$$
$$6.32x + 13.664 - 4.27x = 17.56$$
$$2.05x = 3.896$$
$$x = 1.9$$

$\boxed{1.9 \text{ lbs of turkey}, 1.3 \text{ lbs of cheese}}$

33. Let $x =$ ml of 5% HCl

Solve:

$100 - x =$ ml of 15% HCl

$$0.05x + 0.15(100 - x) = 0.08(100)$$
$$0.05x + 15 - 0.15x = 8$$
$$-0.1x = -7$$
$$x = 70$$

70ml of 5% HCl
30ml of 15% HCl

34. Let x = gallons of 100% alcohol

Solve:

$$0.20(5) + 1.00x = 0.50(5 + x)$$
$$1 + x = 2.5 + 0.50x$$
$$0.50x = 1.5$$
$$x = \frac{1.5}{0.5} = 3$$

3 gallons.

35. Let x = number of gallons to be drained.

Solve:

$$0.40(5 - x) + 1.00x = 0.80(5)$$
$$2 - 0.40x + x = 4$$
$$2 + 0.60x = 4$$
$$0.60x = 2$$
$$x \approx 3.3$$

About 3.3 gallons.

36. Let $x =$ \$ of grant with 42.5% overhead

$1{,}170{,}000 - x =$ \$ of grant with 26% overhead

Overhead generated $= 0.39(1{,}170{,}000) = 456{,}300$

Solve:

$$0.425x + 0.26(1{,}170{,}000 - x) = 456{,}300$$
$$0.425x + 304{,}200 - 0.26x = 456{,}300$$
$$0.165x = 152100$$
$$x = 921818.\overline{18}$$

On campus (42.5%) grant: \$921,818
Off campus (26%) grant: \$248,182

37. $x =$ lbs of caramels (\$1.50/lb)

$1.25 - x =$ lbs of gummy bears (\$2/lb)

Solve:

$$1.5x + 2(1.25 - x) = 2.50$$
$$1.5x + 2.5 - 2x = 2.50$$
$$-0.5x = 0$$
$$x = 0$$

No caramels, 1.25lb of gummy bears

38. Let x = lbs of Jamaican Blue Mountain Coffee

Solve:

$$12(x) + 4.20(2 - x) = 14.25$$
$$12x + 8.40 - 4.20x = 14.25$$
$$7.80x = 5.85$$
$$x = 0.75$$

She bought:

0.75 lbs Jamaican Blue Mountain
1.25 lbs of regular coffee beans.

39. distance = rate · time

distance = 100,000,000 miles

rate = 670,616,629 mph

$$\text{time} = \frac{\text{distance}}{\text{rate}}$$

$= 0.15$ hours $\cong$ 9 minutes

40. distance = rate · time

distance = 0.5 miles

rate = 760 mph

$$\text{time} = \frac{\text{distance}}{\text{rate}}$$

$= 0.0006579$ hours $\cong$ 2.4 seconds

41.
$$x + 0.047x = 3.21$$
$$1.047x = 3.21$$
$$x = 3.065$$

So, at the beginning of November, gas was \$3.07 per gallon.

42. Let x = price in September. Then, since the price decreased by 40% by the end of Nov., the price for the TV would be 60% of the price in September. So, we solve the following equation for x:

$$\$299 = 0.60x$$
$$x \approx \$498$$

43. Let x = number of mL of distilled water (which has 0% salt).
Solve for x:

$$0.03(100\,mL) + 0.00(x\,mL) = 0.009(100 + x)mL$$
$$3mL + 0mL = (0.9mL + 0.009x)$$
$$2.1mL = 0.009x$$
$$x \approx 233mL$$

44. Let x = number of mL of 20% solution.
Solve for x:

$$0.00(100\,mL) + 0.20(x\,mL) = 0.05(100 + x)mL$$
$$0.20x = (5 + 0.05x)mL$$
$$0.15x = 5mL$$
$$x \approx 33mL$$

45. rate (r) = boat speed (s) ± current speed (c)

boat speed: s = 16 mph

upstream: $r = s - c$, $t = 1/3$ hours

downstream: $r = s + c$, $t = 1/4$ hours

Distance is the same both ways (rate · time)

Solve:

$$(16-c)\left(\frac{1}{3}\right) = (16+c)\left(\frac{1}{4}\right)$$

$$4(16-c) = 3(16+c)$$

$$64 - 4c = 48 + 3c$$

$$7c = 16$$

$$\boxed{c = \frac{16}{7} \cong 2.3 \text{ mph}}$$

46. rate (r) = plane speed (s) ± wind speed (w)

plane speed: s = 130 mph

upwind: $r = s - w$, $t = 2$ hours

downwind: $r = s + w$, $t = 1.25$ hours

Distance is the same both ways (rate · time)

Solve:

$$2(130-w) = 1.25(130+w)$$

$$260 - 2w = 162.5 + 1.25w$$

$$97.5 = 3.25w$$

$$\boxed{w = 30 \text{ mph}}$$

47. rate of walker = r_w

rate of jogger = $r_w + 2$

time of walker = 1 hour

time of jogger = $\frac{2}{3}$ hour

$$r_w(1) = (r_w + 2)(2/3)$$

$$r_w = \tfrac{2}{3} r_w + 4/3$$

$$\tfrac{1}{3} r_w = \tfrac{4}{3}$$

$$r_w = 4$$

$$\boxed{\begin{array}{l}\text{walker: } 4 \text{ mph} \\ \text{jogger: } 6 \text{ mph}\end{array}}$$

48. dist. of Southern route = d

dist. of Northern route = $d + 300$

time of S route = 45 hours

time of N route = 50 hours

$$\frac{d}{45} = \frac{d+300}{50}$$

$$50d = 45(d + 300)$$

$$50d = 45d + 13{,}500$$

$$5d = 13{,}500$$

$$d = 2700$$

$$\boxed{\begin{array}{l}\text{S route} = 2{,}700 \text{ miles} \\ \text{N route} = 3{,}000 \text{ miles}\end{array}}$$

49. Let x = number of minutes it takes a rider to get to class

Using Distance = Rate × Time, and the fact that since they use the same path, their distances are the same, we must solve the equation:

$$2(12 + x) = 6(x)$$

$$24 + 2x = 6x$$

$$24 = 4x$$

$$x = 6$$

So, it takes the bicyclist 6 minutes to get to class, and the walker 18 minutes.

50. Let x = number of minutes a car travels before catching the truck
When it catches the truck, the car and truck will have traveled the same distance.
So, we must solve:

$$70x = 50(x+30)$$
$$70x = 50x + 1500$$
$$x = 75$$

It takes the car 75 minutes to catch the truck.

51. Let $x =$ hours it takes Cynthia to paint house alone. Christopher can paint 1/15 house per hour. Cynthia can paint $1/x$ house per hour.
Together they paint $\left(\frac{1}{15}+\frac{1}{x}\right)$ house per hour.

$$\frac{1}{15}+\frac{1}{x}=\frac{1}{9}$$
$$3x+45=5x$$
$$2x=45$$
$$x=22.5$$

Cynthia can paint the house alone in 22.5 hours.

52. Let x = number of hours it takes Morgan to complete the yard alone.
Jay: 1/3 of the yard per hour
Morgan: $1/x$ of the yard per hour
Together: 1 hour for entire yard
Solve:

$$\frac{1}{3}+\frac{1}{x}=1$$
$$3x\cdot\left(\frac{1}{3}+\frac{1}{x}\right)=3x$$
$$x+3=3x$$
$$x=1.5$$

It takes 1.5 hours for Morgan to do the yard herself.

53. Tracey can do 1/4 of a delivery per hour, and Robin can do 1/6 of a delivery per hour. Together, they complete 1/4 + 1/6 = 1/(12/5) of the delivery in an hour. So, together, they complete the job in 2.4 hours.

54. Joshua can do the job at a rate of 1/30 job per minute. Amber can do it in 1/20 job per minute. Together, they work at $(1/30+1/20)=1/12$ job per minute. They will finish in 12 minutes

55.

$$\frac{4}{5}=\frac{264}{x_1}$$
$$4x_1=264(5)$$
$$4x_1=1320$$
$$x_1=330 \text{ hertz}$$

$$\frac{4}{6}=\frac{264}{x_2}$$
$$4x_2=264(6)$$
$$4x_2=1584$$
$$x_2=396 \text{ hertz}$$

56.

$\frac{10}{12} = \frac{220}{x_1}$

$10x_1 = 220(12)$

$10x_1 = 2640$

$\boxed{x_1 = 264 \text{ hertz}}$

$\frac{10}{15} = \frac{220}{x_2}$

$10x_2 = 220(15)$

$10x_2 = 3300$

$\boxed{x_2 = 330 \text{ hertz}}$

57.

Let x = exam grade needed

Test average = $\frac{86+80+84+90}{4} = 85$

To earn a "B":

$\frac{1}{3}(85) + \frac{2}{3}x = 80$

LCD = 3

$85 + 2x = 240$

$2x = 155$

$\boxed{x = 77.5}$

To earn an "A":

$\frac{1}{3}(85) + \frac{2}{3}x = 90$

LCD = 3

$85 + 2x = 270$

$2x = 185$

$\boxed{x = 92.5}$

58.

Let x = exam grade needed

Avg = $\frac{80+83+71+61+95+x+x}{7} = 80$

$\frac{2x+390}{7} = 80$

$2x + 390 = 560$

$2x = 170$

$\boxed{x = 85}$

59.

Let x = # field goals

$8 - x$ = # touchdowns

$3x + 7(8-x) = 48$

$3x + 56 - 7x = 48$

$-4x = -8$

$x = 2$

$\boxed{\text{2 field goals, 6 touchdowns}}$

60.

TE: $\frac{100\text{yds}}{12\text{secs}}$ DB: $\frac{100\text{yds}}{10\text{secs}}$

Let d be the distance the TE runs.

Then $d + 5$ is the distance the DB runs.

Time spent running is the same for both.

dist=rate $\cdot$ time, time= dist/rate

TE: $t = \frac{d}{100/12}$

DB: $t = \frac{d+5}{100/10}$

$\frac{d}{100/12} = \frac{d+5}{100/10}$

$\frac{12}{100}d = \frac{10}{100}(d+5)$

$12d = 10d + 50$

$2d = 50$

$d = 25$

$\boxed{\text{TE catches ball at 20 yard line and is tackled 25 yards later at the 45.}}$

61.

$(42)(5) = (60)(x)$

$210 = 60x$

$x = 3.5$

$\boxed{\text{Maria should sit 3.5 feet from the center.}}$

62.

$(33+42)(4) = 60x$

$(75)(4) = 60x$

$x = 5$

$\boxed{\text{Maria should sit 5 feet from the center.}}$

63. Let the board be 1 unit long.
Let x = distance from Maria to fulcrum.
$1-x$ = distance from Max to fulcrum.
$60x = 42(1-x)$
$60x = 42 - 42x$
$102x = 42$
$x \cong 0.4$
Fulcrum is 0.4 units from Maria and 0.6 units from Max.

64. Let the board be 1 unit long.
Let x = distance from Maria to fulcrum.
$1-x$ = distance from Max/Martin to fulcrum.
$60x = (42+33)(1-x)$
$60x = 75 - 75x$
$135x = 75$
$x = 0.5\overline{5}$
Fulcrum is 0.56 units from Maria and 0.44 units from Max/Martin.

65. $\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_i}$
$f = 3,\ d_i = 5$
$\frac{1}{3} = \frac{1}{d_0} + \frac{1}{5}$
LCD $= 15d_0$
$5d_0 = 15 + 3d_0$
$2d_0 = 15$
Object is $d_0 = 7.5$ cm from lens.

66. $\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_i}$
$f = 8,\ d_i = 2$
$\frac{1}{8} = \frac{1}{d_0} + \frac{1}{2}$
LCD $= 8d_0$
$d_0 = 8 + 4d_0$
$-3d_0 = 8$
$d_0 = \frac{-8}{3} \approx -2.67$
Object is 2.67 cm behind lens.

67. $\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_i}$
$f = 2,\ d_i = \frac{1}{2}d_0$
$\frac{1}{2} = \frac{1}{d_0} + \frac{1}{\frac{1}{2}d_0}$
Since $\frac{1}{\frac{1}{2}d_0} = \frac{2}{d_0}$,
$\frac{1}{2} = \frac{1}{d_0} + \frac{2}{d_0} = \frac{3}{d_0} \Rightarrow d_0 = 6$
Object distance = 6 cm

68. $\frac{1}{f} = \frac{1}{d_0} + \frac{1}{d_i}$
$f = 8,\ d_i = \frac{1}{2}d_0$
$\frac{1}{8} = \frac{1}{d_0} + \frac{1}{\left(\frac{1}{2}d_0\right)}$
$\frac{1}{8} = \frac{1}{d_0} + \frac{2}{d_0}$
$\frac{1}{8} = \frac{3}{d_0}$
$d_0 = 24$ cm

69.
$$P = 2l + 2w$$
$$P - 2l = 2w$$
$$\frac{P - 2l}{2} = w$$

70.
$$P = 2l + 2w$$
$$P - 2w = 2l$$
$$\frac{P - 2w}{2} = l$$

71.
$$A = \tfrac{1}{2}bh$$
$$2A = bh$$
$$\frac{2A}{b} = h$$

72.
$$C = 2\pi r$$
$$\frac{C}{2\pi} = r$$

73.
$$A = lw$$
$$\frac{A}{l} = w$$

74.
$$d = rt$$
$$\frac{d}{r} = t$$

75.
$$V = lwh$$
$$\frac{V}{lw} = h$$

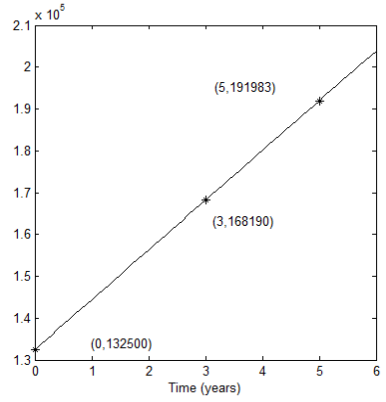
76.
$$V = \pi r^2 h$$
$$\frac{V}{\pi r^2} = h$$

77. Let x = Janine's average speed (in mph).
Then, Tricia's speed = $(12 + x)$ mph. We must solve the equation:
$$2.5(12 + x) + 2.5x = 320$$
$$30 + 2.5x + 2.5x = 320$$
$$5x = 290$$
$$x = 58$$
So, Janine's average speed is 58 mph and Tricia's average speed is 70 mph.

78. Let x = Rick's average speed (in mph).
Then, Mike's speed = $(8 + x)$ mph. We must solve the equation:
$$1.5(8 + x) + 1.5x = 210$$
$$12 + 1.5x + 1.5x = 210$$
$$3x = 198$$
$$x = 66$$
So, Rick's average speed is 66 mph and Mike's average speed is 74 mph.

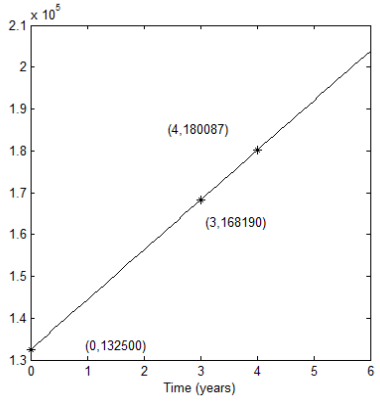
79. $y = 11896.67x + 132500$

$\$191,983.35$



80. $y = 11896.67x + 132500$

$\$144,397$

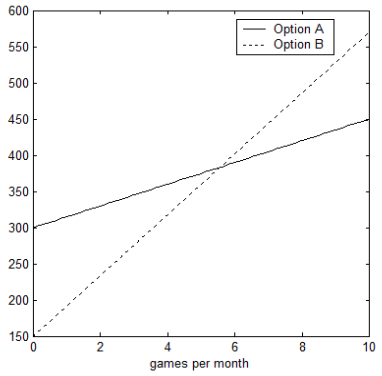


81. Let $x =$ number of times you play.

Option A: $y_1 = 300 + 15x$

Option B: $y_2 = 150 + 42x$

Option B is better if you play about 5 times or less per month. Option A is better if you play 6 times or more per month.

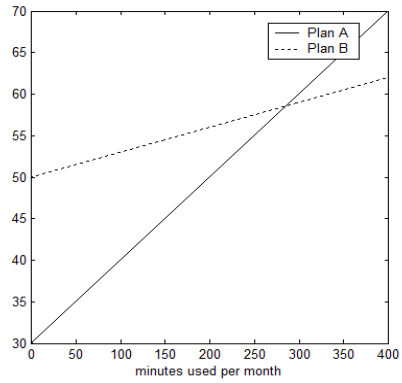


82. Let $x =$ number of minutes used.

Plan A: $y_1 = 30 + 0.1x$

Plan B: $y_2 = 50 + 0.03x$

Plan A is better if you use about 285 minutes or less per month. Plan B is better if you use more than 285 minutes per month.



Section 1.3 Solutions ----------

1. $x^2 - 5x + 6 = 0$

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

$x - 3 = 0$ or $x - 2 = 0$

$\boxed{x = 3 \text{ or } x = 2}$

2. $v^2 + 7v + 6 = 0$

$(v+6)(v+1) = 0$

$v + 6 = 0$ or $v + 1 = 0$

$\boxed{v = -6 \text{ or } v = -1}$

3. $p^2 - 8p + 15 = 0$

$(p-5)(p-3) = 0$

$\boxed{p = 5 \text{ or } p = 3}$

4. $u^2 - 2u - 24 = 0$

$(u-6)(u+4) = 0$

$\boxed{u = 6 \text{ or } u = -4}$

5.	$x^2 = 12 - x$ $x^2 + x - 12 = 0$ $(x+4)(x-3) = 0$ $x+4=0$ or $x-3=0$ $\boxed{x=-4 \text{ or } x=3}$	**6.**	$11x = 2x^2 + 12$ $2x^2 - 11x + 12 = 0$ $(2x-3)(x-4) = 0$ $2x-3=0$ or $x-4=0$ $\boxed{x=\frac{3}{2} \text{ or } x=4}$
7.	$16x^2 + 8x = -1$ $16x^2 + 8x + 1 = 0$ $(4x+1)(4x+1) = 0$ $4x+1=0$ $\boxed{x=-1/4}$	**8.**	$3x^2 + 10x - 8 = 0$ $(3x-2)(x+4) = 0$ $3x-2=0$ or $x+4=0$ $\boxed{x=\frac{2}{3} \text{ or } x=-4}$
9.	$9y^2 + 1 = 6y$ $9y^2 - 6y + 1 = 0$ $(3y-1)(3y-1) = 0$ $\boxed{y=1/3}$	**10.**	$4x = 4x^2 + 1$ $4x^2 - 4x + 1 = 0$ $(2x-1)(2x-1) = 0$ $\boxed{x=1/2}$
11.	$8y^2 - 16y = 0$ $8y(y-2) = 0$ $8y=0$ or $y-2=0$ $\boxed{y=0 \text{ or } y=2}$	**12.**	$3A^2 = -12A$ $3A^2 + 12A = 0$ $3A(A+4) = 0$ $3A=0$ or $A+4=0$ $\boxed{A=0 \text{ or } A=-4}$
13.	$9p^2 = 12p - 4$ $9p^2 - 12p + 4 = 0$ $(3p-2)(3p-2) = 0$ $3p-2=0$ $\boxed{p=\frac{2}{3}}$	**14.**	$4u^2 = 20u - 25$ $4u^2 - 20u + 25 = 0$ $(2u-5)(2u-5) = 0$ $\boxed{u=5/2}$
15.	$x^2 - 9 = 0$ $(x+3)(x-3) = 0$ $x+3=0$ or $x-3=0$ $\boxed{x=-3 \text{ or } x=3}$	**16.**	$16v^2 - 25 = 0$ $(4v-5)(4v+5) = 0$ $\boxed{v=5/4 \text{ or } v=-5/4}$

17.	$x(x+4)=12$ $x^2+4x=12$ $x^2+4x-12=0$ $(x+6)(x-2)=0$ $x+6=0$ or $x-2=0$ $\boxed{x=-6 \text{ or } x=2}$	**18.**	$3t^2-48=0$ $3(t^2-16)=0$ $3(t+4)(t-4)=0$ $t+4=0$ or $t-4=0$ $\boxed{t=-4 \text{ or } t=4}$
19.	$2p^2-50=0$ $2(p^2-25)=0$ $2(p-5)(p+5)=0$ $\boxed{p=-5 \text{ or } p=5}$	**20.**	$5y^2-45=0$ $5(y^2-9)=0$ $5(y-3)(y+3)=0$ $\boxed{y=-3 \text{ or } y=3}$
21.	$3x^2=12$ $3x^2-12=0$ $3(x^2-4)=0$ $3(x-2)(x+2)=0$ $\boxed{x=-2 \text{ or } x=2}$	**22.**	$7v^2=28$ $7v^2-28=0$ $7(v^2-4)=0$ $7(v-2)(v+2)=0$ $\boxed{v=-2 \text{ or } v=2}$
23.	$p^2-8=0$ $p^2=8$ $p=\pm\sqrt{8}$ $\boxed{p=\pm 2\sqrt{2}}$	**24.**	$y^2-72=0$ $y^2=72$ $y=\pm\sqrt{72}$ $(72=2^3\cdot 3^2)$ $\boxed{y=\pm 6\sqrt{2}}$
25.	$x^2+9=0$ $x^2=-9$ $\boxed{x=\pm 3i}$	**26.**	$v^2+16=0$ $v^2=-16$ $\boxed{v=\pm 4i}$
27.	$(x-3)^2=36$ $x-3=\pm 6$ $x=3\pm 6$ $\boxed{x=-3, 9}$	**28.**	$(x-1)^2=25$ $x-1=\pm 5$ $x=\pm 5+1$ $\boxed{x=-4, 6}$

29.

$$(2x+3)^2 = -4$$
$$2x+3 = \pm 2i$$
$$2x = -3 \pm 2i$$
$$\boxed{x = \frac{-3 \pm 2i}{2}}$$

30.

$$(4x-1)^2 = -16$$
$$4x-1 = \pm 4i$$
$$4x = 1 \pm 4i$$
$$\boxed{x = \tfrac{1}{4} \pm i}$$

31.

$$(5x-2)^2 = 27$$
$$5x-2 = \pm\sqrt{27}$$
$$5x = 2 \pm 3\sqrt{3}$$
$$\boxed{x = \frac{2 \pm 3\sqrt{3}}{5}}$$

32.

$$(3x+8)^2 = 12$$
$$3x+8 = \pm\sqrt{12}$$
$$3x = -8 \pm 2\sqrt{3}$$
$$\boxed{x = \frac{-8 \pm 2\sqrt{3}}{3}}$$

33.

$$(1-x)^2 = 9$$
$$1-x = \pm 3$$
$$-x = -1 \pm 3$$
$$\boxed{x = 1 \pm 3 = -2,\ 4}$$

34.

$$(1-x)^2 = -9$$
$$1-x = \pm 3i$$
$$-x = -1 \pm 3i$$
$$\boxed{x = 1 \pm 3i}$$

35.

$$x^2 + 6x$$
$$\left(\frac{1}{2} \cdot 6\right)^2 = 3^2 = 9$$
$$x^2 + 6x + \boxed{9}$$

36.

$$x^2 - 8x$$
$$\left(\frac{1}{2} \cdot 8\right)^2 = 4^2 = 16$$
$$x^2 - 8x + \boxed{16}$$

37.

$$x^2 - 12x$$
$$\left(\frac{1}{2} \cdot 12\right)^2 = 6^2 = 36$$
$$x^2 - 12x + \boxed{36}$$

38.

$$x^2 + 20x$$
$$\left(\frac{1}{2} \cdot 20\right)^2 = 10^2 = 100$$
$$x^2 + 20x + \boxed{100}$$

39.

$$x^2 - \frac{1}{2}x$$
$$\left(\frac{1}{2} \cdot \frac{1}{2}\right)^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16}$$
$$x^2 - \frac{1}{2}x + \boxed{\frac{1}{16}}$$

40.

$$x^2 - \frac{1}{3}x$$
$$\left(\frac{1}{3} \cdot \frac{1}{2}\right)^2 = \left(\frac{1}{6}\right)^2 = \frac{1}{36}$$
$$x^2 - \frac{1}{3}x + \boxed{\frac{1}{36}}$$

41.

$$x^2+\frac{2}{5}x$$

$$\left(\frac{1}{2}\cdot\frac{2}{5}\right)^2=\left(\frac{1}{5}\right)^2=\frac{1}{25}$$

$$x^2+\frac{2}{5}x+\boxed{\frac{1}{25}}$$

42.

$$x^2+\frac{4}{5}x$$

$$\left(\frac{1}{2}\cdot\frac{4}{5}\right)^2=\left(\frac{2}{5}\right)^2=\frac{4}{25}$$

$$x^2+\frac{4}{5}x+\boxed{\frac{4}{25}}$$

43.

$$x^2-2.4x$$

$$\left(\frac{1}{2}\cdot 2.4\right)^2=1.2^2=1.44$$

$$x^2-2.4+\boxed{1.44}$$

44.

$$x^2+1.6x$$

$$\left(\frac{1}{2}\cdot 1.6\right)^2=0.8^2=0.64$$

$$x^2+1.6x+\boxed{0.64}$$

45.

$$x^2+2x=3$$

$$x^2+2x+1=3+1$$

$$(x+1)^2=4$$

$$x+1=\pm 2$$

$$x=-1\pm 2$$

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

46.

$$y^2+8y-2=0$$

$$y^2+8y+16=2+16$$

$$(y+4)^2=18$$

$$y+4=\pm\sqrt{18}$$

$$\boxed{y=-4\pm 3\sqrt{2}}$$

47.

$$t^2-6t=-5$$

$$t^2-6t+9=-5+9$$

$$(t-3)^2=4$$

$$t-3=\pm 2$$

$$\boxed{t=3\pm 2=1,5}$$

48.

$$x^2+10x=-21$$

$$x^2+10x+25=-21+25$$

$$(x+5)^2=4$$

$$x+5=\pm 2$$

$$\boxed{x=-5\pm 2=-7,-3}$$

49.

$$y^2-4y=-3$$

$$y^2-4y+4=-3+4$$

$$(y-2)^2=1$$

$$y-2=\pm 1$$

$$\boxed{y=\pm 1+2=1,3}$$

50.

$$x^2-7x=-12$$

$$x^2-7x+\left(\frac{7}{2}\right)^2=-12+\left(\frac{7}{2}\right)^2$$

$$\left(x-\frac{7}{2}\right)^2=-12+\frac{49}{4}=\frac{1}{4}$$

$$x-\frac{7}{2}=\pm\frac{1}{2}$$

$$\boxed{x=\frac{7}{2}\pm\frac{1}{2}=3,4}$$

51.

$$2p^2+8p=-3$$
$$2\left(p^2+4p\right)=-3$$
$$2\left(p^2+4p+4\right)=-3+8$$
$$2(p+2)^2=5$$
$$(p+2)^2=\frac{5}{2}$$
$$p+2=\pm\sqrt{\frac{5}{2}}$$
$$\boxed{p=-2\pm\sqrt{\frac{5}{2}}=\frac{-4\pm\sqrt{10}}{2}}$$

52.

$$2x^2-4x=-3$$
$$2\left(x^2-2x\right)=-3$$
$$2\left(x^2-2x+1\right)=-3+2$$
$$2(x-1)^2=-1$$
$$(x-1)^2=\frac{-1}{2}$$
$$x-1=\pm i\frac{1}{\sqrt{2}}$$
$$\boxed{x=1\pm i\frac{\sqrt{2}}{2}}$$

53.

$$2x^2-7x=-3$$
$$2\left(x^2-\frac{7}{2}x\right)=-3$$
$$2\left(x^2-\frac{7}{2}x+\left(\frac{7}{4}\right)^2\right)=-3+2\left(\frac{7}{4}\right)^2$$
$$2\left(x-\frac{7}{4}\right)^2=-3+2\left(\frac{49}{16}\right)$$
$$\left(x-\frac{7}{4}\right)^2=\frac{-3}{2}+\frac{49}{16}=\frac{25}{16}$$
$$x-\frac{7}{4}=\pm\frac{5}{4}$$
$$\boxed{x=\frac{7}{4}\pm\frac{5}{4}=\frac{1}{2},3}$$

54.

$$3x^2-5x=10$$
$$3\left(x^2-\frac{5}{3}x\right)=10$$
$$3\left(x^2-\frac{5}{3}x+\left(\frac{5}{6}\right)^2\right)=10+3\left(\frac{5}{6}\right)^2$$
$$3\left(x-\frac{5}{6}\right)^2=10+3\left(\frac{25}{36}\right)$$
$$\left(x-\frac{5}{6}\right)^2=\frac{10}{3}+\frac{25}{36}=\frac{145}{36}$$
$$x-\frac{5}{6}=\pm\sqrt{\frac{145}{36}}=\pm\frac{\sqrt{145}}{6}$$

$(145=5\cdot 29)$ so the radical can't be reduced.

$$\boxed{x=\frac{5}{6}\pm\frac{\sqrt{145}}{6}=\frac{5\pm\sqrt{145}}{6}}$$

55.

$$\frac{x^2}{2} - 2x = \frac{1}{4}$$

$$x^2 - 4x = \frac{1}{2}$$

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

$$(x-2)^2 = \frac{9}{2}$$

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

$$\boxed{x = 2 \pm \frac{3}{\sqrt{2}} = \frac{4 \pm 3\sqrt{2}}{2}}$$

56.

$$\frac{t^2}{3} + \frac{2t}{3} + \frac{5}{6} = 0$$

$$t^2 + 2t = -\frac{5}{2}$$

$$t^2 + 2t + 1 = -\frac{5}{2} + 1$$

$$(t+1)^2 = \frac{-3}{2}$$

$$t + 1 = \pm i\sqrt{\frac{3}{2}}$$

$$\boxed{t = -1 \pm i\sqrt{\frac{3}{2}} = -1 \pm i\frac{\sqrt{6}}{2}}$$

57.

$$t^2 + 3t - 1 = 0$$

$$t = \frac{-3 \pm \sqrt{9+4}}{2}$$

$$\boxed{t = \frac{-3 \pm \sqrt{13}}{2}}$$

58.

$$t^2 + 2t - 1 = 0$$

$$t = \frac{-2 \pm \sqrt{4+4}}{2} = -1 \pm \frac{1}{2}\sqrt{8}$$

$$\boxed{t = -1 \pm \sqrt{2}}$$

59.

$$s^2 + s + 1 = 0$$

$$s = \frac{-1 \pm \sqrt{1-4}}{2} = \frac{-1 \pm \sqrt{-3}}{2}$$

$$\boxed{s = \frac{-1 \pm i\sqrt{3}}{2}}$$

60.

$$2s^2 + 5s + 2 = 0$$

$$s = \frac{-5 \pm \sqrt{25-16}}{4} = \frac{-5 \pm \sqrt{9}}{4}$$

$$\boxed{s = \frac{-5 \pm 3}{4} = -2, \frac{-1}{2}}$$

61.

$$3x^2 - 3x - 4 = 0$$

$$x = \frac{3 \pm \sqrt{9+48}}{6} = \frac{1}{2} \pm \frac{\sqrt{57}}{6}$$

$$\boxed{x = \frac{3 \pm \sqrt{57}}{6}}$$

62.

$$4x^2 - 2x - 7 = 0$$

$$x = \frac{2 \pm \sqrt{4 + 4 \cdot 28}}{8} = \frac{2 \pm \sqrt{116}}{8}$$

$$\left(116 = 2^2 \cdot 29\right)$$

$$\boxed{x = \frac{2 \pm 2\sqrt{29}}{8} = \frac{1 \pm \sqrt{29}}{4}}$$

63. $x^2 - 2x + 17 = 0$

$$x = \frac{2 \pm \sqrt{4 - 4 \cdot 17}}{2} = \frac{2 \pm \sqrt{-64}}{2}$$

$$\boxed{x = \frac{2 \pm 8i}{2} = 1 \pm 4i}$$

64. $4m^2 + 7m + 8 = 0$

$$m = \frac{-7 \pm \sqrt{49 - 4 \cdot 32}}{8} = \frac{-7 \pm \sqrt{-79}}{8}$$

$$\boxed{m = -\frac{7}{8} \pm i\frac{\sqrt{79}}{8}}$$

65. $5x^2 + 7x - 3 = 0$

$$x = \frac{-7 \pm \sqrt{49 + 60}}{10}$$

$$\boxed{x = \frac{-7 \pm \sqrt{109}}{10}}$$

66. $3x^2 + 5x + 11 = 0$

$$x = \frac{-5 \pm \sqrt{25 - 132}}{6} = \frac{-5 \pm \sqrt{-107}}{6}$$

$$\boxed{x = -\frac{5}{6} \pm i\frac{\sqrt{107}}{6}}$$

67. $\frac{1}{4}x^2 + \frac{2}{3}x - \frac{1}{2} = 0$

$3x^2 + 8x - 6 = 0$

$$x = \frac{-8 \pm \sqrt{64 - 4(3)(-6)}}{2(3)} = \frac{-8 \pm 2\sqrt{34}}{2(3)}$$

$$\boxed{x = \frac{-4 \pm \sqrt{34}}{3}}$$

68. $\frac{1}{4}x^2 - \frac{2}{3}x - \frac{1}{3} = 0$

$3x^2 - 8x - 4 = 0$

$$x = \frac{8 \pm \sqrt{64 - 4(3)(-4)}}{2(3)} = \frac{8 \pm 4\sqrt{7}}{2(3)}$$

$$\boxed{x = \frac{4 \pm 2\sqrt{7}}{3}}$$

69. $(-22)^2 - 4(1)(121) = 484 - 484 = \boxed{0}$

$\boxed{\text{1 real solution}}$ (repeated root)

70. $(-28)^2 - 4(1)(196) = 784 - 784 = \boxed{0}$

$\boxed{\text{1 real solution}}$ (repeated root)

71. $(-30)^2 - 4(2)(68) = 900 - 544 = \boxed{356}$

$\boxed{\text{2 real solutions}}$ (distinct)

72. $(27)^2 - 4(-3)(66) = 729 + 792 = \boxed{1521}$

$\boxed{\text{2 real solutions}}$ (distinct)

73. $(-7)^2 - 4(9)(8) = 49 - 288 = \boxed{-239}$

$\boxed{\text{2 complex solutions}}$ (complex conjugate)

74. $(5)^2 - 4(-3)(-7) = 25 - 84 = \boxed{-59}$

$\boxed{\text{2 complex solutions}}$ (complex conjugate)

75. $v^2 - 8v - 20 = 0$

$(v - 10)(v + 2) = 0$

$$\boxed{v = -2, 10}$$

76. $v^2 - 8v + 20 = 0$

$$v = \frac{8 \pm \sqrt{64 - 80}}{2} = \frac{8 \pm \sqrt{-16}}{2}$$

$$\boxed{v = \frac{8 \pm 4i}{2} = 4 \pm 2i}$$

77.

$$t^2+5t-6=0$$
$$(t+6)(t-1)=0$$
$$\boxed{t=-6,1}$$

78.

$$t^2+5t+6=0$$
$$(t+2)(t+3)=0$$
$$\boxed{t=-2,-3}$$

79.

$$(x+3)^2=16$$
$$x+3=\pm 4$$
$$\boxed{x=-3\pm 4=-7,1}$$

80.

$$(x+3)^2=-16$$
$$x+3=\pm 4i$$
$$\boxed{x=-3\pm 4i}$$

81.

$$(p-2)^2=4p$$
$$p^2-4p+4=4p$$
$$p^2-8p+4=0$$
$$p=\frac{8\pm\sqrt{64-4(1)(4)}}{2(1)}=\frac{8\pm 4\sqrt{3}}{2}$$
$$\boxed{p=4\pm 2\sqrt{3}}$$

82.

$$(u+5)^2=16u$$
$$u^2+10u+25=16u$$
$$u^2-6u+25=0$$
$$u=\frac{6\pm\sqrt{36-4(25)}}{2}=\frac{6\pm 8i}{2}$$
$$\boxed{u=3\pm 4i}$$

83.

$$8w^2+2w+21=0$$
$$w=\frac{-2\pm\sqrt{4-4\cdot 8\cdot 21}}{16}$$
$$w=\frac{-2\pm\sqrt{-668}}{16}=\frac{-2\pm 2i\sqrt{167}}{16}$$
$$\boxed{w=\frac{-1\pm i\sqrt{167}}{8}}$$

84.

$$8w^2+2w-21=0$$
$$(4w+7)(2w-3)=0$$
$$4w+7=0 \text{ or } 2w-3=0$$
$$\boxed{w=\frac{-7}{4},\frac{3}{2}}$$

85.

$$3p^2-9p+1=0$$
$$p=\frac{9\pm\sqrt{81-12}}{6}$$
$$\boxed{p=\frac{9\pm\sqrt{69}}{6}}$$

86.

$$3p^2-9p-1=0$$
$$p=\frac{9\pm\sqrt{81+12}}{6}$$
$$\boxed{p=\frac{9\pm\sqrt{93}}{6}}$$

87. $\frac{2}{3}t^2 - \frac{4}{3}t - \frac{1}{5} = 0$

LCD = 15

$10t^2 - 20t - 3 = 0$

$t = \frac{20 \pm \sqrt{400 + 120}}{20}$

$t = \frac{20 \pm \sqrt{520}}{20} = \frac{20 \pm 2\sqrt{130}}{20}$

$\boxed{t = \frac{10 \pm \sqrt{130}}{10}}$

88. $\frac{1}{2}x^2 + \frac{2}{3}x - \frac{2}{5} = 0$

LCD = 30

$15x^2 + 20x - 12 = 0$

$x = \frac{-20 \pm \sqrt{400 + 4 \cdot 15 \cdot 12}}{30}$

$x = \frac{-20 \pm \sqrt{1120}}{30}$

$x = \frac{-20 \pm 4\sqrt{70}}{30}$

$\boxed{x = \frac{-10 \pm 2\sqrt{70}}{15}}$

89. $x + \frac{12}{x} = 7 \quad \boxed{x \neq 0}$

$x^2 + 12 = 7x$

$x^2 - 7x + 12 = 0$

$(x-3)(x-4) = 0$

$x - 3 = 0$ or $x - 4 = 0$

$\boxed{x = 3 \text{ or } x = 4}$

90. $x - \frac{10}{x} = -3 \quad \boxed{x \neq 0}$

$x^2 - 10 = -3x$

$x^2 + 3x - 10 = 0$

$(x+5)(x-2) = 0$

$x + 5 = 0$ or $x - 2 = 0$

$\boxed{x = -5 \text{ or } x = 2}$

91. $\frac{4(x-2)}{x-3} + \frac{3}{x} = \frac{-3}{x(x-3)} \quad \boxed{x \neq 0, 3}$

LCD = $x(x-3)$

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

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

$4x^2 - 5x - 6 = 0$

$(4x+3)(x-2) = 0$

$4x + 3 = 0$ or $x - 2 = 0$

$\boxed{x = -3/4 \text{ or } x = 2}$

92. $\frac{5}{y+4} = 4 + \frac{3}{y-2} \quad \boxed{y \neq -4, 2}$

LCD = $(y+4)(y-2)$

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

$5y - 10 = 4(y^2 + 2y - 8) + 3y + 12$

$5y - 10 = 4y^2 + 8y - 32 + 3y + 12$

$-4y^2 - 6y + 10 = 0$

$2y^2 + 3y - 5 = 0$

$(2y+5)(y-1) = 0$

$2y + 5 = 0$ or $y - 1 = 0$

$\boxed{y = -\frac{5}{2} \text{ or } y = 1}$

93.

$$x^2 - 0.1x - 0.12 = 0$$
$$(x - 0.4)(x + 0.3) = 0$$
$$\boxed{x = -0.3,\ 0.4}$$

94.

$$y^2 - 0.5y + 0.06 = 0$$
$$(y - 0.2)(y - 0.3) = 0$$
$$\boxed{y = 0.2,\ 0.3}$$

95.

$$6.25t^2 - 35t + 360 = 310$$
$$6.25t^2 - 35t + 50 = 0$$
$$625t^2 - 3500t + 5000 = 0$$
$$625(t^2 - 6t + 8) = 0$$
$$625(t - 4)(t - 2) = 0$$
$$\boxed{t = 4 \text{ (March 2015) and } 2 \text{ (January 2015)}}$$

96.

$$-0.39t^2 + 4.29t + 120.1 = 124$$
$$-0.39t^2 + 4.29t - 3.9 = 0$$
$$39t^2 - 429t + 390 = 0$$
$$39(t^2 - 11t + 10) = 0$$
$$39(t - 1)(t - 10) = 0$$
$$\boxed{t = 1 \text{ (Dec. 2014) and } 10 \text{ (Sept. 2015)}}$$

97. Solve $P(q) = 0$:

$$-100 + (0.2q - 3)q = 0$$
$$-100 + 0.2q^2 - 3q = 0$$
$$0.2q^2 - 3q - 100 = 0$$
$$q^2 - 15q - 500 = 0$$
$$q = \frac{15 \pm \sqrt{(-15)^2 - 4(1)(-500)}}{2(1)}$$
$$= \frac{15 \pm \sqrt{2,225}}{2} = \frac{15 \pm 47.17}{2}$$
$$= 31.085,\ \cancel{-16.09}$$

So, approximately 31,000 units must be sold to break even.

98. Solve $P(q) = 40$:

$$-100 + (0.2q - 3)q = 40$$
$$-100 + 0.2q^2 - 3q = 40$$
$$0.2q^2 - 3q - 140 = 0$$
$$q^2 - 15q - 700 = 0$$
$$(q - 35)(q + 20) = 0$$
$$q = 35,\ \cancel{-20}$$

So, 35,000 units must be sold to achieve this profit level.

99. Solve $P(x) = 460$:

$$-5(x + 3)(x - 24) = 460$$
$$-5x^2 + 105x + 360 = 460$$
$$-5x^2 + 105x - 100 = 0$$
$$x^2 - 21x + 20 = 0$$
$$(x - 20)(x - 1) = 0$$
$$x = 1,\ 20$$

So, the smallest price increase that will produce a weekly profit of \$460 is \$1 per bottle.

100. Solve $P(x) = 630$:

$$-5(x + 3)(x - 24) = 630$$
$$-5x^2 + 105x + 360 = 630$$
$$-5x^2 + 105x - 270 = 0$$
$$x^2 - 21x + 54 = 0$$
$$(x - 18)(x - 3) = 0$$
$$x = 3,\ 18$$

So, the smallest price increase that will produce a weekly profit of \$630 is \$3 per bottle.

101. Solve $P(t) = 160,\ 1 \le t \le 6$:

$$-t^2 + 13t + 130 = 160$$
$$-t^2 + 13t - 30 = 0$$
$$t^2 - 13t + 30 = 0$$
$$(t-10)(t-3) = 0$$
$$t = 3,\ \cancel{10}$$

So, 160 people would have contracted the flu after 3 days.

102. Solve $P(t) = 172,\ 1 \le t \le 6$:

$$-t^2 + 13t + 130 = 172$$
$$-t^2 + 13t - 42 = 0$$
$$t^2 - 13t + 42 = 0$$
$$(t-6)(t-7) = 0$$
$$t = 6,\ \cancel{7}$$

So, 172 people would have contracted the flu after 6 days.

103. a.

The width of useable space =
(8.5 – 2(1)) inches = 6.5 inches
The length of useable space =
(11 – 2(1.25)) inches = 8.5 inches
So, the amount of useable space is the area, namely (6.5 in)(8.5 in) = 55.25 in^2.

b. Let x = amount of margin reduction (in inches)
Width of useable space =
$8.5 - 2(1) + 2x = 6.5 + 2x$
Length of useable space =
$11 - 2(1.25) + 2x = 8.5 + 2x$
So, the useable area is
$(6.5 + 2x)(8.5 + 2x) = 55.25 + 30x + 4x^2$

c. $55.25 + 30x + 4x^2$ - 55.25 =
$4x^2 + 30x$
This represents the increase in useable area of the paper.

d. Find x such that
$10\left(55.25 + 30x + 4x^2\right) = 11(55.25)$.
Solving for x yields:
$$552.5 + 300x + 40x^2 = 607.75$$
$$40x^2 + 300x - 55.25 = 0$$
$$8x^2 + 60x - 11.05 = 0$$

Continued onto next page.

104. a.

The width of useable space =
(8.5 – 2(1)) inches = 6.5 inches
The length of useable space =
(11 – 2(1)) inches = 9 inches
So, the amount of useable space is the area, namely (6.5 in)(9 in) = 58.5 in^2.

b. Let x = amount of margin reduction (in inches)
Width of useable space =
$8.5 - 2(1) + 2x = 6.5 + 2x$
Length of useable space =
$11 - 2(1) + 2x = 9 + 2x$
So, the useable area is
$(6.5 + 2x)(9 + 2x) = 58.5 + 31x + 4x^2$

c. $58.5 + 31x + 4x^2$ - 58.5 =
$4x^2 + 31x$
This represents the increase in useable area of the paper.

d. Find x such that
$15\left(58.5 + 31x + 4x^2\right) = 16(58.5)$.
Solving for x yields:
$$60x^2 + 465x - 58.5 = 0$$
$$12x^2 + 93x - 11.7 = 0$$

Continued onto next page.

$$x = \frac{-60 \pm \sqrt{60^2 - 4(8)(-11.05)}}{2(8)}$$
$$= \frac{-60 \pm \sqrt{3,953.6}}{16} \approx \frac{2.877}{16} \approx 0.2$$

So, about 0.2 inches.

$$x = \frac{-93 \pm \sqrt{93^2 - 4(12)(-11.7)}}{2(12)}$$
$$= \frac{-93 \pm \sqrt{9,210.6}}{24} \approx \frac{2.9719}{24} \approx 0.1$$

So, about 0.1 inches.

105. Form a right triangle with legs of length x and 25in. and hypotenuse of length 32in. Then, by the Pythagorean Theorem, we solve:

$$x^2 + 25^2 = 32^2$$
$$x^2 = 399$$
$$x = \pm\sqrt{399} \approx \pm 20$$

So, the TV is approximately 20 inches high.

106. Form a right triangle with legs of length x and 20in. and hypotenuse of length 42in. Then, by the Pythagorean Theorem, we solve:

$$x^2 + 20^2 = 42^2$$
$$x^2 = 1364$$
$$x = \pm\sqrt{1364} \approx \pm 37$$

So, the TV is approximately 37 inches wide.

107. Let the numbers be x, $x+1$.

$$x + (x+1) = 35$$
$$2x = 34 \Rightarrow x = 17$$
$$x(x+1) = 306$$
$$x^2 + x = 306$$
$$x^2 + x - 306 = 0$$
$$(x+18)(x-17) = 0$$
$$x = \cancel{-18}, 17$$

So, the numbers are 17 and 18.

108. Let the numbers be x, $x+2$.

$$x + (x+2) = 24$$
$$2x = 22 \Rightarrow x = 11$$
$$x(x+2) = 143$$
$$x^2 + 2x = 143$$
$$x^2 + 2x - 143 = 0$$
$$(x+13)(x-11) = 0$$
$$x = \cancel{-13}, 11$$

So, the numbers are 11 and 13.

109. Let l = length of the rectangle (in ft.) Then, the width $w = l - 6$ (in ft.) We must solve:

$$135 = lw$$
$$135 = l(l-6)$$
$$l^2 - 6l - 135 = 0$$
$$(l-15)(l+9) = 0$$
$$l = 15, \cancel{-9}$$

So, the rectangle has:
length 15ft. and width 9ft.

110.

$$\text{Area} = \text{length} \cdot \text{width} = (2w+2)(w) = 31.5$$
$$2w^2 + 2w - 31.5 = 0$$
$$w = \frac{-2 \pm \sqrt{4 + 4 \cdot 2 \cdot 31.5}}{4}$$
$$w = \frac{-2 \pm \sqrt{256}}{4} = \frac{-2 \pm 16}{4}$$

Widths and lengths are always positive, so

$$w = \frac{14}{4} = \frac{7}{2} m, \; l = 2\left(\frac{7}{2}\right) + 2 = 9m$$

111.

$$\text{Area} = \frac{1}{2} b \cdot h = 60$$

$$h = 3b + 2$$

$$\frac{1}{2} b(3b + 2) = 60$$

$$\frac{3}{2} b^2 + b = 60$$

$$3b^2 + 2b - 120 = 0$$

$$(3b + 20)(b - 6) = 0$$

$$\boxed{b = \frac{-20}{3}, 6; \; h = 20}$$

112.

$$s^2 = A$$

$$(s + 3)^2 = A + 69$$

$$(s + 3)^2 = s^2 + 69$$

$$s^2 + 6s + 9 = s^2 + 69$$

$$6s - 60 = 0$$

$$\boxed{s = 10 \text{ yards}}$$

113.

$$h = -16t^2 + 100$$

$$\text{Ground} \rightarrow h = 0$$

$$-16t^2 + 100 = 0$$

$$t^2 = \frac{100}{16}$$

$$t = \pm \frac{10}{4} \; (\text{Time must be} \geq 0)$$

$$\boxed{\text{Impact with ground in } 2.5 \text{ sec}}$$

114.

$$h = -16t^2 - 5t + 100$$

$$\text{Ground} \rightarrow h = 0$$

$$16t^2 + 5t - 100 = 0$$

$$t = \frac{-5 \pm \sqrt{25 + 4 \cdot 16 \cdot 100}}{32}$$

$$t = \frac{-5 \pm \sqrt{6425}}{32} = \frac{-5 \pm 5\sqrt{257}}{32}$$

$$\boxed{t \cong 2.3 \text{ sec}}$$

115.

$$15^2 + 15^2 = r^2$$

$$r^2 = 450$$

$$r = \pm\sqrt{450} = \pm 15\sqrt{2}$$

$$\boxed{r \approx 21.2 \text{ feet}}$$

116.

$$d^2 = 90^2 + 90^2$$

$$d^2 = 16200$$

$$d = \pm\sqrt{16200} = \pm 90\sqrt{2}$$

$$\boxed{d \cong 127 \text{ feet}}$$

117. volume $= l \cdot w \cdot h$

$v = (x-2)(x-2)(1)$

$9 = (x-2)^2$

$x - 2 = \pm 3$

$x = 2 \pm 3 = -1, 5$

$x = 5$

Original square was $5\text{ft} \times 5\text{ft}$

118. volume $= l \cdot w \cdot h = 12$

$l = 2w,\ h = 1$

$v = (2w-2)(w-2)(1) = 12$

$(2w-2)(w-2) = 12$

$2w^2 - 6w + 4 = 12$

$2w^2 - 6w - 8 = 0$

$w^2 - 3w - 4 = 0$

$(w+1)(w-4) = 0$

Original rectangle was $4\text{ft} \times 8\text{ft}$

119. Let $w =$ width of border

Total area of garden + border $= (8+2w)(5+2w) = 4w^2 + 26w + 40$

Area of garden $= 8 \cdot 5 = 40$

Area of border $= \underbrace{(4w^2 + 26w + 40)}_{total} - \underbrace{40}_{garden} = 4w^2 + 26w$

Volume of border = Area $\cdot$ depth $(\text{depth} = 4\text{in.} = 1/3\text{ ft})$

$= (4w^2 + 26w)(1/3)$

Volume $= 27\text{ ft}^3$

$\frac{1}{3}(4w^2 + 26w) = 27$

$4w^2 + 26w = 81$

$4w^2 + 26w - 81 = 0$

$w = \frac{-26 \pm \sqrt{26^2 + 4 \cdot 4 \cdot 81}}{2 \cdot 4} = \frac{-26 \pm \sqrt{1972}}{8}$

$w \cong \cancel{-8.8}, 2.3$

Width of border is 2.3 feet.

120.

$$\text{Area of Rose Garden} = \frac{\pi r^2}{2} = \frac{\pi 6^2}{2} = 18\pi$$

$$\text{Volume of mulch} = \text{Area} \cdot \text{depth} = 18\pi \cdot d$$

$$\text{Volume of mulch} = 54 \text{ ft}^3$$

$$18\pi d = 54$$

$$d = \frac{54}{18\pi} \cong 0.95$$

$$\boxed{\text{Mulch will be about 1 foot deep}}$$

121.

Let x = days for Kimmie to complete job herself.

$x - 5$ = days for Lindsey to complete job herself.

$\frac{1}{x}$ = % of job Kimmie can do per day.

$\frac{1}{x-5}$ = % of job Lindsey can do per day.

$$\frac{1}{x} + \frac{1}{x-5} = \frac{1}{6} \text{ (Together they can do it in 6 days.)}$$

LCD = $x(x-5)6$ $\boxed{x \neq 0, 5}$

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

$$6x - 30 + 6x = x^2 - 5x$$

$$x^2 - 17x + 30 = 0$$

$$(x-15)(x-2) = 0$$

$$x = \cancel{2}, 15$$

Kimmie alone: 15 days

$\boxed{\text{Lindsey alone: 10 days}}$

122.

Jack can clean $\frac{1}{4}$ house per hour.

Ryan can clean $\frac{1}{6}$ house per hour.

Together they can clean $\frac{1}{4} + \frac{1}{6} = \frac{10}{24} = \frac{5}{12}$ house per hour.

$\boxed{\text{They can clean the house in } \frac{12}{5} = 2.4 \text{ hours.}}$

123. Factored incorrectly

$t^2 - 5t - 6 = 0$

$(t+1)(t-6) = 0$

$\boxed{t = -1, 6}$

124. Forgot $\pm$

$(2y-3)^2 = 25$

$2y - 3 = \pm 5$

$2y = 3 \pm 5$

$y = \dfrac{3 \pm 5}{2} = -1, 4$

125. $\sqrt{-a}$ is imaginary for positive a

$a^2 = -\dfrac{9}{16}$, so $\boxed{a = \pm\sqrt{\dfrac{9}{16}} = \pm\dfrac{3}{4}i}$

126. In completing the square we should add 2 (not 1) to the right side. So, $2(x^2 - 2x + 1) = 3 + 2$.

The solutions are $1 \pm \sqrt{\frac{5}{2}}$.

127. False

$x = -5/3$ satisfies 1st equation but not 2nd

128. True

129. True

130. True

131. If $x = a$ is a repeated root for a quadratic equation, then $(x-a)^2 = 0$. Simplifying yields:

$\boxed{x^2 - 2ax + a^2 = 0}$

132. If $x = bi$ is a root for a quadratic equation, then so is $x = -bi$.

$(x + bi)(x - bi) = 0$

Then, $x^2 - b^2 i^2 = 0$

$\boxed{x^2 + b^2 = 0}$

133. $(x-2)(x-5) = 0$

$\boxed{x^2 - 7x + 10 = 0}$

134. $x(x+3) = 0$

$\boxed{x^2 + 3x = 0}$

135.

$s = \dfrac{1}{2}gt^2$

$t^2 = \dfrac{2s}{g}$

$\boxed{t = \pm\sqrt{\dfrac{2s}{g}}}$

136.

$A = P(1+r)^2$

$\dfrac{A}{P} = (1+r)^2$

$1 + r = \pm\sqrt{\dfrac{A}{P}}$

$\boxed{r = -1 \pm \sqrt{\dfrac{A}{P}}}$

137.

$a^2 + b^2 = c^2$

$\boxed{c = \pm\sqrt{a^2 + b^2}}$

138.

$P = EI - RI^2$

$RI^2 - EI + P = 0$

This equation is quadratic in I.

$\boxed{I = \dfrac{E \pm \sqrt{E^2 - 4RP}}{2R}}$

139.

$$x^4 - 4x^2 = 0$$
$$x^2\left(x^2 - 4\right) = 0$$
$$x^2(x-2)(x+2) = 0$$
$$\boxed{x = 0,\ \pm 2}$$

140.

$$3x - 6x^2 = 0$$
$$3x(1-2x) = 0$$
$$\boxed{x = 0,\ ½}$$

141.

$$x^3 + x^2 - 4x - 4 = 0$$
$$\left(x^3 + x^2\right) - 4\left(x+1\right) = 0$$
$$x^2\left(x+1\right) - 4\left(x+1\right) = 0$$
$$\left(x^2 - 4\right)\left(x+1\right) = 0$$
$$(x-2)(x+2)(x+1) = 0$$
$$\boxed{x = -1,\ \pm 2}$$

142.

$$x^3 + 2x^2 - x - 2 = 0$$
$$\left(x^3 + 2x^2\right) - \left(x+2\right) = 0$$
$$x^2\left(x+2\right) - \left(x+2\right) = 0$$
$$\left(x^2 - 1\right)\left(x+2\right) = 0$$
$$(x-1)(x+1)(x+2) = 0$$
$$\boxed{x = \pm 1,\ -2}$$

143.

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \qquad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$x_1 + x_2 = \frac{-b}{2a} + \frac{\sqrt{b^2 - 4ac}}{2a} - \frac{b}{2a} - \frac{\sqrt{b^2 - 4ac}}{2a}$$
$$= \frac{-2b}{2a} = \boxed{\frac{-b}{a}}$$

144.

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \qquad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

$$x_1 \cdot x_2 = \frac{\left(-b + \sqrt{b^2 - 4ac}\right)\left(-b - \sqrt{b^2 - 4ac}\right)}{2a \cdot 2a}$$
$$= \frac{b^2 - \left(b^2 - 4ac\right)}{4a^2} = \frac{4ac}{4a^2} = \boxed{\frac{c}{a}}$$

145.

$$\left[x-\left(3+\sqrt{5}\right)\right]\left[x-\left(3-\sqrt{5}\right)\right]=0$$
$$\left[\left(x-3\right)-\sqrt{5}\right]\left[\left(x-3\right)+\sqrt{5}\right]=0$$
$$\left(x-3\right)^2-5=0$$
$$x^2-6x+9-5=0$$
$$\boxed{x^2-6x+4=0}$$

146.

$$\left[x-\left(2-i\right)\right]\left[x-\left(2+i\right)\right]=0$$
$$\left[\left(x-2\right)+i\right]\left[\left(x-2\right)-i\right]=0$$
$$\left(x-2\right)^2-i^2=0$$
$$x^2-4x+4+1=0$$
$$\boxed{x^2-4x+5=0}$$

147.

Let x = speed in still air and y = time to make the trip with a tail wind.

Using Distance = Rate × Time, we obtain the following two equations:

With tail wind: $(x+50)y=600$ **(1)**

Against head wind:

$(x-50)(y+1)=600$ (**2**)

Solve **(1)** for y: $y=\dfrac{600}{x+50}$

Substitute this into **(2)** and solve for x:

$$(x-50)\left(\frac{600}{x+50}+1\right)=600$$
$$(x-50)\left(\frac{600+x+50}{x+50}\right)=600$$
$$(x-50)(650+x)=600(x+50)$$
$$650x-32,500-50x+x^2=600x+30,000$$
$$x^2-62,500=0$$
$$(x-250)(x+250)=0$$
$$x=250,\ \cancel{-250}$$

So, the plane in still air travels at $\boxed{250\text{mph}}$.

148.

Let c = Current rate.

Down river: rate = $10+c$ in t hours

Up river: rate = $10-c$ in $t+1$ hours.

Using Distance = Rate × Time, we obtain:

Distance down river: $d=(10+c)(t)=24$ **(1)**

Distance up river: $d=(10-c)(t+1)=24$ **(2)**

Equating (**1**) and (**2**) yields:

$$(10+c)(t)=(10-c)(t+1)$$
$$10t+ct=10t+10-ct-c$$
$$2ct=10-c$$
$$t=\frac{10-c}{2c}\quad(\mathbf{3})$$

Substitute (**3**) into (**1**) to solve for c:

$$(10+c)\left(\frac{10-c}{2c}\right)=24$$
$$(10+c)(10-c)=2c(24)$$
$$100-c^2=48c$$
$$-c^2-48c+100=0$$
$$c^2+48c-100=0$$
$$c=\frac{-48\pm\sqrt{48^2+400}}{2}$$
$$=\frac{-48\pm\sqrt{2704}}{2}=\frac{-48\pm52}{2}$$

The rate must be postive, so $\boxed{c=2\text{ mph}}$.

149.

2 distinct real roots of $ax^2+bx+c=0$ are: $x_1=\dfrac{-b+\sqrt{b^2-4ac}}{2a}$ $x_2=\dfrac{-b-\sqrt{b^2-4ac}}{2a}$

If real roots are negatives of x_1, x_2, then $x_1^*=\dfrac{b-\sqrt{b^2-4ac}}{2a}$ $x_2^*=\dfrac{b+\sqrt{b^2-4ac}}{2a}$

Replace b with $-b$. So, $\boxed{ax^2-bx+c=0}$.

150.

$$ax^2+bx+c=0 \quad\Rightarrow\quad x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

Label the roots as $x_1=\dfrac{-b+\sqrt{b^2-4ac}}{2a}$, $x_2=\dfrac{-b-\sqrt{b^2-4ac}}{2a}$

$$\boxed{x_1^*=\frac{1}{x_1}=\frac{2a}{-b+\sqrt{b^2-4ac}} \qquad x_2^*=\frac{1}{x_2}=\frac{-2a}{b+\sqrt{b^2-4ac}}}$$

Using these roots in a new quadratic equation,

$$\left[x-\frac{2a}{-b+\sqrt{b^2-4ac}}\right]\left[x-\frac{-2a}{b+\sqrt{b^2-4ac}}\right]=0$$

$$\left[x+\frac{2a}{b-\sqrt{b^2-4ac}}\right]\left[x+\frac{2a}{b+\sqrt{b^2-4ac}}\right]=0$$

$$x^2+x\left(\frac{2a}{b+\sqrt{b^2-4ac}}\right)+x\left(\frac{2a}{b-\sqrt{b^2-4ac}}\right)+\left(\frac{2a}{b-\sqrt{b^2-4ac}}\right)\left(\frac{2a}{b+\sqrt{b^2-4ac}}\right)=0$$

$$x^2+\frac{2ax\left(b+\sqrt{b^2-4ac}\right)+2ax\left(b-\sqrt{b^2-4ac}\right)}{\left(b-\sqrt{b^2-4ac}\right)\left(b+\sqrt{b^2-4ac}\right)}+\frac{4a^2}{4ac}=x^2+\frac{4abx+4a^2}{4ac}=0$$

$$x^2+\frac{b}{c}x+\frac{a}{c}=0$$

$$\boxed{cx^2+bx+a=0}$$

151. Let x = speed of small jet (in mph). Then, the speed of the 757-jet = x+100 (mph) Form a right triangle depicting the relative position of the jets after two hours of flight. Using Distance = Rate $\times$ time, this triangle will have legs of length $2x$ and $2(x+100)$, and hypotenuse of length 1000 miles. Using the Pythagorean Theorem then yields

$$(2x)^2+(2(x+100))^2=1000^2$$

$$4x^2+4x^2+800x+40,000=1,000,000$$

$$x^2+100x-120,000=0$$

$$x=\frac{-100\pm\sqrt{100^2+4(120,000)}}{2}=\frac{-100\pm700}{2}=\cancel{-400}, 300$$

So, the speed of the small jet is 300mph and the speed of the 757-jet is 400mph.

152. Let x = speed of small boat (in mph).
Then, the speed of the large boat = x+10 (mph).
Form a right triangle depicting the relative position of the jets after three hours. Using Distance = Rate × time, this triangle will have legs of length $3x$ and $3(x+10)$, and hypotenuse of length 150 miles. Using the Pythagorean Theorem then yields

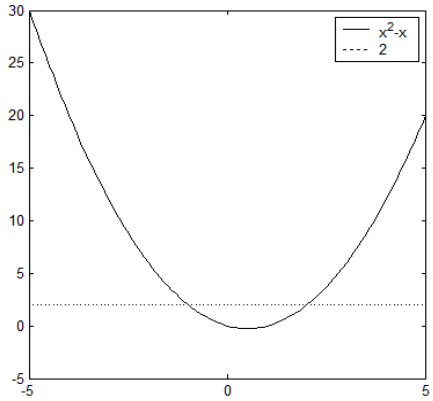
$$(3x)^2 + (3(x+10))^2 = 150^2$$
$$9x^2 + 9x^2 + 180x + 900 = 22,500$$
$$x^2 + 10x - 1200 = 0$$
$$(x+40)(x-30) = 0$$
$$x = \cancel{-40}, 30$$

So, the speed of the small boat is 30mph and the speed of the large boat is 40mph.

153. $x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$

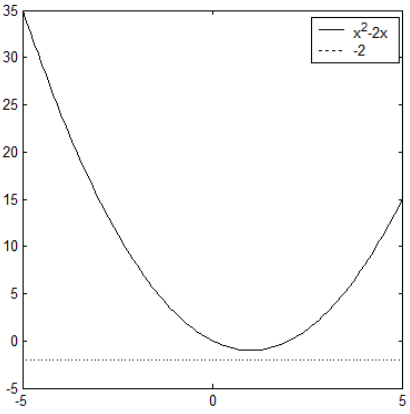
$\boxed{x = -1, 2}$



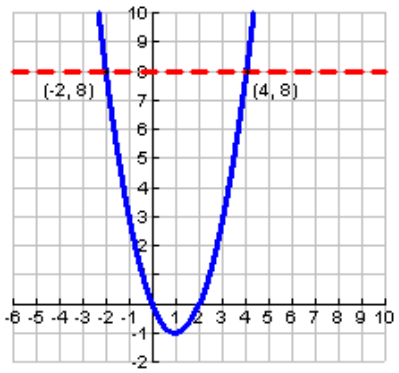
154. $x^2 - 2x + 2 = 0$

$$x = \frac{2 \pm \sqrt{4 - 4 \cdot 2}}{2} = \frac{2 \pm \sqrt{-4}}{2}$$

$\boxed{x = 1 \pm i}$



155. (a) Consider $x^2 - 2x - b = 0$. **(1)**
For $b = 8$, **(1)** factors as $(x-4)(x+2) = 0$, so that $x = -2, 4$.
Graphically, we let $y1 = x^2 - 2x,\ y2 = 8$ and look for the intersection points of the graphs:



Note that they intersect at precisely the *x*-values obtained algebraically. So, yes, these values agree with the points of intersections.

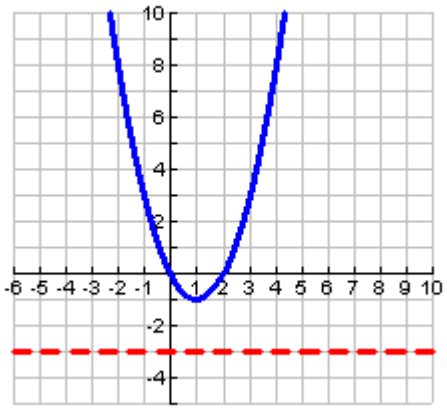
(b) We do the same thing now for different values of *b*.

$\underline{b = -3}$:

$$x^2 - 2x + 3 = 0$$

$$x = \frac{2 \pm \sqrt{4 - 4(3)}}{2} = 1 \pm i\sqrt{2}$$

So, we don't expect the graphs to intersect. Indeed, we have:



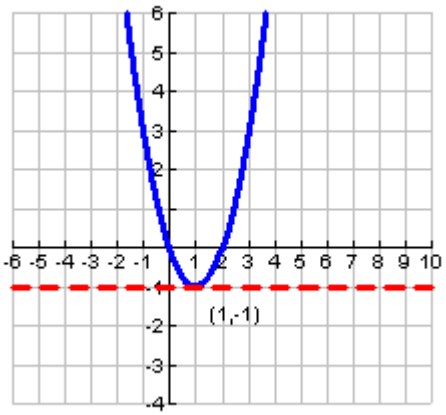
$\underline{b = -1}$:

$$x^2 - 2x + 1 = 0$$

$$(x-1)^2 = 0$$

$$x = 1$$

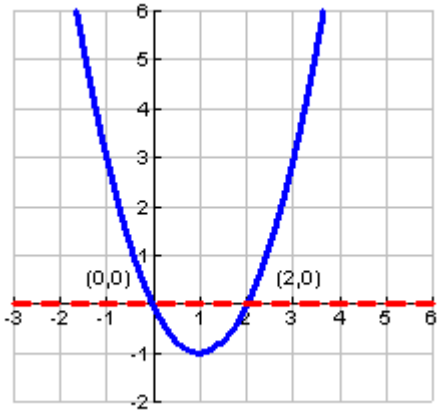
So, we expect the graphs to intersect once. Indeed, we have:



$\underline{b=0}$:

$$x^2-2x=0$$
$$x(x-2)=0$$
$$x=0,2$$

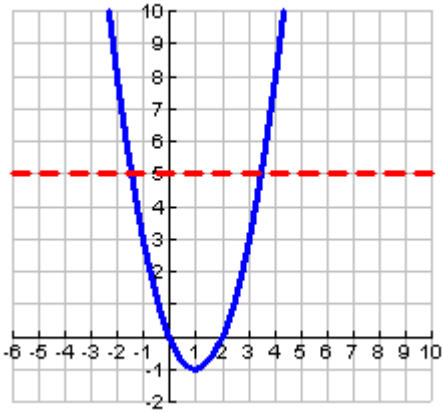
So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



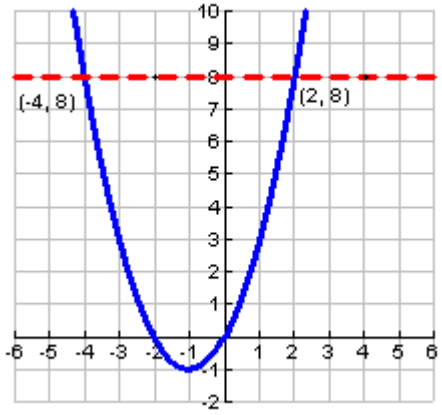
$\underline{b=5}$:

$$x^2-2x-5=0$$
$$x=\frac{2\pm\sqrt{4+4(5)}}{2}=1\pm\sqrt{6}$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



156. (a) Consider $x^2+2x-b=0$. **(1)**
For $b=8$, **(1)** factors as $(x+4)(x-2)=0$, so that $x=2,-4$.
Graphically, we let $y1=x^2+2x,\ y2=8$ and look for the intersection points of the graphs:



Note that they intersect at precisely the *x*-values obtained algebraically. So, yes, these values agree with the points of intersections.

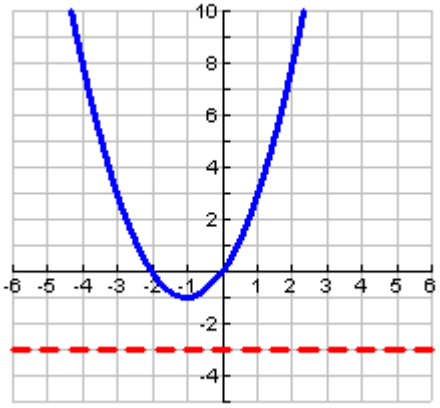
b) We do the same thing now for different values of b.

$\underline{b=-3}$:

$$x^2+2x+3=0$$

$$x=\frac{-2\pm\sqrt{4-4(3)}}{2}=-1\pm i\sqrt{2}$$

So, we don't expect the graphs to intersect. Indeed, we have:



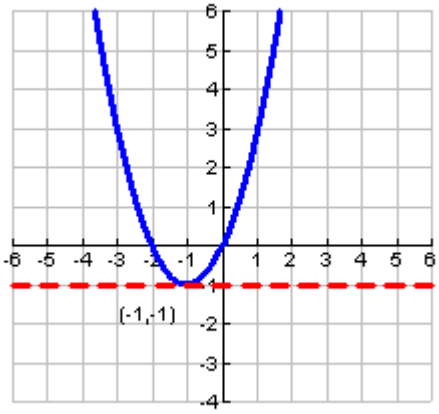
$\underline{b=-1}$:

$$x^2+2x+1=0$$

$$(x+1)^2=0$$

$$x=-1$$

So, we expect the graphs to intersect once. Indeed, we have:



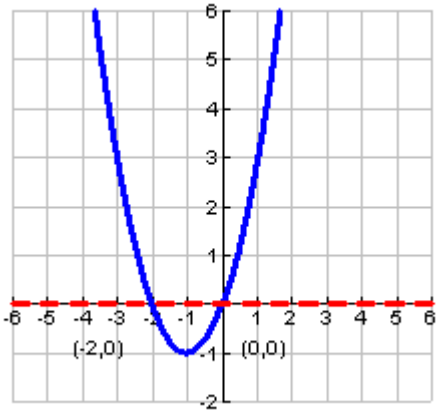
$\underline{b=0}$:

$$x^2+2x=0$$

$$x(x+2)=0$$

$$x=0,-2$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:

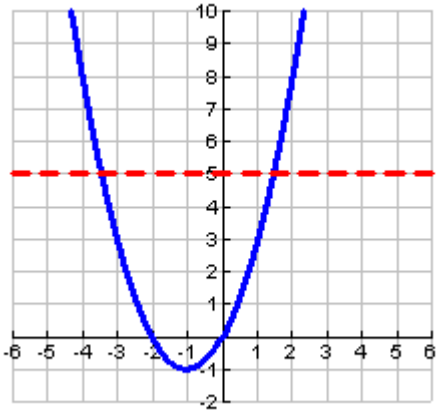


$\underline{b=5}$:

$$x^2+2x-5=0$$

$$x=\frac{-2\pm\sqrt{4+4(5)}}{2}=-1\pm\sqrt{6}$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



Section 1.4 Solutions ----------

1. $\sqrt{t-5}=2$

$t-5=4$

$\boxed{t=9}$

2. $\sqrt{2t-7}=3$

$2t-7=9$

$2t=16$

$\boxed{t=8}$

3. $(4p-7)^{1/2}=5$

$4p-7=25$

$4p=32$

$\boxed{p=8}$

4. $11=(21-p)^{1/2}$

$121=21-p$

$\boxed{p=-100}$

5. $\sqrt{u+1}=-4$

$\boxed{\text{no solution}}$

$u+1=16$

$u=15$

Check: $\sqrt{15+1}$

$=\sqrt{16}=4$

6. $-\sqrt{3-2u}=9$

$\sqrt{3-2u}=-9$

$\boxed{\text{no solution}}$

$3-2u=81$

$2u=-78$

$u=-39$

$-\sqrt{3+2\cdot 39}=-9$

7. $\sqrt[3]{5x+2}=3$

$5x+2=3^3=27$

$5x=25$

$\boxed{x=5}$

8. $\sqrt[3]{1-x}=-2$

$1-x=-8$

$\boxed{x=9}$

9. $(4y+1)^{\frac{1}{3}}=-1$

$4y+1=-1$

$4y=-2$

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

10. $(5x-1)^{\frac{1}{3}}=4$

$5x-1=64$

$5x=65$

$\boxed{x=13}$

11. $\sqrt{12+x}=x$

$12+x=x^2$

$x^2-x-12=0$

$(x+3)(x-4)=0$

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

Check -3:

$\sqrt{12-3}=\sqrt{9}\neq -3$

Check 4:

$\sqrt{12+4}=\sqrt{16}=4$

12. $x=\sqrt{56-x}$

$x^2=56-x$

$x^2+x-56=0$

$(x+8)(x-7)=0$

$x=-8,\ \boxed{7}$

Check -8:

$\sqrt{56+8}=\sqrt{64}\neq -8$

Check 7:

$\sqrt{56-7}=\sqrt{49}=7$

13. $y=5\sqrt{y}$

$y^2=25y$

$y^2-25y=0$

$y(y-25)=0$

$\boxed{y=0,25}$

Check 0:

$0=5\sqrt{0}$

Check 25:

$25=5\sqrt{25}$

14. $\sqrt{y}=\frac{y}{4}$

$y=\frac{y^2}{16}$

$y^2-16y=0$

$y(y-16)=0$

$\boxed{y=0,16}$

Check 0:

$\sqrt{0}=0/4$

Check 16:

$\sqrt{16}=16/4$

15. $s=3\sqrt{s-2}$

$s^2=9(s-2)$

$s^2=9s-18$

$s^2-9s+18=0$

$(s-3)(s-6)=0$

$\boxed{s=3,6}$

Check 3:

$3=3\sqrt{3-2}=3\sqrt{1}$

Check 6:

$6=3\sqrt{6-2}=3\sqrt{4}$

16. $-2s=\sqrt{3-s}$

$4s^2=3-s$

$4s^2+s-3=0$

$(s+1)(4s-3)=0$

$s=\boxed{-1},\frac{3}{4}$

Check -1:

$(-2)(-1)=\sqrt{3+1}$

$2=2$

Check $3/4$:

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

$-\frac{3}{2}=\sqrt{\frac{9}{4}}\neq\frac{3}{2}$

17. $\sqrt{2x+6} = x+3$

$2x+6 = (x+3)^2$

$x^2+4x+3 = 0$

$(x+3)(x+1) = 0$

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

Check -3:

$\sqrt{2(-3)+6} = -3+3$

$\sqrt{0} = 0$

Check -1:

$\sqrt{2(-1)+6} = -1+3$

$\sqrt{4} = 2$

18. $\sqrt{8-2x} = 2x-2$

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

$4x^2-6x-4 = 0$

$2x^2-3x-2 = 0$

$(2x+1)(x-2) = 0$

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

Check $\frac{-1}{2}$:

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

$\sqrt{9} \neq -3$

Check 2:

$\sqrt{8-4} = 2(2)-2$

$\sqrt{4} = 2$

19. $\sqrt{1-3x} = x+1$

$1-3x = x^2+2x+1$

$x^2+5x = 0$

$x(x+5) = 0$

$x = -5, \boxed{0}$

Check -5:

$\sqrt{1+15} \neq -4$

Check 0:

$\sqrt{1} = 1$

20. $\sqrt{2-x} = x-2$

$2-x = (x-2)^2$

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

$x^2-3x+2 = 0$

$(x-2)(x-1) = 0$

$x = \cancel{1}, \boxed{2}$

21. $3x-6\sqrt{x-1} = 3$

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

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

$(x-1)^2 = \left(2\sqrt{x-1}\right)^2$

$(x-1)^2-4(x-1) = 0$

$(x-1)(x-1-4) = 0$

$(x-1)(x-5) = 0$

$x = 1, 5$

22. $5x-10\sqrt{x+2} = -10$

$x-2\sqrt{x+2} = -2$

$x+2 = 2\sqrt{x+2}$

$(x+2)^2 = \left(2\sqrt{x+2}\right)^2$

$(x+2)^2-4(x+2) = 0$

$(x+2)(x+2-4) = 0$

$(x+2)(x-2) = 0$

$x = -2, 2$

23. $3x-6\sqrt{x+2} = 3$

$x-2\sqrt{x+2} = 1$

$x-1 = 2\sqrt{x+2}$

$(x-1)^2 = \left(2\sqrt{x+2}\right)^2$

$(x-1)^2 = 4(x+2)$

$x^2-2x+1 = 4x+8$

$x^2-6x-7 = 0$

$(x-7)(x+1) = 0$

$x = \cancel{-1}, 7$

24. $2x-4\sqrt{x+1} = 4$

$x-2\sqrt{x+1} = 2$

$x-2 = 2\sqrt{x+1}$

$(x-2)^2 = \left(2\sqrt{x+1}\right)^2$

$(x-2)^2 = 4(x+1)$

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

$x^2-8x = 0$

$x(x-8) = 0$

$x = \cancel{0}, 8$

25. $3\sqrt{x+4}-2x = 9$

$3\sqrt{x+4} = 2x+9$

$\left(3\sqrt{x+4}\right)^2 = (2x+9)^2$

$9(x+4) = 4x^2+36x+81$

$9x+36 = 4x^2+36x+81$

$4x^2+27x+45 = 0$

$(4x+15)(x+3) = 0$

$x = -\frac{15}{4}, -3$

26.

$$2\sqrt{x+1}-3x=-5$$
$$2\sqrt{x+1}=3x-5$$
$$\left(2\sqrt{x+1}\right)^2=(3x-5)^2$$
$$4(x+1)=9x^2-30x+25$$
$$4x+4=9x^2-30x+25$$
$$9x^2-34x+21=0$$
$$(9x-7)(x-3)=0$$
$$x=\cancel{\tfrac{7}{9}},\ 3$$

27.

$$\sqrt{x^2-4}=x-1$$
$$x^2-4=(x-1)^2$$
$$x^2-4=x^2-2x+1$$
$$2x=5$$
$$\boxed{x=\frac{5}{2}}$$

28.

$$\sqrt{25-x^2}=x+1$$
$$25-x^2=(x+1)^2$$
$$25-x^2=x^2+2x+1$$
$$2x^2+2x-24=0$$
$$x^2+x-12=0$$
$$(x+4)(x-3)=0$$
$$x=\cancel{-4},\ \boxed{3}$$

29.

$$\sqrt{x^2-2x-5}=x+1$$
$$x^2-2x-5=(x+1)^2$$

No solution.

$$x^2-2x-5=x^2+2x+1$$
$$-6=4x$$
$$\cancel{-\tfrac{3}{2}}=x$$

30.

$$\sqrt{2x^2-8x+1}=x-3$$
$$2x^2-8x+1=(x-3)^2$$
$$2x^2-8x+1=x^2-6x+9$$
$$x^2-2x-8=0$$
$$(x-4)(x+2)=0$$
$$\boxed{x=\cancel{-2},4}$$

31.

$$\sqrt{3x+1}-\sqrt{6x-5}=1$$
$$\sqrt{3x+1}=\sqrt{6x-5}+1$$
$$\left(\sqrt{3x+1}\right)^2=\left(\sqrt{6x-5}+1\right)^2$$
$$3x+1=6x-5+2\sqrt{6x-5}+1$$
$$3x+1=6x-4+2\sqrt{6x-5}$$
$$(-3x+5)^2=\left(2\sqrt{6x-5}\right)^2$$
$$9x^2-30x+25=4(6x-5)$$
$$9x^2-30x+25=24x-20$$
$$9x^2-54x+45=0$$
$$(9x-9)(x-5)=0$$
$$x=1,\cancel{5}$$

32.

$$\sqrt{2-x}+\sqrt{6-5x}=6$$
$$\sqrt{2-x}=6-\sqrt{6-5x}$$
$$\left(\sqrt{2-x}\right)^2=\left(6-\sqrt{6-5x}\right)^2$$
$$2-x=36-12\sqrt{6-5x}+(6-5x)$$
$$2-x=42-5x-12\sqrt{6-5x}$$
$$-40+4x=-12\sqrt{6-5x}$$
$$-10+x=-3\sqrt{6-5x}$$
$$\left(-10+x\right)^2=\left(-3\sqrt{6-5x}\right)^2$$
$$100-20x+x^2=9(6-5x)$$
$$100-20x+x^2=54-45x$$
$$x^2+25x+46=0$$
$$(x+23)(x+2)=0$$
$$x=\cancel{-23},\ -2$$

33.

$$\sqrt{x+12}+\sqrt{8-x}=6$$
$$\sqrt{x+12}=6-\sqrt{8-x}$$
$$\left(\sqrt{x+12}\right)^2=\left(6-\sqrt{8-x}\right)^2$$
$$x+12=36-12\sqrt{8-x}+(8-x)$$
$$2x-32=-12\sqrt{8-x}$$
$$x-16=-6\sqrt{8-x}$$
$$\left(x-16\right)^2=\left(-6\sqrt{8-x}\right)^2$$
$$x^2-32x+256=36(8-x)$$
$$x^2-32x+256=288-36x$$
$$x^2+4x-32=0$$
$$(x-4)(x+8)=0$$
$$x=4,-8$$

34.

$$\sqrt{5-x}+\sqrt{3x+1}=4$$
$$\sqrt{5-x}=4-\sqrt{3x+1}$$
$$\left(\sqrt{5-x}\right)^2=\left(4-\sqrt{3x+1}\right)^2$$
$$5-x=16-8\sqrt{3x+1}+(3x+1)$$
$$5-x=17+3x-8\sqrt{3x+1}$$
$$-12-4x=-8\sqrt{3x+1}$$
$$3+x=2\sqrt{3x+1}$$
$$(3+x)^2=\left(2\sqrt{3x+1}\right)^2$$
$$9+6x+x^2=4(3x+1)$$
$$9+6x+x^2=12x+4$$
$$x^2-6x+5=0$$
$$(x-5)(x-1)=0$$
$$x=1,5$$

35.

$$\sqrt{2x-1}=1+\sqrt{x-1}$$
$$2x-1=1+2\sqrt{x-1}+x-1$$
$$x-1=2\sqrt{x-1}$$
$$x^2-2x+1=4(x-1)$$
$$x^2-2x+1=4x-4$$
$$x^2-6x+5=0$$
$$(x-5)(x-1)=0$$
$$\boxed{x=1,5}$$

36.

$$\sqrt{8-x}=2+\sqrt{2x+3}$$
$$8-x=4+4\sqrt{2x+3}+2x+3$$
$$-3x+1=4\sqrt{2x+3}$$
$$9x^2-6x+1=16(2x+3)$$
$$9x^2-6x+1=32x+48$$
$$9x^2-38x-47=0$$
$$(9x-47)(x+1)=0$$
$$x=\tfrac{47}{9},\ \boxed{-1}$$

37.

$$\sqrt{3x-5}=7-\sqrt{x+2}$$
$$3x-5=49-14\sqrt{x+2}+x+2$$
$$2x-56=-14\sqrt{x+2}$$
$$x-28=-7\sqrt{x+2}$$
$$x^2-56x+784=49(x+2)$$
$$x^2-56x+784=49x+98$$
$$x^2-105x+686=0$$
$$(x-98)(x-7)=0$$
$$x=\boxed{7},\ \cancel{98}$$

38.

$$\sqrt{x+5}=1+\sqrt{x-2}$$
$$x+5=1+2\sqrt{x-2}+x-2$$
$$6=2\sqrt{x-2}$$
$$9=x-2$$
$$\boxed{x=11}$$

39. $\sqrt{2+\sqrt{x}} = \sqrt{x}$

$2+\sqrt{x} = x$

$\sqrt{x} = x-2$

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

$x^2 - 5x + 4 = 0$

$(x-4)(x-1) = 0$

$x = \cancel{1}, \boxed{4}$

40. $\sqrt{2-\sqrt{x}} = \sqrt{x}$

$2-\sqrt{x} = x$

$\sqrt{x} = 2-x$

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

$x^2 - 5x + 4 = 0$

$(x-1)(x-4) = 0$

$x = \boxed{1}, \cancel{4}$

41. Let $u = x^{1/3}$

$u^2 + 2u = 0$

$u(u+2) = 0$

$u = -2, 0$

$x^{1/3} = 0 \rightarrow \boxed{x = 0}$

$x^{1/3} = -2 \rightarrow \boxed{x = -8}$

42. Let $u = x^{1/4}$

$u^2 - 2u = 0$

$u(u-2) = 0$

$u = 0, 2$

$x^{1/4} = 0 \rightarrow \boxed{x = 0}$

$x^{1/4} = 2 \rightarrow \boxed{x = 16}$

43. Let $u = x^2$

$u^2 - 3u + 2 = 0$

$(u-1)(u-2) = 0$

$u = 1, 2$

$x^2 = 1 \rightarrow \boxed{x = \pm 1}$

$x^2 = 2 \rightarrow \boxed{x = \pm\sqrt{2}}$

44. Let $u = x^2$

$u^2 - 8u + 16 = 0$

$(u-4)^2 = 0$

$u = 4$

$x^2 = 4$

$\boxed{x = \pm 2}$

45. Let $u = x^2$

$2u^2 + 7u + 6 = 0$

$(2u+3)(u+2) = 0$

$u = -3/2$ $\quad$ $u = -2$

$x^2 = -3/2$ $\quad$ $x^2 = -2$

$x = \pm i\sqrt{3/2}$ $\quad$ $x = \pm i\sqrt{2}$

$\boxed{x = \dfrac{\pm i\sqrt{6}}{2}}$ $\quad$ $\boxed{x = \pm i\sqrt{2}}$

46. Let $u = x^4$

$u^2 - 17u + 16 = 0$

$(u-16)(u-1) = 0$

$u = 1$ $\quad$ $u = 16$

$x^4 = 1$ $\quad$ $x^4 = 16$

$x^2 = \pm 1$ $\quad$ $x^2 = \pm 4$

if $x^2 = 1$ $\quad$ if $x^2 = 4$

$\boxed{x = \pm 1}$ $\quad$ $\boxed{x = \pm 2}$

if $x^2 = -1$ $\quad$ if $x^2 = -4$

$\boxed{x = \pm i}$ $\quad$ $\boxed{x = \pm 2i}$

47. Let $u = 2x + 1$

$u^2 + 5u + 4 = 0$

$(u+4)(u+1) = 0$

$u = -4$ $\quad$ $u = -1$

$2x + 1 = -4$ $\quad$ $2x + 1 = -1$

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

$\boxed{x = -5/2}$ $\quad$ $\boxed{x = -1}$

48. Let $u = x - 3$

$u^2 + 6u + 8 = 0$

$(u+2)(u+4) = 0$

$u = -2 \quad u = -4$

$x - 3 = -2 \quad x - 3 = -4$

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

49. Let $u = t - 1$

$4u^2 - 9u + 2 = 0$

$(4u-1)(u-2) = 0$

$u = 1/4 \quad u = 2$

$t - 1 = 1/4 \quad t - 1 = 2$

$\boxed{t = 5/4} \quad \boxed{t = 3}$

50. Let $u = 1 - y$

$2u^2 + 5u - 12 = 0$

$(2u-3)(u+4) = 0$

$u = 3/2 \quad u = -4$

$1 - y = 3/2 \quad 1 - y = -4$

$\boxed{y = -1/2} \quad \boxed{y = 5}$

51. Let $u = x^{-4}$

$u^2 - 17u + 16 = 0$

$(u-16)(u-1) = 0$

$u = 1 \quad u = 16$

$x^{-4} = 1 \quad x^{-4} = 16$

$x^2 = 1 \quad x^2 = \pm 1/4$

$\boxed{x = \pm 1, \pm i} \quad \boxed{x = \pm\frac{1}{2}, \pm\frac{1}{2}i}$

52. Let $x = u^{-1}$

$2x^2 + 5x - 12 = 0$

$(2x-3)(x+4) = 0$

$x = 3/2 \quad x = -4$

$u^{-1} = 3/2 \quad u^{-1} = -4$

$\boxed{u = 2/3} \quad \boxed{u = -1/4}$

53. Let $u = y^{-1}$

$3u^2 + u - 4 = 0$

$(3u+4)(u-1) = 0$

$u = -4/3 \quad u = 1$

$y^{-1} = -4/3 \quad y^{-1} = 1$

$\boxed{y = -3/4} \quad \boxed{y = 1}$

54.

Let $u = a^{-1}$

$5u^2 + 11u + 2 = 0$

$(5u+1)(u+2) = 0$

$u = -1/5 \Rightarrow a^{-1} = -1/5 \Rightarrow \boxed{a = -5}$

$u = -2 \Rightarrow a^{-1} = -2 \Rightarrow \boxed{a = -1/2}$

55.

Let $u = z^{1/5}$

$u^2 - 2u + 1 = 0$

$(u-1)^2 = 0$

$u = 1 \Rightarrow z^{1/5} = 1 \Rightarrow \boxed{z = 1}$

56.

Let $u = x^{1/4}$

$2u^2 + u - 1 = 0 \Rightarrow (2u-1)(u+1) = 0 \Rightarrow u = -1, \frac{1}{2}$

$x^{1/4} = \frac{1}{2}$ or ~~$x^{1/4} = -1$~~ $\Rightarrow \boxed{x = \frac{1}{16}}$

57.

$(x+3)^{5/3} = 32$

$x + 3 = 32^{3/5}$

$x = -3 + \left(32^{1/5}\right)^3 = -3 + 2^3 = -3 + 8 = 5$

58.

$(x+2)^{4/3} = 16$

$x + 2 = 16^{3/4}$

$x = -2 + \left(16^{1/4}\right)^3 = -2 + 2^3 = -2 + 8 = 6$

59.

$$(x+1)^{2/3} = 4$$
$$x+1 = \pm 4^{3/2}$$
$$x = -1 \pm 4^{3/2} = -1 \pm 8$$
$$x = -9 \text{ or } x = 7$$

60.

$$(x-7)^{4/3} = 81$$
$$x-7 = \pm 81^{3/4}$$
$$x = 7 \pm 27$$
$$x = -20 \text{ or } x = 34$$

61. Let $u = t^{-1/3}$

$$6u^2 - u - 1 = 0$$
$$(3u+1)(2u-1) = 0$$

$u = -1/3$ $\quad$ $u = 1/2$

$t^{-1/3} = -1/3$ $\quad$ $t^{-1/3} = 1/2$

$t = (-1/3)^{-3}$ $\quad$ $t = (1/2)^{-3}$

$\boxed{t = -27}$ $\quad$ $\boxed{t = 8}$

62. $u = t^{-1/3}$

$$u^2 - u - 6 = 0$$
$$(u-3)(u+2) = 0$$

$u = 3$ $\quad$ $u = -2$

$t^{-1/3} = 3$ $\quad$ $t^{-1/3} = -2$

$t = 3^{-3}$ $\quad$ $t = (-2)^{-3}$

$\boxed{t = 1/27}$ $\quad$ $\boxed{t = -1/8}$

63. $3 = \dfrac{1}{(x+1)^2} + \dfrac{2}{(x+1)}$ $\boxed{x \neq -1}$

$$3(x+1)^2 = 1 + 2(x+1)$$
$$3(x+1)^2 - 2(x+1) - 1 = 0$$

Let $u = x+1$

$$3u^2 - 2u - 1 = 0$$
$$(3u+1)(u-1) = 0$$

$u = -1/3$ $\quad$ $u = 1$

$x + 1 = -1/3$ $\quad$ $x + 1 = 1$

$\boxed{x = -4/3}$ $\quad$ $\boxed{x = 0}$

64. $\dfrac{1}{(x+1)^2} + \dfrac{4}{x+1} + 4 = 0$

$\boxed{x \neq -1}$

LCD $= (x+1)^2$

$$1 + 4(x+1) + 4(x+1)^2 = 0$$

Let $u = x+1$

$$4u^2 + 4u + 1 = 0$$
$$(2u+1)^2 = 0$$
$$u = -1/2$$
$$x + 1 = -1/2$$
$\boxed{u = -3/2}$

65.

$$\left(\frac{1}{2x-1}\right)^2 + \frac{1}{2x-1} - 12 = 0$$

$\boxed{x \neq 1/2}$

Let $u = \dfrac{1}{2x-1}$

$$u^2 + u - 12 = 0$$
$$(u+4)(u-3) = 0$$
$$u = -4$$
$$\frac{1}{2x-1} = -4$$
$$-4(2x-1) = 1$$
$$-8x + 4 = 1$$
$$-8x = -3$$
$\boxed{x = 3/8}$

$$u = 3$$
$$\frac{1}{2x-1} = 3$$
$$3(2x-1) = 1$$
$$6x - 3 = 1$$
$$6x = 4$$
$\boxed{x = 2/3}$

66. $\dfrac{5}{(2x+1)^2} - \dfrac{3}{2x+1} = 2$

$\boxed{x \neq -1/2}$

Let $u = \dfrac{1}{2x+1}$

$$5u^2 - 3u - 2 = 0$$
$$(5u+2)(u-1) = 0$$
$$u = -2/5$$
$$\frac{1}{2x+1} = \frac{-2}{5}$$
$$-2(2x+1) = 5$$
$$-4x - 2 = 5$$
$$-4x = 7$$
$\boxed{x = -7/4}$

$$u = 1$$
$$\frac{1}{2x+1} = 1$$
$$2x + 1 = 1$$
$$2x = 0$$
$\boxed{x = 0}$

67. Let $x = u^{2/3}$

$x^2 - 5x + 4 = 0$

$(x-4)(x-1) = 0$

$x = 4 \qquad x = 1$

$u^{2/3} = 4 \qquad u^{2/3} = 1$

$u = \pm 4^{3/2} \qquad u = \pm 1^{3/2}$

$\boxed{u = \pm 8} \qquad \boxed{u = \pm 1}$

68. Let $x = u^{2/3}$

$x^2 + 5x + 4 = 0$

$(x+4)(x+1) = 0$

$x = -4 \qquad x = -1$

$u^{2/3} = -4 \qquad u^{2/3} = -1$

$u = (-4)^{3/2} \qquad u = (-1)^{3/2}$

$u = \left[(-4)^{1/2}\right]^3 \qquad u = \left[(-1)^{1/2}\right]^3$

$u = [2i]^3 \qquad u = (\pm i)^3$

$\boxed{u = \pm 8i} \qquad \boxed{u = \pm i}$

69. $t^4 - t^2 - 6 = 0$

Let $u = t^2$

$u^2 - u - 6 = 0$

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

$u = -2 \qquad u = 3$

$t^2 = -2 \qquad t^2 = 3$

~~$t = \pm i\sqrt{2}$~~ $\qquad \boxed{t = \sqrt{3},\ \cancel{-\sqrt{3}}}$

70.

$u = \sqrt[4]{-2u^2 - 1}$

$u^4 = -2u^2 - 1$

$u^4 + 2u^2 + 1 = 0$

Let $x = u^2$. Then, $x^2 + 2x + 1 = 0$

$(x+1)^2 = 0 \implies x = -1$

So, $u^2 = -1 \implies u = i, \cancel{-i}$

$\boxed{u = i}$

71.

$x^3 - x^2 - 12x = 0$

$x(x^2 - x - 12) = 0$

$x(x-4)(x+3) = 0$

$\boxed{x = 0, -3, 4}$

72.

$2y^3 - 11y^2 + 12y = 0$

$y(2y^2 - 11y + 12) = 0$

$y(2y-3)(y-4) = 0$

$\boxed{y = 0, 4, 3/2}$

73.

$4p^3 - 9p = 0$

$p(4p^2 - 9) = 0$

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

$\boxed{p = 0, \pm 3/2}$

74.

$25x^3 = 4x$

$25x^3 - 4x = 0$

$x(25x^2 - 4) = 0$

$x(5x-2)(5x+2) = 0$

$\boxed{x = 0, \pm 2/5}$

75.

$u^5 - 16u = 0$

$u(u^4 - 16) = 0$

$u(u^2 - 4)(u^2 + 4) = 0$

$u(u-2)(u+2)(u-2i)(u+2i) = 0$

$\boxed{u = 0, \pm 2, \pm 2i}$

76.

$$t^5 - 81t = 0$$
$$t\left(t^4 - 81\right) = 0$$
$$t\left(t^2 - 9\right)\left(t^2 + 9\right) = 0$$
$$t(t-3)(t+3)(t-3i)(t+3i) = 0$$
$$\boxed{t = 0,\ \pm 3,\ \pm 3i}$$

77.

$$x^3 - 5x^2 - 9x + 45 = 0$$
$$\left(x^3 - 5x^2\right) - (9x - 45) = 0$$
$$x^2(x-5) - 9(x-5) = 0$$
$$\left(x^2 - 9\right)(x-5) = 0$$
$$(x-3)(x+3)(x-5) = 0$$
$$\boxed{x = \pm 3,\ 5}$$

78.

$$2p^3 - 3p^2 - 8p + 12 = 0$$
$$\left(2p^3 - 3p^2\right) - (8p - 12) = 0$$
$$p^2(2p-3) - 4(2p-3) = 0$$
$$\left(p^2 - 4\right)(2p-3) = 0$$
$$(p-2)(p+2)(2p-3) = 0$$
$$\boxed{p = \pm 2,\ 3/2}$$

79.

$$y(y-5)^3 - 14(y-5)^2 = 0$$
$$(y-5)^2\left[y(y-5) - 14\right] = 0$$
$$(y-5)^2\left(y^2 - 5y - 14\right) = 0$$
$$(y-5)^2(y-7)(y+2) = 0$$
$$\boxed{y = -2, 5, 7}$$

80.

$$v(v+3)^3 - 40(v+3)^2 = 0$$
$$(v+3)^2\left[v(v+3) - 40\right] = 0$$
$$(v+3)^2\left(v^2 + 3v - 40\right) = 0$$
$$(v+3)^2(v-5)(v+8) = 0$$
$$\boxed{v = -8, -3, 5}$$

81.

$$x^{9/4} - 2x^{5/4} - 3x^{1/4} = 0$$
$$x^{1/4}\left[x^2 - 2x - 3\right] = 0$$
$$x^{1/4}(x-3)(x+1) = 0$$
$$\boxed{x = 0, 3, \cancel{-1}}$$

82.

$$u^{7/3} + u^{4/3} - 20u^{1/3} = 0$$
$$u^{1/3}\left[u^2 + u - 20\right] = 0$$
$$u^{1/3}(u+5)(u-4) = 0$$
$$\boxed{u = -5, 0, 4}$$

83.

$$t^{5/3} - 25t^{-1/3} = 0$$
$$t^{-1/3}\left[t^2 - 25\right] = 0$$
$$t^{-1/3}(t-5)(t+5) = 0$$
$$\boxed{t = \pm 5}$$

(Note: $t^{-1/3} = 0$ has no solution.)

84.

$$4x^{9/5} - 9x^{-1/5} = 0$$
$$x^{-1/5}\left[4x^2 - 9\right] = 0$$
$$x^{-1/5}(2x-3)(2x+3) = 0$$
$$\boxed{x = \pm 3/2}$$

(Note: $x^{-1/5} = 0$ has no solution.)

85.

$$y^{3/2} - 5y^{1/2} + 6y^{-1/2} = 0$$
$$y^{-1/2}\left[y^2 - 5y + 6\right] = 0$$
$$y^{-1/2}(y-3)(y-2) = 0$$
$$\boxed{y = 2, 3}$$

(Note: $y^{-1/2} = 0$ has no solution.)

86.

$$4p^{5/3} - 5p^{2/3} - 6p^{-1/3} = 0$$
$$p^{-1/3}\left(4p^2 - 5p - 6\right) = 0$$
$$p^{-1/3}(4p+3)(p-2) = 0$$
$$\boxed{p = -3/4, 2}$$

(Note: $p^{-1/3} = 0$ has no solution.)

87. Solve $d(t) = 3$. (Note: The right-side is 3, and not 3,000,000, because $d(t)$ is measured in millions.)

$$3\sqrt{t+1} - 0.75t = 3$$
$$3\sqrt{t+1} = 3 + 0.75t$$
$$\left(3\sqrt{t+1}\right)^2 = \left(3 + 0.75t\right)^2$$
$$9t + 9 = 9 + 4.5t + 0.5625t^2$$
$$0.5625t^2 - 4.5t = 0$$
$$t(0.5625t - 4.5) = 0$$
$$t = 0, \ \tfrac{4.5}{0.5625} = 8$$

So, this occurs in January and September.

88. Solve $d(t) = 4$. (Note: The right-side is 4, and not 4,000,000, because $d(t)$ is measured in millions.)

$$3\sqrt{t+1} - 0.75t = 4$$
$$3\sqrt{t+1} = 4 + 0.75t$$
$$\left(3\sqrt{t+1}\right)^2 = \left(4 + 0.75t\right)^2$$
$$9t + 9 = 16 + 6t + 0.5625t^2$$
$$0.5625t^2 - 3t + 7 = 0$$

No real solutions

So, this never occurs. The demand for the product is never 4,000,000 units.

89. Solve $\sqrt{\frac{wh}{3,600}} = BSA$ for h, when $w = 72$ and $BSA = 1.8$.

$$\sqrt{\frac{72h}{3,600}} = 1.8$$
$$\frac{\sqrt{72h}}{60} = 1.8$$
$$\sqrt{72h} = (1.8)(60)$$
$$72h = 108^2$$
$$h = \frac{11,664}{72} = 162$$

So, the height of such a female is 162 cm.

90. Solve $\sqrt{\frac{wh}{3,600}} = BSA$ for w, when $h = 177$ and $BSA = 2.1$.

$$\sqrt{\frac{177w}{3,600}} = 2.1$$
$$\frac{\sqrt{177w}}{60} = 2.1$$
$$\sqrt{177w} = (2.1)(60)$$
$$177w = 126^2$$
$$w = \frac{15,876}{177} \approx 90$$

So, the weight of such a male is about 90 kg.

91.

$$C = \sqrt{10 + a}$$
$$C = 9$$
$$9 = \sqrt{10 + a}$$
$$81 = 10 + a$$
$$\boxed{a = 71 \text{ years old}}$$

92.

$$C = \sqrt{5a + 1}$$
$$C = 20$$
$$20 = \sqrt{5a + 1}$$
$$400 = 5a + 1$$
$$5a = 399$$
$$a = \frac{399}{5} = 79.8$$
$$\boxed{79.8 \text{ years old}}$$

93.

$P = 5\sqrt{t^2+1}+50$

$P = 85$

$85 = 5\sqrt{t^2+1}+50$

$35 = 5\sqrt{t^2+1}$

$7 = \sqrt{t^2+1}$

$49 = t^2+1$

$t^2 = 48$

$t = \sqrt{48}$

$t = 4\sqrt{3}$ (t must be ≥ 0)

$t \cong 7$ months

March

94.

$S = 1000 + 10\sqrt{2t}$

$S = 1230$

$1230 = 1000 + 10\sqrt{2t}$

$230 = 10\sqrt{2t}$

$23 = \sqrt{2t}$

$529 = 2t$

$t = 264.5 \cong 265$

In the year 2255

95.

$T = \frac{\sqrt{d}}{4} + \frac{d}{1100}$, $T = 3$

$3 = \frac{\sqrt{d}}{4} + \frac{d}{1100}$

LCD = 1100

$3300 = 275\sqrt{d} + d$

$d + 275\sqrt{d} - 3300 = 0$

Let $u = \sqrt{d}$

$u^2 + 275u - 3300 = 0$

$u = \frac{-275 \pm \sqrt{275^2 + 4 \cdot 1 \cdot 3300}}{2(1)}$

$u = -286.5, 11.5$

$\sqrt{d} = 11.5$

$d = 132$ ft

96. $\frac{\sqrt{d}}{4} = 3 \Rightarrow \sqrt{d} = 12 \Rightarrow d = 144$ feet

97.

$$1 = 2\pi\sqrt{\frac{L}{9.8}}$$

$$\left(\frac{1}{2\pi}\right)^2 = \frac{L}{9.8}$$

$$0.24824\,\text{m} \approx \frac{9.8}{4\pi^2} = L$$

Convert to centimeters:

$$\frac{0.24824\ \cancel{\text{m}} \mid 100\ \text{cm}}{\mid 1\ \cancel{\text{m}}} \approx 25\,\text{cm}$$

98.

$$1 = 2\pi\sqrt{\frac{L}{32}}$$

$$\left(\frac{1}{2\pi}\right)^2 = \frac{L}{32}$$

$$0.81057\,\text{ft} \approx \frac{32}{4\pi^2} = L$$

Convert to inches:

$$\frac{0.81057\ \cancel{\text{ft}} \mid 12\ \text{in}}{\mid 1\ \cancel{\text{ft}}} \approx 10\,\text{in}$$

99.

$$18 = 30\sqrt{1-\frac{v^2}{c^2}}$$

$$\frac{3}{5} = \frac{18}{30} = \sqrt{1-\frac{v^2}{c^2}}$$

$$\left(\frac{3}{5}\right)^2 = 1-\frac{v^2}{c^2}$$

$$\frac{16}{25} = \frac{v^2}{c^2}$$

$$v^2 = \frac{16}{25}c^2$$

$$v = \frac{4}{5}c$$

So, 80% of the speed of light.

100.

$$5 = 30\sqrt{1-\frac{v^2}{c^2}}$$

$$\frac{1}{6} = \frac{5}{30} = \sqrt{1-\frac{v^2}{c^2}}$$

$$\left(\frac{1}{6}\right)^2 = 1-\frac{v^2}{c^2}$$

$$\frac{35}{36} = \frac{v^2}{c^2}$$

$$v^2 = \frac{35}{36}c^2$$

$$v = \frac{\sqrt{35}}{6}c$$

So, about 98.6% of the speed of light.

101. $t = 5$ is extraneous; there is no solution.

102. $x = -1$ is extraneous.

$\boxed{x = 2}$

103. Forgot about the substitution $u = x^{1/3}$.

$x^{1/3} = -4, 5$

$\boxed{x = -64, 125}$

104. $x^2 = -1$

$x = \pm\sqrt{-i}$

$\boxed{x = \pm i}$ $(\text{not } \pm 1)$

105. True

Let $u = (2x-1)^3$

$u^2 + 4u + 3 = 0$ (quadratic)

106. False

Let $u = t^5$

$u^5 + 2u + 1 = 0$ (not quadratic)

107. False

108. False

$\left(\sqrt{x+2} + \sqrt{x}\right)^2 = \left(\sqrt{x+5}\right)^2$

$x + 2 + 2\sqrt{x}\sqrt{x+2} + x = x + 5$

109. Solve $\sqrt{x^2} = x$.

If $x \geq 0$, then $\sqrt{x^2} = x$, while if $x < 0$, then $\sqrt{x^2} = -x$. So, the solution set is $\boxed{[0, \infty)}$.

110. Solve $\sqrt{x^2} = -x$.

If $x \geq 0$, then $\sqrt{x^2} = x$, while if $x < 0$, then $\sqrt{x^2} = -x$. So, the solution set is $\boxed{(-\infty, 0]}$.

111. Let $u = 3x^2 + 2x$

$u = \sqrt{u}$

$u = 0, 1$

$3x^2 + 2x = 0$

$x(3x+2) = 0$

$\boxed{x = 0, -2/3}$

$3x^2 + 2x = 1$

$3x^2 + 2x - 1 = 0$

$(3x-1)(x+1) = 0$

$\boxed{x = -1, 1/3}$

112. Factor out $x^{1/3}$

$x^{1/3}\left(3x^{1/4} - x^{1/2} - 2\right) = 0$

Let $u = x^{1/4}$.

$3u - u^2 - 2 = 0$

$u^2 - 3u + 2 = 0$

$(u-2)(u-1) = 0$

$u = 2$

$x^{1/4} = 2$

$\boxed{x = 16}$

$u = 1$

$x^{1/4} = 1$

$\boxed{x = 1}$

$x^{1/3} = 0$

$\boxed{x = 0}$

113. $\sqrt{x+6}+\sqrt{11+x}=5\sqrt{3+x}$

$(x+6)+2\sqrt{x+6}\sqrt{11+x}+(11+x)=25(3+x)$

$2x+17+2\sqrt{x+6}\sqrt{11+x}=75+25x$

$2\sqrt{x+6}\sqrt{11+x}=58+23x$

$4(x+6)(11+x)=529x^2+2668x+3364$

$4(x^2+17x+66)=529x^2+2668x+3364$

$4x^2+68x+264=529x^2+2668x+3364$

$525x^2+2600x+3100=0$

$21x^2+104x+124=0$

$(21x+62)(x+2)=0$

$x=\cancel{\frac{-62}{21}}$, $\boxed{x=-2}$

114.

$$\left[2x\left(x\left(x\right)^{1/2}\right)^{1/3}\right]^{1/4}=2$$

$$2x\left(x\left(x\right)^{1/2}\right)^{1/3}=2^4=16$$

$$x\left[x\cdot x^{1/2}\right]^{1/3}=8$$

$$\left[x\cdot x^{1/2}\right]^{1/3}=\frac{8}{x}\quad \boxed{x\neq 0}$$

$$x\cdot x^{1/2}=x^{3/2}=\left(\frac{8}{x}\right)^3$$

$$x=\left[\left(\frac{8}{x}\right)^3\right]^{2/3}=\left(\frac{8}{x}\right)^2=\frac{64}{x^2}$$

$$x^3=64$$

$$\boxed{x=4}$$

115.

$$\sqrt{x-3}=4-\sqrt{x+2}$$

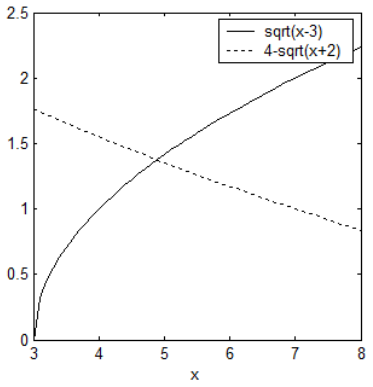
$$x-3=16-8\sqrt{x+2}+x+2$$

$$-21=-8\sqrt{x+2}$$

$$441=64(x+2)=64x+128$$

$$313=64x$$

$$\boxed{x=\frac{313}{64}\cong 4.891}$$



116.

$$2\sqrt{x+1}=1+\sqrt{3-x}$$

$$4(x+1)=1+2\sqrt{3-x}+3-x$$

$$4x+4=4-x+2\sqrt{3-x}$$

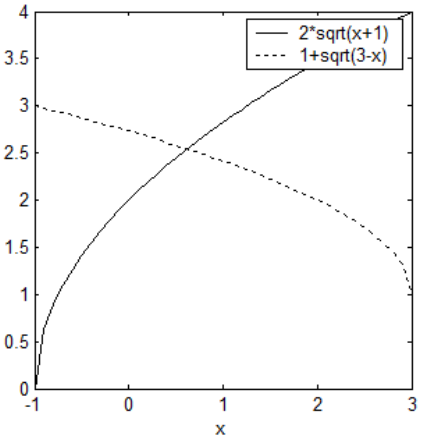
$$5x=2\sqrt{3-x}$$

$$25x^2=4(3-x)=12-4x$$

$$25x^2+4x-12=0$$

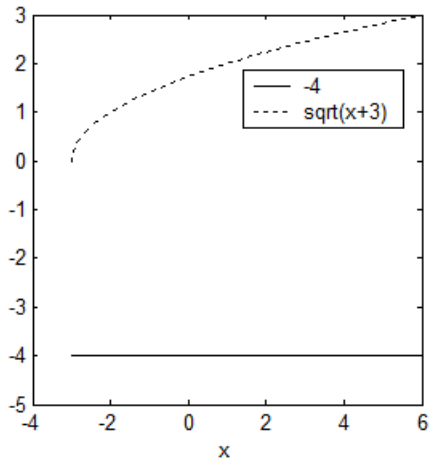
$$x=\frac{-4\pm\sqrt{4^2-4(25)(-12)}}{2(25)}$$

$$x\cong\frac{-4\pm 34.9}{50}\cong\cancel{-0.778},\ \boxed{0.62}$$



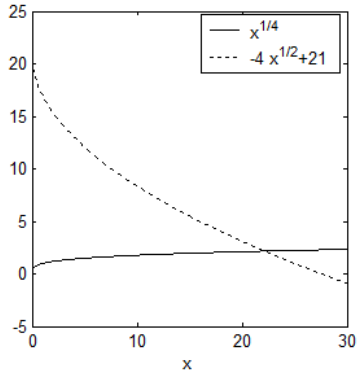
117.

$$-4 = \sqrt{x+3}$$
$$16 = x+3$$
$$x = 13 \text{ (Extraneous)}$$
$$\boxed{\text{no solution}}$$



118.

$$x^{1/4} = -4x^{1/2} + 21$$
$$4x^{1/2} + x^{1/4} - 21 = 0$$
Let $u = x^{1/4}$ to obtain
$$4u^2 + u - 21 = 0$$
$$u = \frac{-1 \pm \sqrt{1 - 4(4)(-21)}}{2(4)}$$
$$u \cong \frac{-1 \pm 18.4}{8} \cong -2.4,\ 2.2$$
$x^{1/4} = -2.4$ $\boxed{\text{no solution}}$ $x^{1/4} = 2.2$ $\boxed{x \cong 22.2}$

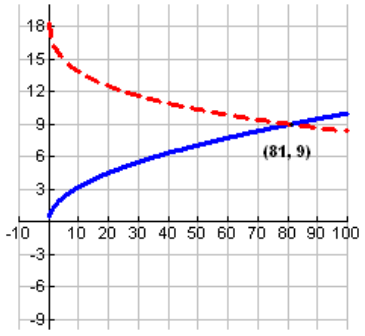


119.

$$x^{1/2} = -4x^{1/4} + 21$$
$$x^{1/2} + 4x^{1/4} - 21 = 0$$
Let $u = x^{1/4}$ to obtain
$$u^2 + 4u - 21 = 0$$
$$(u+7)(u-3) = 0$$
$$u = -7, 3$$
$x^{1/4} = -7$ $\boxed{\text{no solution}}$ $x^{1/4} = 3$ $\boxed{x = 81}$

Yes, the two solutions agree.

Graphically, let:
$y1 = x^{1/2}$, $y2 = -4x^{1/4} + 21$.



120.

$x^{-1} = 3x^{-2} - 10$

$3x^{-2} - x^{-1} - 10 = 0$

Let $u = x^{-1}$ to obtain

$3u^2 - u - 10 = 0$

$(3u + 5)(u - 2) = 0$

$u = -5/3,\ 2$

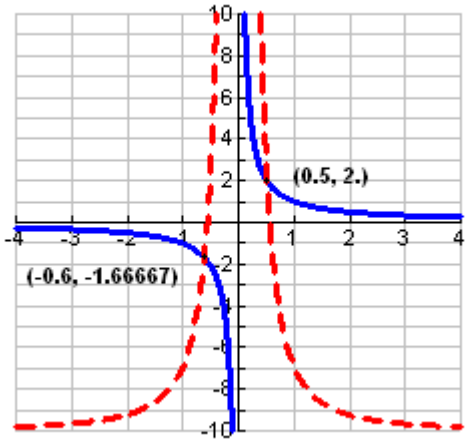
$x^{-1} = -5/3 \qquad x^{-1} = 2$

$\boxed{x = -3/5} \qquad \boxed{x = 1/2}$

Yes, the two solutions agree.

Graphically, let:

$y1 = x^{-1},\ y2 = 3x^{-2} - 10$.



121.

$x^{-2} = 3x^{-1} - 10$

$x^{-2} - 3x^{-1} + 10 = 0$

Let $u = x^{-1}$ to obtain

$u^2 - 3u + 10 = 0$

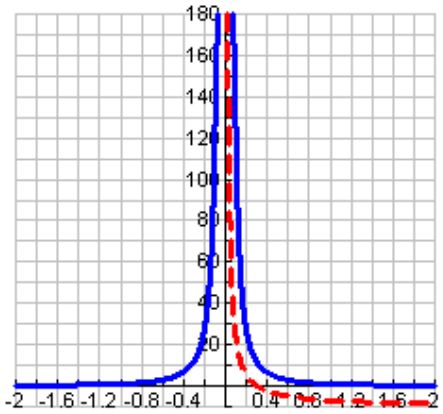
$u = \dfrac{3 \pm \sqrt{9 - 4(10)(1)}}{2} = \dfrac{3 \pm i\sqrt{31}}{2}$

So, there are no real solutions. As such, we expect the graphs to not intersect.

Yes, the two solutions agree.

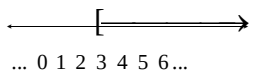
Graphically, let:

$y1 = x^{-2},\ y2 = 3x^{-1} - 10$.

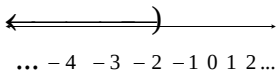


Section 1.5 Solutions ----------

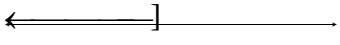
1. $[3, \infty)$



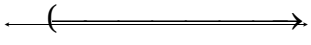
2. $(-\infty, -2)$

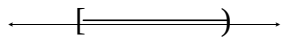
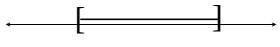
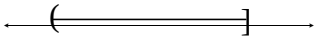
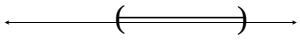
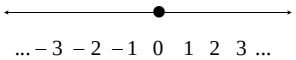
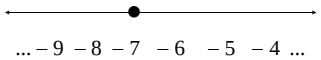
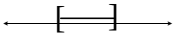
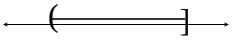
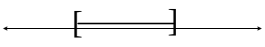
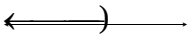
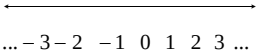
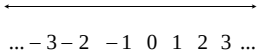
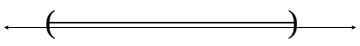


3. $(-\infty, -5]$

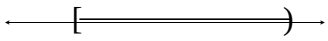


4. $(-7, \infty)$

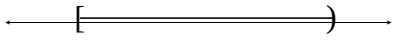


5. $[-2,3)$ 	**6.** $[-4,-1]$ 
7. $(-3,5]$ 	**8.** $(0,6)$ 
9. $[0,0]$ 	**10.** $[-7,-7]$ 
11. $[4,6]$ 	**12.** $(-3,2]$ 
13. $[-8,-6]$ 	**14.** $(-\infty,2)$ 
15. $\varnothing$ 	**16.** $\varnothing$ 
17. $\{x : 0 \le x < 2\}$	**18.** $\{x : 0 < x \le 3\}$
19. $\{x : -7 < x < -2\}$	**20.** $\{x : -3 \le x \le 2\}$
21. $\{x : x \le 6\}$	**22.** $\{x : x > 5\}$
23. $\{x : -\infty < x < \infty\}$	**24.** $\{x : 4 \le x \le 4\}$
25. $-3 < x \le 7 \quad (-3,7]$	**26.** $-\frac{1}{2} \le x < \frac{7}{8} \quad \left[-\frac{1}{2}, \frac{7}{8}\right)$
27. $3 \le x < 5 \quad [3,5)$	**28.** $4 < x \le 8 \quad (4,8]$
29. $-2 \le x \quad [-2,\infty)$	**30.** $x < -3 \quad (-\infty,-3)$
31. $-\infty < x < 8 \quad (-\infty,8)$	**32.** $-2 \le x < \infty \quad [-2,\infty)$
33. $(-5,3)$ 	**34.** $[-5,7)$ 

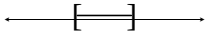
35. $[-6,5)$



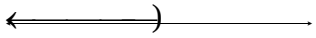
36. $[-6,1)$



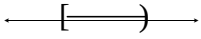
37. $[-1,1]$



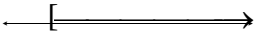
38. $(-\infty,-5)$



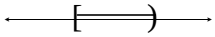
39. $[1,4)$



40. $[-3,\infty)$

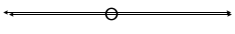


41. $[-1,2)$



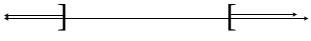
42. $[-2,5)$

43. $(-\infty,4)\cup(4,\infty)$

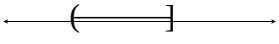


44. $(-\infty,\infty)$

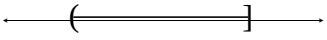
45. $(-\infty,-3]\cup[3,\infty)$



46. $(-2,1]$

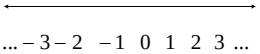


47. $(-3,2]$

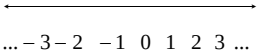


48. $(-\infty,\infty)$

49. $\varnothing$



50. $\varnothing$



51. $(-\infty,2)\cup[3,5)$

52. $(-\infty,-5)\cup[0,2]$

53. $(-\infty,-4]\cup(2,5]$

54. $[-12,-5)\cup(-2,\infty)$

55. $[-4,-2)\cup(3,7]$

56. $(-\infty,-2)\cup(2,\infty)$

57. $(-6,-3]\cup[0,4)$

58. $(-\infty,-5]\cup[-1,\infty)$

59. $x-3<7$

$x<10$

$\boxed{(-\infty,10)}$

60. $x+4>9$

$x>5$

$\boxed{(5,\infty)}$

61. $3x-2\le 4$

$3x\le 6$

$x\le 2$

$\boxed{(-\infty,2]}$

62. $3x+7\ge -8$

$3x\ge -15$

$x\ge -5$

$\boxed{[-5,\infty)}$

63. $-5p\ge 10$

Divide by -5 and flip sign

$p\le -2$

$\boxed{(-\infty,-2]}$

64. $-4u<12$

Divide by -4 and flip sign

$u>-3$

$\boxed{(-3,\infty)}$

65. $3-2x\le 7$

$-2x\le 4$

$x\ge -2$

$\boxed{[-2,\infty)}$

66. $4-3x>-17$

$-3x>-21$

$x<7$

$\boxed{(-\infty,7)}$

67. $-1.8x+2.5>3.4$

$-1.8x>0.9$

$x<\frac{0.9}{-1.8}=-0.5$

$\boxed{(-\infty,-0.5)}$

68. $2.7x-1.3<6.8$

$2.7x<8.1$

$x<3$

$\boxed{(-\infty,3)}$

69. $3(t+1)>2t$

$3t+3>2t$

$t+3>0$

$t>-3$

$\boxed{(-3,\infty)}$

70. $2(y+5)\le 3(y-4)$

$2y+10\le 3y-12$

$10\le y-12$

$22\le y$

$\boxed{[22,\infty)}$

71. $7-2(1-x)>5+3(x-2)$

$7-2+2x>5+3x-6$

$5+2x>3x-1$

$5>x-1$

$x<6$

$\boxed{(-\infty,6)}$

72. $4-3(2+x)<5$

$4-6-3x<5$

$-2-3x<5$

$-3x<7$

$x>-7/3$

$\boxed{(-7/3,\infty)}$

73.

$$\frac{x+2}{3}-2\ge\frac{x}{2}$$

$\text{LCD}=6$

$2(x+2)-2(6)\ge x(3)$

$2x+4-12\ge 3x$

$-8\ge x$ or $x\le -8$

$\boxed{(-\infty,-8]}$

74.

$$\frac{y-3}{5}-2\le\frac{y}{4}$$

$$20\cdot\left(\frac{y-3}{5}-2\right)\le 20\cdot\frac{y}{4}$$

$4(y-3)-2(20)\le 5y$

$4y-12-40\le 5y$

$-52\le y$

$\boxed{[-52,\infty)}$

75.

$$\frac{t-5}{3}\le -4$$

$\text{LCD}=3$

$t-5\le -4(3)$

$t-5\le -12$

$t\le -7$

$\boxed{(-\infty,-7]}$

76.

$$\frac{2p+1}{5}>-3$$

$$5\cdot\left(\frac{2p+1}{5}\right)>5\cdot(-3)$$

$2p+1>-15$

$2p>-16$

$p>-8$

$\boxed{(-8,\infty)}$

77.

Multiply by $\text{LCD}=6$

$4y-3(5-y)<10y-6(2+y)$

$4y-15+3y<10y-12-6y$

$7y-15<4y-12$

$3y-15<-12$

$3y<3$

$y<1$

$\boxed{(-\infty,1)}$

78.

$$\frac{s}{2}-\frac{s-3}{3}>\frac{s}{4}-\frac{1}{12}$$

$\text{LCD}=12$

$6s-4(s-3)>3s-1$

$6s-4s+12>3s-1$

$2s+12>3s-1$

$s<13$

$\boxed{(-\infty,13)}$

79.

$-2<x+3<5$

$-5<x<2$

$\boxed{(-5,2)}$

80.

$1<x+6<12$

$-5<x<6$

$\boxed{(-5,6)}$

81.

$-8 \le 4 + 2x < 8$

$-12 \le 2x < 4$

Divide by 2

$-6 \le x < 2$

$\boxed{[-6, 2)}$

82.

$0 < 2 + x \le 5$

$-2 < x \le 3$

$\boxed{(-2, 3]}$

83.

$-3 < 1 - x \le 9$

$-4 < -x \le 8$

Divide by -1

Flip the signs

$-8 \le x < 4$

$\boxed{[-8, 4)}$

84.

$3 \le -2 - 5x \le 13$

$5 \le -5x \le 15$

Divide by -5

Flip the signs

$-1 \ge x \ge -3$

$\boxed{[-3, -1]}$

85.

$0 < 2 - \frac{1}{3}y < 4$

$-2 < -\frac{1}{3}y < 2$

Multiply by -3

Flip the signs

$-6 < y < 6$

$\boxed{(-6, 6)}$

86.

$3 < \frac{1}{2}A - 3 < 7$

$6 < \frac{1}{2}A < 10$

Multiply by 2

$12 < A < 20$

$\boxed{(12, 20)}$

87.

$\frac{1}{2} \le \frac{1+y}{3} \le \frac{3}{4}$

Multiply by 3

$\frac{3}{2} \le 1 + y \le \frac{9}{4}$

$\frac{1}{2} \le y \le \frac{5}{4}$

$\boxed{\left[\frac{1}{2}, \frac{5}{4}\right]}$

88.

$-1 < \frac{2-z}{4} \le \frac{1}{5}$

Multiply by 4

$-4 < 2 - z \le \frac{4}{5}$

$-6 < -z \le -\frac{6}{5}$

Multiply by -1

Flip the signs

$6 > z \ge \frac{6}{5}$

$\boxed{\left[\frac{6}{5}, 6\right)}$

89.

$-0.7 \le 0.4x + 1.1 \le 1.3$

$-1.8 \le 0.4x \le 0.2$

$-\frac{1.8}{0.4} \le x \le \frac{0.2}{0.4}$

$-4.5 \le x \le 0.5$

$\boxed{[-4.5,\ 0.5]}$

90.

$7.1 > 4.7 - 1.2x > 1.1$

$2.4 > -1.2x > -3.6$

$-2 < x < 3$

$\boxed{(-2, 3)}$

91.

Low weight:

$\underbrace{110}_{1^{st}\ 5\text{ feet}} + \underbrace{2}_{2\text{ lbs}}\underbrace{(9)}_{9\text{ inches}} = 128$

High weight:

$\underbrace{110}_{1^{st}\ 5\text{ feet}} + \underbrace{6}_{6\text{ lbs}}\underbrace{(9)}_{9\text{ inches}} = 164$

$\boxed{128 \le w \le 164}$

92. Low weight:

$$\underbrace{105}_{1^{st}\ 5\text{ feet}} + \underbrace{1}_{1\text{ lbs}}\ \underbrace{(9)}_{9\text{ inches}} = 114$$

High weight:

$$\underbrace{105}_{1^{st}\ 5\text{ feet}} + \underbrace{5}_{5\text{ lbs}}\ \underbrace{(9)}_{9\text{ inches}} = 150$$

$\boxed{114 \le w \le 150}$

93.

$\text{Revenue} = 100x \left(x = \#\text{ dresses}\right)$

$\text{Cost} = 4000 + 20x$

$\text{Profit} = \text{Revenue} - \text{Cost}$

$= 100x - (4000 + 20x) > 0$

$100x - 4000 - 20x > 0$

$80x > 4000$

$x > 50$

$\boxed{\text{More than 50 dresses}}$

94.

$\text{If champ by age 2: Revenue} = 30,000$

$2000 + 400(24) \le \text{Cost} \le 2000 + 1000(24)$

$11,600 \le \text{Cost} \le 26,000$

$\text{Profit} = \text{revenue} - \text{cost}$

$30,000 - 26,000 \le \text{profit} \le 30,000 - 11,600$

$4{,}000 \le \text{profit} \le 18{,}400$

$\boxed{\$4{,}000 \text{ to } \$18{,}400}$

95. Solve: $5,000 + 1.75x \ge 10,000$

(Note: We changed from 10 to 10,000 on the right-side of the inequality because $R(x)$ is measured in thousands of dollars.)

$$1.75x \ge 5,000$$

$$x \ge 2,857.14$$

So, must sell at least 285,700 units.

96. Solve: $5,000 + 1.75x \ge 7,500$

(Note: We changed from 7.5 to 7,500 on the right-side of the inequality because $R(x)$ is measured in thousands of dollars.)

$$1.75x \ge 2,500$$

$$x \ge 1,428.57$$

So, must sell at least 142,900 units.

97. Use the formula

$$THR = \left(HR_{\max} - HR_{rest}\right) \times I + HR_{rest}$$

with $HR_{rest} = 65$, $HR_{\max} = 170$.

Solve for I first when THR = 100 and then when THR = 140:

$$100 = (170 - 65)I + 65$$
$$35 = 105I$$
$$I \approx 0.33$$

So, about 33%.

$$140 = (170 - 65)I + 65$$
$$75 = 105I$$
$$I \approx 0.71$$

So, about 71%.

So, can consider workouts between 33% and 71% intensity.

98. Use the formula

$$THR = \left(HR_{\max} - HR_{rest}\right) \times I + HR_{rest}$$

with $HR_{rest} = 75,\ HR_{\max} = 175$.

Solve for I first when THR = 110 and then when THR = 150:

$$110 = (175 - 75)I + 75$$
$$35 = 100I$$
$$I \approx 0.35$$

So, about 35%.

$$150 = (175 - 75)I + 75$$
$$75 = 100I$$
$$I \approx 0.75$$

So, about 75%.

So, can consider workouts between 35% and 75% intensity.

99.

Cell Phone Charge: $50 + 0.22x$

$(x = \text{minutes over 800 used})$

$$67.16 \le 50 + 0.22x \le 96.86$$
$$17.16 \le 0.22x \le 46.86$$
$$78 \le x \le 213$$

Least minutes: $800 + 78 = \boxed{878}$

Most minutes: $800 + 213 = \boxed{1013}$

100. Let x = number of minutes used in excess of 1000.

Solve:

$$36.40 \le 30 + 0.08x \le 47.20$$
$$6.40 \le 0.08x \le 17.20$$
$$\frac{6.40}{0.08} \le x \le \frac{17.20}{0.08}$$
$$80 \le x \le 215$$

The least number of minutes used was 1,080, and the most used was 1,215.

101. Let x = grade on the 4th exam.

$$\frac{67 + 77 + 84 + x}{4} \ge 80$$
$$67 + 77 + 84 + x \ge 320$$
$$228 + x \ge 320$$
$$x \ge \boxed{92}$$

102. Let x = grade on the exam.

$$80 \le \frac{96 + 87 + 79 + 89 + x}{5} \le 90$$
$$400 \le 351 + x \le 450$$
$$49 \le x \le 99$$

You would need to score between 49% and 99% on the final exam.

103. Let x = invoice price.

$$\frac{27,999}{1.30} < x < \frac{27,999}{1.15}$$
$$\boxed{\$21,537.69 < x < \$24,346.96}$$

104. Let x = invoice price.

$$\frac{42,599}{1.30} < x < \frac{42,599}{1.15}$$

$$\boxed{\$32,768.46 < x < \$37,042.61}$$

105. $0.9\, r_T \le r_R \le 1.1\, r_T$

106. $\frac{S}{N} \ge 2$ if N fluctuates by 10%

$$\frac{S}{1.1\,N} > 2 \text{ or } \boxed{S > 2.2\,N}$$

107. $0.85L \le B \le 0.95L$

108. $0.95h_t \le h_m \le 1.05h_t$

109. Let x = number of times play. We want the smallest value of x for which

$$160 + 10x \le 55x.$$

Solving yields:

$$160 \le 45x$$

$$3.56 \approx \frac{160}{45} \le x$$

So, they would need to play $\boxed{4 \text{ times}}$ in order to make the membership a better deal.

110. Let x = number of times play. We want the smallest value of x for which

$$125 + 10x \le 40x.$$

Solving yields:

$$125 \le 30x$$

$$4.17 \approx \frac{125}{30} \le x$$

So, they would need to play $\boxed{5 \text{ times}}$ in order to make the membership a better deal.

111. Let T = amount of tax paid.
Least amount of tax = \$5,156.25
Greatest amount of tax = \$18,481

So, the range of taxes is:

$$\boxed{5,156.25 \le T \le 18,481.25}$$

112. Let T = amount of tax paid.
Least amount of tax = \$18,481.25
Greatest amount of tax = \$46,075.25

So, the range of taxes is:

$$\boxed{18,481.25 \le T \le 46,075.25}$$

113. Mixed up parenthesis and brackets $[-1, 4)$

114. Performed union instead of intersection. $(3, 4)$

115. Forgot to flip the sign when dividing by -3. Answer should be $[2, \infty)$.

116. $x \geq -2$ corresponds to $[-2, \infty)$

117. True. In fact, the two inequalities are equivalent.

118. False. Need to switch the sign.

119. a, b

120. c, d

121. a, b

122. c, d

123. c

124. a, b

125. Mentally, realize that $x \leq -x$ holds only when the left-side is negative or zero. Hence, the solution set is $(-\infty, 0]$.

126. Mentally, realize that $x > -x$ holds only with the right-side is negative, which occurs when $x > 0$. Hence, the solution set is $(0, \infty)$.

127. Observe that

$$ax + b < ax - c$$

$$b < -c$$

This is false because we are assuming that $0 < b < c$, so that $-c < b$. Hence, the inequality has no solution.

128. Observe that

$$-ax + b < -ax + c$$

$$b < c$$

This is true, by assumption. Hence, the solution set is all real numbers.

129.

a)

$$2.7x + 3.1 < 9.4x - 2.5$$

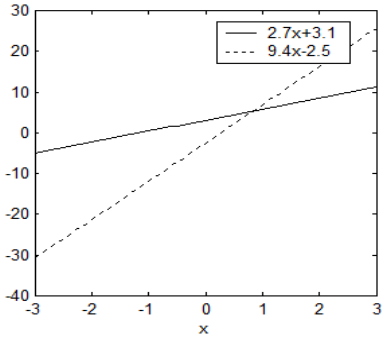
$$2.7x + 5.6 < 9.4x$$

$$5.6 < 6.7x$$

$$x > 0.83582 \text{ (rounded)}$$

c) Agree

b)



130.

a)

$$-0.5x + 2.7 > 4.1x - 3.6$$

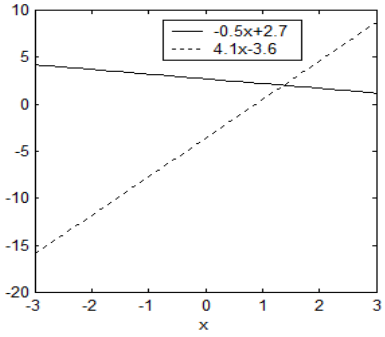
$$2.7 > 4.6x - 3.6$$

$$6.3 > 4.6x$$

$$x < 1.36957 \text{ (rounded)}$$

c) Agree

b)



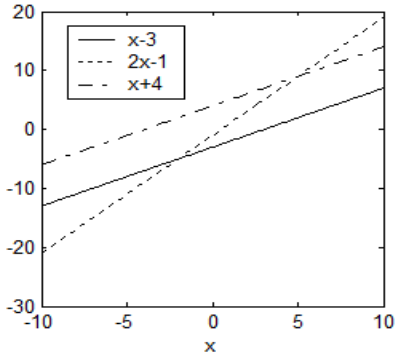
131.

a)

$$x-3<2x-1<x+4$$
$$-3<x-1<4$$
$$-2<x<5$$
$$(-2,5)$$

c) Agree

b)



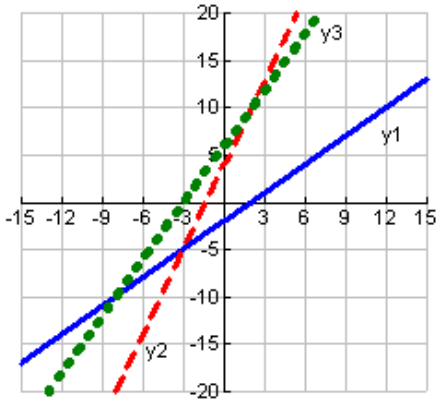
132.

a)

$$x-2<3x+4\le 2x+6$$
$$x-2<3x+4 \text{ and } 3x+4\le 2x+6$$
$$-6<2x \text{ and } x\le 2$$
$$-3<x$$
$$(-3,2]$$

c) Agree

b) Graphically, let $y1=x-2,\ y2=3x+4,\ y3=2x+6$



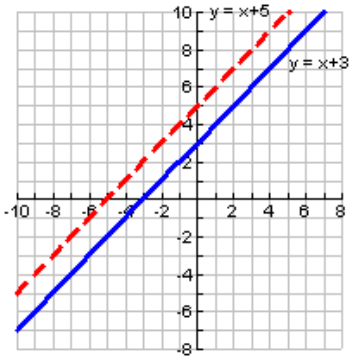
133.

a)

$$x+3<x+5$$
$$3<5$$
true for any $x\in(-\infty,\infty)$

c) Agree

b)



134. **a)**

$\frac{1}{2}x-3>-\frac{2}{3}x+1$

$\frac{7}{6}x>4$

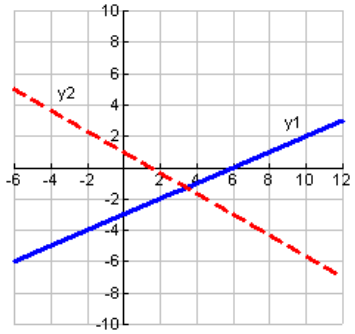
$x>4\left(\frac{6}{7}\right)=\frac{24}{7}$

$\left(\frac{24}{7},\infty\right)$

c) Agree

b) Graphically, let

$y1=\frac{1}{2}x-3,\ y2=-\frac{2}{3}x+1$



Section 1.6 Solutions ----------

1. $(x-5)(x+2)\geq 0$

CP's: $x=-2,\ 5$

$\boxed{(-\infty,-2]\cup[5,\infty)}$

2. $(x+3)(x-1)<0$

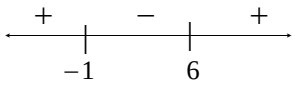
CP's: $x=-3,1$

$\boxed{(-3,1)}$

3. $u^2-5u-6\leq 0$

$(u-6)(u+1)\leq 0$

CP's: $u=6,-1$

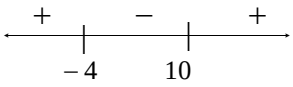


$\boxed{[-1,6]}$

4. $u^2-6u-40>0$

$(u-10)(u+4)>0$

CPs: $-4,10$



$\boxed{(-\infty,-4)\cup(10,\infty)}$

5. $p^2+4p+3<0$

$(p+3)(p+1)<0$

CP's: $p=-3,-1$

$\boxed{(-3,-1)}$

6. $p^2-2p-15\geq 0$

$(p-5)(p+3)\geq 0$

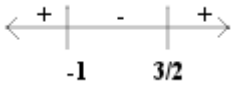
CP's: $p=-3,5$

$\boxed{(-\infty,-3]\cup[5,\infty)}$

7. $2t^2 - t - 3 \le 0$

$(2t-3)(t+1) \le 0$

CP's: $t = -1, 3/2$



$\boxed{[-1, 3/2]}$

8. $3t^2 + 5t - 2 \ge 0$

$(3t-1)(t+2) \ge 0$

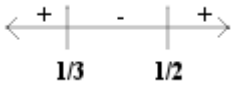
CP's: $t = -2, 1/3$

$\boxed{(-\infty, -2] \cup [1/3, \infty)}$

9. $6v^2 - 5v + 1 < 0$

$(3v-1)(2v-1) < 0$

CP's: $v = 1/3, 1/2$

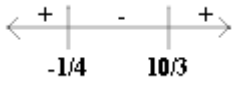


$\boxed{(1/3, 1/2)}$

10. $12t^2 - 37t - 10 < 0$

$(3t-10)(4t+1) < 0$

CP's: $t = -1/4, 10/3$

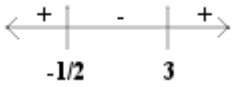


$\boxed{(-1/4, 10/3)}$

11. $2s^2 - 5s - 3 \ge 0$

$(2s+1)(s-3) \ge 0$

CP's: $s = -1/2, 3$



$\boxed{(-\infty, -1/2] \cup [3, \infty)}$

12. $s^2 + 8s + 12 \le 0$

$(s+2)(s+6) \le 0$

CP's: $s = -6, -2$

$\boxed{[-6, -2]}$

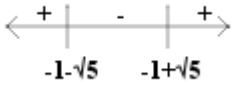
13. $y^2 + 2y - 4 \ge 0$ Note: Can't factor

To find CP's solve $y^2 + 2y - 4 = 0$

$$y = \frac{-2 \pm \sqrt{2^2 - 4(1)(-4)}}{2(1)}$$

$$y = \frac{-2 \pm \sqrt{20}}{2}$$

$$y = \frac{-2 \pm 2\sqrt{5}}{2} = -1 \pm \sqrt{5}$$



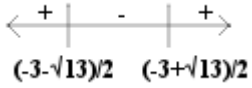
$\boxed{\left(-\infty, -1-\sqrt{5}\right] \cup \left[-1+\sqrt{5}, \infty\right)}$

14. $y^2 + 3y - 1 \le 0$ Note: can't factor

To find CP's solve $y^2 + 3y - 1 = 0$

$$y = \frac{-3 \pm \sqrt{3^2 - 4(1)(-1)}}{2(1)}$$

$$y = \frac{-3 \pm \sqrt{13}}{2}$$



$\boxed{\left[\frac{-3-\sqrt{13}}{2}, \frac{-3+\sqrt{13}}{2}\right]}$

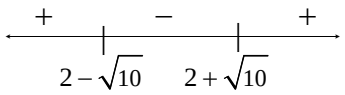
15. $x^2 - 4x < 6$

$x^2 - 4x - 6 < 0$

CPs: Use quadratic formula:

$$x = \frac{4 \pm \sqrt{16 - 4(1)(-6)}}{2} = \frac{4 \pm 2\sqrt{10}}{2}$$

$$= 2 \pm \sqrt{10}$$



$\boxed{\left(2-\sqrt{10}, 2+\sqrt{10}\right)}$

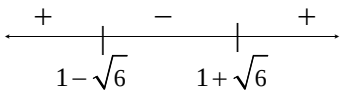
16. $x^2 - 2x > 5$

$x^2 - 2x - 5 > 0$

CPs: Use quadratic formula:

$$x = \frac{2 \pm \sqrt{4 - 4(1)(-5)}}{2} = \frac{2 \pm 2\sqrt{6}}{2}$$

$$= 1 \pm \sqrt{6}$$



$\boxed{\left(-\infty, 1-\sqrt{6}\right) \cup \left(1+\sqrt{6}, \infty\right)}$

17. $u^2 - 3u \geq 0$

$u(u-3) \geq 0$

CP's: $u = 0, 3$

$\boxed{(-\infty, 0] \cup [3, \infty)}$

18. $u^2 + 4u \leq 0$

$u(u+4) \leq 0$

CP's: $u = 0, -4$

$\boxed{[-4, 0]}$

19. $x^2 - 2x \leq 0$

$x(x-2) \leq 0$

CP's: $x = 0, 2$

$\boxed{[0, 2]}$

20. $x^2 + 3x \geq 0$

$x(x+3) \geq 0$

CP's: $x = -3, 0$

$\boxed{(-\infty, -3] \cup [0, \infty)}$

21. $x^2 - 9 > 0$

$(x-3)(x+3) > 0$

CP's: $x = -3, 3$

$\boxed{(-\infty, -3) \cup (3, \infty)}$

22. $x^2 - 16 \geq 0$

$(x-4)(x+4) \geq 0$

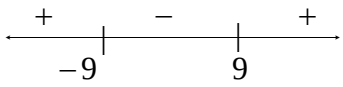
CP's: $-4, 4$

$\boxed{(-\infty, -4] \cup [4, \infty)}$

23. $t^2 - 81 < 0$

$(t-9)(t+9) < 0$

CP's: $t = -9, 9$

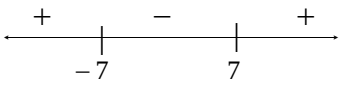


$\boxed{(-9, 9)}$

24. $t^2 - 49 \le 0$

$(t-7)(t+7) \le 0$

CP's: $t = -7, 7$



$\boxed{[-7, 7]}$

25. $z^2 + 16 > 0$

No critical points

$z^2 + 16 > 0$ for all z

$\boxed{\mathbb{R}}$ (consistent)

26. $z^2 + 2 \ge 0$

$\boxed{\mathbb{R}}$ (consistent)

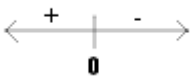
27. $y^2 < -4$ $\boxed{\text{no real solution}}$

(A real number squared is always non-negative.)

28. $y^2 \le -25$ $\boxed{\text{no real solution}}$

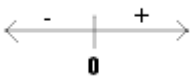
(A real number squared is always non-negative.)

29. $\dfrac{-3}{x} \le 0$ $x = 0$ is CP



$\boxed{(0, \infty)}$

30. $\dfrac{3}{x} \le 0$ $x = 0$ is CP

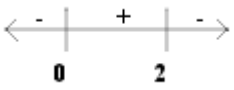


$\boxed{(-\infty, 0)}$

31. $\dfrac{y}{y+3} > 0$ CP's: $y = -3, 0$

$\boxed{(-\infty, -3) \cup (0, \infty)}$

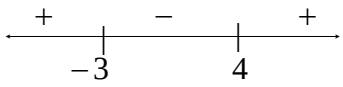
32. $\dfrac{y}{2-y} \le 0$ CP's: $y = 0, 2$



$\boxed{(-\infty, 0] \cup (2, \infty)}$

33. $\dfrac{t+3}{t-4} \ge 0$

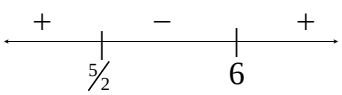
CPs: $-3, 4$



$\boxed{(-\infty, -3] \cup (4, \infty)}$

34. $\dfrac{2t-5}{t-6} < 0$

CPs: $\frac{5}{2}, 6$

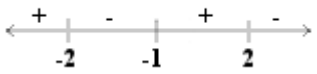


$\boxed{(\frac{5}{2}, 6)}$

35.

$$\frac{s+1}{(2-s)(2+s)} \geq 0$$

CP's: $s = -2, -1, 2$

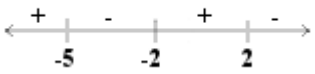


$$\boxed{(-\infty, -2) \cup [-1, 2)}$$

36.

$$\frac{s+5}{(2-s)(2+s)} \leq 0$$

CP's: $s = -5, -2, 2$



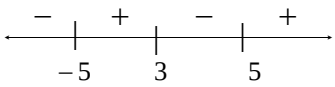
$$\boxed{[-5, -2) \cup (2, \infty)}$$

37.

$$\frac{x-3}{x^2-25} \geq 0$$

$$\frac{x-3}{(x-5)(x+5)} \geq 0$$

CPs: $3, \pm 5$



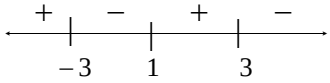
$$\boxed{(-5, 3] \cup (5, \infty)}$$

38.

$$\frac{1-x}{x^2-9} \leq 0$$

$$\frac{1-x}{(x-3)(x+3)} \leq 0$$

CPs: $1, \pm 3$



$$\boxed{(-3, 1] \cup (3, \infty)}$$

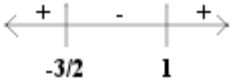
39.

$$2u^2 + u < 3$$

$$2u^2 + u - 3 < 0$$

$$(2u+3)(u-1) < 0$$

CP's: $u = -3/2, 1$



$$\boxed{(-3/2, 1)}$$

40.

$$u^2 - 3u \geq 18$$

$$u^2 - 3u - 18 \geq 0$$

$$(u-6)(u+3) \geq 0$$

CP's: $u = -3, 6$

$$\boxed{(-\infty, -3] \cup [6, \infty)}$$

41.

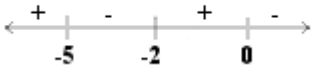
$$\frac{3t^2}{t+2}-5t\ge 0$$

$$\frac{3t^2-5t(t+2)}{t+2}\ge 0$$

$$\frac{3t^2-5t^2-10t}{t+2}\ge 0$$

$$\frac{-2t^2-10t}{t+2}\ge 0$$

$$\frac{-2t(t+5)}{t+2}\ge 0 \quad \text{CP's: } t=-5,-2,0$$



$$\boxed{(-\infty,-5]\cup(-2,0]}$$

42.

$$\frac{-2t-t^2}{4-t}-t\ge 0$$

$$\frac{-2t-t^2-t(4-t)}{4-t}\ge 0$$

$$\frac{-2t-t^2-4t+t^2}{4-t}\ge 0$$

$$\frac{-6t}{4-t}\ge 0$$

CP's: $t=0,4$

$$\boxed{(-\infty,0]\cup(4,\infty)}$$

43.

$$\frac{3p-2p^2}{4-p^2}-\frac{(3+p)}{(2-p)}<0$$

$$\frac{p(3-2p)}{(2-p)(2+p)}-\frac{(3+p)}{(2-p)}<0$$

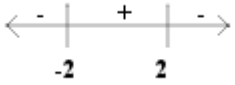
$$\frac{p(3-2p)-(3+p)(2+p)}{(2-p)(2+p)}<0$$

$$\frac{3p-2p^2-6-5p-p^2}{(2-p)(2+p)}>0$$

$$\frac{-3p^2-2p-6}{(2-p)(2+p)}<0$$

$$\frac{3p^2+2p+6}{(2-p)(2+p)}>0$$

CP's: $p=-2,2$



$$\boxed{(-2,2)}$$

44.

$$\frac{-7p}{(p-10)(p+10)}-\frac{(p+2)}{(p+10)}\le 0$$

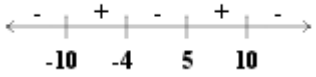
$$\frac{-7p-(p+2)(p-10)}{(p-10)(p+10)}\le 0$$

$$\frac{-7p-p^2+8p+20}{(p-10)(p+10)}\le 0$$

$$\frac{-p^2+p+20}{(p-10)(p+10)}\le 0$$

$$\frac{(-p+5)(p+4)}{(p-10)(p+10)}\le 0$$

CP's: $p=-10,-4,5,10$



$$\boxed{(-\infty,-10)\cup[-4,5]\cup(10,\infty)}$$

45.

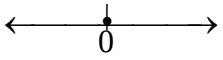
$$\frac{x^2}{5+x^2} < 0$$

$\boxed{\text{No solution}}$

46.

$$\frac{x^2}{5+x^2} \le 0$$

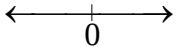
$\boxed{x = 0}$



47.

$$\frac{x^2+10}{x^2+16} > 0$$

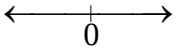
$\boxed{\mathbb{R}}$ (consistent)



48.

$$-\left(\frac{x^2+2}{x^2+4}\right) < 0$$

$\boxed{\mathbb{R}}$ (consistent)

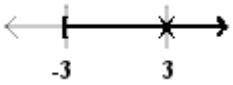


49.

$$\frac{(v-3)(v+3)}{(v-3)} \ge 0 \quad \boxed{v \ne 3}$$

$v+3 \ge 0$

$v \ge -3$



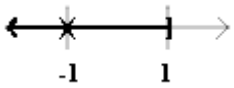
$\boxed{[-3,3) \cup (3,\infty)}$

50.

$$(v-1)\frac{(v+1)}{(v+1)} \le 0 \quad \boxed{v \ne -1}$$

$(v-1) \le 0$

$v \le 1$



$\boxed{(-\infty,-1) \cup (-1,-1]}$

51.

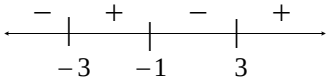
$$\frac{2}{t-3} + \frac{1}{t+3} \ge 0$$

$$\frac{2(t+3)+(t-3)}{(t-3)(t+3)} \ge 0$$

$$\frac{3t+3}{(t-3)(t+3)} \ge 0$$

$$\frac{3(t+1)}{(t-3)(t+3)} \ge 0$$

CPs: $-1, \pm 3$



$\boxed{(-3,-1] \cup (3,\infty)}$

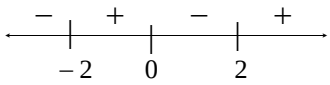
52.

$$\frac{1}{t-2} + \frac{1}{t+2} \le 0$$

$$\frac{(t+2)+(t-2)}{(t-2)(t+2)} \le 0$$

$$\frac{2t}{(t-2)(t+2)} \le 0$$

CPs: $0, \pm 2$



$\boxed{(-\infty,-2) \cup [0,2)}$

53.

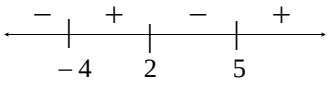
$$\frac{3}{x+4}-\frac{1}{x-2}\le 0$$

$$\frac{3(x-2)-(x+4)}{(x+4)(x-2)}\le 0$$

$$\frac{2x-10}{(x+4)(x-2)}\le 0$$

$$\frac{2(x-5)}{(x+4)(x-2)}\le 0$$

CPs: $-4, 2, 5$



$\boxed{(-\infty,-4)\cup(2,5]}$

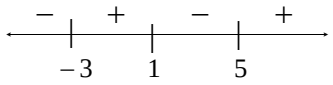
54.

$$\frac{2}{x-5}-\frac{1}{x-1}\ge 0$$

$$\frac{2(x-1)-(x-5)}{(x-5)(x-1)}\ge 0$$

$$\frac{x+3}{(x-5)(x-1)}\ge 0$$

CPs: $-3, 1, 5$



$\boxed{[-3,1)\cup(5,\infty)}$

55.

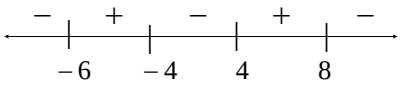
$$\frac{1}{p+4}+\frac{1}{p-4}-\frac{p^2-48}{p^2-16}>0$$

$$\frac{(p-4)+(p+4)-\left(p^2-48\right)}{(p+4)(p-4)}>0$$

$$\frac{-\left(p^2-2p-48\right)}{(p+4)(p-4)}>0$$

$$\frac{-(p-8)(p+6)}{(p+4)(p-4)}>0$$

CPs: $-6, \pm 4, 8$



$\boxed{(-6,-4)\cup(4,8)}$

56.

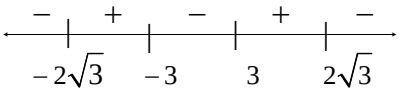
$$\frac{1}{p-3}-\frac{1}{p+3}-2\le 0$$

$$\frac{(p+3)-(p-3)-\left(p^2-9\right)}{(p+3)(p-3)}\le 0$$

$$\frac{-p^2+12}{(p+3)(p-3)}\le 0$$

$$\frac{-\left(p-2\sqrt{3}\right)\left(p+2\sqrt{3}\right)}{(p+3)(p-3)}\le 0$$

CPs: $\pm 3, \pm 2\sqrt{3}$



$\boxed{\left(-\infty,-2\sqrt{3}\right]\cup(-3,3)\cup\left[2\sqrt{3},\infty\right)}$

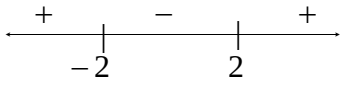
57.

$$\frac{1}{p-2}-\frac{1}{p+2}-\frac{3}{p^2-4}\geq 0$$

$$\frac{(p+2)-(p-2)-3}{(p+2)(p-2)}\geq 0$$

$$\frac{1}{(p+2)(p-2)}\geq 0$$

CPs: ± 2



$\boxed{(-\infty,-2)\cup(2,\infty)}$

58.

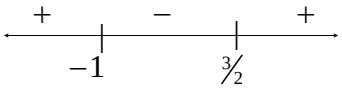
$$\frac{2}{2p-3}-\frac{1}{p+1}-\frac{1}{2p^2-p-3}\leq 0$$

$$\frac{2}{2p-3}-\frac{1}{p+1}-\frac{1}{(2p-3)(p+1)}\leq 0$$

$$\frac{2(p+1)-(2p-3)-1}{(2p-3)(p+1)}\leq 0$$

$$\frac{4}{(2p-3)(p+1)}\leq 0$$

CPs: $-1, \frac{3}{2}$



$\boxed{\left(-1,\tfrac{3}{2}\right)}$

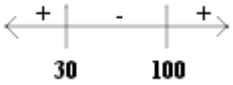
59.

$$-x^2+130x-3000>0$$

$$x^2-130x+3000<0$$

$$(x-30)(x-100)<0$$

CP's: $x=30,100$



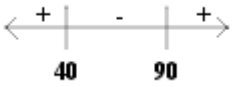
Between 30 and 100 orders

60.

$$x^2-130x+3600>0$$

$$(x-40)(x-90)>0$$

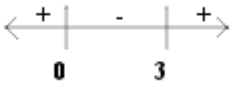
CP's: $x=40,90$



Less than 40 or more than 90 orders

61. Car is worth more than you owe:

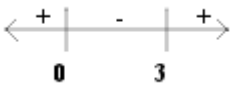
$$\frac{t}{t-3}>0 \quad \text{CP's: } t=0,3$$



$\boxed{(3,\infty)}$ Greater than 3 years

You owe more than it's worth:

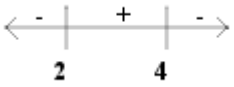
$$\frac{t}{t-3}<0 \quad \text{CP's: } t=0,3$$



$\boxed{(0,3)}$ First 3 years

62. Car is worth more than you owe:

$$-\left(\frac{2-t}{4-t}\right)>0$$



$\boxed{(2,4)}$ Between 2 and 4 years

You owe more than it's worth:

$$-\left(\frac{2-t}{4-t}\right)<0$$

$\boxed{(0,2)\cup(4,\infty)}$

63. $h = -16t^2 + 1200t$

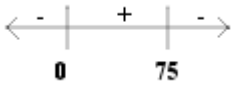
bullet is in the air if $h > 0$

$-16t^2 + 1200t > 0$

$-16t(t - 75) > 0$

CP's: $t = 0, 75$

$(0, 75)$



Bullet is in the air for 75 sec

64. $h = -16t^2 + 600t$

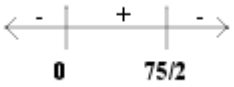
bullet is in the air if $h > 0$

$-16t^2 + 600t > 0$

$-8t(2t - 75) > 0$

CP's: $t = 0, 75/2$

$(0, 75/2)$



Bullet is in the air for 37.5 sec

65. Area $= l \cdot w$

$P = 2l + 2w = 100$

$l = \dfrac{100 - 2w}{2}$

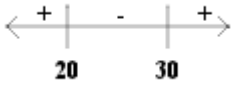
$A = l \cdot w = \left(\dfrac{100 - 2w}{2}\right)(w)$

$50w - w^2 \geq 600$

$w^2 - 50w + 600 \leq 0$

$(w - 20)(w - 30) \leq 0$

CP's: $w = 20, 30$



$[20, 30]$

$20 \leq$ width ≤ 30

$20 \leq$ length ≤ 30

Between 20 and 30 feet

66. $6.25t^2 - 25t + 325 \leq 525$

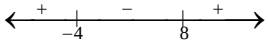
$6.25t^2 - 25t - 200 \leq 0$

$625t^2 - 2500t - 20000 \leq 0$

$625(t^2 - 4t - 32) \leq 0$

$625(t - 8)(t + 4) \leq 0$

CP's: $t = -4, 8$



$[-4, 8]$

$t = 0$ corresponds to Nov. 2014

$t = 8$ corresponds to July 2015

From Nov. 2014 to July 2015 the stock value was no more than \$525

67. $-5(x + 3)(x - 24) < 460$

$-5x^2 + 105x + 360 < 460$

$-5x^2 + 105x - 100 < 0$

$x^2 - 21x + 20 > 0$

$(x - 20)(x - 1) > 0$

The solution set is $(-\infty, 1) \cup (20, \infty)$.

So, a price increase less than \$1 or greater than \$20 per bottle.

68. $-5(x + 3)(x - 24) > 550$

$-5x^2 + 105x + 360 > 550$

$-5x^2 + 105x - 190 > 0$

$x^2 - 21x + 38 < 0$

$(x - 19)(x - 2) < 0$

The solution set is $(2, 19)$. So, a price increase between \$2 and \$19 per bottle.

69. $400 \pm 7 = 393, 407$

$$\frac{1,360,000}{407} \le \text{price per acre} \le \frac{1,360,000}{393}$$

$\$3,341.52 \le \text{price per acre} \le \$3460.56$

$\boxed{\$3,342 \text{ to } \$3,461 \text{ per acre}}$

70. $1000 \pm 10 = 990, 1010$

$$\frac{1,000,000}{1010} \le \text{price per acre} \le \frac{1,000,000}{990}$$

$\$990.10 \le \text{price per acre} \le \$1010.10$

$\boxed{\$990 \text{ to } \$1,010 \text{ per acre}}$

71. Cannot divide by x.

$x^2 - 3x > 0$

$x(x-3) > 0$

$(-\infty, 0) \cup (3, \infty)$

72. Cannot take square root.

$u^2 - 25 < 0$

$(u-5)(u+5) < 0$

$(-5, 5)$

73. $\dfrac{(x-2)(x+2)}{(x+2)} > 0$ $\boxed{x \neq 2}$

$x - 2 > 0$

$x > 2$

Should have considered $x = -2$ a CP

74. Can't cross-multiply

$\dfrac{x+4}{x} + \dfrac{1}{3} < 0$

$\dfrac{3(x+4)+x}{3x} < 0$

$\dfrac{4x+12}{3x} < 0$

$\dfrac{4(x+3)}{3x} < 0$

$x = 0, -3$ are CP's

$(-3, 0)$

75. False $(-a, a)$

76. False $(-\infty, -a] \cup [a, \infty)$

77. Assume that $ax^2 + bx + c < 0$. If $b^2 - 4ac < 0$, then either there are infinitely many solutions or no real solution.

78. Assume that $ax^2 + bx + c > 0$. If $b^2 - 4ac < 0$, then either there are infinitely many solutions or no real solution.

79. $x^2 + a^2 \ge 0$

True for all real values of x

$\boxed{\mathbb{R}}$

80. $\dfrac{x^2 - b^2}{x+b} < 0$ $\boxed{x \neq -b}$

$\dfrac{(x-b)(x+b)}{x+b} < 0$

$x - b < 0$

$x < b$ $\boxed{(-\infty, -b) \cup (-b, b)}$

81.

$$\frac{x^2+a^2}{x^2+b^2} \geq 0$$

$\boxed{\mathbb{R}}$

82.

$$\frac{a}{x^2}+b<0$$

$$\frac{a+bx^2}{x^2}<0$$

No real values for which this is true.

$\boxed{\text{No solution}}$

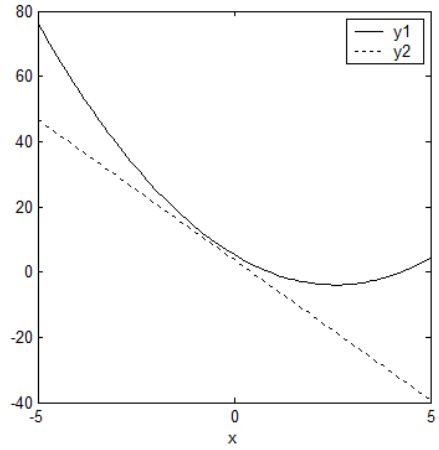
83.

$y_1 = 1.4x^2 - 7.2x + 5.3$

$y_2 = -8.6x + 3.7$

Find when $y_1 > y_2$

$\boxed{\mathbb{R}}$



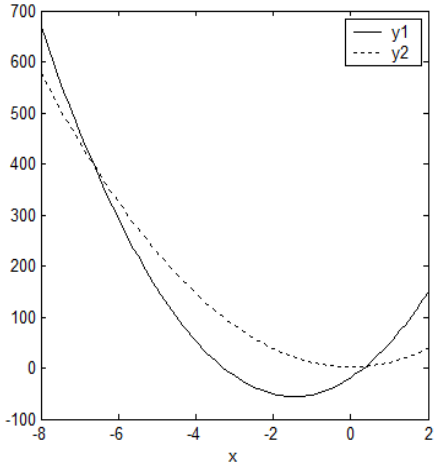
84.

$y_1 = 17x^2 + 50x - 19$

$y_2 = 9x^2 + 2$

Find when $y_1 < y_2$

$\boxed{(-6.65, 0.4)}$



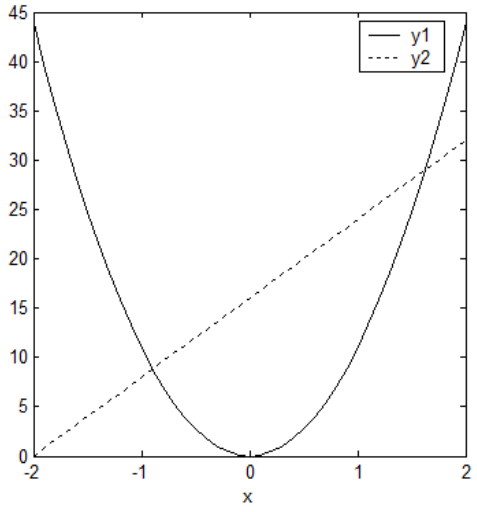
85.

$y_1 = 11x^2$

$y_2 = 8x + 16$

Find when $y_1 < y_2$

$\boxed{(-0.8960, 1.6233)}$



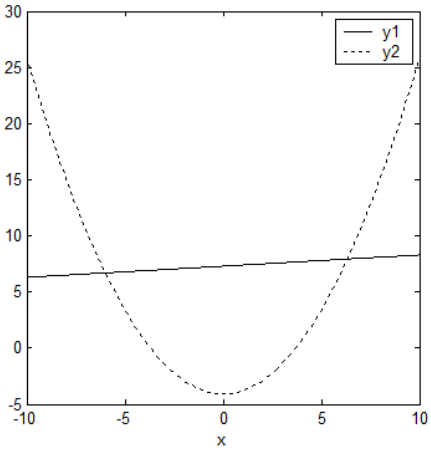
86.

$y_1 = 0.1x + 7.3$

$y_2 = 0.3x^2 - 4.1$

Find when $y_1 > y_2$

$\boxed{(-6, 6.33)}$



87.

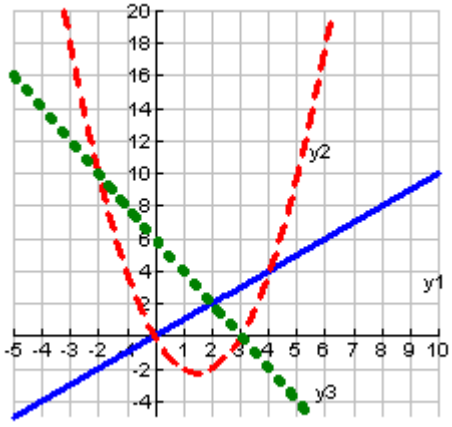
$y_1 = x$

$y_2 = x^2 - 3x$

$y_3 = 6 - 2x$

Find when $y_1 < y_2 < y_3$.

$\boxed{(-2, 0)}$



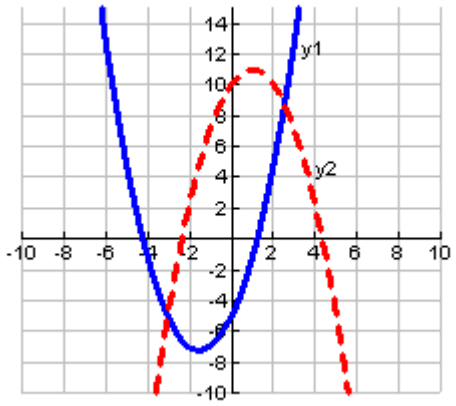
88.

$y_1 = x^2 + 3x - 5$

$y_2 = -x^2 + 2x + 10$

Find when $y_1 \geq y_2$.

$\boxed{(-\infty, -3] \cup [2.5, \infty)}$



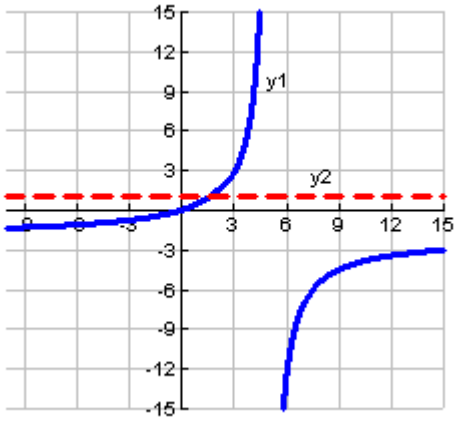
89.

$y_1 = \dfrac{2p}{5-p}$

$y_2 = 1$

Find when $y_1 > y_2$.

$\boxed{\left(\frac{5}{3}, 5\right)}$



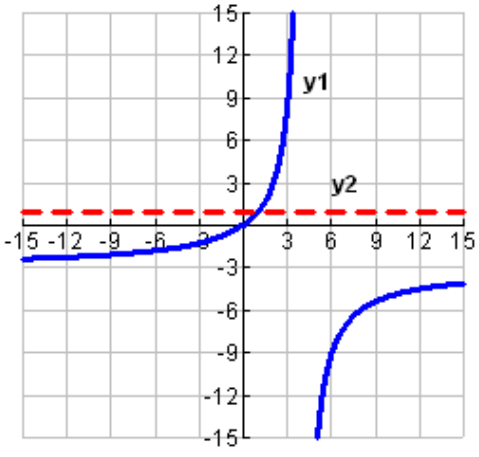
90.

$y_1 = \dfrac{3p}{4-p}$

$y_2 = 1$

Find when $y_1 < y_2$.

$\boxed{(-\infty, 1) \cup (4, \infty)}$



Section 1.7 Solutions ----------

1.	$x = -3$ or $x = 3$		**2.**	$x = -2$ or $x = 2$	
3.	No solution (absolute value is always non-negative)		**4.**	No solution (absolute value is always non-negative)	
5.	$t + 3 = -2$ $\boxed{t = -5}$	$t + 3 = 2$ $\boxed{t = -1}$	**6.**	$t - 3 = -2$ $\boxed{t = 1}$	$t - 3 = 2$ $\boxed{t = 5}$
7.	$p - 7 = 3$ $\boxed{p = 10}$	$p - 7 = -3$ $\boxed{p = 4}$	**8.**	$p + 7 = 3$ $\boxed{p = -4}$	$p + 7 = -3$ $\boxed{p = -10}$
9.	$4 - y = -1$ $\boxed{y = 5}$	$4 - y = 1$ $\boxed{y = 3}$	**10.**	$2 - y = -11$ $\boxed{y = 13}$	$2 - y = 11$ $\boxed{y = -9}$
11.	$3x = -9$ $\boxed{x = -3}$	$3x = 9$ $\boxed{x = 3}$	**12.**	$5x = -50$ $\boxed{x = -10}$	$5x = 50$ $\boxed{x = 10}$
13.	$2x + 7 = -9$ $2x = -16$ $\boxed{x = -8}$	$2x + 7 = 9$ $2x = 2$ $\boxed{x = 1}$	**14.**	$2x - 5 = 7$ $2x = 12$ $\boxed{x = 6}$	$2x - 5 = -7$ $2x = -2$ $\boxed{x = -1}$
15.	$3t - 9 = 3$ $3t = 12$ $\boxed{t = 4}$	$3t - 9 = -3$ $3t = 6$ $\boxed{t = 2}$	**16.**	$4t + 2 = 2$ $4t = 0$ $\boxed{t = 0}$	$4t + 2 = -2$ $4t = -4$ $\boxed{t = -1}$
17.	$7 - 2x = -9$ $2x = 16$ $\boxed{x = 8}$	$7 - 2x = 9$ $2x = -2$ $\boxed{x = -1}$	**18.**	$6 - 3y = 12$ $-3y = 6$ $\boxed{y = -2}$	$6 - 3y = -12$ $-3y = -18$ $\boxed{y = 6}$
19.	$1 - 3y = 1$ $-3y = 0$ $\boxed{y = 0}$	$1 - 3y = -1$ $-3y = -2$ $\boxed{y = \frac{2}{3}}$	**20.**	$5 - x = 2$ $-x = -3$ $\boxed{x = 3}$	$5 - x = -2$ $-x = -7$ $\boxed{x = 7}$
21.	$4.7 - 2.1x = -3.3$ $2.1x = 8$ $\boxed{x = \frac{80}{21}}$	$4.7 - 2.1x = 3.3$ $2.1x = 1.4$ $\boxed{x = \frac{2}{3}}$	**22.**	$5.2x + 3.7 = -2.4$ $5.2x = -6.1$ $\boxed{x = -\frac{61}{52}}$	$5.2x + 3.7 = 2.4$ $5.2x = -1.3$ $\boxed{x = -\frac{1}{4}}$

23.

$\frac{2}{3}x-\frac{4}{7}=-\frac{5}{3}$ $\qquad$ $\frac{2}{3}x-\frac{4}{7}=\frac{5}{3}$

LCD = 21 $\qquad$ LCD = 21

$14x-12=-35$ $\qquad$ $14x-12=35$

$14x=-23$ $\qquad$ $14x=47$

$\boxed{x=-23/14}$ $\qquad$ $\boxed{x=47/14}$

24.

$\frac{1}{2}x+\frac{3}{4}=-\frac{1}{16}$ $\qquad$ $\frac{1}{2}x+\frac{3}{4}=\frac{1}{16}$

$8x+12=-1$ $\qquad$ $8x+12=1$

$8x=-13$ $\qquad$ $8x=-11$

$\boxed{x=-13/8}$ $\qquad$ $\boxed{x=-11/8}$

25.

$|x-5|=8$

$x-5=8$ $\qquad$ $x-5=-8$

$\boxed{x=13}$ $\qquad$ $\boxed{x=-3}$

26.

$|x+3|=11$

$x+3=11$ $\qquad$ $x+3=-11$

$\boxed{x=8}$ $\qquad$ $\boxed{x=-14}$

27.

$3|x-2|+1=19$

$3|x-2|=18$

$|x-2|=6$

$x-2=6$ *or* $x-2=-6$

$x=-4,8$

28.

$2|1-x|-4=2$

$2|1-x|=6$

$|1-x|=3$

$1-x=3$ *or* $1-x=-3$

$x=-2,4$

29.

$5=7-|2-x|$

$-2=-|2-x|$

$2=|2-x|$

$2-x=2$ *or* $2-x=-2$

$x=0,4$

30.

$-1=3-|x-3|$

$-4=-|x-3|$

$4=|x-3|$

$x-3=4$ *or* $x-3=-4$

$x=-1,7$

31.

$2|p+3|=20$

$|p+3|=10$

$p+3=10$ $\qquad$ $p+3=-10$

$\boxed{p=7}$ $\qquad$ $\boxed{p=-13}$

32.

$-3|p-4|=-6$

$|p-4|=2$

$p-4=2$ $\qquad$ $p-4=-2$

$\boxed{p=6}$ $\qquad$ $\boxed{p=2}$

33.

$5|y-2|-10=4|y-2|-3$

$|y-2|=7$

$y-2=7$ $\qquad$ $y-2=-7$

$\boxed{y=9}$ $\qquad$ $\boxed{y=-5}$

34.

$3-|y+9|=11-3|y+9|$

$2|y+9|=8$

$|y+9|=4$

$y+9=4$ $\qquad$ $y+9=-4$

$\boxed{y=-5}$ $\qquad$ $\boxed{y=-13}$

35. $4-x^2=-1$ $\quad$ $4-x^2=1$

$x^2=5$ $\quad$ $x^2=3$

$\boxed{x=\pm\sqrt{5}}$ $\quad$ $\boxed{x=\pm\sqrt{3}}$

36. $7-x^2=-3$ $\quad$ $7-x^2=3$

$x^2=10$ $\quad$ $x^2=4$

$\boxed{x=\pm\sqrt{10}}$ $\quad$ $\boxed{x=\pm2}$

37. $x^2+1=-5$ $\quad$ $x^2+1=5$

$x^2=-6$ $\quad$ $x^2=4$

no solution $\quad$ $\boxed{x=\pm2}$

38. $x^2-1=-5$ $\quad$ $x^2-1=5$

$x^2=-4$ $\quad$ $x^2=6$

$x=\pm2i$ $\quad$ $\boxed{x=\pm\sqrt{6}}$

39. $-7<x<7$

$(-7,7)$

40. $-9<y<9$

$(-9,9)$

41. $y\le-5$ or $y\ge5$

$(-\infty,-5]\cup[5,\infty)$

42. $x\le-2$ or $x\ge2$

$(-\infty,-2]\cup[2,\infty)$

43. $-7<x+3<7$

$-10<x<4$

$(-10,4)$

44. $-4\le x+2\le4$

$-6\le x\le2$

$[-6,2]$

45. $x-4<-2$ or $x-4>2$

$x<2$ $\quad$ $x>6$

$(-\infty,2)\cup(6,\infty)$

46. $-3<x-1<3$

$-2<x<4$

$(-2,4)$

47. $-1\le4-x\le1$

$-5\le-x\le-3$

$3\le x\le5$

$[3,5]$

48. $-3<1-y<3$

$-4<-y<2$

$4>y>-2$

$(-2,4)$

49. $\mathbb{R}$

50. No solution

51.

$|2t+3|<5$

$-5<2t+3<5$

$-8<2t<2$

$-4<t<1$

$\boxed{(-4,1)}$

52.

$|3t-5|>1$

$3t-5>1$ or $3t-5<-1$

$3t>6$ or $3t<4$

$t>2$ or $t<4/3$

$\boxed{(-\infty,4/3)\cup(2,\infty)}$

53.

$$|7-2y| \geq 3$$
$$7-2y \geq 3 \text{ or } 7-2y \leq -3$$
$$-2y \geq -4 \text{ or } -2y \leq -10$$
$$y \leq 2 \text{ or } y \geq 5$$
$$\boxed{(-\infty, 2] \cup [5, \infty)}$$

54.

$$|6-5y| \leq 1$$
$$-1 \leq 6-5y \leq 1$$
$$-7 \leq -5y \leq -5$$
$$\tfrac{7}{5} \geq y \geq 1$$
$$\boxed{[1, \tfrac{7}{5}]}$$

55. $\mathbb{R}$

56.

$$4-3x \leq -1 \quad \text{or} \quad 4-3x \geq 1$$
$$-3x \leq -5 \quad \text{or} \quad -3x \geq -3$$
$$x \geq 5/3 \quad \text{or} \quad x \leq 1$$
$$\boxed{(-\infty, 1] \cup [5/3, \infty)}$$

57.

$$2|4x| - 9 \geq 3$$
$$2|4x| \geq 12$$
$$|4x| \geq 6$$
$$4x \geq 6 \text{ or } 4x \leq -6$$
$$x \geq \tfrac{3}{2} \text{ or } x \leq -\tfrac{3}{2}$$
$$\boxed{(-\infty, -\tfrac{3}{2}] \cup [\tfrac{3}{2}, \infty)}$$

58.

$$5|x-1| + 2 \leq 7$$
$$5|x-1| \leq 5$$
$$|x-1| \leq 1$$
$$-1 \leq x-1 \leq 1$$
$$0 \leq x \leq 2$$
$$\boxed{[0, 2]}$$

59.

$$2|x+1| - 3 \leq 7$$
$$2|x+1| \leq 10$$
$$|x+1| \leq 5$$
$$-5 \leq x+1 \leq 5$$
$$-6 \leq x \leq 4$$
$$\boxed{[-6, 4]}$$

60.

$$3|x-1| - 5 > 4$$
$$3|x-1| > 9$$
$$|x-1| > 3$$
$$x-1 > 3 \text{ or } x-1 < -3$$
$$x > 4 \text{ or } x < -2$$
$$\boxed{(-\infty, -2) \cup (4, \infty)}$$

61.

$$3 - 2|x+4| < 5$$
$$-2|x+4| < 2$$
$$|x+4| > -1$$
$$\boxed{(-\infty, \infty)}$$

62.

$$7-3|x+2| \ge -14$$
$$-3|x+2| \ge -21$$
$$|x+2| \le 7$$
$$-7 \le x+2 \le 7$$
$$-9 \le x \le 5$$
$$\boxed{[-9,5]}$$

63.

$$9-|2x| < 3$$
$$-|2x| < -6$$
$$|2x| > 6$$
$$2x > 6 \quad \text{or} \quad 2x < -6$$
$$x > 3 \quad \text{or} \quad x < -3$$
$$\boxed{(-\infty,-3)\cup(3,\infty)}$$

64.

$$4-|x+1| > 1$$
$$-|x+1| > -3$$
$$|x+1| < 3$$
$$-3 < x+1 < 3$$
$$-4 < x < 2$$
$$\boxed{(-4,2)}$$

65.

$$-\frac{1}{2} < 1-2x < \frac{1}{2}$$
$$-\frac{3}{2} < -2x < -\frac{1}{2}$$
$$\frac{3}{4} > x > \frac{1}{4}$$
$$\boxed{(1/4,3/4)}$$

66.

$$|2-3x| \ge 2$$

$2-3x \le -2$		$2-3x \ge 2$
$4 \le 3x$	or	$0 \ge 3x$
$4/3 \le x$		$x \le 0$

$$\boxed{(-\infty,0]\cup[4/3,\infty)}$$

67.

$$-1.8 < 2.6x + 5.4 < 1.8$$
$$-7.2 < 2.6x < -3.6$$
$$-2.769 < x < -1.385$$
$$\boxed{(-2.769,-1.385)}$$

68.

$3.7-5.5x < -4.3$		$3.7-5.5x > 4.3$
$-5.5x < -8$	or	$-5.5x > 0.6$
$x > \frac{16}{11}$		$x < -\frac{6}{55}$

$$\boxed{\left(-\infty,-\tfrac{6}{55}\right)\cup\left(\tfrac{16}{11},\infty\right)}$$

69.

$$x^2-1 \le 8$$
$$x^2-9 \le 0$$
$$(x-3)(x+3) \le 0$$

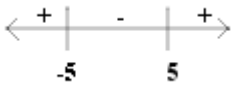
CP's: $x = -3, 3$

$$-3 \le x \le 3$$
$$\boxed{[-3,3]}$$

70.

$$x^2+4 \ge 29$$
$$x^2-25 \ge 0$$
$$(x-5)(x+5) \ge 0$$

CP's: $-5, 5$



$$\boxed{(-\infty,-5]\cup[5,\infty)}$$

71. $|x-2| < 7$

72. $|x+2| > 3$

73. $|x-3/2| \ge 1/2$

74. $|x-11/3| \le 5/3$

75. $|x-a| \le 2$

76. $|x+3| \ge a$

77. $|T-83| \le 15$

78. $|x-97.8| \le 1.2$

79. In order to win the hole, $d < 4$.
In order to have a tie, $d = 4$.

80. $|f - f_C| \le 15$

81.
$$|(200+5x)-(210+4.8x)| < 5$$
$$|-10+0.2x| < 5$$
$$-5 < -10+0.2x < 5$$
$$5 < 0.2x < 15$$
$$25 < x < 75$$
So, where the number of units sold is between 25 and 75.

82.
$$|(200+5x)-(210+4.8x)| < 3$$
$$|-10+0.2x| < 3$$
$$-3 < -10+0.2x < 3$$
$$7 < 0.2x < 13$$
$$35 < x < 65$$
So, when the number of units sold is between 35 and 65.

83. $x-3=-7$ also yields a solution $x=-4$

84. $-7 < x-3 < 7$ is the appropriate inequality. The answer is (-4,10).

85. Didn't switch signs when dividing by -2. The answer is [2,3].

86. Absolute value can never yield a negative number, so no solution.

87. True

88. True

89. False

90. $x-7 \ge 0$ $\boxed{x \ge 7}$

91.
$$-b < x-a < b$$
$$a-b < x < a+b$$
$$\boxed{(a-b, a+b)}$$

92. $a-x < -b$ or $a-x > b$
$a+b < x$ $\quad$ $a-b > x$
$$\boxed{(-\infty, a-b) \cup (a+b, \infty)}$$

93. $\mathbb{R}$

94. No solution

95. $x-a=-b$ $\quad$ $\boxed{x=a-b}$

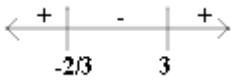
$x-a=b$ $\quad$ $\boxed{x=a+b}$

96. No solution

97. No solution

98.
$$3x^2-7x+2 < -8$$
$$3x^2-7x+10 < 0$$
no solution

$$3x^2-7x+2 > 8$$
$$3x^2-7x-6 > 0$$
$$(3x+2)(x-3) > 0$$
CP's: $x = -2/3, 3$



$$\boxed{(-\infty, -2/3) \cup (3, \infty)}$$

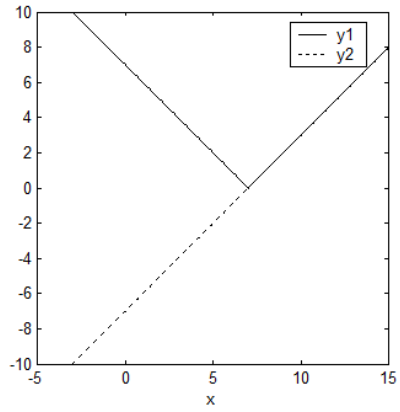
99.

$y_1 = |x-7|$

$y_2 = x-7$

$\boxed{x \geq 7}$

Agree

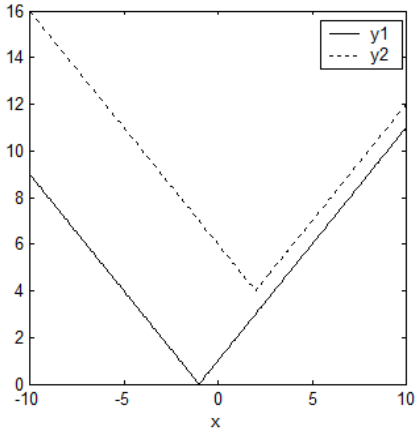


100.

$y_1 = |x+1|$

$y_2 = |x-2|+4$

Do not coincide, agree.



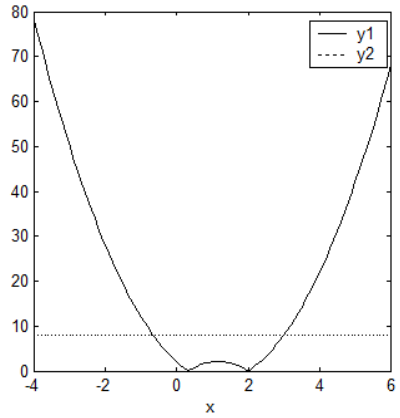
101.

$y_1 = |3x^2 - 7x + 2|$

$y_2 = 8$

$(-\infty, -\frac{2}{3}) \cup (3, \infty)$

Agree

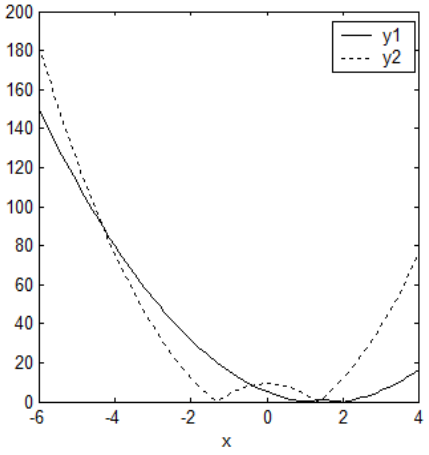


102.

$$y_1 = \left|2.7x^2 - 7.9x + 5\right|$$
$$y_2 = \left|5.3x^2 - 9.2\right|$$

$x = -4.31,\ \ x = -0.38$

$(-\infty, -4.31] \cup [-0.38, \infty)$



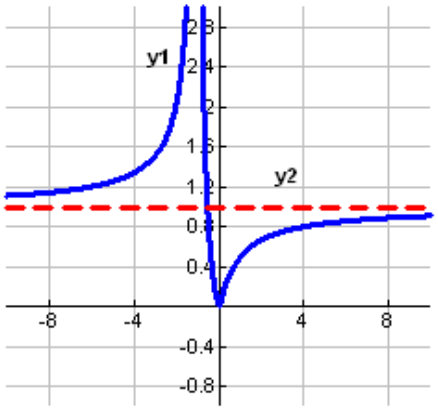
103.

$$y_1 = \left|\frac{x}{x+1}\right|$$

$y_2 = 1$

Find when $y_1 < y_2$.

$\boxed{(-\frac{1}{2}, \infty)}$



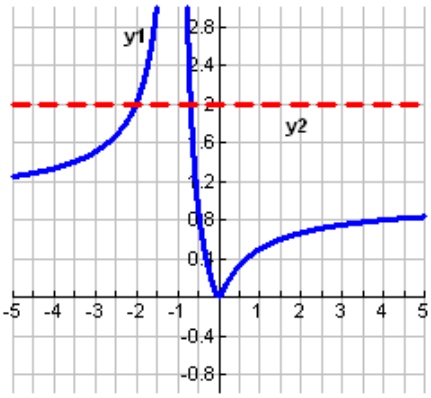
104.

$$y_1 = \left|\frac{x}{x+1}\right|$$

$y_2 = 2$

Find when $y_1 < y_2$.

$\boxed{(-\infty, -2) \cup (-\frac{2}{3}, \infty)}$



Chapter 1 Review Solutions ----------

1. $7x-4=12$

$7x=16$

$\boxed{x=16/7}$

2. $13d+12=7d+6$

$6d=-6$

$\boxed{d=-1}$

3. $20p+14=6-5p$

$25p=-8$

$\boxed{p=-8/25}$

4. $4x-28-4=4$

$4x=36$

$\boxed{x=9}$

5. $3x+21-2=4x-8$

$\boxed{x=27}$

6. $7c+3c-15=2c+6-14$

$10c-15=2c-8$

$8c=7$

$\boxed{c=7/8}$

7. $14-\left[-3y+12+9\right]=8y+12-6+4$

$14+3y-21=8y+10$

$-17=5y$

$\boxed{y=-17/5}$

8. $6-4x+2x-14-52=6x-12+6\left[6x-9+6\right]$

$-2x-60=6x-12+36x-18$

$-2x-60=42x-30$

$-30=44x$

$\boxed{x=\frac{-30}{44}=\frac{-15}{22}}$

9. $b\neq 0$

$12-3b=6+4b$

$6=7b$

$\boxed{b=6/7}$

10. $3g+9g=7$

$12g=7$

$\boxed{g=7/12}$

11. LCD = 28

$4(13x)-28x=7x-2(3)$

$52x-28x=7x-6$

$17x=-6$

$\boxed{x=-6/17}$

12. LCD = 6

$30b+b=2b-29$

$29b=-29$

$\boxed{b=-1}$

13.

$$x \neq 0$$
$$\text{LCD} = x$$
$$1 - 4x = 3 - 5x$$
$$-2 = -x$$
$$2 = x$$
$$\boxed{x = 2}$$

14.

$$x \neq -1, 1$$
$$\text{LCD} = (x+1)(x-1)$$
$$4(x-1) - 8(x+1) = 3(x+1)(x-1)$$
$$4x - 4 - 8x - 8 = 3(x^2 - 1)$$
$$-4x - 12 = 3x^2 - 3$$
$$3x^2 + 4x + 9 = 0$$
$$x = \frac{-4 \pm \sqrt{4^2 - 4(3)(9)}}{2(3)}$$
$$x = \frac{-4 \pm \sqrt{-92}}{6} = \frac{-4 \pm 2i\sqrt{23}}{6}$$
$$\boxed{x = -\frac{2}{3} \pm i\frac{\sqrt{23}}{3}}$$

15.

$$t \neq -4, 0$$
$$\text{LCD} = t(t+4)$$
$$2t - 7(t+4) = 6$$
$$2t - 7t - 28 = 6$$
$$-5t = 34$$
$$\boxed{t = -34/5}$$

16.

$$x \neq -\frac{1}{3}, \frac{7}{2}$$
$$-2(2x-7) = 3(3x+1)$$
$$-4x + 14 = 9x + 3$$
$$13x = 11$$
$$\boxed{x = 11/13}$$

17.

$$x \neq 0$$
$$\text{LCD} = 2x$$
$$3 - 12 = 18x$$
$$-9 = 18x$$
$$\boxed{x = -\frac{1}{2}}$$

18.

$$m \neq -\frac{5}{2}, 0$$
$$3 - \frac{5}{m} = 2 + \frac{5}{m}$$
$$3m - 5 = 2m + 5$$
$$\boxed{m = 10}$$

19.

$$7x - 2 + 4x = 3[5 - 2x] + 12$$
$$11x - 2 = 15 - 6x + 12$$
$$17x = 29$$
$$\boxed{x = 29/17}$$

20.

$$\text{LCD} = 15$$
$$3x - (x-3) = -90$$
$$2x + 3 = -90$$
$$2x = -93$$
$$\boxed{x = -93/2}$$

21.

$$3x-2\left[3y+12-7\right]=y-2x+6x-18$$
$$3x-6y-10=y-2x+6x-18$$
$$-x+8=7y$$
$$\boxed{x=8-7y}$$

22.

$$y+2=\frac{x+3}{1+2x}+2=\frac{5x+5}{1+2x}$$
$$1-2y=1-2\left(\frac{x+3}{1+2x}\right)=\frac{-5}{1+2x}$$
$$\frac{y+2}{1-2y}=\frac{\dfrac{5(x+1)}{1+2x}}{\dfrac{-5}{1+2x}}=\boxed{-(x+1)}$$

23.

Let x = total distance

Drives: 16 miles

Bus: $\frac{3}{4}x$

Taxi: $\frac{1}{12}x$

$$16+\frac{3}{4}x+\frac{1}{12}x=x$$
$$\text{LCD}=12$$
$$192+9x+x=12x$$
$$2x=192$$
$$\boxed{x=96 \text{ miles}}$$

24.

$$B+L+D+4S=2000$$
$$D=1.5B$$
$$L=D-100=1.5B-100$$
$$S=\frac{1}{4}L=\frac{1}{4}(1.5B-100)$$
$$\underbrace{B}_{\text{breakfast}}+\underbrace{1.5B-100}_{\text{lunch}}+\underbrace{1.5B}_{\text{dinner}}+\underbrace{4\cdot\frac{1}{4}(1.5B-100)}_{\text{snacks}}=2000$$
$$B+1.5B-100+1.5B+1.5B-100=2000$$
$$5.5B=2200$$
$$B=400$$
$$\boxed{\begin{aligned}B&=400\\L&=500\\D&=600\\S&=125\end{aligned}}$$

25.

x = number

$$12+\frac{1}{4}x=\frac{1}{3}x$$
$$\text{LCD}=12$$
$$144+3x=4x$$
$$\boxed{x=144}$$

26.

$$x, x+2, x+4, x+6$$
$$x+(x+2)+(x+4)+(x+6)=3+3(x+6)$$
$$4x+12=3x+21$$
$$x=9$$
$$\boxed{9,11,13,15}$$

27.

$P = 2l + 2w$

$l = 1 + 2w$

$P = 2(1 + 2w) + 2w$

$P = 20$

$20 = 2 + 4w + 2w$

$6w = 18$

$\boxed{\begin{array}{l} w = 3 \text{ inches} \\ l = 7 \text{ inches} \end{array}}$

28.

$x =$ Perimeter

$10 + \frac{1}{3}x + \frac{1}{6}x = x$

$\text{LCD} = 18$

$180 + 6x + 3x = 18x$

$9x = 180$

$\boxed{x = 20 \text{ inches}}$

29.

$x =$ amount invested @ 20%

$25000 - x =$ amount invested @ 8%

Earned interest $= 27600 - 25000 = 2600$

$0.2x + 0.08(25000 - x) = 2600$

$0.2x + 2000 - 0.08x = 2600$

$0.12x = 600$

$x = 5000$

$\boxed{\begin{array}{l} \$5,000 @ 20\% \\ \$20,000 @ 8\% \end{array}}$

30.

\$2500 in mutual funds

\$2500 in stock

$x =$ rate of mutual fund

$4x =$ rate of stock

$x(2500) + 4x(2500) = 250$

$2500x + 10000x = 250$

$12500x = 250$

$x = 0.02$

$\boxed{\begin{array}{l} \text{Mutual Fund: } 2\% \\ \text{Stock: } 8\% \end{array}}$

31.

$x =$ ml of 5%

$150 - x =$ ml of 10%

$0.05x + 0.10(150 - x) = 0.08(150)$

$0.05x + 15 - 0.10x = 12$

$-0.05x = -3$

$x = 60$

$\boxed{\begin{array}{l} 60 \text{ ml of } 5\% \\ 90 \text{ ml of } 10\% \end{array}}$

32.

$x =$ ounces of 8%

4 ounces of 20%

Desired: 12%

$0.08x + 0.20(4) = 0.12(x + 4)$

Multiply by 100

$8x + 80 = 12x + 48$

$32 = 4x$

$\boxed{x = 8}$

33. x = final exam grade

$$\frac{3x+95+82+90}{6} \geq 90$$

$$3x + 267 \geq 540$$

$$3x \geq 273$$

$\boxed{\text{At least } 91}$

34. x = original price

$$0.80x = 25000$$

$$x = 31250$$

$\boxed{\$31,250}$

35.

$$b^2 - 4b - 21 = 0$$

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

$\boxed{b = -3, 7}$

36.

$$x^2 - 3x - 54 = 0$$

$$(x-9)(x+6) = 0$$

$\boxed{x = -6, 9}$

37.

$$x^2 - 8x = 0$$

$$x(x-8) = 0$$

$\boxed{x = 0, 8}$

38.

$$(3y-5)(2y+1) = 0$$

$$3y - 5 = 0 \quad 2y + 1 = 0$$

$\boxed{y = 5/3 \text{ or } y = -1/2}$

39.

$$q^2 = 169$$

$$q = \pm\sqrt{169}$$

$\boxed{q = \pm 13}$

40.

$$c^2 = -36$$

$$c = \pm\sqrt{-36}$$

$\boxed{c = \pm 6i}$

41.

$$2x - 4 = \pm\sqrt{-64}$$

$$2x - 4 = \pm 8i$$

$$2x = 4 \pm 8i$$

$\boxed{x = 2 \pm 4i}$

42.

$$d + 7 = \pm\sqrt{4}$$

$$d = -7 \pm 2$$

$\boxed{d = -9, -5}$

43.

$$x^2 - 4x = 12$$
$$x^2 - 4x + 4 = 12 + 4$$
$$(x-2)^2 = 16$$
$$x - 2 = \pm 4$$
$$x = 2 \pm 4$$
$$\boxed{x = -2, 6}$$

44.

$$2x^2 - 5x = 7$$
$$2\left(x^2 - \frac{5}{2}x\right) = 7$$
$$2\left(x^2 - \frac{5}{2}x + \frac{25}{16}\right) = 7 + \frac{25}{8}$$
$$2\left(x - \frac{5}{4}\right)^2 = \frac{81}{8}$$
$$\left(x - \frac{5}{4}\right)^2 = \frac{81}{16}$$
$$x - \frac{5}{4} = \pm\frac{9}{4}$$
$$x = \frac{5}{4} \pm \frac{9}{4}$$
$$\boxed{x = -1, \frac{7}{2}}$$

45.

$$x^2 - x = 8$$
$$x^2 - x + \frac{1}{4} = 8 + \frac{1}{4}$$
$$\left(x - \frac{1}{2}\right)^2 = \frac{33}{4}$$
$$x - \frac{1}{2} = \pm\sqrt{\frac{33}{4}}$$
$$\boxed{x = \frac{1 \pm \sqrt{33}}{2}}$$

46.

$$m^2 - 8m = -15$$
$$m^2 - 8m + 16 = -15 + 16$$
$$(m-4)^2 = 1$$
$$m - 4 = \pm 1$$
$$m = 4 \pm 1$$
$$\boxed{m = 3, 5}$$

47.

$$3t^2 - 4t - 7 = 0$$
$$a = 3, b = -4, c = -7$$
$$t = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-7)}}{2(3)}$$
$$t = \frac{4 \pm \sqrt{100}}{6} = \frac{4 \pm 10}{6}$$
$$\boxed{t = -1, \frac{7}{3}}$$

48.

$$4x^2 + 5x + 7 = 0$$
$$a = 4, b = 5, c = 7$$
$$x = \frac{-5 \pm \sqrt{5^2 - 4(4)(7)}}{2(4)}$$
$$x = \frac{-5 \pm \sqrt{-87}}{8}$$
$$\boxed{x = \frac{-5 \pm i\sqrt{87}}{8}}$$

49.

$$8f^2 - \frac{1}{3}f - \frac{7}{6} = 0$$

LCD = 6

$$48f^2 - 2f - 7 = 0$$

$a = 48, b = -2, c = -7$

$$f = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(48)(-7)}}{2(48)}$$

$$f = \frac{2 \pm \sqrt{1348}}{96}$$

$$f = \frac{2 \pm 2\sqrt{337}}{96}$$

$$\boxed{f = \frac{1 \pm \sqrt{337}}{48}}$$

50.

$$x^2 + 6x - 6 = 0$$

$a = 1, b = 6, c = -6$

$$x = \frac{-6 \pm \sqrt{6^2 - 4(1)(-6)}}{2(1)}$$

$$x = \frac{-6 \pm \sqrt{60}}{2}$$

$$x = \frac{-6 \pm 2\sqrt{15}}{2}$$

$$\boxed{x = -3 \pm \sqrt{15}}$$

51.

$a = 5, b = -3, c = -3$

$$q = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(-3)}}{2(5)}$$

$$\boxed{q = \frac{3 \pm \sqrt{69}}{10}}$$

52.

$$x - 7 = \pm\sqrt{-12}$$

$$\boxed{x = 7 \pm 2i\sqrt{3}}$$

53.

$$(2x - 5)(x + 1) = 0$$

$$\boxed{x = -1, \frac{5}{2}}$$

54.

$$g^2 + 3g - 3 = 0$$

$a = 1, b = 3, c = -3$

$$g = \frac{-3 \pm \sqrt{3^2 - 4(1)(-3)}}{2(1)}$$

$$\boxed{g = \frac{-3 \pm \sqrt{21}}{2}}$$

55.

$$7x^2 + 19x - 6 = 0$$

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

$$\boxed{x = -3, 2/7}$$

56.

$$2b^2 + 1 = 7$$

$$2b^2 = 6$$

$$b^2 = 3$$

$$\boxed{b = \pm\sqrt{3}}$$

57.

$$r^2 = \frac{S}{\pi h}$$

$$r = \pm\sqrt{\frac{S}{\pi h}}$$

$$\boxed{r = \sqrt{\frac{S}{\pi h}}} \quad \left(\begin{array}{l}\text{negative radius is}\\ \text{non-physical}\end{array}\right)$$

58.

$$r^3 = \frac{3V}{\pi h}$$

$$\boxed{r = \sqrt[3]{\frac{3V}{\pi h}}}$$

59.

$$vt = h + 16t^2$$

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

60.

$$2\pi rh = A - 2\pi r^2$$

$$\boxed{h = \frac{A - 2\pi r^2}{2\pi r}}$$

61.

$$A = \frac{1}{2}bh$$

$$b = h + 3 \quad A = 2$$

$$2 = \frac{1}{2}(h+3)h$$

$$4 = h^2 + 3h$$

$$h^2 + 3h - 4 = 0$$

$$(h+4)(h-1) = 0$$

$$h = -4, 1 \ (\text{height must be positive})$$

$$\boxed{h = 1 \text{ ft}, b = 4 \text{ ft}}$$

62.

$$-16t^2 + 500 = 0$$

$$16t^2 = 500$$

$$t^2 = \frac{500}{16}$$

$$t = \pm\sqrt{\frac{500}{16}} = \pm\frac{10\sqrt{5}}{4} = \pm\frac{5\sqrt{5}}{2}$$

$$\boxed{\text{Approximately 5.6 seconds}}$$

63.

$$2x - 4 = 2^3 = 8$$

$$2x = 12$$

$$\boxed{x = 6}$$

64.

$$\boxed{\text{no solution}}$$

65.

$$2x - 7 = 3^5$$

$$2x = 7 + 243 = 250$$

$$\boxed{x = 125}$$

66.

$$x^2 = 7x - 10$$

$$x^2 - 7x + 10 = 0$$

$$(x-2)(x-5) = 0$$

$$\boxed{x = 2, 5}$$

67. $(x-4)^2 = x^2+5x+6$

$x^2-8x+16 = x^2+5x+6$

$13x = 10$

$\cancel{x = \frac{10}{13}}$ (This answer would make the first $\sqrt{\ }$ equal to a negative number)

$\boxed{\text{no solution}}$

68. $2x-7 = x+3$

$\boxed{x = 10}$

69. $x+3 = 4-4\sqrt{3x+2}+3x+2$

$-2x-3 = -4\sqrt{3x+2}$

$2x+3 = 4\sqrt{3x+2}$

$(2x+3)^2 = 16(3x+2)$

$4x^2+12x+9 = 48x+32$

$4x^2-36x-23 = 0$

$x = \frac{36 \pm \sqrt{36^2-4(4)(-23)}}{2(4)}$

$x = \frac{36 \pm \sqrt{1664}}{8} \cong -0.6, 9.6$

$\boxed{x \cong -0.6}$ (9.6 doesn't check)

70. $16+8\sqrt{x-3}+x-3 = x-5$

$8\sqrt{x-3} = -18$

$\boxed{\text{no solution}}$

71. $x^2-4x+4 = 49-x^2$

$2x^2-4x-45 = 0$

$x = \frac{-(-4) \pm \sqrt{(-4)^2-4(2)(-45)}}{2(2)}$

$x = \frac{4 \pm \sqrt{376}}{4}$

$x \cong \cancel{-3.85}, 5.85$

$\boxed{x \cong 5.85}$

72. $\sqrt{2x-5} = 3+\sqrt{x+2}$

$2x-5 = 9+6\sqrt{x+2}+x+2$

$x-16 = 6\sqrt{x+2}$

$(x-16)^2 = 36(x+2)$

$x^2-32x+256 = 36x+72$

$x^2-68x+184 = 0$

$x = \frac{68 \pm \sqrt{68^2-4(1)(184)}}{2}$

$x = \frac{68 \pm \sqrt{3888}}{2}$

$\boxed{x \cong 65.2}$

73.

$$x^2 = 3 - x$$

$$x^2 + x - 3 = 0$$

$$x = \frac{-1 \pm \sqrt{1 - 4(1)(-3)}}{2(1)}$$

$$x = \frac{-1 \pm \sqrt{13}}{2} \cong -2.303, \cancel{1.3}$$

$$\boxed{x \cong -2.303}$$

74.

$$15 + 2\sqrt{x-4} + \sqrt{x} = 25$$

$$2\sqrt{x-4} + \sqrt{x} = 10$$

$$2\sqrt{x-4} = 10 - \sqrt{x}$$

$$4(x-4) = 100 - 20\sqrt{x} + x$$

$$4x - 16 = 100 - 20\sqrt{x} + x$$

$$3x - 116 = -20\sqrt{x}$$

$$9x^2 - 696x + 13456 = 400x$$

$$9x^2 - 1096x + 13456 = 0$$

$$x = \frac{1096 \pm \sqrt{1096^2 - 4(9)(13456)}}{18}$$

$$x \cong \frac{1096 \pm 846.6}{18} \cong 108, 13.9$$

$$\boxed{x = 13.9}$$

75.

$$(3x-2)^2 - 11(3x-2) + 28 = 0$$

Let $u = 3x - 2$

$$u^2 - 11u + 28 = 0$$

$$(u-4)(u-7) = 0$$

$$u = 4, 7$$

$3x - 2 = 4$

$3x = 6 \Rightarrow \boxed{x = 2}$

$3x - 2 = 7$

$3x = 9 \Rightarrow \boxed{x = 3}$

76.

$$u = x^2$$

$$u^2 - 6u + 9 = 0$$

$$(u-3)^2 = 0$$

$$u = 3$$

$$x^2 = 3$$

$$\boxed{x = \pm\sqrt{3}}$$

77.

$$u = \frac{x}{1-x} \quad \boxed{x \neq 1}$$

$$u^2 + 2u - 15 = 0$$

$$(u+5)(u-3) = 0$$

$$u = -5, 3$$

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

$$-5 + 5x = x$$

$$4x = 5$$

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

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

$$3 - 3x = x$$

$$4x = 3$$

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

78.

Let $u = (x-4)^2$

$$3u^2 - 11u - 20 = 0$$

$$(3u+4)(u-5) = 0$$

$$u = -\frac{4}{3}, 5$$

$$(x-4)^2 = -\frac{4}{3}$$

(no solution)

$$(x-4)^2 = 5$$

$$x - 4 = \pm\sqrt{5}$$

$$\boxed{x = 4 \pm \sqrt{5}}$$

79.

$y^{-2}-5y^{-1}+4=0$

Let $u=y^{-1}$

$u^2-5u+4=0$

$(u-4)(u-1)=0$

$u=4,1$

So, we have:

$y^{-1}=4 \Rightarrow \boxed{y=\frac{1}{4}}$

$y^{-1}=1 \Rightarrow \boxed{y=1}$

80.

$p^{-2}+4p^{-1}-12=0$

Let $u=p^{-1}$

$u^2+4u-12=0$

$(u+6)(u-2)=0$

$u=-6,2$

So, we have:

$p^{-1}=-6 \Rightarrow \boxed{p=-\frac{1}{6}}$

$p^{-1}=2 \Rightarrow \boxed{p=\frac{1}{2}}$

81.

$2x^{2/3}+3x^{1/3}-5=0$

Let $u=x^{1/3}$

$2u^2+3u-5=0$

$(2u+5)(u-1)=0$

$u=-\frac{5}{2},1$

$x^{1/3}=-\frac{5}{2}$

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

$\boxed{x=-\frac{125}{8}}$

$x^{1/3}=1$

$\boxed{x=1}$

82.

Let $u=x^{1/3}$

$2u^2-3u-5=0$

$(2u-5)(u+1)=0$

$u=-1,\frac{5}{2}$

$x^{1/3}=\frac{5}{2}$

$\boxed{x=\frac{125}{8}}$

$x^{1/3}=-1$

$\boxed{x=-1}$

83.

$x^{-2/3}+3x^{-1/3}+2=0$

Let $u=x^{-1/3}$.

$u^2+3u+2=0$

$(u+2)(u+1)=0$

$u=-2,-1$

So, we have:

$x^{-1/3}=-2 \Rightarrow x=(-2)^{-3}=\boxed{-\frac{1}{8}}$

$x^{-1/3}=-1 \Rightarrow x=(-1)^{-3}=\boxed{-1}$

84.

$y^{-1/2}-2y^{-1/4}+1=0$

Let $u=y^{-1/4}$.

$u^2-2u+1=0$

$(u-1)^2=0$

$u=1$

So, we have:

$y^{-1/4}=1 \Rightarrow \boxed{y=1}$

85.

Let $u = x^2$

$u^2 + 5u - 36 = 0$

$(u+9)(u-4) = 0$

$u = -9, 4$

$-9 = x^2$ $\quad$ $4 = x^2$

$\boxed{x = \pm 3i}$ $\quad$ $\boxed{x = \pm 2}$

86.

Let $u = x^{-1/2}$

$u^2 - 4u + 3 = 0$

$(u-1)(u-3) = 0$

$u = 1, 3$

$1 = x^{-1/2}$ $\quad$ $3 = x^{-1/2}$

$\boxed{x = 1^{-2} = 1}$ $\quad$ $\boxed{x = 3^{-2} = \frac{1}{9}}$

87.

$x^3 + 4x^2 - 32x = 0$

$x(x^2 + 4x - 32) = 0$

$x(x+8)(x-4) = 0$

$\boxed{x = 0, -8, 4}$

88.

$9t^3 - 25t = 0$

$t(9t^2 - 25) = 0$

$t(3t-5)(3t+5) = 0$

$\boxed{t = 0, \pm 5/3}$

89.

$p^3 - 3p^2 - 4p + 12 = 0$

$(p^3 - 3p^2) - 4(p-3) = 0$

$p^2(p-3) - 4(p-3) = 0$

$(p^2 - 4)(p-3) = 0$

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

$\boxed{p = \pm 2, 3}$

90.

$4x^3 - 9x^2 + 4x - 9 = 0$

$(4x^3 - 9x^2) + (4x - 9) = 0$

$x^2(4x-9) + (4x-9) = 0$

$(x^2 + 1)(4x-9) = 0$

$\boxed{x = \pm i, 9/4}$

91.

$p(2p-5)^2 - 3(2p-5) = 0$

$(2p-5)[p(2p-5) - 3] = 0$

$(2p-5)(2p^2 - 5p - 3) = 0$

$(2p-5)(2p+1)(p-3) = 0$

$\boxed{p = -1/2, 5/2, 3}$

92.

$2(t^2-9)^3 - 20(t^2-9)^2 = 0$

$2(t^2-9)^2 \underbrace{[t^2 - 9 - 10]}_{t^2 - 19} = 0$

$2(t-3)(t+3)(t-\sqrt{19})(t+\sqrt{19}) = 0$

$\boxed{t = \pm 3, \pm\sqrt{19}}$

93.

$$y - 81y^{-1} = 0$$
$$y - \frac{81}{y} = 0$$
$$\frac{y^2 - 81}{y} = 0$$
$$\frac{(y-9)(y+9)}{y} = 0$$
$$\boxed{y = \pm 9}$$

94.

$$9x^{3/2} - 37x^{1/2} + 4x^{-1/2} = 0$$
$$x^{-1/2}\left(9x^2 - 37x + 4\right) = 0$$
$$x^{-1/2}(9x-1)(x-4) = 0$$
$$\boxed{x = 1/9,\ 4}$$

95. $(-\infty, -4]$

96. $(-1, 7]$

97. $[2, 6]$

98. $(-1, \infty)$

99. $x > -6$

100. $x \le 0$

101. $-3 \le x \le 7$

102. $-5 < x \le 2$

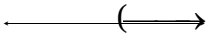
103. $x \ge -4$

$[-4, \infty)$

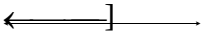
104. $[-4, 4]$

$-4 \le x \le 4$

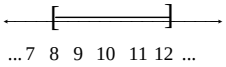
105. $(4, \infty)$



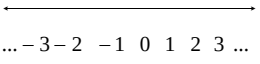
106. $(-\infty, 2]$



107. $[8, 12]$

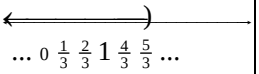


108. $\varnothing$



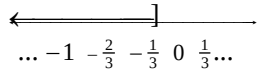
109.

$$3x < 5$$
$$x < 5/3$$
$$\boxed{(-\infty, 5/3)}$$



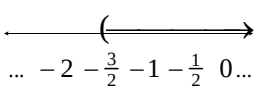
110.

$$6x \le -2$$
$$x \le -1/3$$
$$\boxed{(-\infty, -1/3]}$$



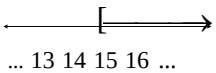
111.

$$4x - 4 > 2x - 7$$
$$2x > -3$$
$$x > -3/2$$
$$\boxed{(-3/2, \infty)}$$



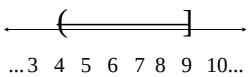
112.

$$x + 3 \ge 18$$
$$x \ge 15$$
$$\boxed{[15, \infty)}$$



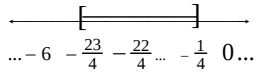
113.

$$6 < 2 + x \le 11$$
$$4 < x \le 9$$
$$\boxed{(4, 9]}$$



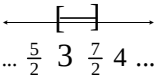
114.

$$-6 \le -4x - 7 \le 16$$
$$1 \le -4x \le 23$$
$$-\frac{1}{4} \ge x \ge -\frac{23}{4}$$
$$\boxed{\left[-\frac{23}{4}, -\frac{1}{4}\right]}$$



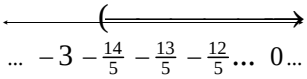
115.

$$\text{LCD} = 12$$
$$8 \le 2(1+x) \le 9$$
$$8 \le 2 + 2x \le 9$$
$$6 \le 2x \le 7$$
$$3 \le x \le 7/2$$
$$\boxed{[3, 7/2]}$$



116.

$$\text{LCD} = 18$$
$$6x + 2(x+4) > 3x - 6$$
$$6x + 2x + 8 > 3x - 6$$
$$5x > -14$$
$$x > -14/5$$
$$\boxed{(-14/5, \infty)}$$



117.

$$\frac{72+65+69+70+x}{5} \ge 70$$
$$x + 276 \ge 350$$
$$\boxed{x \ge 74}$$

So, the lowest score is 74.

118.

$$\text{Cost} = 8500 + 50x$$
$$\text{Revenue} = 300x$$
$$\text{Profit} = 300x - (8500 + 50x) > 0$$
$$250x > 8500$$
$$\boxed{x > 34}$$

So, greater than 34 suits.

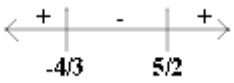
119.

$$x^2 - 36 \le 0$$
$$(x-6)(x+6) \le 0$$
CP's: $x = -6, 6$

$$\boxed{[-6, 6]}$$

120.

$$6x^2 - 7x - 20 < 0$$
$$(3x+4)(2x-5) < 0$$
CP's: $x = -\frac{4}{3}, \frac{5}{2}$



$$\boxed{\left(-\frac{4}{3}, \frac{5}{2}\right)}$$

121.

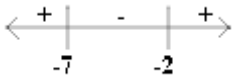
$$x^2 - 4x \ge 0$$
$$x(x-4) \ge 0$$
CP's: $x = 0, x = 4$

$$\boxed{(-\infty, 0] \cup [4, \infty)}$$

122. $x^2+9x+14\le 0$

$(x+7)(x+2)\le 0$

CP's: $-7,-2$



$\boxed{[-7,-2]}$

123. $x^2-7x>0$

$x(x-7)>0$

CP's: $x=0,7$

$\boxed{(-\infty,0)\cup(7,\infty)}$

124. $x^2<-4$

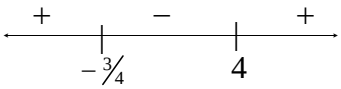
$\boxed{\text{no solution}}$

125. $4x^2-12>13x$

$4x^2-13x-12>0$

$(4x+3)(x-4)>0$

CPs: $x=-\frac{3}{4},\ 4$



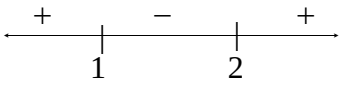
$\boxed{(-\infty,-\frac{3}{4})\cup(4,\infty)}$

126. $3x\le x^2+2$

$x^2-3x+2\ge 0$

$(x-2)(x-1)\ge 0$

CPs: $x=1,2$



$(-\infty,1]\cup[2,\infty)$

127. $\dfrac{x}{x-3}<0$ $\boxed{x\ne 3}$

CP's: $x=0,3$

$\boxed{(0,3)}$

128. $\dfrac{x-1}{x-4}>0$ $\boxed{x\ne 4}$

CP's: $1,4$

$\boxed{(-\infty,1)\cup(4,\infty)}$

129. $\dfrac{x^2-3x}{3}-\dfrac{18(3)}{3}\ge 0$

$\dfrac{x^2-3x-54}{3}\ge 0$

$\dfrac{(x-9)(x+6)}{3}\ge 0$

CP's: $x=-6,9$

$\boxed{(-\infty,-6]\cup[9,\infty)}$

130.

$$\frac{(x-7)(x+7)}{x-7} \geq 0 \quad \boxed{x \neq 7}$$

$$x+7 \geq 0$$

$$x \geq -7$$

$$\boxed{[-7,7) \cup (7,\infty)}$$

131.

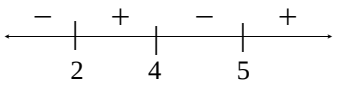
$$\frac{3}{x-2} - \frac{1}{x-4} \leq 0$$

$$\frac{3(x-4)-(x-2)}{(x-2)(x-4)} \leq 0$$

$$\frac{2x-10}{(x-2)(x-4)} \leq 0$$

$$\frac{2(x-5)}{(x-2)(x-4)} \leq 0$$

CPs: $x = 2, 4, 5$



$$\boxed{(-\infty, 2) \cup (4, 5]}$$

132.

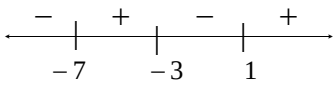
$$\frac{4}{x-1} \leq \frac{2}{x+3}$$

$$\frac{4}{x-1} - \frac{2}{x+3} \leq 0$$

$$\frac{4(x+3)-2(x-1)}{(x-1)(x+3)} \leq 0$$

$$\frac{2(x+7)}{(x-1)(x+3)} \leq 0$$

CPs: $x = -7, -3, 1$



$$\boxed{(-\infty, -7] \cup (-3, 1)}$$

133.

$$\frac{x^2+9}{x-3} \geq 0$$

CP: 3 (since $x^2 + 9 > 0$, for all x)

$$(3, \infty)$$

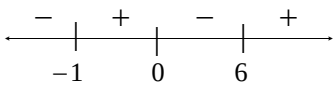
134.

$$x < \frac{5x+6}{x} \quad \Rightarrow \quad x - \frac{5x+6}{x} < 0$$

$$\frac{x^2-5x-6}{x} < 0$$

$$\frac{(x-6)(x+1)}{x} < 0$$

CPs: $-1, 0, 6$



$$\boxed{(-\infty, -1) \cup (0, 6)}$$

135.

$$|x-3| = -4$$

$$\boxed{\text{no solution}}$$

136. $2+x=-5$ or $2+x=5$

$\boxed{x=-7 \text{ or } x=3}$

137. $3x-4=-1.1$ $\quad$ $3x-4=1.1$

$3x=2.9$ $\quad$ $3x=5.1$

$\boxed{x\approx 0.9667}$ $\quad$ $\boxed{x=1.7}$

138. $x^2-6=-3$ $\quad$ $x^2-6=3$

$x^2=3$ $\quad$ $x^2=9$

$\boxed{x=\pm\sqrt{3}}$ $\quad$ $\boxed{x=\pm 3}$

139. $-4<x<4$

$\boxed{(-4,4)}$

140. $-6<x-3<6$

$-3<x<9$

$\boxed{(3,9)}$

141. $x+4<-7$ $\quad$ $x+4>7$

$x<-11$ $\quad$ $x>3$

$\boxed{(-\infty,-11)\cup(3,\infty)}$

142. $-4\le -7+y\le 4$

$3\le y\le 11$

$\boxed{[3,11]}$

143. $|2x|>6$

$2x<-6$ $\quad$ $2x>6$

$x<-3$ $\quad$ $x>3$

$\boxed{(-\infty,-3)\cup(3,\infty)}$

144. $\frac{4+2x}{3}\le -\frac{1}{7}$ $\quad$ $\frac{4+2x}{3}\ge \frac{1}{7}$

LCD = 21 $\quad$ $7(4+2x)\ge 3$

$7(4+2x)\le -3$ $\quad$ $28+14x\ge 3$

$28+14x\le -3$ $\quad$ $14x\ge -25$

$14x\le -31$ $\quad$ $x\ge -25/14$

$x\le -31/14$

$\boxed{(-\infty,-31/14]\cup[-25/14,\infty)}$

145. $\mathbb{R}$

146. $-4\le 1-2x\le 4$

$-5\le -2x\le 3$

$\frac{5}{2}\ge x\ge -\frac{3}{2}$

$\boxed{\left[-\frac{3}{2},\frac{5}{2}\right]}$

147. $|T-85|\le 10$ or $75\le T\le 95$

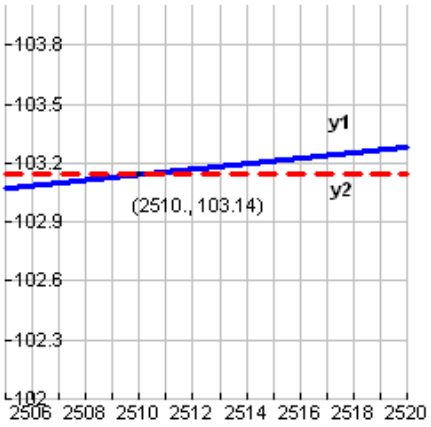
148. $|B-0.08|\le 0.007$

149.

$y1 = 0.031x + 0.017(4000 - x)$

$y2 = 103.14$

$\boxed{x = 2{,}510}$

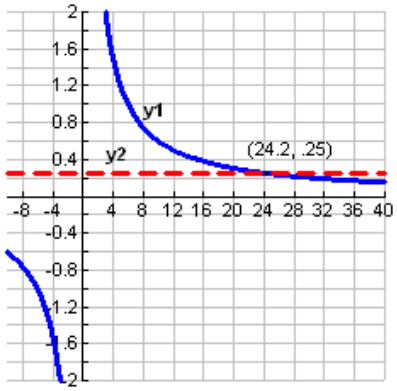


150.

$$y1 = \frac{1}{0.16x} - \frac{0.2}{x}$$

$$y2 = \frac{1}{4}$$

$\boxed{x = 24.2}$

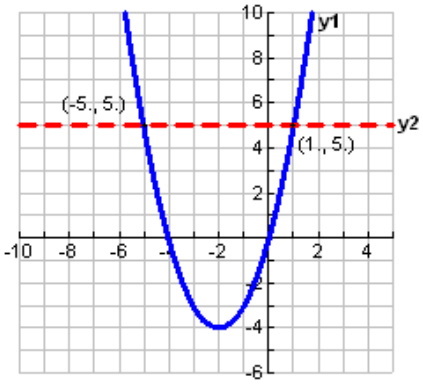


151. (a) Consider $x^2 + 4x - b = 0$. **(1)** For $b = 5$, **(1)** factors as $(x-1)(x+5) = 0$, so that $x = -5, 1$.

Note that they intersect at precisely the x-values obtained algebraically. So, yes, these values agree with the points of intersections.

Graphically, we let $y1 = x^2 + 4x$, $y2 = 5$ and look for the intersection points of the graphs:

(b) We do the same thing now for different values of *b*.

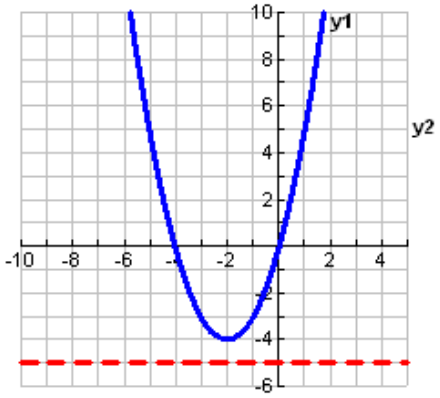


$\underline{b=-5}$:

$$x^2+4x+5=0$$

$$x=\frac{-4\pm\sqrt{16-4(5)}}{2}=\frac{-4\pm 2i}{2}=-2\pm i$$

So, we don't expect the graphs to intersect. Indeed, we have:



$\underline{b=7}$:

$$x^2+4x-7=0$$

$$x=\frac{-4\pm\sqrt{16+4(7)}}{2}=\frac{-4\pm 2\sqrt{11}}{2}=-2\pm\sqrt{11}$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:

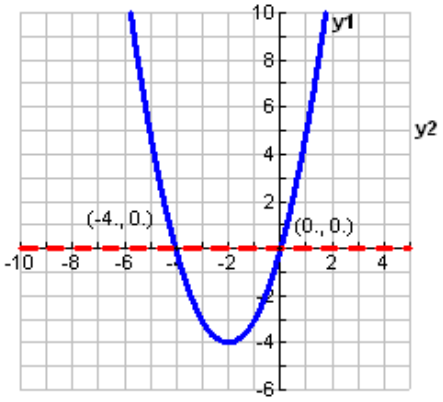
$\underline{b=0}$:

$$x^2+4x=0$$

$$x(x+4)=0$$

$$x=0,-4$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



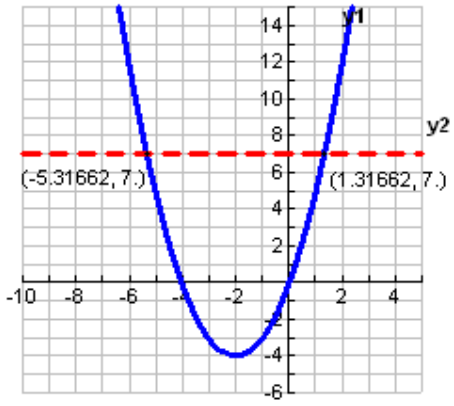
$\underline{b=12}$:

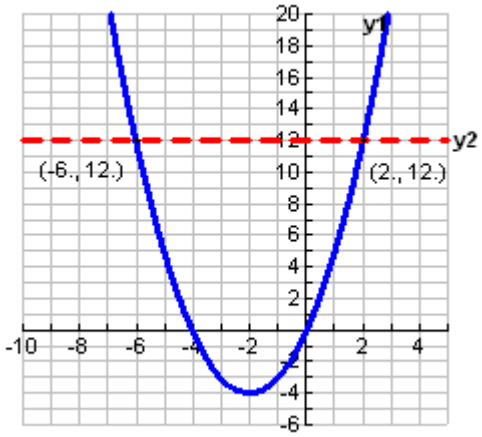
$$x^2+4x-12=0$$

$$(x+6)(x-2)=0$$

$$x=-6,2$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



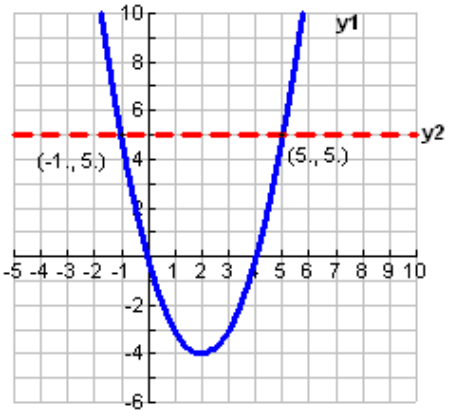


152. (a) Consider $x^2-4x-b=0$. **(1)** For $b=5$, **(1)** factors as $(x+1)(x-5)=0$, so that $x=-1,5$.

Note that they intersect at precisely the *x*-values obtained algebraically. So, yes, these values agree with the points of intersections.

(b) We do the same thing now for different values of *b*.

Graphically, we let $y1=x^2-4x$, $y2=5$ and look for the intersection points of the graphs:



$\underline{b=-5}$:

$$x^2-4x+5=0$$

$$x=\frac{4\pm\sqrt{16-4(5)}}{2}=\frac{4\pm 2i}{2}=2\pm i$$

So, we don't expect the graphs to intersect. Indeed, we have:

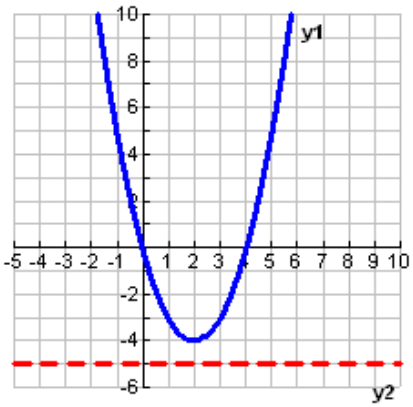
$\underline{b=0}$:

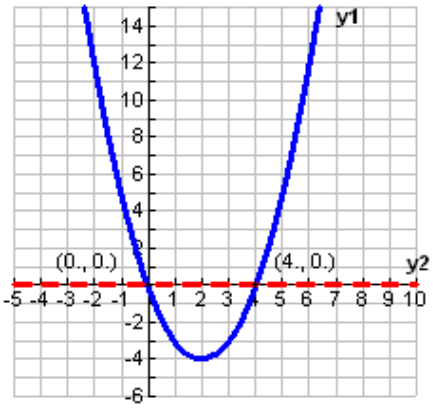
$$x^2-4x=0$$

$$x(x-4)=0$$

$$x=0,4$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



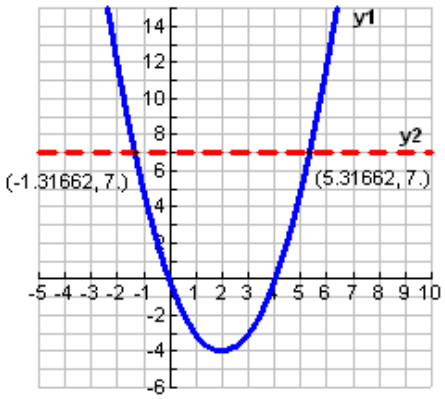


$\underline{b=7}$:

$$x^2-4x-7=0$$

$$x=\frac{4\pm\sqrt{16+4(7)}}{2}=\frac{4\pm2\sqrt{11}}{2}=2\pm\sqrt{11}$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



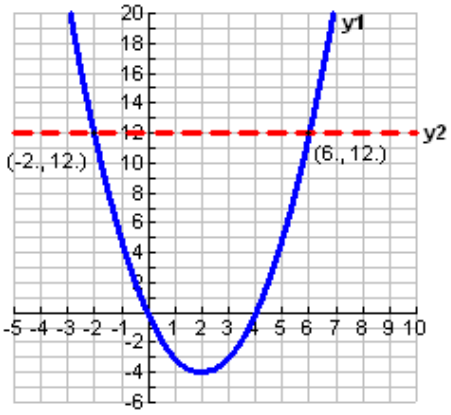
$\underline{b=12}$:

$$x^2-4x-12=0$$

$$(x-6)(x+2)=0$$

$$x=6,-2$$

So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



153.

$2x^{1/4} = -x^{1/2} + 6$

$x^{1/2} + 2x^{1/4} - 6 = 0$

Let $u = x^{1/4}$ to obtain

$u^2 + 2u - 6 = 0$

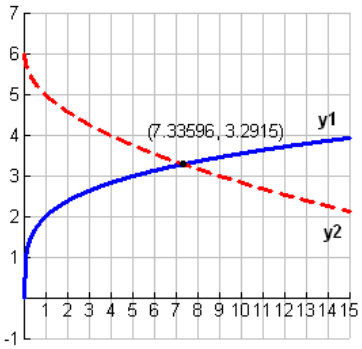
$$u = \frac{-2 \pm \sqrt{4 + 4(6)}}{2} = -1 \pm \sqrt{7}$$

$x^{1/4} = -1 - \sqrt{7}$ $\quad$ $x^{1/4} = -1 + \sqrt{7}$

no solution $\quad$ $\boxed{x = \left(-1 + \sqrt{7}\right)^4 \approx 7.34}$

Graphically, let

$y1 = 2x^{1/4}$, $y2 = -x^{1/2} + 6$



154.

$2x^{-1/2} = x^{-1/4} + 6$

$2x^{-1/2} - x^{-1/4} - 6 = 0$

Let $u = x^{-1/4}$ to obtain

$2u^2 - u - 6 = 0$

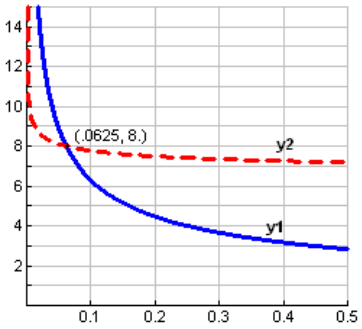
$$u = \frac{-1 \pm \sqrt{1 + 4(2)(6)}}{2(2)} = \frac{1 \pm 7}{4} = 2, -\frac{3}{2}$$

$x^{-1/4} = 2$ $\quad$ $x^{-1/4} = -\frac{3}{2}$

$\boxed{x = \frac{1}{16}}$ $\quad$ no solution

Graphically, let

$y1 = 2x^{-1/2}$, $y2 = x^{-1/4} + 6$



155. a)

$-0.61x + 7.62 > 0.24x - 5.47$

$13.09 > 0.85x$

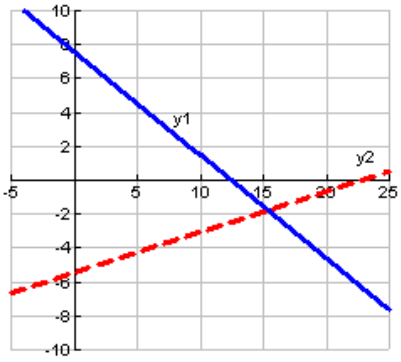
$15.4 > x$

$\boxed{(-\infty, 15.4)}$

c) Agree

b) Graphically, let

$y1 = -0.61x + 7.62$, $y2 = 0.24x - 5.47$

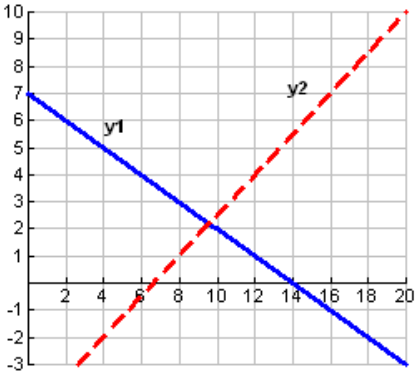


156. a)

$$-\frac{1}{2}x+7<\frac{3}{4}x-5$$
$$-2x+28<3x-20$$
$$48<5x$$
$$9.6<x$$
$$\boxed{(9.6,\infty)}$$

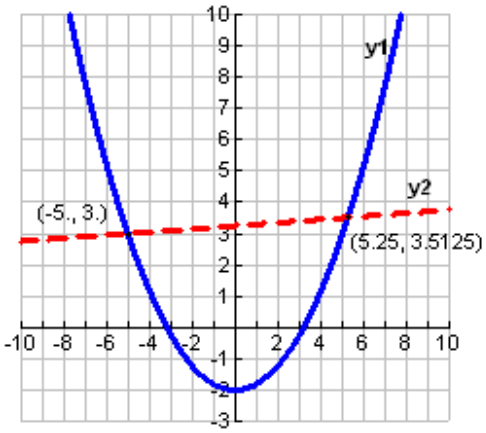
c) Agree

Graphically, let
$y1=-0.5x+7,\ \ y2=0.75x-5$



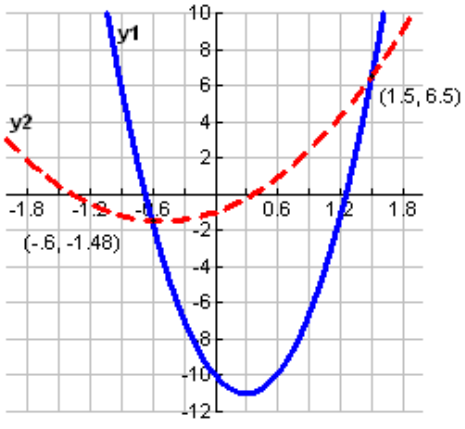
157.

$y1=0.2x^2-2$
$y2=0.05x+3.25$
Find when $y1>y2$
$\boxed{(-\infty,-5)\cup(5.25,\infty)}$



158.

$y1=12x^2-7x-10$
$y2=2x^2+2x-1$
Find when $y1<y2$
$\boxed{\left(-\frac{3}{5},\frac{3}{2}\right)}$



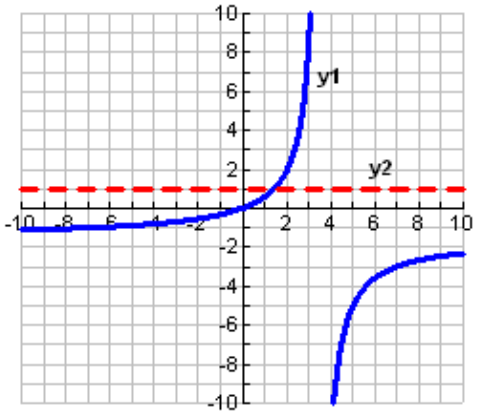
159.

$y1 = \dfrac{3p}{7-2p}$

$y2 = 1$

Find when $y1 > y2$

$\boxed{\left(\frac{7}{5}, \frac{7}{2}\right)}$



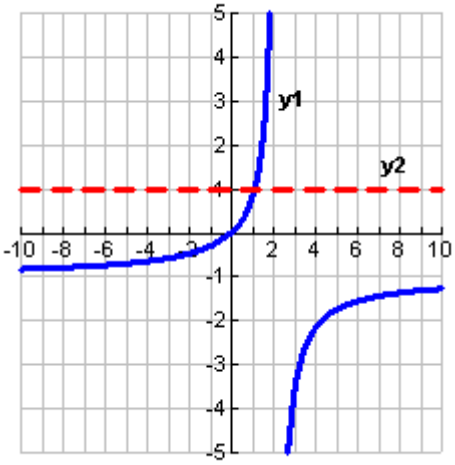
160.

$y1 = \dfrac{7p}{15-2p}$

$y2 = 1$

Find when $y1 < y2$

$\boxed{\left(-\infty, \frac{5}{3}\right) \cup \left(\frac{15}{2}, \infty\right)}$



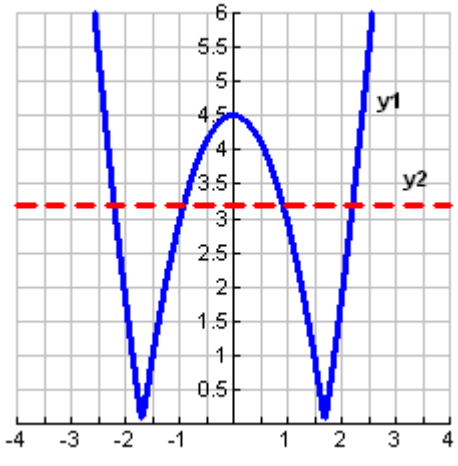
161.

$y1 = \left|1.6x^2 - 4.5\right|$

$y2 = 3.2$

Find when $y1 < y2$

$\boxed{(-2.19, -0.9) \cup (0.9, 2.19)}$



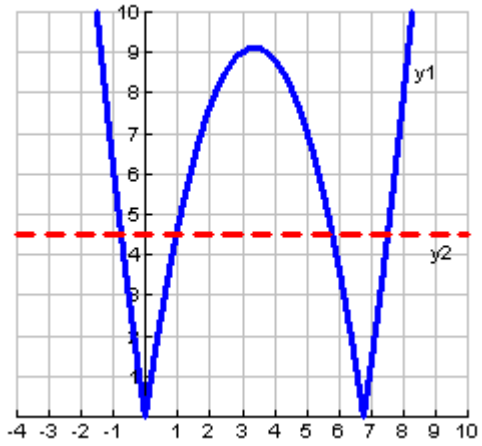
162.

$y1 = |0.8x^2 - 5.4x|$

$y2 = 4.5$

Find when $y1 > y2$

$\boxed{(-\infty, -0.75) \cup (0.97, 5.78) \cup (7.5, \infty)}$



Chapter 1 Practice Test Solutions ----------

1.

$4p - 7 = 6p - 1$

$-6 = 2p$

$\boxed{-3 = p}$

2.

$-2z + 2 + 3 = -3z + 3z - 3$

$-2z = -8$

$\boxed{z = 4}$

3.

$3t = t^2 - 28$

$t^2 - 3t - 28 = 0$

$(t - 7)(t + 4) = 0$

$\boxed{t = -4, 7}$

4.

$8x^2 - 13x = 6$

$8x^2 - 13x - 6 = 0$

$(8x + 3)(x - 2) = 0$

$\boxed{x = -\frac{3}{8}, 2}$

5.

$6x^2 - 13x - 8 = 0$

$(3x - 8)(2x + 1) = 0$

$\boxed{x = -\frac{1}{2}, \frac{8}{3}}$

6.

$$\frac{3}{x-1} - \frac{5}{x+2} = 0$$

$$\frac{3(x+2) - 5(x-1)}{(x-1)(x+2)} = 0$$

$$\frac{-2x + 11}{(x-1)(x+2)} = 0$$

$\boxed{x = 11/2}$

7.

$$\frac{5}{y-3}+1-\frac{30}{y^2-9}=0$$

$$\frac{5(y+3)+(y^2-9)-30}{(y-3)(y+3)}=0$$

$$\frac{y^2+5y-24}{(y-3)(y+3)}=0$$

$$\frac{(y+8)\cancel{(y-3)}}{\cancel{(y-3)}(y+3)}=0$$

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

8.

$$x^4-5x^2-36=0$$

$$\left(x^2+4\right)\left(x^2-9\right)=0$$

$$(x-2i)(x+2i)(x-3)(x+3)=0$$

$$\boxed{x=\pm 3,\ \pm 2i}$$

9.

$$\sqrt{2x+1}+x=7$$

$$\sqrt{2x+1}=7-x$$

$$2x+1=(7-x)^2$$

$$2x+1=49-14x+x^2$$

$$x^2-16x+48=0$$

$$(x-12)(x-4)=0$$

$$\boxed{x=4},\ \cancel{12}$$

10.

Let $u=x^{1/3}$

$$2u^2+3u-2=0$$

$$\left(2u-1\right)\left(u+2\right)=0$$

$$u=-2,1/2$$

So, $\boxed{x=-8,\ \frac{1}{8}}$

11.

$$3y-2=9-6\sqrt{3y+1}+3y+1$$

$$-12=-6\sqrt{3y+1}$$

$$\sqrt{3y+1}=2$$

$$3y+1=4$$

$$3y=3$$

$$\boxed{y=1}$$

12.

$$x(3x-5)^3-2(3x-5)^2=0$$

$$(3x-5)^2\left[x(3x-5)-2\right]=0$$

$$(3x-5)^2\left(3x^2-5x-2\right)=0$$

$$(3x-5)^2(3x+1)(x-2)=0$$

$$\boxed{x=5/3,\ -1/3,\ 2}$$

13.

$$x^{7/3}-8x^{4/3}+12x^{1/3}=0$$

$$x^{1/3}\left(x^2-8x+12\right)=0$$

$$x^{1/3}(x-6)(x-2)=0$$

$$\boxed{x=0,2,6}$$

14.

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

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

$$\boxed{C=\frac{5}{9}\left(F-32\right)}$$

15.

$$P=2L+2W$$

$$P-2W=2L$$

$$\boxed{L=\frac{P-2W}{2}}$$

16.

$$7-5x>-18$$

$$-5x>-25$$

$$x<5$$

$$\boxed{(-\infty,5)}$$

17.

$3x+19 \ge 5x-15$

$34 \ge 2x$

$17 \ge x$

$\boxed{(-\infty, 17]}$

18.

$-1 \le 3x+5 < 26$

$-6 \le 3x < 21$

$-2 \le x < 7$

$\boxed{[-2, 7)}$

19.

$\frac{2}{5} < \frac{x+8}{4} \le \frac{1}{2}$

$8 < 5(x+8) \le 10$

$-32 < 5x \le -30$

$-\frac{32}{5} < x \le -6$

$\boxed{\left(-\frac{32}{5}, -6\right]}$

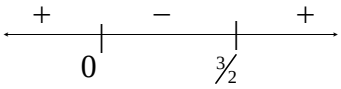
20.

$3x \ge 2x^2$

$0 \ge 2x^2 - 3x$

$0 \ge x(2x-3)$

CPs: $x = 0, \frac{3}{2}$



$\boxed{[0, \frac{3}{2}]}$

21.

$3p^2 - p - 4 \ge 0$

$(3p-4)(p+1) \ge 0$

CP's: $p = \frac{4}{3}, -1$

$\boxed{(-\infty, -1] \cup [\frac{4}{3}, \infty)}$

22.

$|5-2x| > 1$

$5-2x > 1$ or $5-2x < -1$

$-2x > -4$ or $-2x < -6$

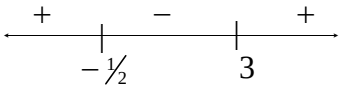
$x < 2$ or $x > 3$

$\boxed{(-\infty, 2) \cup (3, \infty)}$

23.

$\frac{x-3}{2x+1} \le 0$

CPs: $x = -\frac{1}{2}, 3$



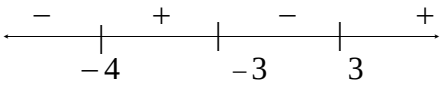
$\boxed{(-\frac{1}{2}, 3]}$

24.

$\frac{x+4}{x^2-9} \ge 0$

$\frac{x+4}{(x-3)(x+3)} \ge 0$

CPs: $x = -4, \pm 3$



$\boxed{[-4, -3) \cup (3, \infty)}$

25. Let x = height of piling

Sand: $\frac{1}{4}x$

Water: 150

Air: $\frac{3}{5}x$

$\frac{1}{4}x + 150 + \frac{3}{5}x = x$

LCD = 20

$5x + 3000 + 12x = 20x$

$3x = 3000$

$\boxed{x = 1000 \text{ ft}}$

26. Let x = purchase price

$|150,000 - x| \leq \underbrace{15,000}_{\text{10\% of list price}}$

$135,000 \leq \text{Purchase Price} \leq 165,000$

$0.07(135,000) \leq \text{commission} \leq 0.07(165,000)$

$\boxed{\$9,450 \leq \text{commission} \leq \$11,550}$

27. Let x = number of minutes in excess of 600

Charges $= 49 + 0.17x$

$53.59 \leq 49 + 0.17x \leq 69.74$

$4.59 \leq 0.17x \leq 20.74$

$27 \leq x \leq 122$

$+ 600$ base

$\boxed{627 \leq x \leq 722}$

28. DVD: $\frac{21}{9}$ ratio

Let x = height of DVD movie

$\frac{21}{9} = \frac{20}{x}$

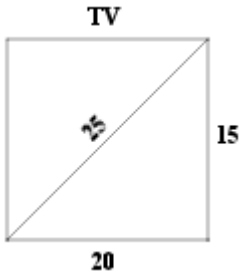
$21x = 180$

$x \cong 8.6$ inches

$\boxed{\text{Movie: } 20 \text{ in.} \times 8.6 \text{ in.}}$

$15 - 8.6 \text{ inches} = 6.4 \text{ inches of black space}$

$\boxed{\text{Bars: } 20 \text{ in.} \times 3.2 \text{ in. each}}$

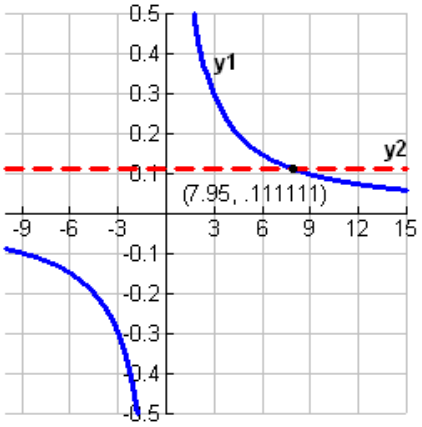


29.

$$y1 = \frac{1}{0.75x} - \frac{0.45}{x}$$

$$y2 = \frac{1}{9}$$

$$\boxed{x = 7.95}$$



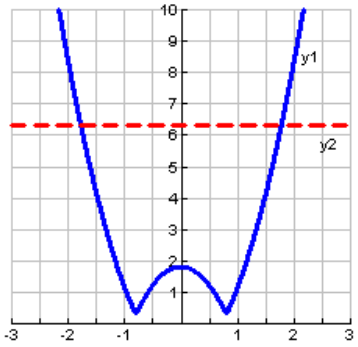
30.

$$y1 = 0.3 + \left|2.4x^2 - 1.5\right|$$

$$y2 = 6.3$$

Find when $y1 \le y2$

$$\boxed{[-1.768, 1.768]}$$



Chapter 1 Cumulative Review----------

1.

$$5\cdot(7-3\cdot 4+2) = 5\cdot(7-12+2)$$
$$= 5\cdot(-5+2)$$
$$= 5\cdot(-3) = \boxed{-15}$$

2.

$$\left(4x^{-3}b^4\right)^{-3} = 4^{-3}x^9b^{-12} = \boxed{\frac{x^9}{64b^{12}}}$$

3.

$$\frac{\left(x^2y^{-2}\right)^3}{\left(x^2y\right)^{-3}} = \frac{x^6y^{-6}}{x^{-6}y^{-3}} = \boxed{\frac{x^{12}}{y^3}}$$

4.

$$\left(-x^4+2x^3\right)+\left(x^3-5x-6\right)$$
$$-\left(5x^4+4x^3-6x+8\right) =$$
$$-x^4+2x^3+x^3-5x-6-5x^4-4x^3+6x-8 =$$
$$\boxed{-6x^4-x^3+x-14}$$

5.

$$x^2(x+5)(x-3) = x^2(x^2+2x-15)$$
$$= \boxed{x^4+2x^3-15x^2}$$

6.

$$3x^3-3x^2-60x = 3x\left(x^2-x-20\right)$$
$$= \boxed{3x(x-5)(x+4)}$$

7.

$$2a^3+2000 = 2\left(a^3+\underbrace{1000}_{=10^3}\right)$$
$$= \boxed{2(a+10)\left(a^2-10a+100\right)}$$

8.

$$\frac{3-x}{x^2-1}\div\frac{5x-15}{x+1} = \frac{-\cancel{(x-3)}}{(x-1)\cancel{(x+1)}}\cdot\frac{\cancel{(x+1)}}{5\cancel{(x-3)}}$$
$$= \boxed{-\frac{1}{5(x-1)}}$$

where $x \neq -1, 1, 3$

9.

$$\frac{6x}{x-2}-\frac{5x}{x+2} = \frac{6x(x+2)-5x(x-2)}{x^2-4}$$
$$= \frac{6x^2+12x-5x^2+10x}{x^2-4}$$
$$= \boxed{\frac{x^2+22x}{x^2-4}}$$

where $x \neq -2, 2$

10.

$$x^3-x^2-30x = 0$$
$$x\left(x^2-x-30\right) = 0$$
$$x(x-6)(x+5) = 0$$
$$\boxed{x = -5, 0, 6}$$

11.

$$\tfrac{2}{7}x = \tfrac{1}{8}x+9$$
$$16x = 7x+504$$
$$9x = 504$$
$$\boxed{x = 56}$$

12.

$$\frac{45}{6-3i}\cdot\frac{6+3i}{6+3i} = \frac{270+135i}{45} = \boxed{6+3i}$$

13.

$$\frac{6x}{5}-\frac{8x}{3} = 4-\frac{7x}{15}$$
$$18x-40x = 60-7x$$
$$-22x = 60-7x$$
$$-15x = 60$$
$$\boxed{x = -4}$$

14.

$$\frac{x-6}{6-x} = \frac{3}{2}, \qquad x \neq 6$$
$$-\frac{\cancel{x-6}}{\cancel{x-6}} = \frac{3}{2}$$
$$-1 = \frac{3}{2}$$

Since this statement is false, the equation has $\boxed{\text{no solution}}$.

15.

Tim rate: 1/9 job in one hour

Chelsea and Tim combined rate:
1/5 job in one hour

Let x = number of hours it takes Chelsea to complete job by herself

Solve:

$$\tfrac{1}{9}+\tfrac{1}{x}=\tfrac{1}{5}$$
$$5x+45=9x$$
$$45=4x \;\Rightarrow\; 11.25=x$$

It takes Chelsea $\boxed{11.25 \text{ hours}}$ by herself.

16.

$$y^2+36=0$$
$$y^2=-36$$
$$y=\pm\sqrt{-36}=\boxed{\pm 6i}$$

17.

$$x^2+12x+40=0$$
$$\left(x^2+12x+36\right)+40-36=0$$
$$(x+6)^2+4=0$$
$$(x+6)^2=-4$$
$$x+6=\pm\sqrt{-4}=\pm 2i$$
$$\boxed{x=-6\pm 2i}$$

18.

$$x^2+x+9=0$$
$$x=\frac{-1\pm\sqrt{1-4(9)}}{2}$$
$$=\frac{-1\pm\sqrt{-35}}{2}$$
$$=\boxed{\frac{-1\pm i\sqrt{35}}{2}}$$

19.

$$\sqrt{4-x}=x-4$$
$$4-x=(x-4)^2$$
$$4-x=x^2-8x+16$$
$$x^2-7x+12=0$$
$$(x-4)(x-3)=0$$
$$x=\not{3},\boxed{4}$$

20.

$$3x^{-2}+8x^{-1}+4=0$$

Let $u=x^{-1}$.

$$3u^2+8u+4=0$$
$$(3u+2)(u+2)=0$$
$$u=-\tfrac{2}{3},-2$$
$$x^{-1}=-\tfrac{2}{3} \;\Rightarrow\; x=\boxed{-\tfrac{3}{2}}$$
$$x^{-1}=-2 \;\Rightarrow\; x=\boxed{-\tfrac{1}{2}}$$

21.

$$0<4-x\le 7$$
$$-4<-x\le 3$$
$$4>x\ge -3$$
$$\boxed{[-3,4)}$$

22.

$$4x^2<9x-11$$
$$4x^2-9x+11<0$$
$$x=\frac{9\pm\sqrt{81-4(4)(11)}}{2(4)}=\frac{9\pm i\sqrt{95}}{8}$$

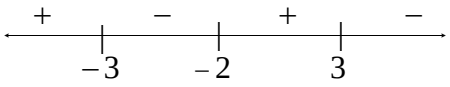
No real solution

23.

$$\frac{x+2}{9-x^2} \geq 0$$

$$\frac{x+2}{(3-x)(3+x)} \geq 0$$

CPs: $x = -2, \pm 3$



$$\boxed{(-\infty, -3) \cup [-2, 3)}$$

24.

$$\left|\frac{4-5x}{7}\right| \geq \frac{3}{14}$$

$$\frac{|4-5x|}{7} \geq \frac{3}{14}$$

$$2|4-5x| \geq 3$$

$2(4-5x) \geq 3$ or $2(4-5x) \leq -3$

$8-10x \geq 3$ $\quad$ $8-10x \leq -3$

$-10x \geq -5$ $\quad$ $-10x \leq -11$

$x \leq \frac{1}{2}$ $\quad$ $x \geq \frac{11}{10}$

$$\boxed{(-\infty, \tfrac{1}{2}] \cup [\tfrac{11}{10}, \infty)}$$

25.

$$\left|\frac{1}{5}x + \frac{2}{3}\right| = \frac{7}{15}$$

$$\frac{|3x+10|}{15} = \frac{7}{15}$$

$$|3x+10| = 7$$

$3x+10 = 7$ or $3x+10 = -7$

$3x = -3$ $\quad$ $3x = -17$

$\boxed{x = -1}$ $\quad$ $\boxed{x = -\frac{17}{3}}$

26.

$$x^6 + \frac{37}{8}x^3 - 27 = 0$$

$$8x^6 + 37x^3 - 216 = 0$$

Let $u = x^3$.

$$8u^2 + 37u - 216 = 0$$

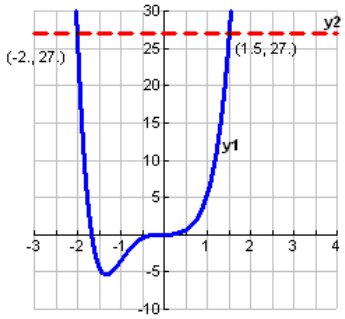
$$u = \frac{-37 \pm \sqrt{37^2 + 4(8)(216)}}{2(8)} = -8, \frac{27}{8}$$

$x^3 = -8 \Rightarrow \boxed{x = -2}$

$x^3 = \frac{27}{8} \Rightarrow \boxed{x = \frac{3}{2}}$

Graphically, let

$$y1 = x^6 + \frac{37}{8}x^3, \quad y2 = 27.$$



27.

$$y1 = \left|\frac{3x}{x-2}\right|$$

$y2 = 1$

Find when $y1 < y2$

$\boxed{(-1, \frac{1}{2})}$