CHAPTER 1

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

1.

$$5x = 35$$

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

$$\boxed{x = 7}$$

3.

$$-3 + n = 12$$

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

$$\boxed{n = 15}$$

5.

$$24 = -3x$$

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

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

7.

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

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

$$\boxed{n = 15}$$

9.

$$3x - 5 = 7$$

$$3x = 12$$

$$\boxed{x = 4}$$

11.

$$9m - 7 = 11$$

$$9m = 18$$

$$\boxed{m = 2}$$

13.

$$5t + 11 = 18$$

$$5t = 7$$

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

15.

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

$$3x = 30 + 6x$$

$$-3x = 30$$

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

17.

$$20n - 30 = 20 - 5n$$

$$20n = 50 - 5n$$

$$25n = 50$$

$$\boxed{n = 2}$$

19.

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

$$4x - 12 = 2x + 12$$

$$2x = 24$$

$$\boxed{x = 12}$$

21.

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

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

$$-15 = 2t$$

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

23.

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

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

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

$$4x = -4$$

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

25.

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

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

$$11p + 42 = 3p + 6$$

$$8p = -36$$

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

27.

$$7x-(2x+3)=x-2$$
$$7x-2x-3=x-2$$
$$5x-3=x-2$$
$$4x=1$$
$$\boxed{x=\tfrac{1}{4}}$$

29.

$$2-(4x+1)=3-(2x-1)$$
$$2-4x-1=3-2x+1$$
$$1-4x=4-2x$$
$$-3=2x$$
$$\boxed{-\tfrac{3}{2}=x}$$

31.

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

33.

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

35.

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

37.

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

39.

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

41.

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

43.

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

45.

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

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

49.

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

51.

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

53.

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

55.

$$(x-2)\left(\frac{x}{x-2} + 5\right) = (x-2)\left(\frac{2}{x-2}\right) \qquad \boxed{x \neq 2}$$
$$x + 5(x-2) = 2$$
$$x + 5x - 10 = 2$$
$$6x = 12$$
$$x = 2$$

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

57.

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

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

59.

$$(x+2)\left(\frac{3x}{x+2} - 4\right) = (x+2)\left(\frac{2}{x+2}\right) \qquad \boxed{x \neq -2}$$
$$3x - 4(x+2) = 2$$
$$-x - 8 = 2$$
$$\boxed{x = -10}$$

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

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

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

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

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: $\boxed{n=\frac{53}{11}}$

67. $\frac{2}{5x+1}=\frac{1}{2x-1}$ $\boxed{x\neq -\frac{1}{5},\frac{1}{2}}$

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

$4x-2=5x+1$

$\boxed{x=-3}$

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

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

$3-3t=2t-2$

$-5t=-5$

$t=1$

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

71.

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

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

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

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

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 $\boxed{84 \text{ min.}}$

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

$$2 + 0.10x = 3.70$$

$$0.10x = 1.70$$

$$x = 17$$

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

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.

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

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

81.

$$f = \frac{c}{\lambda}$$

$$\boxed{\lambda \neq 0}$$

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

85.
Cannot cross multiply- must multiply by LCD first. The correct answer is $p = 6/5$.

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

89. True

91.

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

$$ax = c - b$$

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

93.

$$\frac{b+c}{x+a}=\frac{b-c}{x-a} \quad \boxed{x\neq\pm a}$$

$$(b+c)(x-a)=(b-c)(x+a)$$

$$bx-ba+cx-ca=bx+ba-cx-ca$$

$$2cx=2ba \qquad \boxed{x=\frac{ba}{c}}$$

95.

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

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

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

97.

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

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

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

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

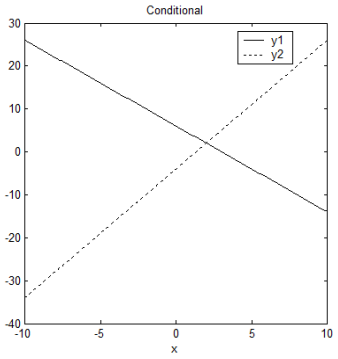
$$yb+xy(c+1)-ax=0$$

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

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

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

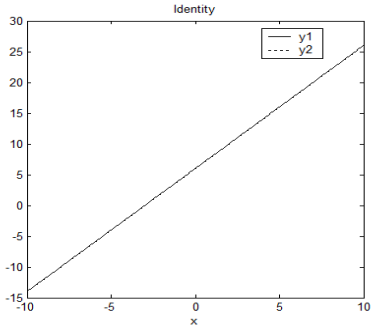
$y2=3x-4$



$\boxed{x=2}$

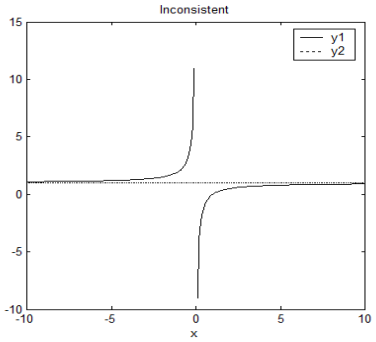
101. $y1=2x+6$

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



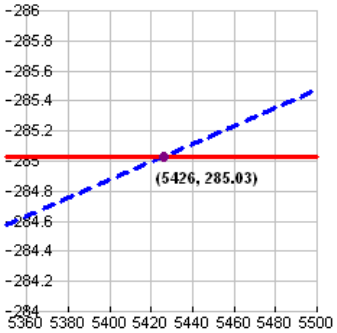
All real numbers

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



No solution

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



$x = 5426$

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

1. Let x = price without coupon

$0.9x = 217.95$

$x = \$242.17$

3. Let x = cost of pizza

Tom: 5.16

Chelsea: $1/8\ x$

Jeff: $1/2\ x$

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

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

$$3x = 41.28$$

$x = \$13.76$

5. Let x = original price

$0.85x = 125,000$

$x = 147,058.82$

Original price $\cong \$147,058.82$

Model price = \$125,000

Savings = \$22,058.82

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

Home $\rightarrow$ Train station = 1 mile

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

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

LCD = 12

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

$12 + 11x = 12x$

$x = 12$

Angela travels 12 miles to the restaurant.

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

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

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

$$19x+165=30x$$

$$11x=165$$

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

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

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.

13.

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

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

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

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

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

$$4x=2+3x+6$$

$$x=8$$

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

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 $\boxed{20 \text{ inches}}$.

19. $w =$ width

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

$$p=2l+2w$$

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

$$260=4w+80+2w$$

$$180=6w$$

$$w=30$$

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

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 $= 2\pi r_2$

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

$r_2 = 2r_1$

$2r_1 = r_1 + 3$

$r_1 = 3$

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

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

$3x = 900$

$x = 300$

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

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

Solve:

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

$0.5x = 2.625$

$x = 5.25$

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

27. Let x = amount invested at 4%.

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

Solve:

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

$$0.04x + 8400 - 0.07x = 7{,}800$$

$$-0.03x = -600$$

$$x = 20{,}000$$

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

29. Let x = amount invested at 10%.

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

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

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

Solve:

$$0.1x + 0.02\left(\frac{14{,}000 - x}{2}\right) + 0.4\left(\frac{14{,}000 - x}{2}\right) = 2610$$

$$0.1x + 140 - 0.01x + 2800 - 0.2x = 2610$$

$$-0.11x = -330$$

$$x = 3{,}000$$

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

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

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

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

Solve:

$32x + 4(33 - x) = 300$

$32x + 132 - 4x = 300$

$28x = 168$

$x = 6$

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

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

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.

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

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

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.

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

Solve for x:

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

45. rate (r) = boat speed $(\mathrm{s}) \pm$ current speed (c)

boat speed: $\mathrm{s} = 16$ mph

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

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

Distance is the same both ways $(\text{rate} \cdot \text{time})$

Solve:

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

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

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

$$7c = 16$$

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

47. rate of walker = $\mathrm{r_w}$

rate of jogger = $\mathrm{r_w} + 2$

time of walker = 1 hour

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

$$\mathrm{r_w}(1) = (r_w + 2)(2/3)$$

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

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

$$r_w = 4$$

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

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.

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.

$$\frac{1}{15} + \frac{1}{x} = \frac{1}{9}$$

$$3x + 45 = 5x$$

$$2x = 45$$

$$x = 22.5$$

$$\boxed{\begin{array}{l}\text{Cynthia can paint the house} \\ \text{alone in } 22.5 \text{ hours.}\end{array}}$$

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.

55.

$\frac{4}{5} = \frac{264}{x_1}$

$4x_1 = 264(5)$

$4x_1 = 1320$

$\boxed{x_1 = 330 \text{ hertz}}$

$\frac{4}{6} = \frac{264}{x_2}$

$4x_2 = 264(6)$

$4x_2 = 1584$

$\boxed{x_2 = 396 \text{ hertz}}$

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

$85 + 2x = 270$

$2x = 185$

$\boxed{x = 92.5}$

59.

Let x = # field goals

$8 - x$ = # touchdowns

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

$3x + 56 - 7x = 48$

$-4x = -8$

$x = 2$

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

61.

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

$210 = 60x$

$x = 3.5$

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

63.

Let the board be 1 unit long.

Let x = distance from Maria to fulcrum.

$1 - x$ = distance from Max to fulcrum.

$60x = 42(1 - x)$

$60x = 42 - 42x$

$102x = 42$

$x \cong 0.4$

$\boxed{\text{Fulcrum is 0.4 units from Maria and 0 .6 units from Max.}}$

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 $\boxed{d_0 = 7.5}$ cm from 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

69.

$$P = 2l + 2w$$

$$P - 2l = 2w$$

$$\frac{P - 2l}{2} = w$$

71.

$$A = \tfrac{1}{2} bh$$

$$2A = bh$$

$$\frac{2A}{b} = h$$

73.

$$A = lw$$

$$\frac{A}{l} = w$$

75.

$$V = lwh$$

$$\frac{V}{lw} = h$$

77. Let x = Janine's average speed (in mph).
Then, Tricia's speed = $(12 + x)$ mph. We must solve the equation:

$$2.5(12 + x) + 2.5x = 320$$

$$30 + 2.5x + 2.5x = 320$$

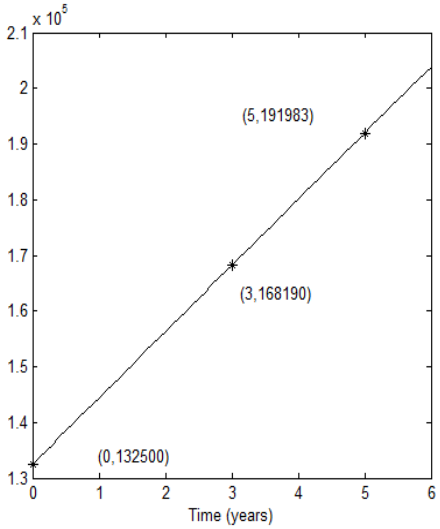
$$5x = 290$$

$$x = 58$$

So, Janine's average speed is 58 mph and Tricia's average speed is 70 mph.

79. $y = 11896.67x + 132500$

$\boxed{\$191,983.35}$

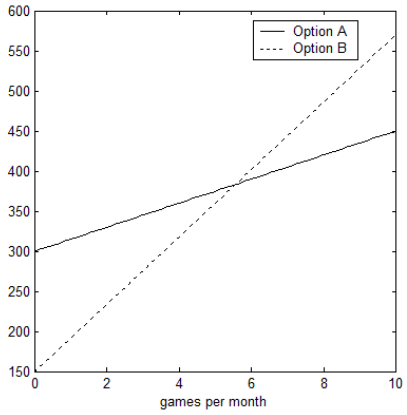


81. Let $x =$ number of times you play.

Option A: $y_1 = 300 + 15x$

Option B: $y_2 = 150 + 42x$

$\boxed{\begin{array}{l}\text{Option B is better if you play}\\ \text{about 5 times or less per month.}\\ \text{Option A is better if you play}\\ \text{6 times or more per month.}\end{array}}$.



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

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

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

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

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

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

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

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

5.

$x^2 = 12 - x$

$x^2 + x - 12 = 0$

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

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

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

7.

$16x^2 + 8x = -1$

$16x^2 + 8x + 1 = 0$

$(4x+1)(4x+1) = 0$

$4x + 1 = 0$

$\boxed{x = -1/4}$

9.

$9y^2 + 1 = 6y$

$9y^2 - 6y + 1 = 0$

$(3y-1)(3y-1) = 0$

$\boxed{y = 1/3}$

11.

$8y^2 - 16y = 0$

$8y(y-2) = 0$

$8y = 0$ or $y - 2 = 0$

$\boxed{y = 0 \text{ or } y = 2}$

13.

$9p^2 = 12p - 4$

$9p^2 - 12p + 4 = 0$

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

$3p - 2 = 0$

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

15.

$x^2 - 9 = 0$

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

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

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

17.

$x(x+4) = 12$

$x^2 + 4x = 12$

$x^2 + 4x - 12 = 0$

$(x+6)(x-2) = 0$

$x + 6 = 0$ or $x - 2 = 0$

$\boxed{x = -6 \text{ or } x = 2}$

19.

$2p^2 - 50 = 0$

$2(p^2 - 25) = 0$

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

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

21.

$3x^2 = 12$

$3x^2 - 12 = 0$

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

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

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

23.

$p^2 - 8 = 0$

$p^2 = 8$

$p = \pm\sqrt{8}$

$\boxed{p = \pm 2\sqrt{2}}$

25.

$x^2 + 9 = 0$

$x^2 = -9$

$\boxed{x = \pm 3i}$

27.

$(x-3)^2 = 36$

$x - 3 = \pm 6$

$x = 3 \pm 6$

$\boxed{x = -3, 9}$

29.

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

31.

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

33.

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

35.

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

37.

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

39.

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

41.

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

43.

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

45.

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

47.

$$t^2 - 6t = -5$$
$$t^2 - 6t + 9 = -5 + 9$$
$$(t-3)^2 = 4$$
$$t-3 = \pm 2$$
$$\boxed{t = 3 \pm 2 = 1, 5}$$

49.

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

51.

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

53.

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

55.

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

57.

$$t^2 + 3t - 1 = 0$$
$$t = \frac{-3 \pm \sqrt{9+4}}{2}$$
$$\boxed{t = \frac{-3 \pm \sqrt{13}}{2}}$$

59.

$$s^2 + s + 1 = 0$$
$$s = \frac{-1 \pm \sqrt{1-4}}{2} = \frac{-1 \pm \sqrt{-3}}{2}$$
$$\boxed{s = \frac{-1 \pm i\sqrt{3}}{2}}$$

61. $3x^2 - 3x - 4 = 0$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

77. $t^2 + 5t - 6 = 0$

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

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

79. $(x + 3)^2 = 16$

$x + 3 = \pm 4$

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

81. $(p - 2)^2 = 4p$

$p^2 - 4p + 4 = 4p$

$p^2 - 8p + 4 = 0$

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

$$\boxed{p = 4 \pm 2\sqrt{3}}$$

83. $8w^2 + 2w + 21 = 0$

$$w = \frac{-2 \pm \sqrt{4 - 4 \cdot 8 \cdot 21}}{16}$$

$$w = \frac{-2 \pm \sqrt{-668}}{16} = \frac{-2 \pm 2i\sqrt{167}}{16}$$

$$\boxed{w = \frac{-1 \pm i\sqrt{167}}{8}}$$

85.

$$3p^2 - 9p + 1 = 0$$

$$p = \frac{9 \pm \sqrt{81 - 12}}{6}$$

$$\boxed{p = \frac{9 \pm \sqrt{69}}{6}}$$

87.

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

$$\text{LCD} = 15$$

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

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

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

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

89.

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

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

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

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

$$x - 3 = 0 \text{ or } x - 4 = 0$$

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

91.

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

$$\text{LCD} = x(x-3)$$

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

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

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

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

$$4x + 3 = 0 \text{ or } x - 2 = 0$$

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

93.

$$x^2 - 0.1x - 0.12 = 0$$

$$(x - 0.4)(x + 0.3) = 0$$

$$\boxed{x = -0.3, 0.4}$$

95.

$$6.25t^2 - 35t + 360 = 310$$

$$6.25t^2 - 35t + 50 = 0$$

$$625t^2 - 3500t + 5000 = 0$$

$$625(t^2 - 6t + 8) = 0$$

$$625(t-4)(t-2) = 0$$

$$\boxed{t = 4 \text{ (March 2015) and } 2 \text{ (January 2015)}}$$

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.

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.

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.

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 $(6.5 + 2x)(8.5 + 2x) = 55.25 + 30x + 4x^2$.

Continued onto next page.

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:

$$552.5+300x+40x^2=607.75$$
$$40x^2+300x-55.25=0$$
$$8x^2+60x-11.05=0$$
$$x=\frac{-60\pm\sqrt{60^2-4(8)(-11.05)}}{2(8)}$$
$$=\frac{-60\pm\sqrt{3,953.6}}{16}\approx\frac{2.877}{16}\approx 0.2$$

So, about 0.2 inches.

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.

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

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

So, the numbers are 17 and 18.

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.

111.

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

$$h = 3b + 2$$

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

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

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

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

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

113.

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

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

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

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

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

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

115.

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

$$r^2 = 450$$

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

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

117.

$$\text{volume} = l \cdot w \cdot h$$

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

$$9 = (x - 2)^2$$

$$x - 2 = \pm 3$$

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

$$x = 5$$

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

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

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

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

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

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

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

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

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

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

$$\boxed{\text{Width of border is } 2.3 \text{ feet.}}$$

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.

$\frac{1}{x}+\frac{1}{x-5}=\frac{1}{6}$ (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

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

123. Factored incorrectly

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

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

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

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

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

127. False

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

129. True

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

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

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

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

135.

$s=\frac{1}{2}gt^2 \Rightarrow t^2=\frac{2s}{g} \Rightarrow \boxed{t=\pm\sqrt{\frac{2s}{g}}}$

137.

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

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

139.

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

141.

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

143.

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

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

145.

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

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 250mph.

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

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 × 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

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

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

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

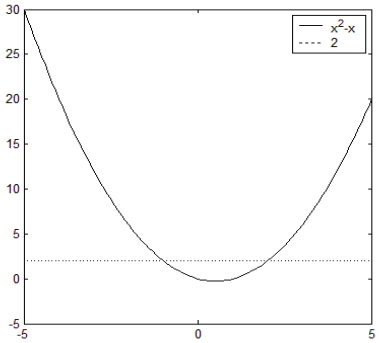
$$x=\frac{-100\pm\sqrt{100^2+4(120{,}000)}}{2}=\frac{-100\pm700}{2}=\cancel{-400},\ 300$$

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

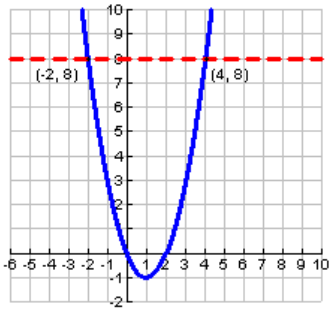
153. $x^2-x-2=0$

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

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



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.

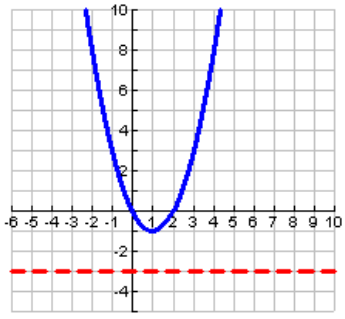
(b) We do the same thing now for different values of *b*.

$\underline{b = -3}$:

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

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

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



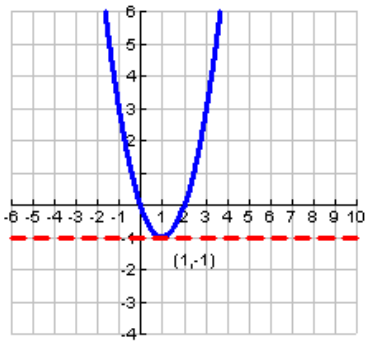
$\underline{b = -1}$:

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

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

$$x = 1$$

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

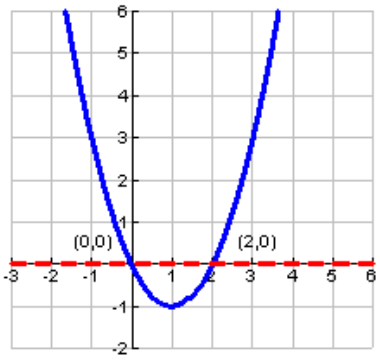


(Continued onto next page)

$\underline{b=0}$:

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

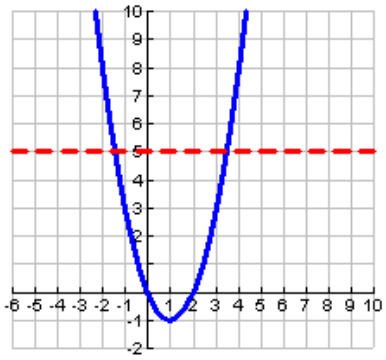
So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



$\underline{b=5}$:

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

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



Section 1.4 Solutions ----------

1. $\sqrt{t-5}=2$
$t-5=4$
$\boxed{t=9}$

3. $(4p-7)^{1/2}=5$
$4p-7=25$
$4p=32$
$\boxed{p=8}$

5. $\sqrt{u+1}=-4$
$\boxed{\text{no solution}}$
$u+1=16$
$u=15$
Check: $\sqrt{15+1}$
$=\sqrt{16}=4$

7. $\sqrt[3]{5x+2}=3$
$5x+2=3^3=27$
$5x=25$
$\boxed{x=5}$

9. $(4y+1)^{\frac{1}{3}}=-1$
$4y+1=-1$
$4y=-2$
$\boxed{y=-\frac{1}{2}}$

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:
$\sqrt{12+4}=\sqrt{16}=4$

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:
$25=5\sqrt{25}$

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:
$6=3\sqrt{6-2}=3\sqrt{4}$

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:

$\sqrt{2(-1)+6} = -1+3$

$\sqrt{4} = 2$

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:

$\sqrt{1} = 1$

21. $3x-6\sqrt{x-1} = 3$

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

$x-1 = 2\sqrt{x-1}$

$(x-1)^2 = \left(2\sqrt{x-1}\right)^2$

$(x-1)^2-4(x-1) = 0$

$(x-1)(x-1-4) = 0$

$(x-1)(x-5) = 0$

$x = 1, 5$

23. $3x-6\sqrt{x+2} = 3$

$x-2\sqrt{x+2} = 1$

$x-1 = 2\sqrt{x+2}$

$(x-1)^2 = \left(2\sqrt{x+2}\right)^2$

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

$x^2-2x+1 = 4x+8$

$x^2-6x-7 = 0$

$(x-7)(x+1) = 0$

$x = \cancel{-1}, 7$

25. $3\sqrt{x+4}-2x = 9$

$3\sqrt{x+4} = 2x+9$

$\left(3\sqrt{x+4}\right)^2 = (2x+9)^2$

$9(x+4) = 4x^2+36x+81$

$9x+36 = 4x^2+36x+81$

$4x^2+27x+45 = 0$

$(4x+15)(x+3) = 0$

$x = -\frac{15}{4}, -3$

27. $\sqrt{x^2-4} = x-1$

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

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

$2x = 5$

$\boxed{x = \frac{5}{2}}$

29. $\sqrt{x^2-2x-5} = x+1$

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

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

$-6 = 4x$

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

No solution.

31. $\sqrt{3x+1}-\sqrt{6x-5} = 1$

$\sqrt{3x+1} = \sqrt{6x-5}+1$

$\left(\sqrt{3x+1}\right)^2 = \left(\sqrt{6x-5}+1\right)^2$

$3x+1 = 6x-5+2\sqrt{6x-5}+1$

$3x+1 = 6x-4+2\sqrt{6x-5}$

$(-3x+5)^2 = \left(2\sqrt{6x-5}\right)^2$

$9x^2-30x+25 = 4(6x-5)$

$9x^2-30x+25 = 24x-20$

$9x^2-54x+45 = 0$

$(9x-9)(x-5) = 0$

$x = 1, \cancel{5}$

33.

$$\sqrt{x+12}+\sqrt{8-x}=6$$
$$\sqrt{x+12}=6-\sqrt{8-x}$$
$$\left(\sqrt{x+12}\right)^2=\left(6-\sqrt{8-x}\right)^2$$
$$x+12=36-12\sqrt{8-x}+(8-x)$$
$$2x-32=-12\sqrt{8-x}$$
$$x-16=-6\sqrt{8-x}$$
$$(x-16)^2=\left(-6\sqrt{8-x}\right)^2$$
$$x^2-32x+256=36(8-x)$$
$$x^2-32x+256=288-36x$$
$$x^2+4x-32=0$$
$$(x-4)(x+8)=0$$
$$x=4,-8$$

35.

$\sqrt{2x-1}=1+\sqrt{x-1}$

$2x-1=1+2\sqrt{x-1}+x-1$

$x-1=2\sqrt{x-1}$

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

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

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

$(x-5)(x-1)=0$

$\boxed{x=1,5}$

37.

$\sqrt{3x-5}=7-\sqrt{x+2}$

$3x-5=49-14\sqrt{x+2}+x+2$

$2x-56=-14\sqrt{x+2}$

$x-28=-7\sqrt{x+2}$

$x^2-56x+784=49(x+2)$

$x^2-56x+784=49x+98$

$x^2-105x+686=0$

$(x-98)(x-7)=0$

$x=\boxed{7}, \cancel{98}$

39.

$\sqrt{2+\sqrt{x}}=\sqrt{x}$

$2+\sqrt{x}=x$

$\sqrt{x}=x-2$

$x=x^2-4x+4$

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

$(x-4)(x-1)=0$

$x=\cancel{1}, \boxed{4}$

41.

Let $u=x^{1/3}$

$u^2+2u=0$

$u(u+2)=0$

$u=-2,0$

$x^{1/3}=0\rightarrow\boxed{x=0}$

$x^{1/3}=-2\rightarrow\boxed{x=-8}$

43.

Let $u=x^2$

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

$(u-1)(u-2)=0$

$u=1,2$

$x^2=1\rightarrow\boxed{x=\pm1}$

$x^2=2\rightarrow\boxed{x=\pm\sqrt{2}}$

45. Let $u = x^2$

$2u^2 + 7u + 6 = 0$

$(2u+3)(u+2) = 0$

$u = -3/2 \quad u = -2$

$x^2 = -3/2 \quad x^2 = -2$

$x = \pm i\sqrt{3/2} \quad x = \pm i\sqrt{2}$

$\boxed{x = \dfrac{\pm i\sqrt{6}}{2}} \quad \boxed{x = \pm i\sqrt{2}}$

47. Let $u = 2x + 1$

$u^2 + 5u + 4 = 0$

$(u+4)(u+1) = 0$

$u = -4 \quad u = -1$

$2x + 1 = -4 \quad 2x + 1 = -1$

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

$\boxed{x = -5/2} \quad \boxed{x = -1}$

49. Let $u = t - 1$

$4u^2 - 9u + 2 = 0$

$(4u-1)(u-2) = 0$

$u = 1/4 \quad u = 2$

$t - 1 = 1/4 \quad t - 1 = 2$

$\boxed{t = 5/4} \quad \boxed{t = 3}$

51. Let $u = x^{-4}$

$u^2 - 17u + 16 = 0$

$(u-16)(u-1) = 0$

$u = 1 \quad u = 16$

$x^{-4} = 1 \quad x^{-4} = 16$

$x^2 = \pm 1 \quad x^2 = \pm 1/4$

$\boxed{x = \pm 1, \pm i} \quad \boxed{x = \pm\dfrac{1}{2}, \pm\dfrac{1}{2}i}$

53. Let $u = y^{-1}$

$3u^2 + u - 4 = 0$

$(3u+4)(u-1) = 0$

$u = -4/3 \quad u = 1$

$y^{-1} = -4/3 \quad y^{-1} = 1$

$\boxed{y = -3/4} \quad \boxed{y = 1}$

55. Let $u = z^{1/5}$

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

$(u-1)^2 = 0$

$u = 1$

$z^{1/5} = 1$

$\boxed{z = 1}$

57.

$(x+3)^{5/3} = 32$

$x + 3 = 32^{3/5}$

$x = -3 + \left(32^{1/5}\right)^3 = -3 + 2^3 = -3 + 8 = 5$

59.

$(x+1)^{2/3} = 4$

$x + 1 = \pm 4^{3/2}$

$x = -1 \pm 4^{3/2} = -1 \pm 8$

$x = -9 \text{ or } x = 7$

61 Let $u = t^{-1/3}$

$6u^2 - u - 1 = 0$

$(3u+1)(2u-1) = 0$

$u = -1/3 \quad u = 1/2$

$t^{-1/3} = -1/3 \quad t^{-1/3} = 1/2$

$t = (-1/3)^{-3} \quad t = (1/2)^{-3}$

$\boxed{t = -27} \quad \boxed{t = 8}$

63.

$3 = \dfrac{1}{(x+1)^2} + \dfrac{2}{(x+1)} \quad \boxed{x \neq -1}$

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

$3(x+1)^2 - 2(x+1) - 1 = 0$

Let $u = x + 1$

$3u^2 - 2u - 1 = 0$

$(3u+1)(u-1) = 0$

$u = -1/3 \quad u = 1$

$x + 1 = -1/3 \quad x + 1 = 1$

$\boxed{x = -4/3} \quad \boxed{x = 0}$

65.

$$\left(\frac{1}{2x-1}\right)^2+\frac{1}{2x-1}-12=0$$

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

Let $u=\dfrac{1}{2x-1}$

$u^2+u-12=0$

$(u+4)(u-3)=0$

Then, we have:

$u=-4$	$u=3$
$\dfrac{1}{2x-1}=-4$	$\dfrac{1}{2x-1}=3$
$-4(2x-1)=1$	$3(2x-1)=1$
$-8x+4=1$	$6x-3=1$
$-8x=-3$	$6x=4$
$\boxed{x=3/8}$	$\boxed{x=2/3}$

67. Let $x=u^{2/3}$

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

$(x-4)(x-1)=0$

$x=4$	$x=1$
$u^{2/3}=4$	$u^{2/3}=1$
$u=\pm 4^{3/2}$	$u=\pm 1^{3/2}$
$\boxed{u=\pm 8}$	$\boxed{u=\pm 1}$

69. $t^4-t^2-6=0$

Let $u=t^2$

$u^2-u-6=0$

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

$u=-2$	$u=3$
$t^2=-2$	$t^2=3$
~~$t=\pm i\sqrt{2}$~~	$\boxed{t=\sqrt{3},\ \cancel{-\sqrt{3}}}$

71.

$x^3-x^2-12x=0$

$x(x^2-x-12)=0$

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

$\boxed{x=0,-3,4}$

73.

$4p^3-9p=0$

$p(4p^2-9)=0$

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

$\boxed{p=0,\pm 3/2}$

75.

$u^5-16u=0$

$u(u^4-16)=0$

$u(u^2-4)(u^2+4)=0$

$u(u-2)(u+2)(u-2i)(u+2i)=0$

$\boxed{u=0,\pm 2,\pm 2i}$

77.

$$x^3 - 5x^2 - 9x + 45 = 0$$
$$\left(x^3 - 5x^2\right) - \left(9x - 45\right) = 0$$
$$x^2(x-5) - 9(x-5) = 0$$
$$\left(x^2 - 9\right)(x-5) = 0$$
$$(x-3)(x+3)(x-5) = 0$$
$$\boxed{x = \pm 3,\ 5}$$

79.

$$y(y-5)^3 - 14(y-5)^2 = 0$$
$$(y-5)^2\left[y(y-5) - 14\right] = 0$$
$$(y-5)^2\left(y^2 - 5y - 14\right) = 0$$
$$(y-5)^2(y-7)(y+2) = 0$$
$$\boxed{y = -2, 5, 7}$$

81.

$$x^{9/4} - 2x^{5/4} - 3x^{1/4} = 0$$
$$x^{1/4}\left[x^2 - 2x - 3\right] = 0$$
$$x^{1/4}(x-3)(x+1) = 0$$
$$\boxed{x = 0, 3, \cancel{-1}}$$

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.)

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.)

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.

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.

91.

$$C = \sqrt{10 + a}$$
$$C = 9$$
$$9 = \sqrt{10 + a}$$
$$81 = 10 + a$$
$$\boxed{a = 71 \text{ years old}}$$

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

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 $u = \sqrt{d}$
$u^2 + 275u - 3300 = 0$
$u = \frac{-275 \pm \sqrt{275^2 + 4 \cdot 1 \cdot 3300}}{2(1)}$
$u = -286.5, 11.5$
$\sqrt{d} = 11.5$
$\boxed{d = 132 \text{ ft}}$

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:

$$\frac{0.24824\ \cancel{\text{m}}\ |\ 100\ \text{cm}}{|\ 1\ \cancel{\text{m}}} \approx \boxed{25\,\text{cm}}$$

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, $\boxed{80\%\text{ of the speed of light}}$.

101.

$t = 5$ is extraneous; there is no solution.

103. Forgot about the substitution $u = x^{1/3}$.

$$x^{1/3} = -4, 5$$

$$\boxed{x = -64, 125}$$

105. True

Let $u = (2x-1)^3$

$u^2 + 4u + 3 = 0$ (quadratic)

107. False

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 $\boxed{[0, \infty)}$.

111.

Let $u = 3x^2 + 2x$

$u = \sqrt{u}$

$u = 0, 1$

$3x^2 + 2x = 0$

$x(3x+2) = 0$

$\boxed{x = 0, -2/3}$

$3x^2 + 2x = 1$

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

$(3x-1)(x+1) = 0$

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

113.

$\sqrt{x+6} + \sqrt{11+x} = 5\sqrt{3+x}$

$(x+6) + 2\sqrt{x+6}\sqrt{11+x} + (11+x) = 25(3+x)$

$2x + 17 + 2\sqrt{x+6}\sqrt{11+x} = 75 + 25x$

$2\sqrt{x+6}\sqrt{11+x} = 58 + 23x$

$4(x+6)(11+x) = 529x^2 + 2668x + 3364$

$4(x^2 + 17x + 66) = 529x^2 + 2668x + 3364$

$4x^2 + 68x + 264 = 529x^2 + 2668x + 3364$

$525x^2 + 2600x + 3100 = 0$

$21x^2 + 104x + 124 = 0$

$(21x + 62)(x + 2) = 0$

$x = \cancel{-62}/21$, $\boxed{x = -2}$

115.

$$\sqrt{x-3} = 4 - \sqrt{x+2}$$

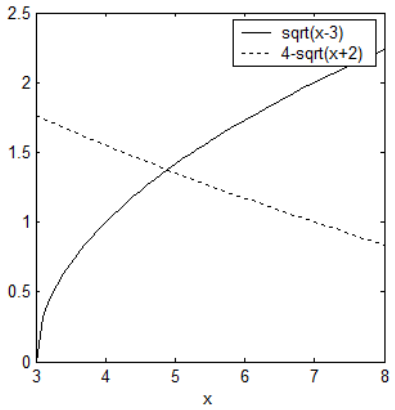
$$x - 3 = 16 - 8\sqrt{x+2} + x + 2$$

$$-21 = -8\sqrt{x+2}$$

$$441 = 64(x+2) = 64x + 128$$

$$313 = 64x$$

$$\boxed{x = \frac{313}{64} \cong 4.891}$$



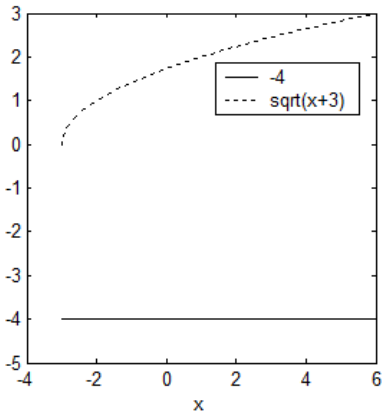
117.

$$-4 = \sqrt{x+3}$$

$$16 = x + 3$$

$$x = 13 \text{ (Extraneous)}$$

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



119.

$$x^{1/2} = -4x^{1/4} + 21$$

$$x^{1/2} + 4x^{1/4} - 21 = 0$$

Let $u = x^{1/4}$ to obtain

$$u^2 + 4u - 21 = 0$$

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

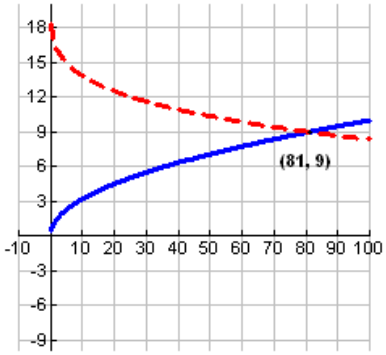
$$u = -7, 3$$

$x^{1/4} = -7$ $\boxed{\text{no solution}}$

$x^{1/4} = 3$ $\boxed{x = 81}$

Graphically, let:

$y1 = x^{1/2}$, $y2 = -4x^{1/4} + 21$.



Yes, the two solutions agree.

121.

$x^{-2} = 3x^{-1} - 10$

$x^{-2} - 3x^{-1} + 10 = 0$

Let $u = x^{-1}$ to obtain

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

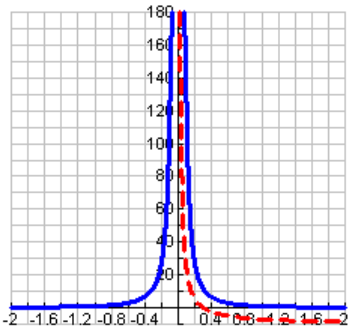
$$u = \frac{3 \pm \sqrt{9 - 4(10)(1)}}{2} = \frac{3 \pm i\sqrt{31}}{2}$$

So, there are no real solutions. As such, we expect the graphs to not intersect.

Yes, the two solutions agree.

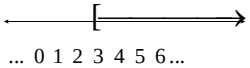
Graphically, let:

$y1 = x^{-2}$, $y2 = 3x^{-1} - 10$.

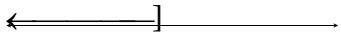


Section 1.5 Solutions ----------

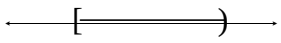
1. $[3, \infty)$



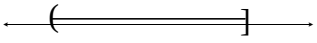
3. $(-\infty, -5]$



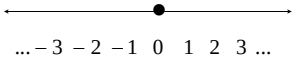
5. $[-2, 3)$



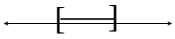
7. $(-3, 5]$



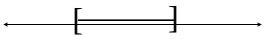
9. $[0, 0]$



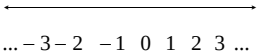
11. $[4, 6]$



13. $[-8, -6]$



15. $\varnothing$



17. $\{x : 0 \le x < 2\}$

19. $\{x : -7 < x < -2\}$

21. $\{x : x \le 6\}$

23. $\{x : -\infty < x < \infty\}$

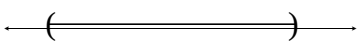
25. $-3 < x \le 7$ $(-3, 7]$

27. $3 \le x < 5$ $[3, 5)$

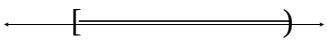
29. $-2 \le x$ $[-2, \infty)$

31. $-\infty < x < 8$ $(-\infty, 8)$

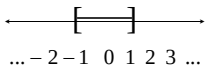
33. $(-5, 3)$



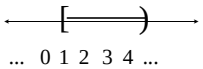
35. $[-6, 5)$



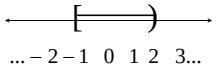
37. $[-1,1]$



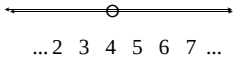
39. $[1,4)$



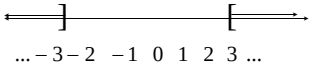
41. $[-1,2)$



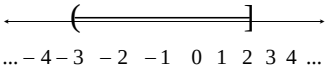
43. $(-\infty,4)\cup(4,\infty)$



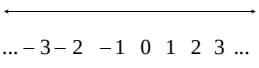
45. $(-\infty,-3]\cup[3,\infty)$



47. $(-3,2]$



49. $\varnothing$



51. $(-\infty,2)\cup[3,5)$

53. $(-\infty,-4]\cup(2,5]$

55. $[-4,-2)\cup(3,7]$

57. $(-6,-3]\cup[0,4)$

59.

$x-3<7$

$x<10$

$\boxed{(-\infty,10)}$

61.

$3x-2\le 4$

$3x\le 6$

$x\le 2$

$\boxed{(-\infty,2]}$

63.

$-5p\ge 10$

Divide by -5 and flip sign

$p\le -2$

$\boxed{(-\infty,-2]}$

65.

$3-2x\le 7$

$-2x\le 4$

$x\ge -2$

$\boxed{[-2,\infty)}$

67.

$-1.8x+2.5>3.4$

$-1.8x>0.9$

$x<\frac{0.9}{-1.8}=-0.5$

$\boxed{(-\infty,-0.5)}$

69.

$3(t+1)>2t$

$3t+3>2t$

$t+3>0$

$t>-3$

$\boxed{(-3,\infty)}$

71.

$7-2(1-x)>5+3(x-2)$

$7-2+2x>5+3x-6$

$5+2x>3x-1$

$5>x-1$

$x<6$

$\boxed{(-\infty,6)}$

73.

$$\frac{x+2}{3}-2\ge\frac{x}{2}$$

LCD = 6

$2(x+2)-2(6)\ge x(3)$

$2x+4-12\ge 3x$

$-8\ge x$ or $x\le -8$

$\boxed{(-\infty,-8]}$

75.

$$\frac{t-5}{3}\le -4$$

LCD = 3

$t-5\le -4(3)$

$t-5\le -12$

$t\le -7$

$\boxed{(-\infty,-7]}$

77.

Multiply by LCD = 6

$4y-3(5-y)<10y-6(2+y)$

$4y-15+3y<10y-12-6y$

$7y-15<4y-12$

$3y-15<-12$

$3y<3$

$y<1$

$\boxed{(-\infty,1)}$

79.

$-2<x+3<5$

$-5<x<2$

$\boxed{(-5,2)}$

81.

$-8\le 4+2x<8$

$-12\le 2x<4$

Divide by 2

$-6\le x<2$

$\boxed{[-6,2)}$

83.

$-3<1-x\le 9$

$-4<-x\le 8$

Divide by -1

Flip the signs

$-8\le x<4$

$\boxed{[-8,4)}$

85.

$$0<2-\frac{1}{3}y<4$$

$$-2<-\frac{1}{3}y<2$$

Multiply by -3

Flip the signs

$-6<y<6$

$\boxed{(-6,6)}$

87.

$$\frac{1}{2}\le\frac{1+y}{3}\le\frac{3}{4}$$

Multiply by 3

$$\frac{3}{2}\le 1+y\le\frac{9}{4}$$

$$\frac{1}{2}\le y\le\frac{5}{4}$$

$\boxed{\left[\frac{1}{2},\frac{5}{4}\right]}$

89.

$-0.7\le 0.4x+1.1\le 1.3$

$-1.8\le 0.4x\le 0.2$

$$-\frac{1.8}{0.4}\le x\le\frac{0.2}{0.4}$$

$-4.5\le x\le 0.5$

$\boxed{[-4.5,\ 0.5]}$

91.

Low weight:

$$\underbrace{110}_{1^{st}\ 5\text{ feet}} + \underbrace{2}_{2\text{ lbs}}\ \underbrace{(9)}_{9\text{ inches}} = 128$$

High weight:

$$\underbrace{110}_{1^{st}\ 5\text{ feet}} + \underbrace{6}_{6\text{ lbs}}\ \underbrace{(9)}_{9\text{ inches}} = 164$$

$\boxed{128 \le w \le 164}$

93.

Revenue $= 100x\ (x = \#\text{ dresses})$

Cost $= 4000 + 20x$

Profit = Revenue − Cost

$= 100x - (4000 + 20x) > 0$

$100x - 4000 - 20x > 0$

$80x > 4000$

$x > 50$

$\boxed{\text{More than 50 dresses}}$

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.

97.

Use the formula

$THR = (HR_{\max} - HR_{rest}) \times I + HR_{rest}$

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.

99.

Cell Phone Charge: $50 + 0.22x$

$(\text{x} = \text{minutes over 800 used})$

$67.16 \le 50 + 0.22x \le 96.86$

$17.16 \le 0.22x \le 46.86$

$78 \le x \le 213$

Least minutes: $800 + 78 = \boxed{878}$

Most minutes: $800 + 213 = \boxed{1013}$

101. Let x = grade on the 4th exam.

$$\frac{67+77+84+x}{4} \geq 80$$

$$67+77+84+x \geq 320$$

$$228+x \geq 320$$

$$x \geq \boxed{92}$$

103. Let x = invoice price.

$$\frac{27,999}{1.30} < x < \frac{27,999}{1.15}$$

$$\boxed{\$21,537.69 < x < \$24,346.96}$$

105. $0.9\, r_T \leq r_R \leq 1.1\, r_T$

107. $0.85L \leq B \leq 0.95L$

109. Let x = number of times play. We want the smallest value of x for which

$$160+10x \leq 55x.$$

Solving yields:

$$160 \leq 45x$$

$$3.56 \approx \frac{160}{45} \leq x$$

So, they would need to play $\boxed{4 \text{ times}}$ 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:

$$\boxed{5,156.25 \leq T \leq 18,481.25}$$

113.
Mixed up parenthesis and brackets $[-1,4)$

115. Forgot to flip the sign when dividing by -3. Answer should be $[2,\infty)$.

117. True. In fact, the two inequalities are equivalent.

119. a, b

121. a, b

123. c

125. Mentally, realize that $x \leq -x$ holds only when the left-side is negative or zero. Hence, the solution set is $(-\infty, 0]$.

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

129.

a)

$$2.7x+3.1 < 9.4x-2.5$$

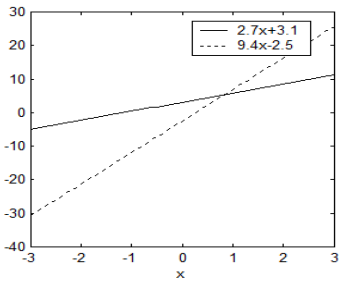
$$2.7x+5.6 < 9.4x$$

$$5.6 < 6.7x$$

$$x > 0.83582 \text{ (rounded)}$$

c) Agree

b)



131.

a)

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

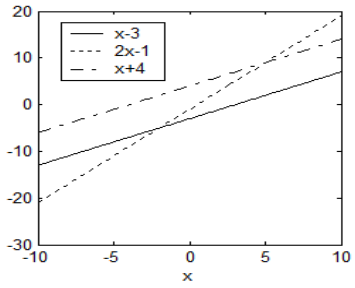
$-3<x-1<4$

$-2<x<5$

$(-2,5)$

c) Agree

b)



133.

a)

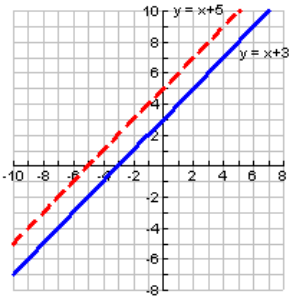
$x+3<x+5$

$3<5$

true for any $x\in(-\infty,\infty)$

c) Agree

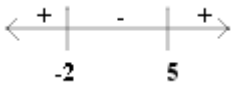
b)



Section 1.6 Solutions ----------

1. $(x-5)(x+2)\geq 0$

CP's: $x=-2,\ 5$

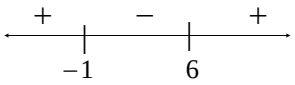


$\boxed{(-\infty,-2]\cup[5,\infty)}$

3. $u^2-5u-6\leq 0$

$(u-6)(u+1)\leq 0$

CP's: $u=6,-1$

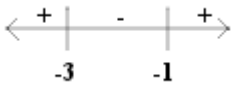


$\boxed{[-1,6]}$

5. $p^2+4p+3<0$

$(p+3)(p+1)<0$

CP's: $p=-3,-1$

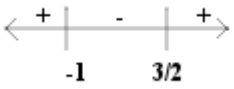


$\boxed{(-3,-1)}$

7. $2t^2-t-3\leq 0$

$(2t-3)(t+1)\leq 0$

CP's: $t=-1,3/2$

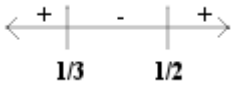


$\boxed{[-1,3/2]}$

9. $6v^2 - 5v + 1 < 0$

$(3v-1)(2v-1) < 0$

CP's: $v = 1/3, 1/2$

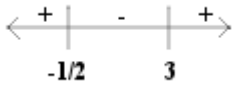


$\boxed{(1/3, 1/2)}$

11. $2s^2 - 5s - 3 \geq 0$

$(2s+1)(s-3) \geq 0$

CP's: $s = -1/2, 3$



$\boxed{(-\infty, -1/2] \cup [3, \infty)}$

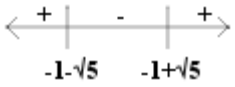
13. $y^2 + 2y - 4 \geq 0$ Note: Can't factor

To find CP's solve $y^2 + 2y - 4 = 0$

$$y = \frac{-2 \pm \sqrt{2^2 - 4(1)(-4)}}{2(1)}$$

$$y = \frac{-2 \pm \sqrt{20}}{2}$$

$$y = \frac{-2 \pm 2\sqrt{5}}{2} = -1 \pm \sqrt{5}$$



$\boxed{\left(-\infty, -1-\sqrt{5}\right] \cup \left[-1+\sqrt{5}, \infty\right)}$

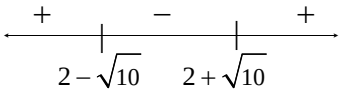
15. $x^2 - 4x < 6$

$x^2 - 4x - 6 < 0$

CPs: Use quadratic formula:

$$x = \frac{4 \pm \sqrt{16 - 4(1)(-6)}}{2} = \frac{4 \pm 2\sqrt{10}}{2}$$

$$= 2 \pm \sqrt{10}$$



$\boxed{\left(2-\sqrt{10}, 2+\sqrt{10}\right)}$

17. $u^2 - 3u \geq 0$

$u(u-3) \geq 0$

CP's: $u = 0, 3$

$\boxed{(-\infty, 0] \cup [3, \infty)}$

19. $x^2 - 2x \leq 0$

$x(x-2) \leq 0$

CP's: $x = 0, 2$

$\boxed{[0, 2]}$

21. $x^2 - 9 > 0$

$(x-3)(x+3) > 0$

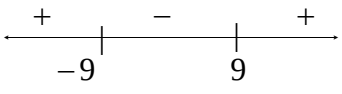
CP's: $x = -3, 3$

$\boxed{(-\infty, -3) \cup (3, \infty)}$

23. $t^2 - 81 < 0$

$(t-9)(t+9) < 0$

CP's: $t = -9, 9$



$\boxed{(-9, 9)}$

25. $z^2+16>0$

No critical points

$z^2+16>0$ for all z

$\boxed{\mathbb{R}}$ (consistent)

27. $y^2<-4$ $\boxed{\text{no real solution}}$

(A real number squared is always non-negative.)

29. $\dfrac{-3}{x}\le 0$ $x=0$ is CP

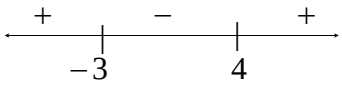
$\boxed{(0,\infty)}$

31. $\dfrac{y}{y+3}>0$ CP's: $y=-3,0$

$\boxed{(-\infty,-3)\cup(0,\infty)}$

33. $\dfrac{t+3}{t-4}\ge 0$

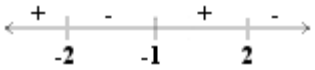
CPs: $-3, 4$



$\boxed{(-\infty,-3]\cup(4,\infty)}$

35. $\dfrac{s+1}{(2-s)(2+s)}\ge 0$

CP's: $s=-2,-1,2$

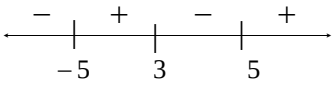


$\boxed{(-\infty,-2)\cup[-1,2)}$

37. $\dfrac{x-3}{x^2-25}\ge 0$

$\dfrac{x-3}{(x-5)(x+5)}\ge 0$

CPs: $3, \pm 5$



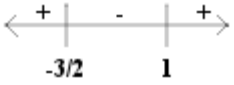
$\boxed{(-5,3]\cup(5,\infty)}$

39. $2u^2+u<3$

$2u^2+u-3<0$

$(2u+3)(u-1)<0$

CP's: $u=-3/2, 1$



$\boxed{(-3/2,1)}$

41.

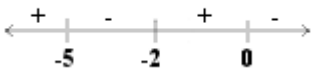
$$\frac{3t^2}{t+2}-5t\ge 0$$

$$\frac{3t^2-5t(t+2)}{t+2}\ge 0$$

$$\frac{3t^2-5t^2-10t}{t+2}\ge 0$$

$$\frac{-2t^2-10t}{t+2}\ge 0$$

$$\frac{-2t(t+5)}{t+2}\ge 0 \quad \text{CP's: } t=-5,-2,0$$



$$\boxed{(-\infty,-5]\cup(-2,0]}$$

43.

$$\frac{3p-2p^2}{4-p^2}-\frac{(3+p)}{(2-p)}<0$$

$$\frac{p(3-2p)}{(2-p)(2+p)}-\frac{(3+p)}{(2-p)}<0$$

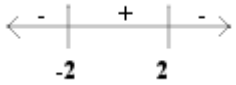
$$\frac{p(3-2p)-(3+p)(2+p)}{(2-p)(2+p)}<0$$

$$\frac{3p-2p^2-6-5p-p^2}{(2-p)(2+p)}>0$$

$$\frac{-3p^2-2p-6}{(2-p)(2+p)}<0$$

$$\frac{3p^2+2p+6}{(2-p)(2+p)}>0$$

CP's: $p=-2,\ 2$



$$\boxed{(-2,2)}$$

45.

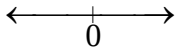
$$\frac{x^2}{5+x^2}<0$$

$$\boxed{\text{No solution}}$$

47.

$$\frac{x^2+10}{x^2+16}>0$$

$$\boxed{\mathbb{R}}\ \text{(consistent)}$$

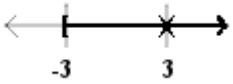


49.

$$\frac{(v-3)(v+3)}{(v-3)}\ge 0 \quad \boxed{v\ne 3}$$

$$v+3\ge 0$$

$$v\ge -3$$



$$\boxed{[-3,3)\cup(3,\infty)}$$

51.

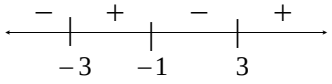
$$\frac{2}{t-3}+\frac{1}{t+3}\ge 0$$

$$\frac{2(t+3)+(t-3)}{(t-3)(t+3)}\ge 0$$

$$\frac{3t+3}{(t-3)(t+3)}\ge 0$$

$$\frac{3(t+1)}{(t-3)(t+3)}\ge 0$$

CPs: $-1,\ \pm 3$



$$\boxed{(-3,-1]\cup(3,\infty)}$$

53.

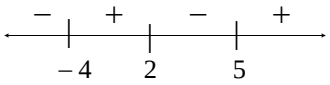
$$\frac{3}{x+4}-\frac{1}{x-2}\le 0$$

$$\frac{3(x-2)-(x+4)}{(x+4)(x-2)}\le 0$$

$$\frac{2x-10}{(x+4)(x-2)}\le 0$$

$$\frac{2(x-5)}{(x+4)(x-2)}\le 0$$

CPs: $-4, 2, 5$



$\boxed{(-\infty,-4)\cup(2,5]}$

55.

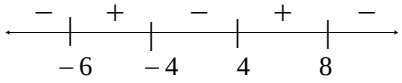
$$\frac{1}{p+4}+\frac{1}{p-4}-\frac{p^2-48}{p^2-16}>0$$

$$\frac{(p-4)+(p+4)-\left(p^2-48\right)}{(p+4)(p-4)}>0$$

$$\frac{-\left(p^2-2p-48\right)}{(p+4)(p-4)}>0$$

$$\frac{-(p-8)(p+6)}{(p+4)(p-4)}>0$$

CPs: $-6, \pm 4, 8$



$\boxed{(-6,-4)\cup(4,8)}$

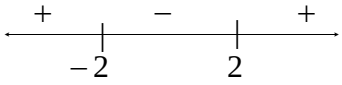
57.

$$\frac{1}{p-2}-\frac{1}{p+2}-\frac{3}{p^2-4}\ge 0$$

$$\frac{(p+2)-(p-2)-3}{(p+2)(p-2)}\ge 0$$

$$\frac{1}{(p+2)(p-2)}\ge 0$$

CPs: ± 2



$\boxed{(-\infty,-2)\cup(2,\infty)}$

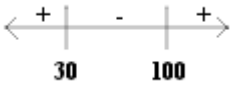
59.

$$-x^2+130x-3000>0$$

$$x^2-130x+3000<0$$

$$(x-30)(x-100)<0$$

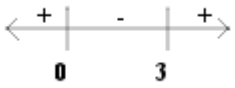
CP's: $x=30,100$



Between 30 and 100 orders

61. Car is worth more than you owe:

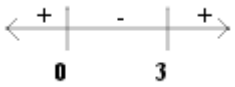
$\frac{t}{t-3}>0$ CP's: $t=0,3$



$\boxed{(3,\infty)}$ $\boxed{\text{Greater than 3 years}}$

You owe more than it's worth:

$\frac{t}{t-3}<0$ CP's: $t=0,3$



$\boxed{(0,3)}$ $\boxed{\text{First 3 years}}$

63.

$h=-16t^2+1200t$

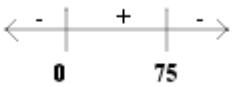
bullet is in the air if $h>0$

$-16t^2+1200t>0$

$-16t(t-75)>0$

CP's: $t=0,75$

$(0,75)$



Bullet is in the air for 75 sec

65. Area $= l \cdot w$

$P = 2l + 2w = 100$

$l = \dfrac{100 - 2w}{2}$

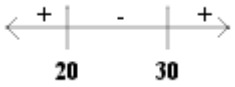
$A = l \cdot w = \left(\dfrac{100 - 2w}{2}\right)(w)$

$50w - w^2 \geq 600$

$w^2 - 50w + 600 \leq 0$

$(w - 20)(w - 30) \leq 0$

CP's: $w = 20, 30$



$[20, 30]$

$20 \leq$ width ≤ 30

$20 \leq$ length ≤ 30

Between 20 and 30 feet

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.

69.

$400 \pm 7 = 393, 407$

$\dfrac{1{,}360{,}000}{407} \leq$ price per acre $\leq \dfrac{1{,}360{,}000}{393}$

$\$3{,}341.52 \leq$ price per acre $\leq \$3460.56$

\$3,342 to \$3,461 per acre

71.

Cannot divide by x.

$x^2 - 3x > 0$

$x(x-3) > 0$

$(-\infty, 0) \cup (3, \infty)$

73. $\dfrac{(x-2)(x+2)}{(x+2)} > 0$ $x \neq 2$

$x - 2 > 0$

$x > 2$

Should have considered $x = -2$ a CP

75. False $(-a, a)$

77. Assume that $ax^2 + bx + c < 0$. If $b^2 - 4ac < 0$, then either there are infinitely many solutions or no real solution.

79. $x^2 + a^2 \geq 0$

True for all real values of x

$\mathbb{R}$

81.

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

$\boxed{\mathbb{R}}$

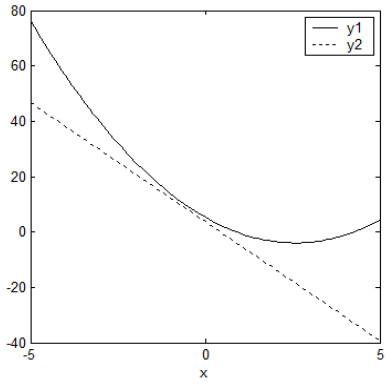
83.

$y_1 = 1.4x^2 - 7.2x + 5.3$

$y_2 = -8.6x + 3.7$

Find when $y_1 > y_2$

$\boxed{\mathbb{R}}$



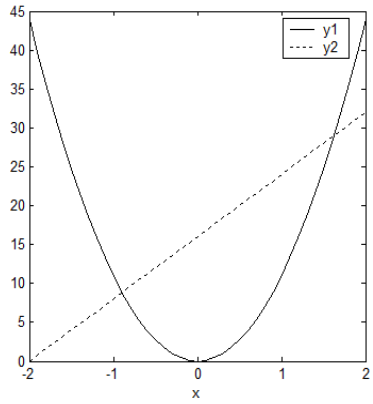
85.

$y_1 = 11x^2$

$y_2 = 8x + 16$

Find when $y_1 < y_2$

$\boxed{(-0.8960, 1.6233)}$



87.

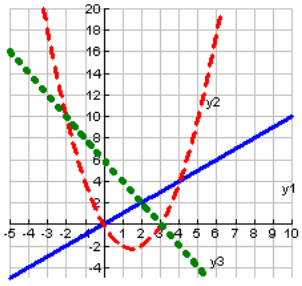
$y_1 = x$

$y_2 = x^2 - 3x$

$y_3 = 6 - 2x$

Find when $y_1 < y_2 < y_3$.

$\boxed{(-2, 0)}$

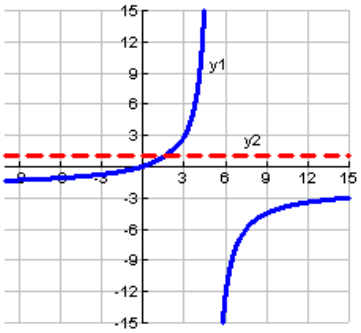


89. $y_1 = \dfrac{2p}{5-p}$

$y_2 = 1$

Find when $y_1 > y_2$.

$\boxed{\left(\frac{5}{3}, 5\right)}$



Section 1.7 Solutions ----------

1.	$x = -3$ or $x = 3$		**3.**	No solution (absolute value is always non-negative)	
5.	$t + 3 = -2$ $\boxed{t = -5}$	$t + 3 = 2$ $\boxed{t = -1}$	**7.**	$p - 7 = 3$ $\boxed{p = 10}$	$p - 7 = -3$ $\boxed{p = 4}$
9.	$4 - y = -1$ $\boxed{y = 5}$	$4 - y = 1$ $\boxed{y = 3}$	**11.**	$3x = -9$ $\boxed{x = -3}$	$3x = 9$ $\boxed{x = 3}$
13.	$2x + 7 = -9$ $2x = -16$ $\boxed{x = -8}$	$2x + 7 = 9$ $2x = 2$ $\boxed{x = 1}$	**15.**	$3t - 9 = 3$ $3t = 12$ $\boxed{t = 4}$	$3t - 9 = -3$ $3t = 6$ $\boxed{t = 2}$
17.	$7 - 2x = -9$ $2x = 16$ $\boxed{x = 8}$	$7 - 2x = 9$ $2x = -2$ $\boxed{x = -1}$	**19.**	$1 - 3y = 1$ $-3y = 0$ $\boxed{y = 0}$	$1 - 3y = -1$ $-3y = -2$ $\boxed{y = 2/3}$
21.	$4.7 - 2.1x = -3.3$ $2.1x = 8$ $\boxed{x = \frac{80}{21}}$	$4.7 - 2.1x = 3.3$ $2.1x = 1.4$ $\boxed{x = \frac{2}{3}}$	**23.**	$\frac{2}{3}x - \frac{4}{7} = -\frac{5}{3}$ LCD = 21 $14x - 12 = -35$ $14x = -23$ $\boxed{x = -23/14}$	$\frac{2}{3}x - \frac{4}{7} = \frac{5}{3}$ LCD = 21 $14x - 12 = 35$ $14x = 47$ $\boxed{x = 47/14}$

25. $|x-5|=8$

$x-5=8$ $\qquad$ $x-5=-8$

$\boxed{x=13}$ $\qquad$ $\boxed{x=-3}$

27.

$3|x-2|+1=19$

$3|x-2|=18$

$|x-2|=6$

$x-2=6$ *or* $x-2=-6$

$x=-4,8$

29.

$5=7-|2-x|$

$-2=-|2-x|$

$2=|2-x|$

$2-x=2$ *or* $2-x=-2$

$x=0,4$

31. $2|p+3|=20$ $\qquad$ $p+3=-10$

$|p+3|=10$ $\qquad$ $\boxed{p=-13}$

$p+3=10$

$\boxed{p=7}$

33. $5|y-2|-10=4|y-2|-3$

$|y-2|=7$

$y-2=7$ $\qquad$ $y-2=-7$

$\boxed{y=9}$ $\qquad$ $\boxed{y=-5}$

35. $4-x^2=-1$ $\qquad$ $4-x^2=1$

$x^2=5$ $\qquad$ $x^2=3$

$\boxed{x=\pm\sqrt{5}}$ $\qquad$ $\boxed{x=\pm\sqrt{3}}$

37. $x^2+1=-5$ $\qquad$ $x^2+1=5$

$x^2=-6$ $\qquad$ $x^2=4$

no solution $\qquad$ $\boxed{x=\pm 2}$

39.

$-7<x<7$

$(-7,7)$

41.

$y\le -5$ or $y\ge 5$

$(-\infty,-5]\cup[5,\infty)$

43.

$-7<x+3<7$

$-10<x<4$

$(-10,4)$

45. $x-4<-2$ $\qquad$ or $\qquad$ $x-4>2$

$x<2$ $\qquad$ $x>6$

$(-\infty,2)\cup(6,\infty)$

47.

$-1\le 4-x\le 1$

$-5\le -x\le -3$

$3\le x\le 5$

$[3,5]$

49. $\mathbb{R}$

51.

$$|2t+3|<5$$
$$-5<2t+3<5$$
$$-8<2t<2$$
$$-4<t<1$$
$$\boxed{(-4,1)}$$

53.

$$|7-2y|\geq 3$$
$$7-2y\geq 3 \text{ or } 7-2y\leq -3$$
$$-2y\geq -4 \text{ or } -2y\leq -10$$
$$y\leq 2 \text{ or } y\geq 5$$
$$\boxed{(-\infty,2]\cup[5,\infty)}$$

55. $\mathbb{R}$

57.

$$2|4x|-9\geq 3$$
$$2|4x|\geq 12$$
$$|4x|\geq 6$$
$$4x\geq 6 \text{ or } 4x\leq -6$$
$$x\geq \tfrac{3}{2} \text{ or } x\leq -\tfrac{3}{2}$$
$$\boxed{(-\infty,-\tfrac{3}{2}]\cup[\tfrac{3}{2},\infty)}$$

59.

$$2|x+1|-3\leq 7$$
$$2|x+1|\leq 10$$
$$|x+1|\leq 5$$
$$-5\leq x+1\leq 5$$
$$-6\leq x\leq 4$$
$$\boxed{[-6,4]}$$

61.

$$3-2|x+4|<5$$
$$-2|x+4|<2$$
$$|x+4|>-1$$
$$\boxed{(-\infty,\infty)}$$

63.

$$9-|2x|<3$$
$$-|2x|<-6$$
$$|2x|>6$$
$$2x>6 \text{ or } 2x<-6$$
$$x>3 \text{ or } x<-3$$
$$\boxed{(-\infty,-3)\cup(3,\infty)}$$

65.

$$-\frac{1}{2}<1-2x<\frac{1}{2}$$
$$-\frac{3}{2}<-2x<-\frac{1}{2}$$
$$\frac{3}{4}>x>\frac{1}{4}$$
$$\boxed{(1/4,3/4)}$$

67.

$$-1.8<2.6x+5.4<1.8$$
$$-7.2<2.6x<-3.6$$
$$-2.769<x<-1.385$$
$$\boxed{(-2.769,-1.385)}$$

69.

$$x^2 - 1 \le 8$$
$$x^2 - 9 \le 0$$
$$(x-3)(x+3) \le 0$$

CP's: $x = -3, 3$

$$-3 \le x \le 3$$
$$\boxed{[-3,3]}$$

71.

$$|x-2| < 7$$

73.

$$|x - 3/2| \ge 1/2$$

75.

$$|x-a| \le 2$$

77. $|T - 83| \le 15$

79. In order to win the hole, $d < 4$.
In order to have a tie, $d = 4$.

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.

83. $x - 3 = -7$ also yields a solution $x = -4$

85. Didn't switch signs when dividing by -2. The answer is [2,3].

87. True

89. False

91.

$$-b < x - a < b$$
$$a - b < x < a + b$$
$$\boxed{(a-b, a+b)}$$

93. $\mathbb{R}$

95.

$x - a = -b$ | $x - a = b$

$\boxed{x = a - b}$ | $\boxed{x = a + b}$

97. No solution

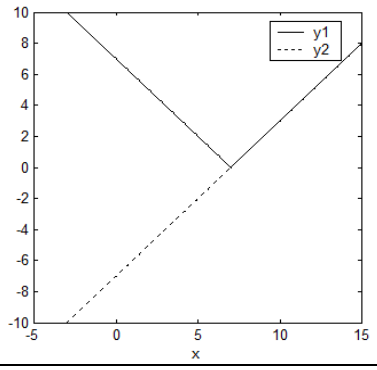
99.

$y_1 = |x-7|$

$y_2 = x-7$

$\boxed{x \geq 7}$

Agree



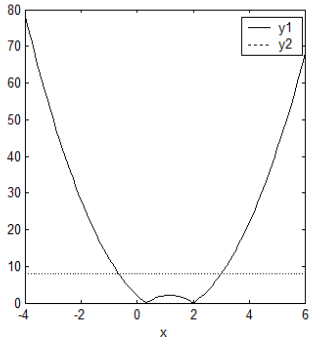
101.

$y_1 = |3x^2 - 7x + 2|$

$y_2 = 8$

$(-\infty, -\frac{2}{3}) \cup (3, \infty)$

Agree



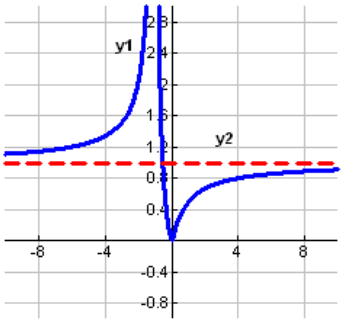
103.

$y_1 = \left|\frac{x}{x+1}\right|$

$y_2 = 1$

Find when $y_1 < y_2$.

$\boxed{(-\frac{1}{2}, \infty)}$



Chapter 1 Review Solutions ----------

1. $7x - 4 = 12$

$7x = 16$

$\boxed{x = 16/7}$

3. $20p + 14 = 6 - 5p$

$25p = -8$

$\boxed{p = -8/25}$

5. $3x+21-2=4x-8$

$\boxed{x=27}$

7. $14-\left[-3y+12+9\right]=8y+12-6+4$

$14+3y-21=8y+10$

$-17=5y$

$\boxed{y=-17/5}$

9. $b\neq 0$

$12-3b=6+4b$

$6=7b$

$\boxed{b=6/7}$

11. $\text{LCD}=28$

$4(13x)-28x=7x-2(3)$

$52x-28x=7x-6$

$17x=-6$

$\boxed{x=-6/17}$

13. $x\neq 0$

$\text{LCD}=x$

$1-4x=3-5x$

$-2=-x$

$2=x$

$\boxed{x=2}$

15. $t\neq -4,0$

$\text{LCD}=t(t+4)$

$2t-7(t+4)=6$

$2t-7t-28=6$

$-5t=34$

$\boxed{t=-34/5}$

17. $x\neq 0$

$\text{LCD}=2x$

$3-12=18x$

$-9=18x$

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

19. $7x-2+4x=3\left[5-2x\right]+12$

$11x-2=15-6x+12$

$17x=29$

$\boxed{x=29/17}$

21. $3x-2\left[3y+12-7\right]=y-2x+6x-18$

$3x-6y-10=y-2x+6x-18$

$-x+8=7y$

$\boxed{x=8-7y}$

23. Let $x=$ total distance

Drives: 16 miles

Bus: $\frac{3}{4}x$

Taxi: $\frac{1}{12}x$

$16+\frac{3}{4}x+\frac{1}{12}x=x$

$\text{LCD}=12$

$192+9x+x=12x$

$2x=192$

$\boxed{x=96 \text{ miles}}$

25.

$x =$ number

$$12 + \frac{1}{4}x = \frac{1}{3}x$$

$\text{LCD} = 12$

$144 + 3x = 4x$

$\boxed{x = 144}$

27.

$P = 2l + 2w$

$l = 1 + 2w$

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

$P = 20$

$20 = 2 + 4w + 2w$

$6w = 18$

$\boxed{\begin{array}{l} w = 3 \text{ inches} \\ l = 7 \text{ inches} \end{array}}$

29.

$x =$ amount invested @ 20%

$25000 - x =$ amount invested @ 8%

Earned interest $= 27600 - 25000 = 2600$

$0.2x + 0.08(25000 - x) = 2600$

$0.2x + 2000 - 0.08x = 2600$

$0.12x = 600$

$x = 5000$

$\boxed{\begin{array}{l} \$5,000 @ 20\% \\ \$20,000 @ 8\% \end{array}}$

31.

$x =$ ml of 5%

$150 - x =$ ml of 10%

$0.05x + 0.10(150 - x) = 0.08(150)$

$0.05x + 15 - 0.10x = 12$

$-0.05x = -3$

$x = 60$

$\boxed{\begin{array}{l} 60 \text{ ml of } 5\% \\ 90 \text{ ml of } 10\% \end{array}}$

33.

$x =$ final exam grade

$$\frac{3x + 95 + 82 + 90}{6} \geq 90$$

$3x + 267 \geq 540$

$3x \geq 273$

$\boxed{\text{At least } 91}$

35.

$b^2 - 4b - 21 = 0$

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

$\boxed{b = -3, 7}$

37.

$x^2 - 8x = 0$

$x(x - 8) = 0$

$\boxed{x = 0, 8}$

39.

$q^2 = 169$

$q = \pm\sqrt{169}$

$\boxed{q = \pm 13}$

41.

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

$2x - 4 = \pm 8i$

$2x = 4 \pm 8i$

$\boxed{x = 2 \pm 4i}$

43.

$x^2 - 4x = 12$

$x^2 - 4x + 4 = 12 + 4$

$(x - 2)^2 = 16$

$x - 2 = \pm 4$

$x = 2 \pm 4$

$\boxed{x = -2, 6}$

45.

$$x^2 - x = 8$$

$$x^2 - x + \frac{1}{4} = 8 + \frac{1}{4}$$

$$\left(x - \frac{1}{2}\right)^2 = \frac{33}{4}$$

$$x - \frac{1}{2} = \pm\sqrt{\frac{33}{4}}$$

$$\boxed{x = \frac{1 \pm \sqrt{33}}{2}}$$

47.

$$3t^2 - 4t - 7 = 0$$

$$a = 3,\ b = -4,\ c = -7$$

$$t = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-7)}}{2(3)}$$

$$t = \frac{4 \pm \sqrt{100}}{6} = \frac{4 \pm 10}{6}$$

$$\boxed{t = -1, \frac{7}{3}}$$

49.

$$8f^2 - \frac{1}{3}f - \frac{7}{6} = 0$$

LCD = 6

$$48f^2 - 2f - 7 = 0$$

$$a = 48,\ b = -2,\ c = -7$$

$$f = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(48)(-7)}}{2(48)}$$

$$f = \frac{2 \pm \sqrt{1348}}{96}$$

$$f = \frac{2 \pm 2\sqrt{337}}{96}$$

$$\boxed{f = \frac{1 \pm \sqrt{337}}{48}}$$

51.

$$a = 5,\ b = -3,\ c = -3$$

$$q = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(-3)}}{2(5)}$$

$$\boxed{q = \frac{3 \pm \sqrt{69}}{10}}$$

53.

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

$$\boxed{x = -1, \frac{5}{2}}$$

55.

$$7x^2 + 19x - 6 = 0$$

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

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

57.

$$r^2 = \frac{S}{\pi h}$$

$$r = \pm\sqrt{\frac{S}{\pi h}}$$

$$\boxed{r = \sqrt{\frac{S}{\pi h}}} \quad \begin{pmatrix}\text{negative radius is}\\ \text{non-physical}\end{pmatrix}$$

59.

$$vt = h + 16t^2$$

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

61.

$$A = \frac{1}{2}bh$$

$$b = h + 3 \quad A = 2$$

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

$$4 = h^2 + 3h$$

$$h^2 + 3h - 4 = 0$$

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

$$h = -4, 1 \text{ (height must be positive)}$$

$$\boxed{h = 1 \text{ ft}, b = 4 \text{ ft}}$$

63.

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

$$2x = 12$$

$$\boxed{x = 6}$$

65.

$$2x - 7 = 3^5$$

$$2x = 7 + 243 = 250$$

$$\boxed{x = 125}$$

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)

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

69.

$$x + 3 = 4 - 4\sqrt{3x+2} + 3x + 2$$

$$-2x - 3 = -4\sqrt{3x+2}$$

$$2x + 3 = 4\sqrt{3x+2}$$

$$(2x+3)^2 = 16(3x+2)$$

$$4x^2 + 12x + 9 = 48x + 32$$

$$4x^2 - 36x - 23 = 0$$

$$x = \frac{36 \pm \sqrt{36^2 - 4(4)(-23)}}{2(4)}$$

$$x = \frac{36 \pm \sqrt{1664}}{8} \cong -0.6, 9.6$$

$$\boxed{x \cong -0.6} \text{ (9.6 doesn't check)}$$

71.

$$x^2 - 4x + 4 = 49 - x^2$$

$$2x^2 - 4x - 45 = 0$$

$$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(2)(-45)}}{2(2)}$$

$$x = \frac{4 \pm \sqrt{376}}{4}$$

$$x \cong \cancel{-3.85}, 5.85$$

$$\boxed{x \cong 5.85}$$

73.

$$x^2 = 3 - x$$

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

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

$$x = \frac{-1 \pm \sqrt{13}}{2} \cong -2.303, \cancel{1.3}$$

$$\boxed{x \cong -2.303}$$

75.

$$(3x-2)^2 - 11(3x-2) + 28 = 0$$

Let $u = 3x - 2$

$$u^2 - 11u + 28 = 0$$

$$(u-4)(u-7) = 0$$

$$u = 4, 7$$

$3x - 2 = 4$ $\qquad$ $3x - 2 = 7$

$3x = 6 \Rightarrow \boxed{x = 2}$ $\qquad$ $3x = 9 \Rightarrow \boxed{x = 3}$

77.

$$u = \frac{x}{1-x} \quad \boxed{x \neq 1}$$

$$u^2 + 2u - 15 = 0$$

$$(u+5)(u-3) = 0$$

$$u = -5, 3$$

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

$$-5 + 5x = x \qquad 3 - 3x = x$$

$$4x = 5 \qquad 4x = 3$$

$$\boxed{x = \frac{5}{4}} \qquad \boxed{x = \frac{3}{4}}$$

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:

$y^{-1} = 4 \Rightarrow \boxed{y = 1/4}$

$y^{-1} = 1 \Rightarrow \boxed{y = 1}$

81.

$$2x^{2/3} + 3x^{1/3} - 5 = 0$$

Let $u = x^{1/3}$

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

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

$$u = -\frac{5}{2}, 1$$

$$x^{1/3} = -\frac{5}{2} \qquad x^{1/3} = 1$$

$$\boxed{x = 1}$$

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

$$\boxed{x = -\frac{125}{8}}$$

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:

$x^{-1/3} = -2 \Rightarrow x = (-2)^{-3} = \boxed{-1/8}$

$x^{-1/3} = -1 \Rightarrow x = (-1)^{-3} = \boxed{-1}$

85. Let $u = x^2$

$u^2 + 5u - 36 = 0$

$(u+9)(u-4) = 0$

$u = -9, 4$

$-9 = x^2$ $\qquad$ $4 = x^2$

$\boxed{x = \pm 3i}$ $\qquad$ $\boxed{x = \pm 2}$

87.

$x^3 + 4x^2 - 32x = 0$

$x\left(x^2 + 4x - 32\right) = 0$

$x(x+8)(x-4) = 0$

$\boxed{x = 0, -8, 4}$

89.

$p^3 - 3p^2 - 4p + 12 = 0$

$\left(p^3 - 3p^2\right) - 4(p-3) = 0$

$p^2(p-3) - 4(p-3) = 0$

$\left(p^2 - 4\right)(p-3) = 0$

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

$\boxed{p = \pm 2, 3}$

91.

$p(2p-5)^2 - 3(2p-5) = 0$

$(2p-5)\left[p(2p-5) - 3\right] = 0$

$(2p-5)\left(2p^2 - 5p - 3\right) = 0$

$(2p-5)(2p+1)(p-3) = 0$

$\boxed{p = -\frac{1}{2}, \frac{5}{2}, 3}$

93.

$y - 81y^{-1} = 0$

$y - \dfrac{81}{y} = 0$

$\dfrac{y^2 - 81}{y} = 0$

$\dfrac{(y-9)(y+9)}{y} = 0$

$\boxed{y = \pm 9}$

95. $(-\infty, -4]$

97. $[2, 6]$

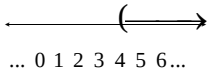
99. $x > -6$

101. $-3 \le x \le 7$

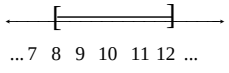
103. $x \ge -4$

$[-4, \infty)$

105. $(4, \infty)$



107. $[8, 12]$

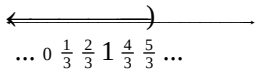


109.

$3x < 5$

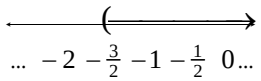
$x < 5/3$

$\boxed{(-\infty, 5/3)}$



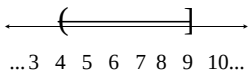
111.

$$4x-4>2x-7$$
$$2x>-3$$
$$x>-3/2$$
$$\boxed{(-3/2,\infty)}$$



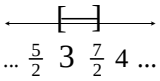
113.

$$6<2+x\le 11$$
$$4<x\le 9$$
$$\boxed{(4,9]}$$



115.

$$\text{LCD}=12$$
$$8\le 2(1+x)\le 9$$
$$8\le 2+2x\le 9$$
$$6\le 2x\le 7$$
$$3\le x\le 7/2$$
$$\boxed{[3,7/2]}$$



117.

$$\frac{72+65+69+70+x}{5}\ge 70$$
$$x+276\ge 350$$
$$\boxed{x\ge 74}$$

So, the lowest score is 74.

119.

$$x^2-36\le 0$$
$$(x-6)(x+6)\le 0$$
CP's: $x=-6,6$

$$\boxed{[-6,6]}$$

121.

$$x^2-4x\ge 0$$
$$x(x-4)\ge 0$$
CP's: $x=0, x=4$

$$\boxed{(-\infty,0]\cup[4,\infty)}$$

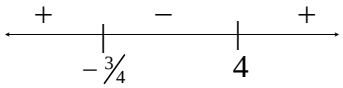
123.

$$x^2-7x>0$$
$$x(x-7)>0$$
CP's: $x=0,7$

$$\boxed{(-\infty,0)\cup(7,\infty)}$$

125.

$$4x^2-12>13x$$
$$4x^2-13x-12>0$$
$$(4x+3)(x-4)>0$$
CPs: $x=-\frac{3}{4}, 4$



$$\boxed{(-\infty,-\tfrac{3}{4})\cup(4,\infty)}$$

127.

$$\frac{x}{x-3} < 0 \quad \boxed{x \neq 3}$$

CP's: $x = 0, 3$

$$\boxed{(0,3)}$$

129.

$$\frac{x^2 - 3x}{3} - \frac{18(3)}{3} \geq 0$$

$$\frac{x^2 - 3x - 54}{3} \geq 0$$

$$\frac{(x-9)(x+6)}{3} \geq 0$$

CP's: $x = -6, 9$

$$\boxed{(-\infty, -6] \cup [9, \infty)}$$

131.

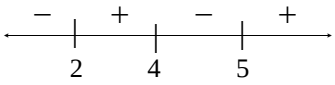
$$\frac{3}{x-2} - \frac{1}{x-4} \leq 0$$

$$\frac{3(x-4)-(x-2)}{(x-2)(x-4)} \leq 0$$

$$\frac{2x-10}{(x-2)(x-4)} \leq 0$$

$$\frac{2(x-5)}{(x-2)(x-4)} \leq 0$$

CPs: $x = 2, 4, 5$



$$\boxed{(-\infty, 2) \cup (4, 5]}$$

133.

$$\frac{x^2 + 9}{x - 3} \geq 0$$

CP: 3 (since $x^2 + 9 > 0$, for all x)

$$(3, \infty)$$

135.

$$|x - 3| = -4$$

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

137.

$3x - 4 = -1.1$

$3x = 2.9$

$$\boxed{x \approx 0.9667}$$

$3x - 4 = 1.1$

$3x = 5.1$

$$\boxed{x = 1.7}$$

139. $-4 < x < 4$

$\boxed{(-4,4)}$

141. $x+4<-7$ $\qquad$ $x+4>7$

$x<-11$ $\qquad$ $x>3$

$\boxed{(-\infty,-11)\cup(3,\infty)}$

143. $|2x|>6$

$2x<-6$ $\qquad$ $2x>6$

$x<-3$ $\qquad$ $x>3$

$\boxed{(-\infty,-3)\cup(3,\infty)}$

145. $\mathbb{R}$

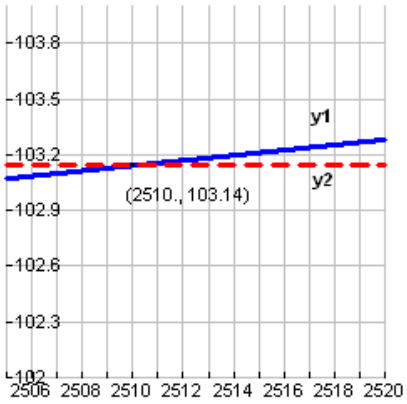
147. $|T-85|\le 10$ or $75\le T\le 95$

149.

$y1 = 0.031x + 0.017(4000 - x)$

$y2 = 103.14$

$\boxed{x = 2,510}$

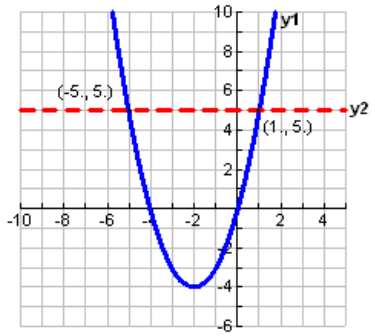


151. (a) Consider $x^2+4x-b=0$. **(1)** For $b=5$, **(1)** factors as $(x-1)(x+5)=0$, so that $x=-5,1$.

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

(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:



$\underline{b=-5}$:

$x^2+4x+5=0$

$x=\dfrac{-4\pm\sqrt{16-4(5)}}{2}=\dfrac{-4\pm 2i}{2}=-2\pm i$

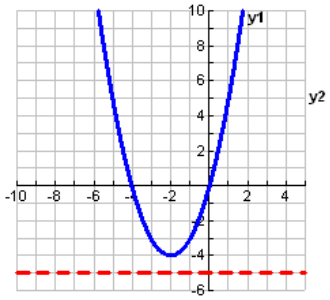
$\underline{b=0}$:

$x^2+4x=0$

$x(x+4)=0$

$x=0,-4$

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

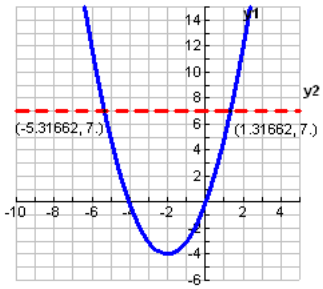


$\underline{b=7}$:

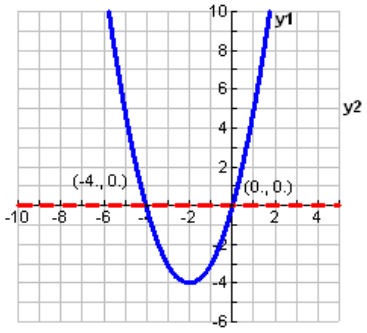
$x^2+4x-7=0$

$$x=\frac{-4\pm\sqrt{16+4(7)}}{2}=\frac{-4\pm2\sqrt{11}}{2}=-2\pm\sqrt{11}$$

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



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



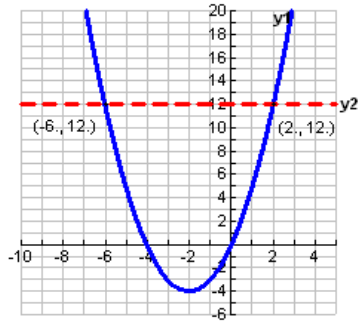
$\underline{b=12}$:

$x^2+4x-12=0$

$(x+6)(x-2)=0$

$x=-6,2$

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

$u^2+2u-6=0$

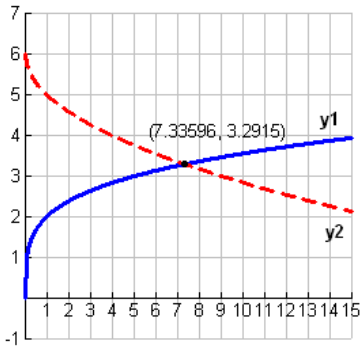
$$u=\frac{-2\pm\sqrt{4+4(6)}}{2}=-1\pm\sqrt{7}$$

$x^{1/4}=-1-\sqrt{7}$ $\quad$ $x^{1/4}=-1+\sqrt{7}$

no solution $\quad$ $\boxed{x=\left(-1+\sqrt{7}\right)^4\approx 7.34}$

Graphically, let

$y1=2x^{1/4}$, $y2=-x^{1/2}+6$



155. a)

$$-0.61x + 7.62 > 0.24x - 5.47$$

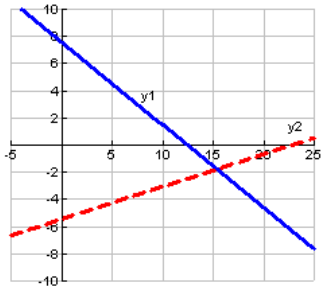
$$13.09 > 0.85x$$

$$15.4 > x$$

$$\boxed{(-\infty, 15.4)}$$

b) Graphically, let

$y1 = -0.61x + 7.62,\ y2 = 0.24x - 5.47$



c) Agree

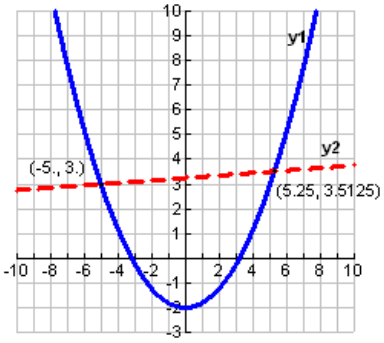
157.

$y1 = 0.2x^2 - 2$

$y2 = 0.05x + 3.25$

Find when $y1 > y2$

$$\boxed{(-\infty, -5) \cup (5.25, \infty)}$$



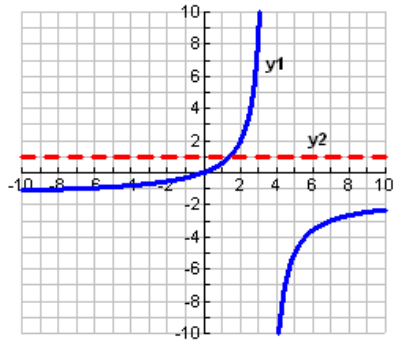
159.

$y1 = \dfrac{3p}{7-2p}$

$y2 = 1$

Find when $y1 > y2$

$\boxed{\left(\frac{7}{5}, \frac{7}{2}\right)}$



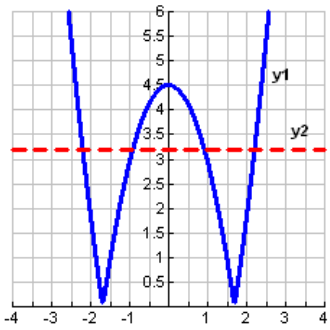
161.

$y1 = \left|1.6x^2 - 4.5\right|$

$y2 = 3.2$

Find when $y1 < y2$

$\boxed{(-2.19, -0.9) \cup (0.9, 2.19)}$



Chapter 1 Practice Test Solutions ----------

1.

$4p - 7 = 6p - 1$

$-6 = 2p$

$\boxed{-3 = p}$

3.

$3t = t^2 - 28$

$t^2 - 3t - 28 = 0$

$(t-7)(t+4) = 0$

$\boxed{t = -4, 7}$

5.

$6x^2 - 13x - 8 = 0$

$(3x-8)(2x+1) = 0$

$\boxed{x = -\frac{1}{2}, \frac{8}{3}}$

7.

$\dfrac{5}{y-3} + 1 - \dfrac{30}{y^2-9} = 0$

$\dfrac{5(y+3) + (y^2-9) - 30}{(y-3)(y+3)} = 0$

$\dfrac{y^2+5y-24}{(y-3)(y+3)} = 0$

$\dfrac{(y+8)\cancel{(y-3)}}{\cancel{(y-3)}(y+3)} = 0$

$\boxed{y = -8}$

9.

$\sqrt{2x+1}+x=7$

$\sqrt{2x+1}=7-x$

$2x+1=(7-x)^2$

$2x+1=49-14x+x^2$

$x^2-16x+48=0$

$(x-12)(x-4)=0$

$\boxed{x=4}$, ~~12~~

11.

$3y-2=9-6\sqrt{3y+1}+3y+1$

$-12=-6\sqrt{3y+1}$

$\sqrt{3y+1}=2$

$3y+1=4$

$3y=3$

$\boxed{y=1}$

13.

$x^{7/3}-8x^{4/3}+12x^{1/3}=0$

$x^{1/3}\left(x^2-8x+12\right)=0$

$x^{1/3}(x-6)(x-2)=0$

$\boxed{x=0,2,6}$

15.

$P=2L+2W$

$P-2W=2L$

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

17.

$3x+19\geq 5x-15$

$34\geq 2x$

$17\geq x$

$\boxed{(-\infty,17]}$

19.

$\dfrac{2}{5}<\dfrac{x+8}{4}\leq\dfrac{1}{2}$

$8<5(x+8)\leq 10$

$-32<5x\leq -30$

$-\dfrac{32}{5}<x\leq -6$

$\boxed{\left(-\dfrac{32}{5},-6\right]}$

21.

$3p^2-p-4\geq 0$

$(3p-4)(p+1)\geq 0$

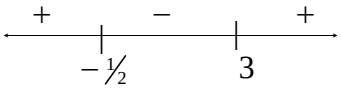
CP's: $p=\frac{4}{3},-1$

$\boxed{(-\infty,-1]\cup\left[\frac{4}{3},\infty\right)}$

23.

$\dfrac{x-3}{2x+1}\leq 0$

CPs: $x=-\frac{1}{2},3$



$\boxed{(-\frac{1}{2},3]}$

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

$5x + 3000 + 12x = 20x$

$3x = 3000$

$\boxed{x = 1000 \text{ ft}}$

27. Let x = number of minutes in excess of 600

Charges = $49 + 0.17x$

$53.59 \le 49 + 0.17x \le 69.74$

$4.59 \le 0.17x \le 20.74$

$27 \le x \le 122$

$+600$ base

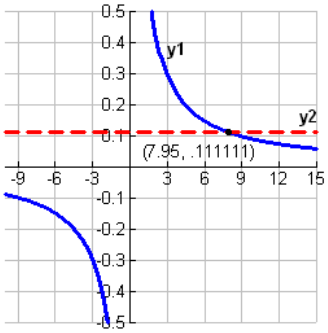
$\boxed{627 \le x \le 722}$

29.

$$y1 = \frac{1}{0.75x} - \frac{0.45}{x}$$

$$y2 = \frac{1}{9}$$

$\boxed{x = 7.95}$



Chapter 1 Cumulative Review----------

1.

$$5 \cdot (7 - 3 \cdot 4 + 2) = 5 \cdot (7 - 12 + 2)$$
$$= 5 \cdot (-5 + 2)$$
$$= 5 \cdot (-3) = \boxed{-15}$$

3.

$$\frac{(x^2 y^{-2})^3}{(x^2 y)^{-3}} = \frac{x^6 y^{-6}}{x^{-6} y^{-3}} = \boxed{\frac{x^{12}}{y^3}}$$

5.

$$x^2(x+5)(x-3) = x^2(x^2 + 2x - 15)$$
$$= \boxed{x^4 + 2x^3 - 15x^2}$$

7.

$$2a^3 + 2000 = 2\left(a^3 + \underbrace{1000}_{=10^3}\right)$$
$$= \boxed{2(a+10)(a^2 - 10a + 100)}$$

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 $x\neq -2,2$

11.

$$\tfrac{2}{7}x=\tfrac{1}{8}x+9$$
$$16x=7x+504$$
$$9x=504$$
$$\boxed{x=56}$$

13.

$$\frac{6x}{5}-\frac{8x}{3}=4-\frac{7x}{15}$$
$$18x-40x=60-7x$$
$$-22x=60-7x$$
$$-15x=60$$
$$\boxed{x=-4}$$

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.

17.

$$x^2+12x+40=0$$
$$\left(x^2+12x+36\right)+40-36=0$$
$$(x+6)^2+4=0$$
$$(x+6)^2=-4$$
$$x+6=\pm\sqrt{-4}=\pm 2i$$
$$\boxed{x=-6\pm 2i}$$

19.

$$\sqrt{4-x}=x-4$$
$$4-x=(x-4)^2$$
$$4-x=x^2-8x+16$$
$$x^2-7x+12=0$$
$$(x-4)(x-3)=0$$
$$x=\cancel{3},\boxed{4}$$

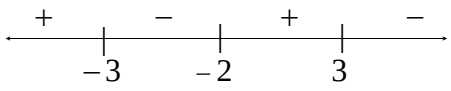
21.

$$0<4-x\leq 7$$
$$-4<-x\leq 3$$
$$4>x\geq -3$$
$$\boxed{[-3,4)}$$

23.

$$\frac{x+2}{9-x^2}\geq 0$$
$$\frac{x+2}{(3-x)(3+x)}\geq 0$$

CPs: $x=-2,\pm 3$



	$\boxed{(-\infty,-3)\cup[-2,3)}$

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 $3x+10=-7$

$3x=-3$ $3x=-17$

$\boxed{x=-1}$ $\boxed{x=-\frac{17}{3}}$

27.

$$y1=\left|\frac{3x}{x-2}\right|$$

$y2=1$

Find when $y1 < y2$

$\boxed{(-1,\frac{1}{2})}$