CHAPTER 1

Section 1.1 Solutions ---

1.
$$\begin{gathered} 5x = 35 \\ \frac{1}{5}\cdot 5x = \frac{1}{5}\cdot 35 \\ \boxed{x = 7} \end{gathered}$$

3.
$$\begin{gathered} -3 + n = 12 \\ 3 + -3 + n = 3 + 12 \\ \boxed{n = 15} \end{gathered}$$

5.
$$\begin{gathered} 24 = -3x \\ -\frac{1}{3}\cdot 24 = -\frac{1}{3}\cdot(-3x) \\ \boxed{-8 = x} \end{gathered}$$

7.
$$\begin{gathered} \frac{1}{5}n = 3 \\ 5\cdot\frac{1}{5}n = 5\cdot 3 \\ \boxed{n = 15} \end{gathered}$$

9.
$$\begin{gathered} 3x - 5 = 7 \\ 3x = 12 \\ \boxed{x = 4} \end{gathered}$$

11.
$$\begin{gathered} 9m - 7 = 11 \\ 9m = 18 \\ \boxed{m = 2} \end{gathered}$$

13.
$$\begin{gathered} 5t + 11 = 18 \\ 5t = 7 \\ \boxed{t = 7/5} \end{gathered}$$

15.
$$\begin{gathered} 3x - 5 = 25 + 6x \\ 3x = 30 + 6x \\ -3x = 30 \\ \boxed{x = -10} \end{gathered}$$

17.
$$\begin{gathered} 20n - 30 = 20 - 5n \\ 20n = 50 - 5n \\ 25n = 50 \\ \boxed{n = 2} \end{gathered}$$

19.
$$\begin{gathered} 4(x-3) = 2(x+6) \\ 4x - 12 = 2x + 12 \\ 2x = 24 \\ \boxed{x = 12} \end{gathered}$$

21.
$$\begin{gathered} -3(4t-5) = 5(6-2t) \\ -12t + 15 = 30 - 10t \\ -15 = 2t \\ \boxed{-15/2 = t} \end{gathered}$$

23.
$$\begin{gathered} 2(x-1) + 3 = x - 3(x+1) \\ 2x - 2 + 3 = x - 3x - 3 \\ 2x + 1 = -2x - 3 \\ 4x = -4 \\ \boxed{x = -1} \end{gathered}$$

25.
$$\begin{gathered} 5p + 6(p+7) = 3(p+2) \\ 5p + 6p + 42 = 3p + 6 \\ 11p + 42 = 3p + 6 \\ 8p = -36 \\ \boxed{p = -\frac{36}{8} = -\frac{9}{2}} \end{gathered}$$

27.

$$\begin{aligned} 7x-(2x+3)&=x-2\\ 7x-2x-3&=x-2\\ 5x-3&=x-2\\ 4x&=1\\ &\boxed{x={}^{1}\!/_{4}} \end{aligned}$$

29.

$$\begin{aligned} 2-(4x+1)&=3-(2x-1)\\ 2-4x-1&=3-2x+1\\ 1-4x&=4-2x\\ -3&=2x\\ &\boxed{-{}^{3}\!/_{2}=x} \end{aligned}$$

31.

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

33.

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

35.

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

37.

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

39.

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

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. $2y\left(\frac{4}{y}-5\right)=2y\left(\frac{5}{2y}\right)$ $\boxed{y\neq 0}$ $8-10y=5$ $-10y=-3$ $\boxed{y=\frac{3}{10}}$	**51.** $6x\left(7-\frac{1}{6x}\right)=6x\left(\frac{10}{3x}\right)$ $\boxed{x\neq 0}$ $42x-1=20$ $42x=21$ $\boxed{x=\frac{1}{2}}$
53. $3a\left(\frac{2}{a}-4\right)=3a\left(\frac{4}{3a}\right)$ $\boxed{a\neq 0}$ $6-12a=4$ $-12a=-2$ $\boxed{a=\frac{1}{6}}$	**55.** $(x-2)\left(\frac{x}{x-2}+5\right)=(x-2)\left(\frac{2}{x-2}\right)$ $\boxed{x\neq 2}$ $x+5(x-2)=2$ $x+5x-10=2$ $6x=12$ $x=2$ $\boxed{\text{No solution}}$ since 2 was excluded from the solution set.
57. $(p-1)\left(\frac{2p}{p-1}\right)=(p-1)\left(3+\frac{2}{p-1}\right)$ $\boxed{p\neq 1}$ $2p=3(p-1)+2$ $2p=3p-3+2$ $2p=3p-1$ $p=1$ $\boxed{\text{No solution}}$ since 1 was excluded from the solution set.	**59.** $(x+2)\left(\frac{3x}{x+2}-4\right)=(x+2)\left(\frac{2}{x+2}\right)$ $\boxed{x\neq -2}$ $3x-4(x+2)=2$ $-x-8=2$ $\boxed{x=-10}$

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

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

$$\begin{aligned}(n+1)+n&=-1\\ n+1+n&=-1\\ 2n&=-2\\ n&=-1\end{aligned}$$

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,

$$\begin{aligned}3(a+3)-2a&=9\\ 3a+9-2a&=9\\ a&=0\end{aligned}$$

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

65.

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

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

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

$$\begin{aligned}6(n-5)&=4(n-1)-9(n-3)\\ 6n-30&=4n-4-9n+27\\ 6n-30&=-5n+23\\ 11n&=53\end{aligned}$$

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

67.

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

$$\begin{aligned}2(2x-1)&=1(5x+1)\\ 4x-2&=5x+1\\ \end{aligned}$$

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

69.

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

$$\begin{aligned}3(1-t)&=2(t-1)\\ 3-3t&=2t-2\\ -5t&=-5\\ t&=1\end{aligned}$$

$\boxed{\text{No solution}}$ 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 $\boxed{\text{84 min.}}$

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

$$2+0.10x=3.70$$

$$0.10x=1.70$$

$$x=17$$

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

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.

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

$$ax=c-b$$

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

93.

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

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

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

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

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.

$$y=\frac{a}{1+\frac{b}{x}+c}\qquad\boxed{x\neq0,\ -\frac{b}{c+1}}$$

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

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

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

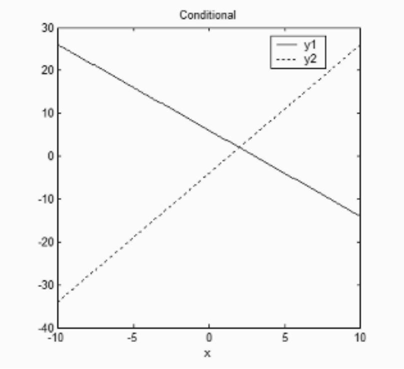
$$yb+xy(c+1)-ax=0$$

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

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

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

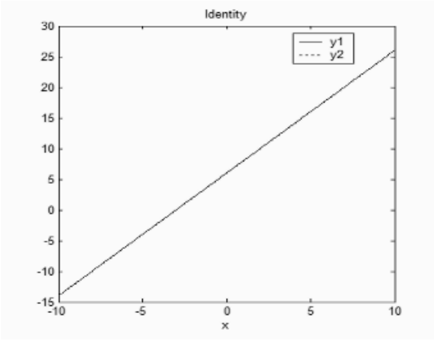
$y2=3x-4$



$\boxed{x=2}$

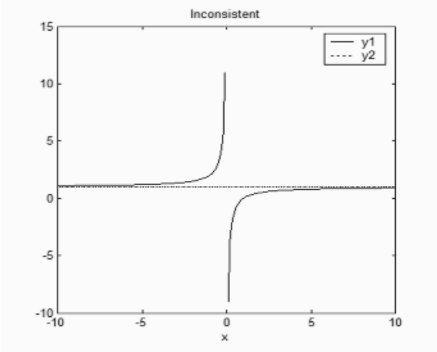
101. $y1=2x+6$

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



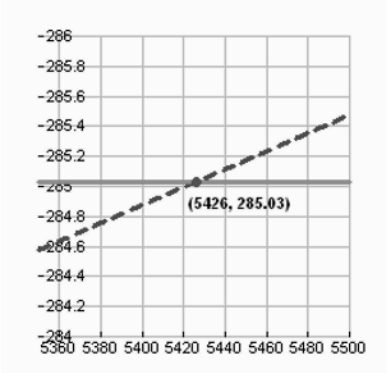
All real numbers

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



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

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



$\boxed{x = 5426}$

Section 1.2 Solutions --

1. Let $x =$ price without coupon

$0.9x = 217.95$

$\boxed{x = \$242.17}$

3. Let $x =$ cost of pizza

Tom: 5.16

Chelsea: $1/8\ x$

Jeff: $1/2\ x$

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

$41.28 + x + 4x = 8x$

$3x = 41.28$

$\boxed{x = \$13.76}$

5. Let $x =$ original price

$0.85x = 125{,}000$

$x = 147{,}058.82$

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

Model price $= \$125{,}000$

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

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

Home $\rightarrow$ Train station $= 1$ mile

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

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

LCD $= 12$

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

$12 + 11x = 12x$

$x = 12$

Angela travels $\boxed{\text{12 miles}}$ 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

$$\frac{1}{3}x+\frac{1}{5}x+\frac{1}{10}x+3+2.5=x$$
$$10x+6x+3x+165=30x$$
$$19x+165=30x$$
$$11x=165$$

$x=15$ awake

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

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 $\boxed{\text{270 units}}$ 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 $\boxed{\text{20 inches}}$.

19. $w =$ width

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

$$p=2l+2w$$
$$260=2(2w+40)+2w$$
$$260=4w+80+2w$$
$$180=6w$$
$$w=30$$

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

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 $= 2\pi r_2$

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

$r_2 = 2r_1$

$2r_1 = r_1 + 3$

$r_1 = 3$

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

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

$3x = 900$

$x = 300$

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

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

Solve:

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

$0.5x = 2.625$

$x = 5.25$

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

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:

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

$32x + 132 - 4x = 300$

$28x = 168$

$x = 6$

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

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

Solve:

$100 - x =$ ml of 15% HCl

$$\begin{aligned} 0.05x + 0.15(100 - x) &= 0.08(100) \\ 0.05x + 15 - 0.15x &= 8 \\ -0.1x &= -7 \\ x &= 70 \end{aligned}$$

$$\boxed{\begin{array}{l} \text{70ml of 5\% HCl} \\ \text{30ml of 15\% HCl} \end{array}}$$

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

Solve:

$$\begin{aligned} 0.40(5 - x) + 1.00x &= 0.80(5) \\ 2 - 0.40x + x &= 4 \\ 2 + 0.60x &= 4 \\ 0.60x &= 2 \\ x &\approx 3.3 \end{aligned}$$

About $\boxed{\text{3.3 gallons}}$.

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

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

Solve:

$$\begin{aligned} 1.5x + 2(1.25 - x) &= 2.50 \\ 1.5x + 2.5 - 2x &= 2.50 \\ -0.5x &= 0 \\ x &= 0 \end{aligned}$$

$$\boxed{\text{No caramels, 1.25lb of gummy bears}}$$

39. distance = rate · time

distance = 100,000,000 miles

rate = 670,616,629 mph

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

$$= 0.15 \text{ hours} \cong \boxed{\text{9 minutes}}$$

41.

$$\begin{aligned} x + 0.047x &= 3.21 \\ 1.047x &= 3.21 \\ x &= 3.065 \end{aligned}$$

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:

$$\begin{aligned} 0.03(100\,mL) + 0.00(x\,mL) &= 0.009(100 + x)mL \\ 3mL + 0mL &= (0.9mL + 0.009x) \\ 2.1mL &= 0.009x \\ x &\approx 233mL \end{aligned}$$

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

boat speed: $s = 16$ mph

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

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

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

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

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

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

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

$$r_w=4$$

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

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 $\boxed{\text{bicyclist 6 minutes to get to class, and the walker 18 minutes}}$.

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.

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

$$3x+45=5x$$

$$2x=45$$

$$x=22.5$$

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

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 $\boxed{\text{2.4 hours}}$.

55.

$$\frac{4}{5}=\frac{264}{x_1} \qquad \frac{4}{6}=\frac{264}{x_2}$$

$$4x_1=264(5) \qquad 4x_2=264(6)$$

$$4x_1=1320 \qquad 4x_2=1584$$

$$\boxed{x_1=330\text{ hertz}} \qquad \boxed{x_2=396\text{ hertz}}$$

57. Let $x=$ exam grade needed

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

To earn a "B":

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

$$\text{LCD}=3$$

$$85+2x=240$$

$$2x=155$$

$$\boxed{x=77.5}$$

To earn an "A":

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

$$\text{LCD}=3$$

$$85+2x=270$$

$$2x=185$$

$$\boxed{x=92.5}$$

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.

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

$$f=3,\ d_i=5$$

$$\frac{1}{3}=\frac{1}{d_0}+\frac{1}{5}$$

$$\text{LCD}=15d_0$$

$$5d_0=15+3d_0$$

$$2d_0=15$$

Object is $\boxed{d_0=7.5}$ cm from lens.

67.

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

$$f=2,\ d_i=\tfrac{1}{2}d_0$$

$$\frac{1}{2}=\frac{1}{d_0}+\frac{1}{\frac{1}{2}d_0}$$

Since $\frac{1}{\frac{1}{2}d_0}=\frac{2}{d_0}$,

$$\frac{1}{2}=\frac{1}{d_0}+\frac{2}{d_0}=\frac{3}{d_0}\ \Rightarrow\ d_0=6$$

$$\boxed{\text{Object distance} = 6\,\text{cm}}$$

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.

$$V=lwh$$

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

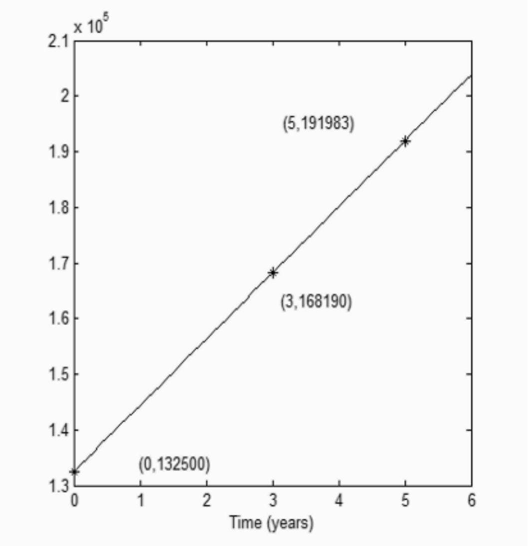
77. Let x = Janine's average speed (in mph).
Then, Tricia's speed = $(12 + x)$ mph. We must solve the equation:

$$\begin{aligned}2.5(12+x)+2.5x&=320\\30+2.5x+2.5x&=320\\5x&=290\\x&=58\end{aligned}$$

So, $\boxed{\text{Janine's average speed is 58 mph and Tricia's average speed is 70 mph.}}$

79. $y = 11896.67x + 132500$

$\boxed{\$191{,}983.35}$

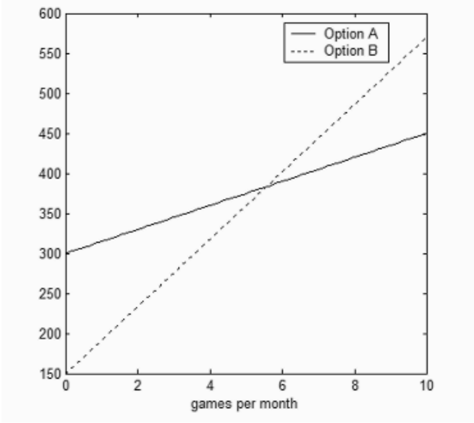


81. Let $x =$ number of times you play.

Option A: $y_1 = 300 + 15x$

Option B: $y_2 = 150 + 42x$

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



Section 1.3 Solutions --

1.

$$x^2 - 5x + 6 = 0$$
$$(x-3)(x-2) = 0$$
$$x - 3 = 0 \text{ or } x - 2 = 0$$
$$\boxed{x = 3 \text{ or } x = 2}$$

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.	$9y^2+1=6y$ $9y^2-6y+1=0$ $(3y-1)(3y-1)=0$ $\boxed{y=\frac{1}{3}}$	**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.
$$\begin{aligned}(2x+3)^2&=-4\\2x+3&=\pm 2i\\2x&=-3\pm 2i\\&\boxed{x=\tfrac{-3\pm 2i}{2}}\end{aligned}$$

31.
$$\begin{aligned}(5x-2)^2&=27\\5x-2&=\pm\sqrt{27}\\5x&=2\pm 3\sqrt{3}\\&\boxed{x=\frac{2\pm 3\sqrt{3}}{5}}\end{aligned}$$

33.
$$\begin{aligned}(1-x)^2&=9\\1-x&=\pm 3\\-x&=-1\pm 3\\&\boxed{x=1\pm 3=-2,4}\end{aligned}$$

35.
$$\begin{aligned}&x^2+6x\\&\left(\frac{1}{2}\cdot 6\right)^2=3^2=9\\&x^2+6x+\boxed{9}\end{aligned}$$

37.
$$\begin{aligned}&x^2-12x\\&\left(\frac{1}{2}\cdot 12\right)^2=6^2=36\\&x^2-12x+\boxed{36}\end{aligned}$$

39.
$$\begin{aligned}&x^2-\frac{1}{2}x\\&\left(\frac{1}{2}\cdot\frac{1}{2}\right)^2=\left(\frac{1}{4}\right)^2=\frac{1}{16}\\&x^2-\frac{1}{2}x+\boxed{\frac{1}{16}}\end{aligned}$$

41.
$$\begin{aligned}&x^2+\frac{2}{5}x\\&\left(\frac{1}{2}\cdot\frac{2}{5}\right)^2=\left(\frac{1}{5}\right)^2=\frac{1}{25}\\&x^2+\frac{2}{5}x+\boxed{\frac{1}{25}}\end{aligned}$$

43.
$$\begin{aligned}&x^2-2.4x\\&\left(\frac{1}{2}\cdot 2.4\right)^2=1.2^2=1.44\\&x^2-2.4+\boxed{1.44}\end{aligned}$$

45.
$$\begin{aligned}x^2+2x&=3\\x^2+2x+1&=3+1\\(x+1)^2&=4\\x+1&=\pm 2\\x&=-1\pm 2\\&\boxed{x=-3,1}\end{aligned}$$

47.
$$\begin{aligned}t^2-6t&=-5\\t^2-6t+9&=-5+9\\(t-3)^2&=4\\t-3&=\pm 2\\&\boxed{t=3\pm 2=1,5}\end{aligned}$$

49.

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

51.

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

53.

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

55.

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

57.

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

59.

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

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.

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

$$x=\frac{2\pm\sqrt{4-4\cdot17}}{2}=\frac{2\pm\sqrt{-64}}{2}$$

$$\boxed{x=\frac{2\pm8i}{2}=1\pm4i}$$

65.

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

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

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

67.

$$\tfrac{1}{4}x^2+\tfrac{2}{3}x-\tfrac{1}{2}=0$$

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

$$x=\frac{-8\pm\sqrt{64-4(3)(-6)}}{2(3)}=\frac{-8\pm2\sqrt{34}}{2(3)}$$

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

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.

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

$$x+3=\pm4$$

$$\boxed{x=-3\pm4=-7,1}$$

81.

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

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

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

$$p=\frac{8\pm\sqrt{64-4(1)(4)}}{2(1)}=\frac{8\pm4\sqrt{3}}{2}$$

$$\boxed{p=4\pm2\sqrt{3}}$$

83.

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

$$w=\frac{-2\pm\sqrt{4-4\cdot8\cdot21}}{16}$$

$$w=\frac{-2\pm\sqrt{-668}}{16}=\frac{-2\pm2i\sqrt{167}}{16}$$

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

85.

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

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

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

87.

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

$$\text{LCD}=15$$

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

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

$$t=\frac{20\pm\sqrt{520}}{20}=\frac{20\pm2\sqrt{130}}{20}$$

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

89.

$$x+\frac{12}{x}=7 \quad \boxed{x\neq0}$$

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

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

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

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

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

91.

$$\frac{4(x-2)}{x-3}+\frac{3}{x}=\frac{-3}{x(x-3)} \quad \boxed{x\neq0,3}$$

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

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

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

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

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

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

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

93.

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

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

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

95.

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

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

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

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

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

$$\boxed{\begin{array}{l}t=4 \text{ (March 2015) and}\\ \qquad 2 \text{(January 2015)}\end{array}}$$

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

$$\begin{aligned} -100+(0.2q-3)q&=0\\ -100+0.2q^2-3q&=0\\ 0.2q^2-3q-100&=0\\ q^2-15q-500&=0 \end{aligned}$$

$$q=\frac{15\pm\sqrt{(-15)^2-4(1)(-500)}}{2(1)}$$

$$=\frac{15\pm\sqrt{2,225}}{2}=\frac{15\pm 47.17}{2}$$

$$=31.085,\ \cancel{-16.09}$$

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

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

$$\begin{aligned} -5(x+3)(x-24)&=460\\ -5x^2+105x+360&=460\\ -5x^2+105x-100&=0\\ x^2-21x+20&=0\\ (x-20)(x-1)&=0 \end{aligned}$$

$$x=1,\ 20$$

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

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

$$\begin{aligned} -t^2+13t+130&=160\\ -t^2+13t-30&=0\\ t^2-13t+30&=0\\ (t-10)(t-3)&=0 \end{aligned}$$

$$t=3,\ \cancel{10}$$

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

103. a.
<u>The width of useable space</u> = (8.5 – 2(1)) inches = 6.5 inches
<u>The length of useable space</u> = (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)
<u>Width of useable space</u> = 8.5 – 2(1) + $2x$ = 6.5 + $2x$
<u>Length of useable space</u> = 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:

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

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:

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

So, the TV is approximately $\boxed{\text{20 inches}}$ high.

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

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

So, $\boxed{\text{the numbers are 17 and 18}}$.

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

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

So, the rectangle has:
$\boxed{\text{length 15ft. and width 9ft.}}$

111.

$$\text{Area} = \frac{1}{2}b \cdot h = 60$$
$$h = 3b + 2$$
$$\frac{1}{2}b(3b+2) = 60$$
$$\frac{3}{2}b^2 + b = 60$$
$$3b^2 + 2b - 120 = 0$$
$$(3b+20)(b-6) = 0$$
$$\boxed{b = \cancel{\frac{-20}{3}}, 6;\ h = 20}$$

113.

$$h = -16t^2 + 100$$
$$\text{Ground} \to h = 0$$
$$-16t^2 + 100 = 0$$
$$t^2 = \frac{100}{16}$$
$$t = \pm\frac{10}{4}\ (\text{Time must be} \geq 0)$$
$$\boxed{\text{Impact with ground in 2.5 sec}}$$

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.

$$\text{volume} = l \cdot w \cdot h$$
$$v = (x-2)(x-2)(1)$$
$$9 = (x-2)^2$$
$$x - 2 = \pm 3$$
$$x = 2 \pm 3 = -1, 5$$
$$x = 5$$
$$\boxed{\text{Original square was 5ft} \times \text{5ft}}$$

119.

Let w = width of border

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

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

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

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

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

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

$$\frac{1}{3}(4w^2 + 26w) = 27$$
$$4w^2 + 26w = 81$$
$$4w^2 + 26w - 81 = 0$$
$$w = \frac{-26 \pm \sqrt{26^2 + 4 \cdot 4 \cdot 81}}{2 \cdot 4} = \frac{-26 \pm \sqrt{1972}}{8}$$
$$w \cong \cancel{-8.8}, 2.3$$
$$\boxed{\text{Width of border is 2.3 feet.}}$$

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.

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

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

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

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

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

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

$x = \cancel{2}, 15$

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.

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

141.

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

143.

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

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

145.

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

147.

Let x = speed in still air and y = time to make the trip with a tail wind.
Using Distance = Rate × Time, we obtain the following two equations:
With tail wind: $(x+50)y=600$ **(1)**
Against head wind: $(x-50)(y+1)=600$ **(2)**
Solve **(1)** for y: $y=\dfrac{600}{x+50}$
Substitute this into **(2)** and solve for x:

$$(x-50)\left(\frac{600}{x+50}+1\right)=600$$

$$(x-50)\left(\frac{600+x+50}{x+50}\right)=600$$

$$(x-50)(650+x)=600(x+50)$$

$$650x-32,500-50x+x^2=600x+30,000$$

$$x^2-62,500=0$$

$$(x-250)(x+250)=0$$

$$x=250,\ \cancel{-250}$$

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

149. 2 distinct real roots of $ax^2+bx+c=0$ are: $x_1=\dfrac{-b+\sqrt{b^2-4ac}}{2a}$ $\quad x_2=\dfrac{-b-\sqrt{b^2-4ac}}{2a}$

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

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

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

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

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

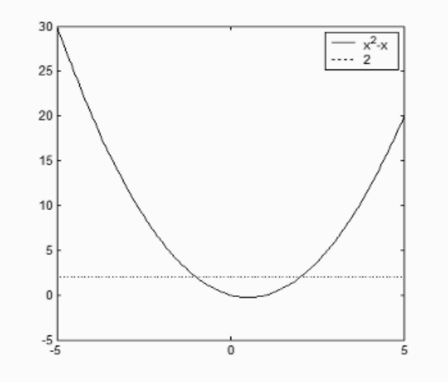
$$x=\frac{-100\pm\sqrt{100^2+4(120,000)}}{2}=\frac{-100\pm700}{2}=\cancel{-400},\ 300$$

So, $\boxed{\text{the speed of the small jet is 300mph and the speed of the 757-jet is 400mph}}$.

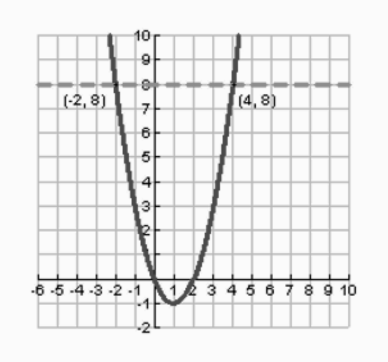
153. $x^2-x-2=0$

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

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



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.

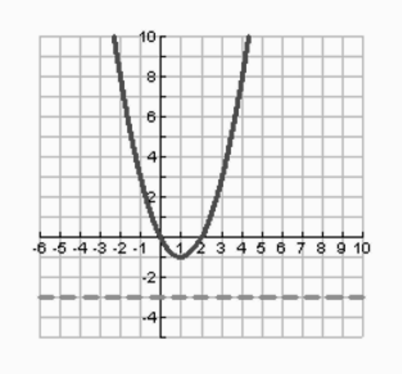
(b) We do the same thing now for different values of *b*.

$\underline{b=-3}$:

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

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

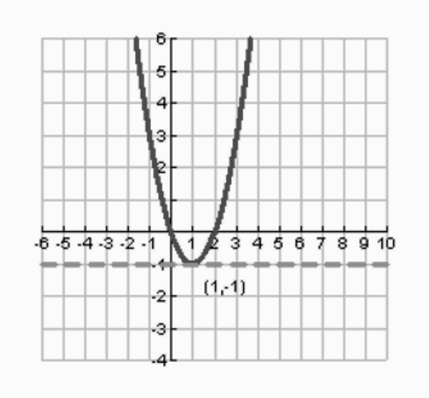
So, we don't expect the graphs to intersect. Indeed, we have:



$\underline{b=-1}$:

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

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



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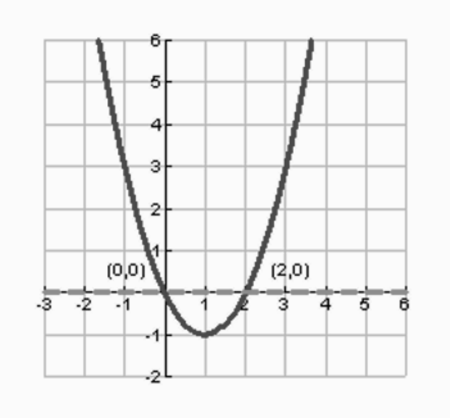
$\underline{b=0}$:

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

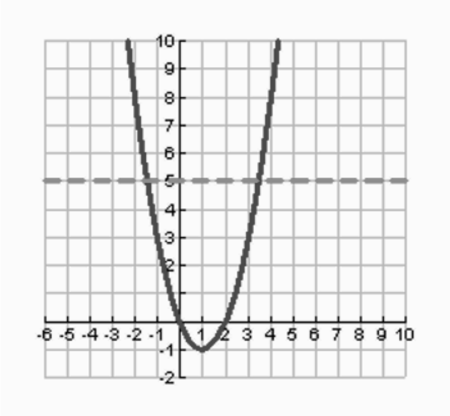
So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



$\underline{b=5}$:

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

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.

$$3\sqrt{x+4}-2x=9$$
$$3\sqrt{x+4}=2x+9$$
$$\left(3\sqrt{x+4}\right)^2=(2x+9)^2$$
$$9(x+4)=4x^2+36x+81$$
$$9x+36=4x^2+36x+81$$
$$4x^2+27x+45=0$$
$$(4x+15)(x+3)=0$$
$$x=-\tfrac{15}{4},-3$$

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.

$$\sqrt{x^2-2x-5}=x+1$$
$$x^2-2x-5=(x+1)^2$$
$$x^2-2x-5=x^2+2x+1\ \boxed{\text{No solution}}.$$
$$-6=4x$$
$$\cancel{-\tfrac{3}{2}}=x$$

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.

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

35.

$$\begin{aligned}&\sqrt{2x-1}=1+\sqrt{x-1}\\ &2x-1=1+2\sqrt{x-1}+x-1\\ &x-1=2\sqrt{x-1}\\ &x^2-2x+1=4(x-1)\\ &x^2-2x+1=4x-4\\ &x^2-6x+5=0\\ &(x-5)(x-1)=0\\ &\boxed{x=1,5}\end{aligned}$$

37.

$$\begin{aligned}&\sqrt{3x-5}=7-\sqrt{x+2}\\ &3x-5=49-14\sqrt{x+2}+x+2\\ &2x-56=-14\sqrt{x+2}\\ &x-28=-7\sqrt{x+2}\\ &x^2-56x+784=49(x+2)\\ &x^2-56x+784=49x+98\\ &x^2-105x+686=0\\ &(x-98)(x-7)=0\\ &x=\boxed{7},\ \cancel{98}\end{aligned}$$

39.

$$\begin{aligned}&\sqrt{2+\sqrt{x}}=\sqrt{x}\\ &2+\sqrt{x}=x\\ &\sqrt{x}=x-2\\ &x=x^2-4x+4\\ &x^2-5x+4=0\\ &(x-4)(x-1)=0\\ &x=\cancel{1},\ \boxed{4}\end{aligned}$$

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

$$\begin{aligned}&u^2+2u=0\\ &u(u+2)=0\\ &u=-2,0\\ &x^{1/3}=0\rightarrow\boxed{x=0}\\ &x^{1/3}=-2\rightarrow\boxed{x=-8}\end{aligned}$$

43. Let $u=x^2$

$$\begin{aligned}&u^2-3u+2=0\\ &(u-1)(u-2)=0\\ &u=1,2\\ &x^2=1\rightarrow\boxed{x=\pm1}\\ &x^2=2\rightarrow\boxed{x=\pm\sqrt{2}}\end{aligned}$$

45. Let $u = x^2$

$$2u^2 + 7u + 6 = 0$$
$$(2u+3)(u+2) = 0$$
$$u = -3/2 \qquad u = -2$$
$$x^2 = -3/2 \qquad x^2 = -2$$
$$x = \pm i\sqrt{3/2} \qquad x = \pm i\sqrt{2}$$
$$\boxed{x = \frac{\pm i\sqrt{6}}{2}} \qquad \boxed{x = \pm i\sqrt{2}}$$

47. Let $u = 2x+1$

$$u^2 + 5u + 4 = 0$$
$$(u+4)(u+1) = 0$$
$$u = -4 \qquad u = -1$$
$$2x+1 = -4 \qquad 2x+1 = -1$$
$$2x = -5 \qquad 2x = -2$$
$$\boxed{x = -5/2} \qquad \boxed{x = -1}$$

49. Let $u = t-1$

$$4u^2 - 9u + 2 = 0$$
$$(4u-1)(u-2) = 0$$
$$u = 1/4 \qquad u = 2$$
$$t-1 = 1/4 \qquad t-1 = 2$$
$$\boxed{t = 5/4} \qquad \boxed{t = 3}$$

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

$$u^2 - 17u + 16 = 0$$
$$(u-16)(u-1) = 0$$
$$u = 1 \qquad u = 16$$
$$x^{-4} = 1 \qquad x^{-4} = 16$$
$$x^2 = \pm 1 \qquad x^2 = \pm 1/4$$
$$\boxed{x = \pm 1, \pm i} \qquad \boxed{x = \pm\frac{1}{2}, \pm\frac{1}{2}i}$$

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

$$3u^2 + u - 4 = 0$$
$$(3u+4)(u-1) = 0$$
$$u = -4/3 \qquad u = 1$$
$$y^{-1} = -4/3 \qquad y^{-1} = 1$$
$$\boxed{y = -3/4} \qquad \boxed{y = 1}$$

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

$$6u^2 - u - 1 = 0$$
$$(3u+1)(2u-1) = 0$$
$$u = -1/3 \qquad u = 1/2$$
$$t^{-1/3} = -1/3 \qquad t^{-1/3} = 1/2$$
$$t = (-1/3)^{-3} \qquad t = (1/2)^{-3}$$
$$\boxed{t = -27} \qquad \boxed{t = 8}$$

63.

$$3 = \frac{1}{(x+1)^2} + \frac{2}{(x+1)} \quad \boxed{x \neq -1}$$
$$3(x+1)^2 = 1 + 2(x+1)$$
$$3(x+1)^2 - 2(x+1) - 1 = 0$$

Let $u = x+1$

$$3u^2 - 2u - 1 = 0$$
$$(3u+1)(u-1) = 0$$
$$u = -1/3 \qquad u = 1$$
$$x+1 = -1/3 \qquad x+1 = 1$$
$$\boxed{x = -4/3} \qquad \boxed{x = 0}$$

65.

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

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

$$\text{Let } u = \frac{1}{2x-1}$$

$$u^2 + u - 12 = 0$$

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

Then, we have:

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

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

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

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

$$\begin{array}{ll}
x = 4 & x = 1 \\
u^{2/3} = 4 & u^{2/3} = 1 \\
u = \pm 4^{3/2} & u = \pm 1^{3/2} \\
\boxed{u = \pm 8} & \boxed{u = \pm 1}
\end{array}$$

69.

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

Let $u = t^2$

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

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

$$\begin{array}{ll}
u = -2 & u = 3 \\
t^2 = -2 & t^2 = 3 \\
\cancel{t = \pm i\sqrt{2}} & \boxed{\begin{array}{l} t = \sqrt{3}, \\ \quad \cancel{-\sqrt{3}} \end{array}}
\end{array}$$

71.

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

$$x\left(x^2 - x - 12\right) = 0$$

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

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

73.

$$4p^3 - 9p = 0$$

$$p\left(4p^2 - 9\right) = 0$$

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

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

75.

$$u^5 - 16u = 0$$

$$u\left(u^4 - 16\right) = 0$$

$$u\left(u^2 - 4\right)\left(u^2 + 4\right) = 0$$

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

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

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.)

$$3\sqrt{t+1}-0.75t=3$$
$$3\sqrt{t+1}=3+0.75t$$
$$\left(3\sqrt{t+1}\right)^2=(3+0.75t)^2$$
$$9t+9=9+4.5t+0.5625t^2$$
$$0.5625t^2-4.5t=0$$
$$t(0.5625t-4.5)=0$$
$$t=0,\ \tfrac{4.5}{0.5625}=8$$

So, this occurs in January and September.

89. Solve $\sqrt{\frac{wh}{3,600}} = BSA$ for h, when $w = 72$ and $BSA = 1.8$.

$$\begin{aligned} \sqrt{\frac{72h}{3,600}} &= 1.8 \\ \frac{\sqrt{72h}}{60} &= 1.8 \\ \sqrt{72h} &= (1.8)(60) \\ 72h &= 108^2 \\ h &= \frac{11,664}{72} = 162 \end{aligned}$$

So, the height of such a female is 162 cm.

91.

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

93.

$$\begin{aligned} &P = 5\sqrt{t^2+1}+50 \\ &P = 85 \\ &85 = 5\sqrt{t^2+1}+50 \\ &35 = 5\sqrt{t^2+1} \\ &7 = \sqrt{t^2+1} \\ &49 = t^2+1 \\ &t^2 = 48 \\ &t = \sqrt{48} \\ &t = 4\sqrt{3} \ (t \text{ must be} \geq 0) \\ &t \cong 7 \text{ months} \\ &\boxed{\text{March}} \end{aligned}$$

95.

$$\begin{aligned} &T = \frac{\sqrt{d}}{4} + \frac{d}{1100}, \quad T = 3 \\ &3 = \frac{\sqrt{d}}{4} + \frac{d}{1100} \\ &\text{LCD} = 1100 \\ &3300 = 275\sqrt{d} + d \\ &d + 275\sqrt{d} - 3300 = 0 \\ &\text{Let } u = \sqrt{d} \\ &u^2 + 275u - 3300 = 0 \\ &u = \frac{-275 \pm \sqrt{275^2 + 4 \cdot 1 \cdot 3300}}{2(1)} \\ &u = -286.5, 11.5 \\ &\sqrt{d} = 11.5 \\ &\boxed{d = 132 \text{ ft}} \end{aligned}$$

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:

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

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

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 $x \ge 0$, then $\sqrt{x^2} = x$, while if $x < 0$, then $\sqrt{x^2} = -x$. So, the solution set is $\boxed{[0,\infty)}$.

111.

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

$u = \sqrt{u}$

$u = 0, 1$

$$3x^2 + 2x = 0 \qquad\qquad 3x^2 + 2x = 1$$

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

$$\boxed{x = 0, -2/3} \qquad\qquad (3x-1)(x+1) = 0$$

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

113.

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

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

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

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

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

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

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

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

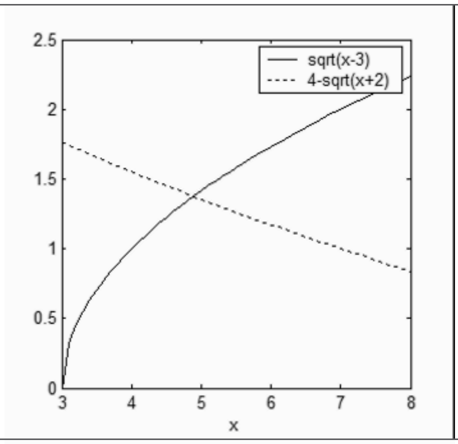
$$21x^2 + 104x + 124 = 0$$

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

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

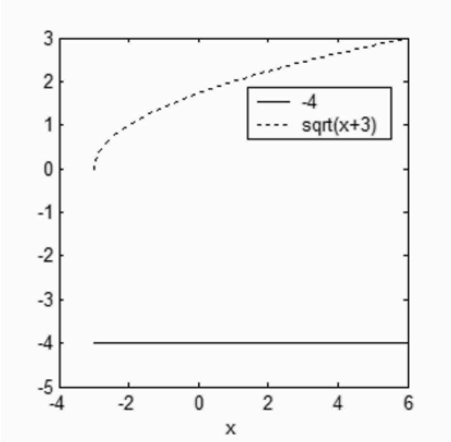
115.

$$\sqrt{x-3}=4-\sqrt{x+2}$$
$$x-3=16-8\sqrt{x+2}+x+2$$
$$-21=-8\sqrt{x+2}$$
$$441=64\left(x+2\right)=64x+128$$
$$313=64x$$
$$\boxed{x=\frac{313}{64}\cong 4.891}$$



117.

$$-4=\sqrt{x+3}$$
$$16=x+3$$
$$x=13\left(\text{Extraneous}\right)$$
$$\boxed{\text{no solution}}$$



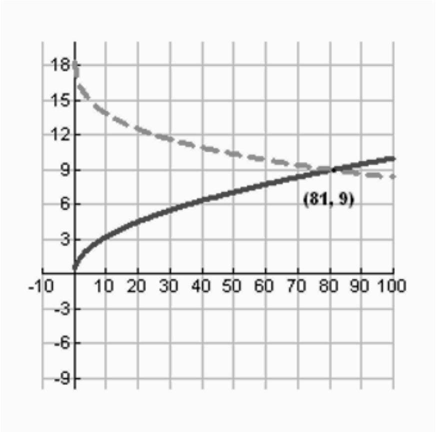
119.

$$x^{1/2}=-4x^{1/4}+21$$
$$x^{1/2}+4x^{1/4}-21=0$$
Let $u=x^{1/4}$ to obtain
$$u^2+4u-21=0$$
$$(u+7)(u-3)=0$$
$$u=-7,3$$
$x^{1/4}=-7$ $\quad$ $x^{1/4}=3$

$\boxed{\text{no solution}}$ $\quad$ $\boxed{x=81}$

Graphically, let:

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



Yes, the two solutions agree.

121.

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

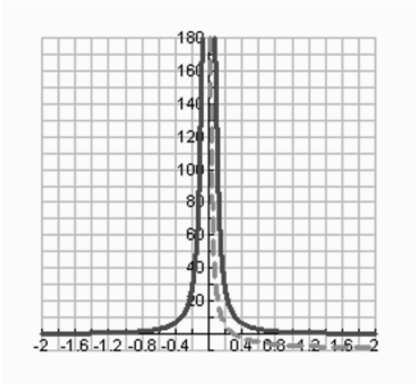
Let $u = x^{-1}$ to obtain

$$u^2 - 3u + 10 = 0$$
$$u = \frac{3 \pm \sqrt{9-4(10)(1)}}{2} = \frac{3 \pm i\sqrt{31}}{2}$$

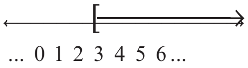
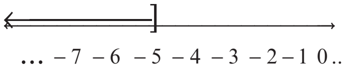
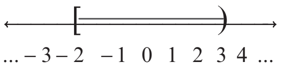
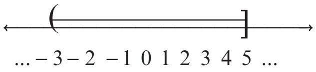
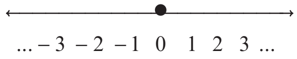
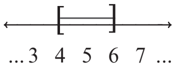
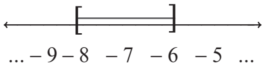
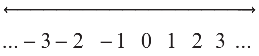
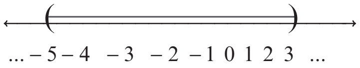
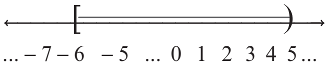
So, there are no real solutions. As such, we expect the graphs to not intersect.

Yes, the two solutions agree.

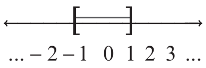
Graphically, let:
$y1 = x^{-2},\ y2 = 3x^{-1} - 10$.



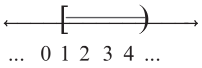
Section 1.5 Solutions

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. $-3 < x \le 7 \quad (-3,7]$	**27.** $3 \le x < 5 \quad [3,5)$
29. $-2 \le x \quad [-2,\infty)$	**31.** $-\infty < x < 8 \quad (-\infty,8)$
33. $(-5,3)$ 	**35.** $[-6,5)$ 

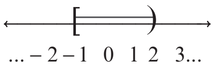
37. $[-1,1]$



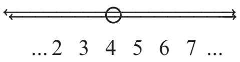
39. $[1,4)$



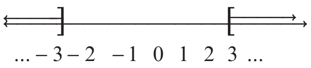
41. $[-1,2)$



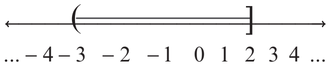
43. $(-\infty,4)\cup(4,\infty)$



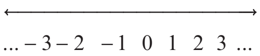
45. $(-\infty,-3]\cup[3,\infty)$



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.

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

$$\text{LCD}=6$$

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

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

$$-8\ge x \text{ or } x\le -8$$

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

75.

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

$$\text{LCD}=3$$

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

$$t-5\le -12$$

$$t\le -7$$

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

77.

Multiply by $\text{LCD}=6$

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

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

$$7y-15<4y-12$$

$$3y-15<-12$$

$$3y<3$$

$$y<1$$

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

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:

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

High weight:

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

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

93.

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

$\text{Cost} = 4000 + 20x$

$\text{Profit} = \text{Revenue} - \text{Cost}$

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

$100x - 4000 - 20x > 0$

$80x > 4000$

$x > 50$

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

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 $THR = \left(HR_{\max} - HR_{rest}\right) \times I + HR_{rest}$ with $HR_{rest} = 65,\ HR_{\max} = 170$.

Solve for I first when $THR = 100$ and then when $THR = 140$:

$$100 = (170 - 65)I + 65$$

$$35 = 105I$$

$$I \approx 0.33$$

So, about 33%.

$$140 = (170 - 65)I + 65$$

$$75 = 105I$$

$$I \approx 0.71$$

So, about 71%.

So, can consider workouts between 33% and 71% intensity.

99.

Cell Phone Charge: $50 + 0.22x$

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

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

$17.16 \le 0.22x \le 46.86$

$78 \le x \le 213$

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 $\boxed{\text{4 times}}$ 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 $\boxed{\text{no solution}}$.

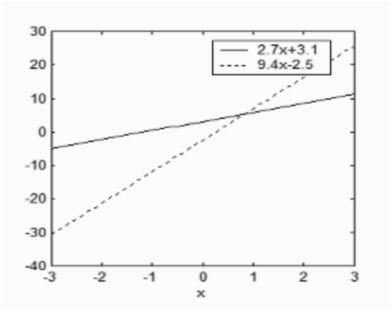
129.

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)



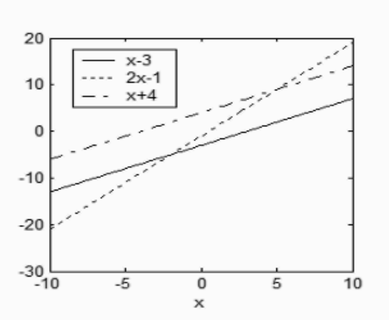
131.

a)

$$x-3<2x-1<x+4$$
$$-3<x-1<4$$
$$-2<x<5$$
$$(-2,5)$$

c) Agree

b)



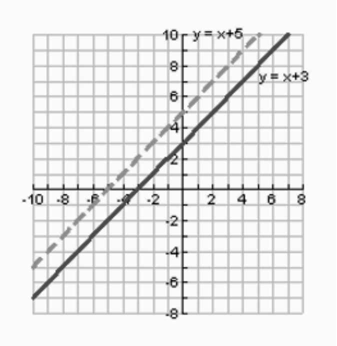
133.

a)

$$x+3<x+5$$
$$3<5$$
true for any $x\in(-\infty,\infty)$

c) Agree

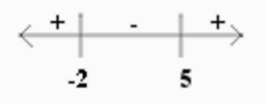
b)



Section 1.6 Solutions --

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

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

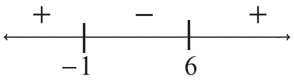


$\boxed{(-\infty,-2]\cup[5,\infty)}$

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

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

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

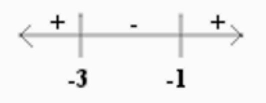


$\boxed{[-1,6]}$

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

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

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

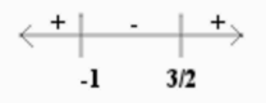


$\boxed{(-3,-1)}$

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

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

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

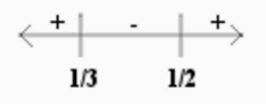


$\boxed{[-1,3/2]}$

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

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

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

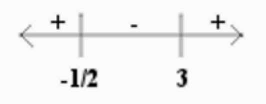


$\boxed{(1/3, 1/2)}$

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

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

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



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

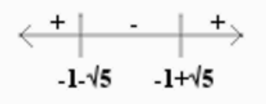
13. $y^2 + 2y - 4 \ge 0$ Note: Can't factor

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

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

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

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



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

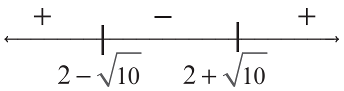
15. $x^2 - 4x < 6$

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

CPs: Use quadratic formula:

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

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

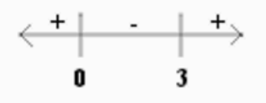


$\boxed{\left(2-\sqrt{10}, 2+\sqrt{10}\right)}$

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

$u(u-3) \ge 0$

CP's: $u = 0, 3$

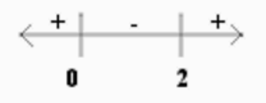


$\boxed{(-\infty, 0] \cup [3, \infty)}$

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

$x(x-2) \le 0$

CP's: $x = 0, 2$

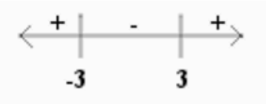


$\boxed{[0, 2]}$

21. $x^2 - 9 > 0$

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

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



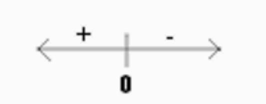
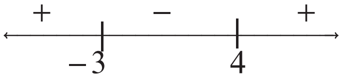
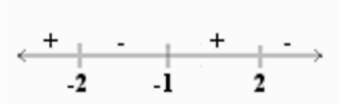
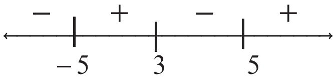
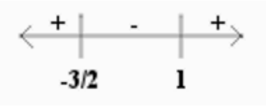
$\boxed{(-\infty, -3) \cup (3, \infty)}$

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.** $y^2<-4$ $\boxed{\text{no real solution}}$ $\left(\begin{array}{c}\text{A real number squared}\\ \text{is always non-negative.}\end{array}\right)$
29. $\dfrac{-3}{x}\le 0 \quad x=0$ is CP  $\boxed{(0,\infty)}$	**31.** $\dfrac{y}{y+3}>0 \quad$ 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.

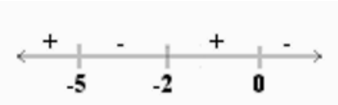
$$\frac{3t^2}{t+2}-5t\ge 0$$

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

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

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

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



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

43.

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

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

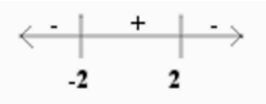
$$\frac{p\left(3-2p\right)-\left(3+p\right)\left(2+p\right)}{\left(2-p\right)\left(2+p\right)}<0$$

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

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

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

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



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

45.

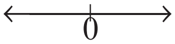
$$\frac{x^2}{5+x^2}<0$$

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

47.

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

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

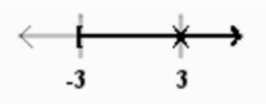


49.

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

$$v+3\ge 0$$

$$v\ge -3$$



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

51.

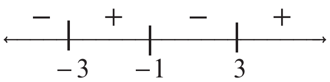
$$\frac{2}{t-3}+\frac{1}{t+3}\ge 0$$

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

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

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

CPs: $-1, \pm 3$



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

53.

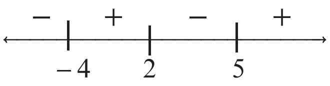
$$\frac{3}{x+4}-\frac{1}{x-2}\le 0$$

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

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

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

CPs: $-4,2,5$



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

55.

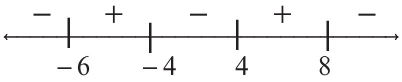
$$\frac{1}{p+4}+\frac{1}{p-4}-\frac{p^2-48}{p^2-16}>0$$

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

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

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

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



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

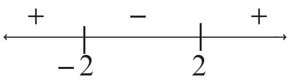
57.

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

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

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

CPs: ± 2



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

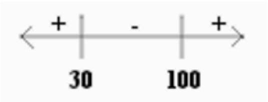
59.

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

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

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

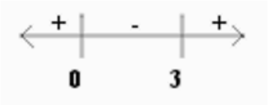
CP's: $x=30,100$



$\boxed{\text{Between 30 and 100 orders}}$

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.

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

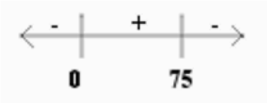
bullet is in the air if $h>0$

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

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

CP's: $t=0,75$

$(0,75)$



$\boxed{\text{Bullet is in the air for 75 sec}}$

65. $\text{Area} = l \cdot w$

$P = 2l + 2w = 100$

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

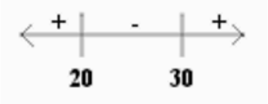
$A = l \cdot w = \left(\frac{100-2w}{2}\right)(w)$

$50w - w^2 \geq 600$

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

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

CP's: $w = 20, 30$



$[20,30]$

$20 \leq \text{width} \leq 30$

$20 \leq \text{length} \leq 30$

$\boxed{\text{Between 20 and 30 feet}}$

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.

$400 \pm 7 = 393, 407$

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

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

$\boxed{\$3{,}342 \text{ to } \$3{,}461 \text{ per acre}}$

71.

Cannot divide by x.

$x^2 - 3x > 0$

$x(x-3) > 0$

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

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

$x - 2 > 0$

$x > 2$

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

$\boxed{\mathbb{R}}$

81.

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

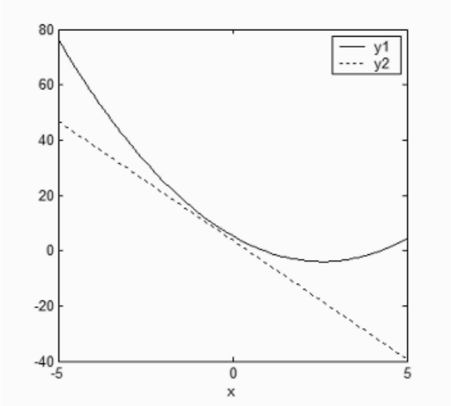
$$\boxed{\mathbb{R}}$$

83.

$$y_1 = 1.4x^2 - 7.2x + 5.3$$
$$y_2 = -8.6x + 3.7$$

Find when $y_1 > y_2$

$$\boxed{\mathbb{R}}$$

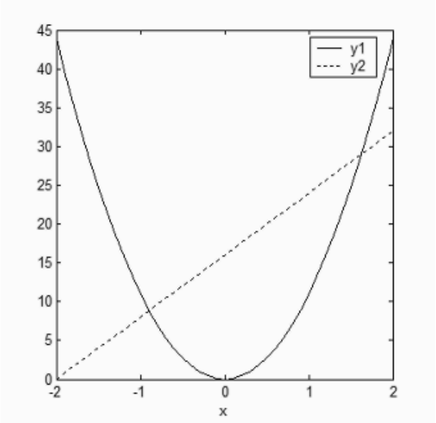


85.

$$y_1 = 11x^2$$
$$y_2 = 8x + 16$$

Find when $y_1 < y_2$

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

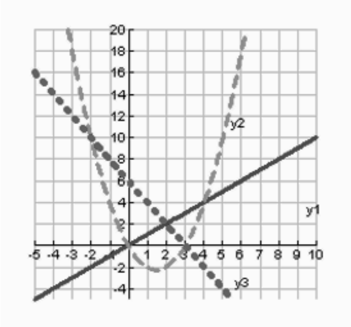


87.

$$y_1 = x$$
$$y_2 = x^2 - 3x$$
$$y_3 = 6 - 2x$$

Find when $y_1 < y_2 < y_3$.

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



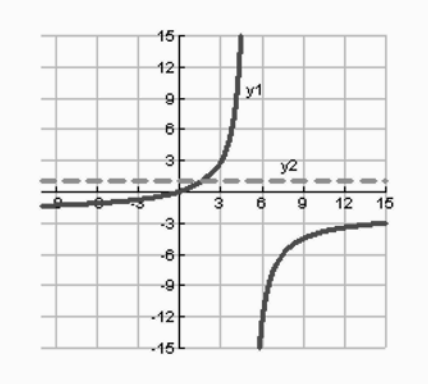
89.

$$y_1 = \frac{2p}{5-p}$$

$$y_2 = 1$$

Find when $y_1 > y_2$.

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



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.**	$\frac{2}{3}x-\frac{4}{7}=-\frac{5}{3}$ $\text{LCD}=21$ $14x-12=-35$ $14x=-23$ $\boxed{x=-23/14}$	$\frac{2}{3}x-\frac{4}{7}=\frac{5}{3}$ $\text{LCD}=21$ $14x-12=35$ $14x=47$ $\boxed{x=47/14}$

25. $\lvert x-5\rvert=8$ $x-5=8 \qquad x-5=-8$ $\boxed{x=13} \qquad \boxed{x=-3}$	**27.** $3\lvert x-2\rvert+1=19$ $3\lvert x-2\rvert=18$ $\lvert x-2\rvert=6$ $x-2=6 \textit{ or } x-2=-6$ $x=-4,8$
29. $5=7-\lvert 2-x\rvert$ $-2=-\lvert 2-x\rvert$ $2=\lvert 2-x\rvert$ $2-x=2 \textit{ or } 2-x=-2$ $x=0,4$	**31.** $2\lvert p+3\rvert=20 \qquad p+3=-10$ $\lvert p+3\rvert=10 \qquad \boxed{p=-13}$ $p+3=10$ $\boxed{p=7}$
33. $5\lvert y-2\rvert-10=4\lvert y-2\rvert-3$ $\lvert y-2\rvert=7$ $y-2=7 \qquad y-2=-7$ $\boxed{y=9} \qquad \boxed{y=-5}$	**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. $x-4<-2$ or $x-4>2$ $x<2 \qquad x>6$ $(-\infty,2)\cup(6,\infty)$	**47.** $-1\le 4-x\le 1$ $-5\le -x\le -3$ $3\le x\le 5$ $[3,5]$
49. $\mathbb{R}$	

51.

$$\begin{gathered} |2t+3|<5 \\ -5<2t+3<5 \\ -8<2t<2 \\ -4<t<1 \\ \boxed{(-4,1)} \end{gathered}$$

53.

$$\begin{gathered} |7-2y|\geq 3 \\ 7-2y\geq 3 \quad \text{or} \quad 7-2y\leq -3 \\ -2y\geq -4 \quad \text{or} \quad -2y\leq -10 \\ y\leq 2 \quad \text{or} \quad y\geq 5 \\ \boxed{(-\infty,2]\cup[5,\infty)} \end{gathered}$$

55. $\mathbb{R}$

57.

$$\begin{gathered} 2|4x|-9\geq 3 \\ 2|4x|\geq 12 \\ |4x|\geq 6 \\ 4x\geq 6 \quad \text{or} \quad 4x\leq -6 \\ x\geq 3/2 \quad \text{or} \quad x\leq -3/2 \\ \boxed{(-\infty,-3/2]\cup[3/2,\infty)} \end{gathered}$$

59.

$$\begin{gathered} 2|x+1|-3\leq 7 \\ 2|x+1|\leq 10 \\ |x+1|\leq 5 \\ -5\leq x+1\leq 5 \\ -6\leq x\leq 4 \\ \boxed{[-6,4]} \end{gathered}$$

61.

$$\begin{gathered} 3-2|x+4|<5 \\ -2|x+4|<2 \\ |x+4|>-1 \\ \boxed{(-\infty,\infty)} \end{gathered}$$

63.

$$\begin{gathered} 9-|2x|<3 \\ -|2x|<-6 \\ |2x|>6 \\ 2x>6 \quad \text{or} \quad 2x<-6 \\ x>3 \quad \text{or} \quad x<-3 \\ \boxed{(-\infty,-3)\cup(3,\infty)} \end{gathered}$$

65.

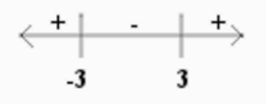
$$\begin{gathered} -\frac{1}{2}<1-2x<\frac{1}{2} \\ -\frac{3}{2}<-2x<-\frac{1}{2} \\ \frac{3}{4}>x>\frac{1}{4} \\ \boxed{(1/4,3/4)} \end{gathered}$$

67.

$$\begin{gathered} -1.8<2.6x+5.4<1.8 \\ -7.2<2.6x<-3.6 \\ -2.769<x<-1.385 \\ \boxed{(-2.769,-1.385)} \end{gathered}$$

69.

$$x^2-1\le 8$$
$$x^2-9\le 0$$
$$(x-3)(x+3)\le 0$$
$$\text{CP's: } x=-3,3$$



$$-3\le x\le 3$$
$$\boxed{[-3,3]}$$

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. $x-a=-b$

$\boxed{x=a-b}$

$x-a=b$

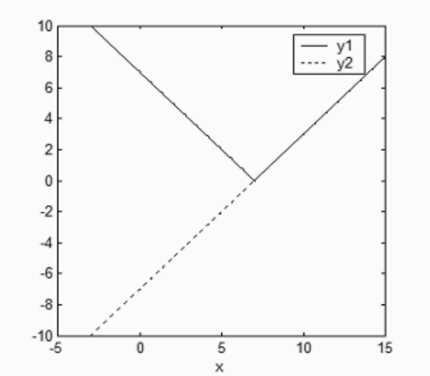
$\boxed{x=a+b}$

97. No solution

99.

$$y_1 = |x-7|$$
$$y_2 = x-7$$
$$\boxed{x \geq 7}$$

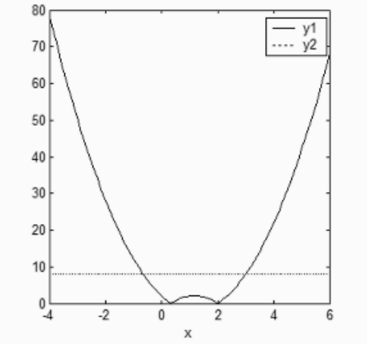
Agree



101.

$$y_1 = |3x^2 - 7x + 2|$$
$$y_2 = 8$$
$$\left(-\infty, -\tfrac{2}{3}\right) \cup (3, \infty)$$

Agree

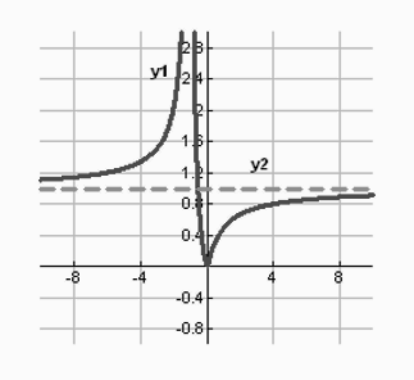


103.

$$y_1 = \left|\frac{x}{x+1}\right|$$
$$y_2 = 1$$

Find when $y_1 < y_2$.

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



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.

$$14-[-3y+12+9]=8y+12-6+4$$
$$14+3y-21=8y+10$$
$$-17=5y$$
$$\boxed{y=-17/5}$$

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.

$$7x-2+4x=3[5-2x]+12$$
$$11x-2=15-6x+12$$
$$17x=29$$
$$\boxed{x=29/17}$$

21.

$$3x-2[3y+12-7]=y-2x+6x-18$$
$$3x-6y-10=y-2x+6x-18$$
$$-x+8=7y$$
$$\boxed{x=8-7y}$$

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% $0.05x+0.10(150-x)=0.08(150)$ $0.05x+15-0.10x=12$ $-0.05x=-3$ $x=60$ $\boxed{\begin{array}{l} \text{60 ml of 5\%}\\ \text{90 ml of 10\%}\end{array}}$
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.

$$\begin{gathered}x^2 - x = 8\\ x^2 - x + \frac{1}{4} = 8 + \frac{1}{4}\\ \left(x - \frac{1}{2}\right)^2 = \frac{33}{4}\\ x - \frac{1}{2} = \pm\sqrt{\frac{33}{4}}\\ \boxed{x = \frac{1 \pm \sqrt{33}}{2}}\end{gathered}$$

47.

$$\begin{aligned}&3t^2 - 4t - 7 = 0\\ &a = 3, b = -4, c = -7\\ &t = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(3)(-7)}}{2(3)}\\ &t = \frac{4 \pm \sqrt{100}}{6} = \frac{4 \pm 10}{6}\\ &\boxed{t = -1, \frac{7}{3}}\end{aligned}$$

49.

$$\begin{aligned}&8f^2 - \frac{1}{3}f - \frac{7}{6} = 0\\ &\text{LCD} = 6\\ &48f^2 - 2f - 7 = 0\\ &a = 48, b = -2, c = -7\\ &f = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(48)(-7)}}{2(48)}\\ &f = \frac{2 \pm \sqrt{1348}}{96}\\ &f = \frac{2 \pm 2\sqrt{337}}{96}\\ &\boxed{f = \frac{1 \pm \sqrt{337}}{48}}\end{aligned}$$

51.

$$\begin{aligned}&a = 5, b = -3, c = -3\\ &q = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(5)(-3)}}{2(5)}\\ &\boxed{q = \frac{3 \pm \sqrt{69}}{10}}\end{aligned}$$

53.

$$\begin{gathered}(2x - 5)(x + 1) = 0\\ \boxed{x = -1, \frac{5}{2}}\end{gathered}$$

55.

$$\begin{aligned}&7x^2 + 19x - 6 = 0\\ &(7x - 2)(x + 3) = 0\\ &\boxed{x = -3, 2/7}\end{aligned}$$

57.

$$\begin{aligned}&r^2 = \frac{S}{\pi h}\\ &r = \pm\sqrt{\frac{S}{\pi h}}\\ &\boxed{r = \sqrt{\frac{S}{\pi h}}} \quad \left(\begin{array}{l}\text{negative radius is}\\ \text{non-physical}\end{array}\right)\end{aligned}$$

59.

$$\begin{aligned}&vt = h + 16t^2\\ &\boxed{v = \frac{h + 16t^2}{t} = \frac{h}{t} + 16t}\end{aligned}$$

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.

$$(x-4)^2=x^2+5x+6$$
$$x^2-8x+16=x^2+5x+6$$
$$13x=10$$
$$\cancel{x=\frac{10}{13}}\left(\begin{array}{l}\text{This answer would make}\\ \text{the first }\sqrt{\ }\text{ equal to a}\\ \text{negative number}\end{array}\right)$$
$$\boxed{\text{no solution}}$$

69.

$$x+3=4-4\sqrt{3x+2}+3x+2$$
$$-2x-3=-4\sqrt{3x+2}$$
$$2x+3=4\sqrt{3x+2}$$
$$(2x+3)^2=16(3x+2)$$
$$4x^2+12x+9=48x+32$$
$$4x^2-36x-23=0$$
$$x=\frac{36\pm\sqrt{36^2-4(4)(-23)}}{2(4)}$$
$$x=\frac{36\pm\sqrt{1664}}{8}\cong-0.6, 9.6$$
$$\boxed{x\cong-0.6}\ (9.6\text{ doesn't check})$$

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.

$$(3x-2)^2 - 11(3x-2) + 28 = 0$$
$$\text{Let } u = 3x - 2$$
$$u^2 - 11u + 28 = 0$$
$$(u-4)(u-7) = 0$$
$$u = 4, 7$$
$$3x - 2 = 4 \qquad 3x - 2 = 7$$
$$3x = 6 \Rightarrow \boxed{x = 2} \qquad 3x = 9 \Rightarrow \boxed{x = 3}$$

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.

$$y^{-2} - 5y^{-1} + 4 = 0$$
$$\text{Let } u = y^{-1}$$
$$u^2 - 5u + 4 = 0$$
$$(u-4)(u-1) = 0$$
$$u = 4, 1$$

So, we have:

$$y^{-1} = 4 \Rightarrow \boxed{y = 1/4}$$
$$y^{-1} = 1 \Rightarrow \boxed{y = 1}$$

81.

$$2x^{2/3} + 3x^{1/3} - 5 = 0$$
$$\text{Let } u = x^{1/3}$$
$$2u^2 + 3u - 5 = 0$$
$$(2u+5)(u-1) = 0$$
$$u = -\frac{5}{2}, 1$$
$$x^{1/3} = -\frac{5}{2} \qquad x^{1/3} = 1$$
$$x = \left(-\frac{5}{2}\right)^3 \qquad \boxed{x = 1}$$
$$\boxed{x = -\frac{125}{8}}$$

83.

$$x^{-2/3} + 3x^{-1/3} + 2 = 0$$
$$\text{Let } u = x^{-1/3}.$$
$$u^2 + 3u + 2 = 0$$
$$(u+2)(u+1) = 0$$
$$u = -2, -1$$

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.

$$\begin{aligned} &\text{Let } u = x^2 \\ &u^2 + 5u - 36 = 0 \\ &(u+9)(u-4) = 0 \\ &u = -9, 4 \end{aligned}$$

$$-9 = x^2 \qquad\qquad 4 = x^2$$

$$\boxed{x = \pm 3i} \qquad\qquad \boxed{x = \pm 2}$$

87.

$$\begin{aligned} &x^3 + 4x^2 - 32x = 0 \\ &x\left(x^2 + 4x - 32\right) = 0 \\ &x(x+8)(x-4) = 0 \\ &\boxed{x = 0, -8, 4} \end{aligned}$$

89.

$$\begin{aligned} &p^3 - 3p^2 - 4p + 12 = 0 \\ &\left(p^3 - 3p^2\right) - 4(p-3) = 0 \\ &p^2(p-3) - 4(p-3) = 0 \\ &\left(p^2 - 4\right)(p-3) = 0 \\ &(p-2)(p+2)(p-3) = 0 \\ &\boxed{p = \pm 2, 3} \end{aligned}$$

91.

$$\begin{aligned} &p(2p-5)^2 - 3(2p-5) = 0 \\ &(2p-5)[p(2p-5) - 3] = 0 \\ &(2p-5)\left(2p^2 - 5p - 3\right) = 0 \\ &(2p-5)(2p+1)(p-3) = 0 \\ &\boxed{p = -\tfrac{1}{2}\,,\ \tfrac{5}{2},\ 3} \end{aligned}$$

93.

$$\begin{aligned} &y - 81y^{-1} = 0 \\ &y - \frac{81}{y} = 0 \\ &\frac{y^2 - 81}{y} = 0 \\ &\frac{(y-9)(y+9)}{y} = 0 \\ &\boxed{y = \pm 9} \end{aligned}$$

95. $(-\infty, -4]$

97. $[2, 6]$

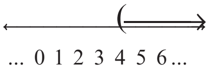
99. $x > -6$

101. $-3 \le x \le 7$

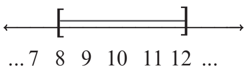
103.

$$\begin{aligned} &x \ge -4 \\ &[-4, \infty) \end{aligned}$$

105. $(4, \infty)$

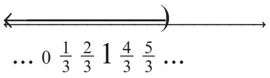


107. $[8, 12]$



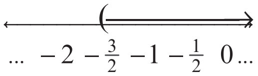
109.

$$\begin{aligned} &3x < 5 \\ &x < 5/3 \\ &\boxed{(-\infty, 5/3)} \end{aligned}$$



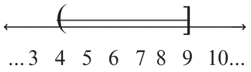
111.

$$4x-4>2x-7$$
$$2x>-3$$
$$x>-3/2$$
$$\boxed{(-3/2,\infty)}$$



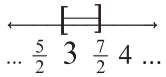
113.

$$6<2+x\le 11$$
$$4<x\le 9$$
$$\boxed{(4,9]}$$



115.

$$\text{LCD}=12$$
$$8\le 2(1+x)\le 9$$
$$8\le 2+2x\le 9$$
$$6\le 2x\le 7$$
$$3\le x\le 7/2$$
$$\boxed{[3,7/2]}$$



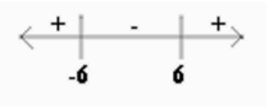
117.

$$\frac{72+65+69+70+x}{5}\ge 70$$
$$x+276\ge 350$$
$$\boxed{x\ge 74}$$

So, the lowest score is 74.

119.

$$x^2-36\le 0$$
$$(x-6)(x+6)\le 0$$
$$\text{CP's: } x=-6,6$$



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

121.

$$x^2-4x\ge 0$$
$$x(x-4)\ge 0$$
$$\text{CP's: } x=0, x=4$$

$$\boxed{(-\infty,0]\cup[4,\infty)}$$

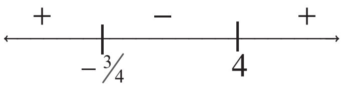
123.

$$x^2-7x>0$$
$$x(x-7)>0$$
$$\text{CP's: } x=0,7$$

$$\boxed{(-\infty,0)\cup(7,\infty)}$$

125.

$$4x^2-12>13x$$
$$4x^2-13x-12>0$$
$$(4x+3)(x-4)>0$$
$$\text{CPs: } x=-3/4,\ 4$$

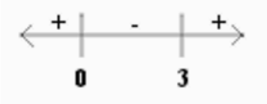


$$\boxed{(-\infty,-3/4)\cup(4,\infty)}$$

127.

$$\frac{x}{x-3}<0 \quad \boxed{x\neq 3}$$

CP's: $x=0,3$



$$\boxed{(0,3)}$$

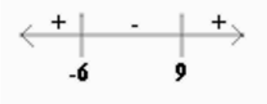
129.

$$\frac{x^2-3x}{3}-\frac{18(3)}{3}\geq 0$$

$$\frac{x^2-3x-54}{3}\geq 0$$

$$\frac{(x-9)(x+6)}{3}\geq 0$$

CP's: $x=-6,9$



$$\boxed{(-\infty,-6]\cup[9,\infty)}$$

131.

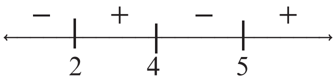
$$\frac{3}{x-2}-\frac{1}{x-4}\leq 0$$

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

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

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

CPs: $x=2,4,5$

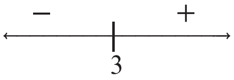


$$\boxed{(-\infty,2)\cup(4,5]}$$

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. $\mathbb{R}$

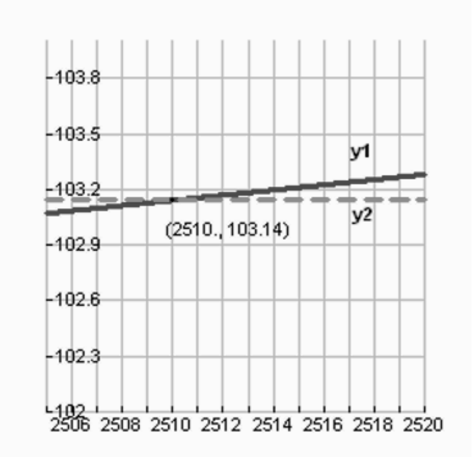
147. $|T-85| \le 10$ or $75 \le T \le 95$

149.

$y1 = 0.031x + 0.017(4000 - x)$

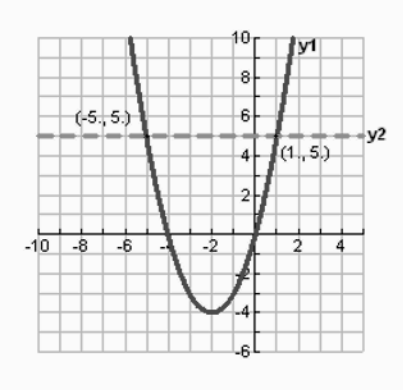
$y2 = 103.14$

$\boxed{x = 2,510}$



151. (a) Consider $x^2 + 4x - b = 0$. **(1)** For $b = 5$, **(1)** factors as $(x-1)(x+5) = 0$, so that $x = -5, 1$.

Graphically, we let $y1 = x^2 + 4x,\ y2 = 5$ 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.

$\underline{b = -5}$:

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

$$x = \frac{-4 \pm \sqrt{16 - 4(5)}}{2} = \frac{-4 \pm 2i}{2} = -2 \pm i$$

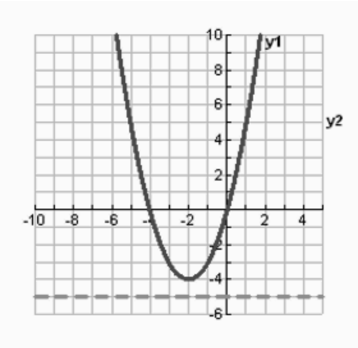
$\underline{b = 0}$:

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

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

$$x = 0, -4$$

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

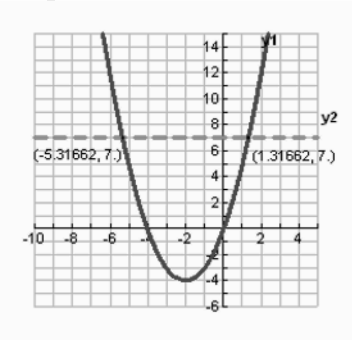


$\underline{b=7}$:

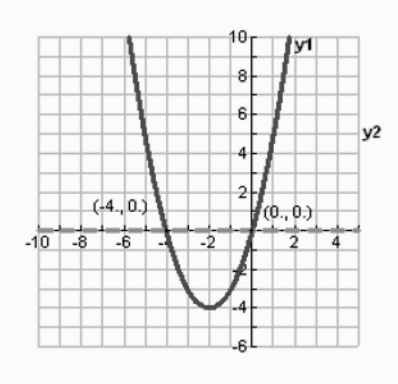
$x^2+4x-7=0$

$x=\frac{-4\pm\sqrt{16+4(7)}}{2}=\frac{-4\pm2\sqrt{11}}{2}=-2\pm\sqrt{11}$

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



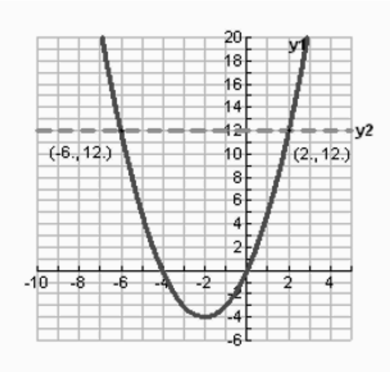
So, we expect the graphs to intersect twice as in part **(a)**. Indeed, we have:



$\underline{b=12}$:

$$x^2+4x-12=0$$
$$(x+6)(x-2)=0$$
$$x=-6,2$$

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

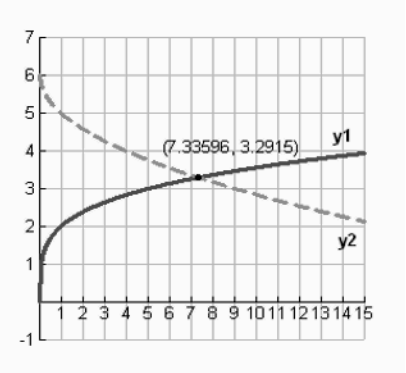
$$u^2+2u-6=0$$
$$u=\frac{-2\pm\sqrt{4+4(6)}}{2}=-1\pm\sqrt{7}$$

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

$x^{1/4}=-1+\sqrt{7}$ $\boxed{x=\left(-1+\sqrt{7}\right)^4\approx7.34}$

Graphically, let

$y1=2x^{1/4}$, $y2=-x^{1/2}+6$

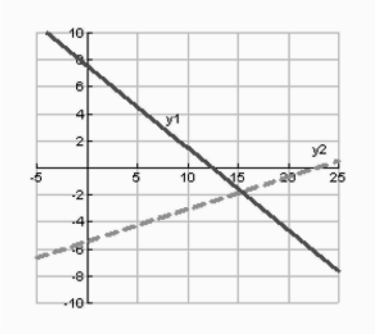


155. a)

$$-0.61x + 7.62 > 0.24x - 5.47$$
$$13.09 > 0.85x$$
$$15.4 > x$$
$$\boxed{(-\infty, 15.4)}$$

b) Graphically, let

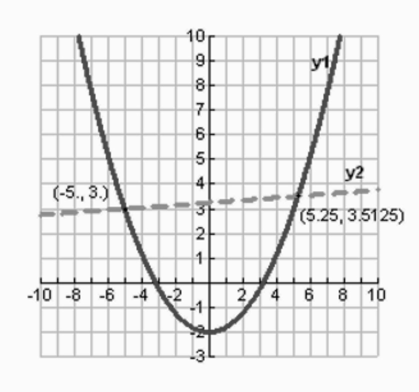
$y1 = -0.61x + 7.62,\ y2 = 0.24x - 5.47$



c) Agree

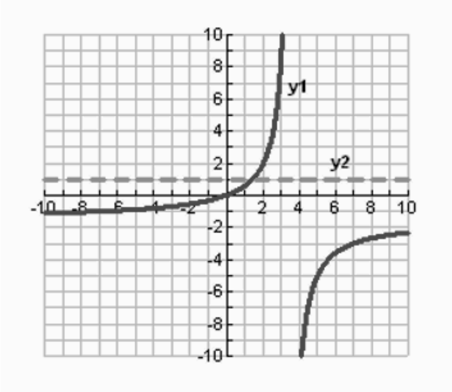
157.

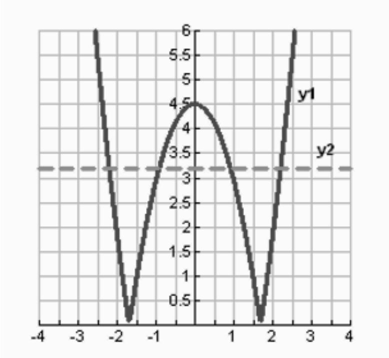
$y1 = 0.2x^2 - 2$
$y2 = 0.05x + 3.25$
Find when $y1 > y2$
$\boxed{(-\infty, -5) \cup (5.25, \infty)}$



159.

$$y1 = \frac{3p}{7 - 2p}$$
$y2 = 1$
Find when $y1 > y2$
$\boxed{\left(\frac{7}{5}, \frac{7}{2}\right)}$



161. $y1 = \lvert 1.6x^2 - 4.5 \rvert$ $y2 = 3.2$ 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.** $\frac{5}{y-3}+1-\frac{30}{y^2-9}=0$ $\frac{5(y+3)+(y^2-9)-30}{(y-3)(y+3)}=0$ $\frac{y^2+5y-24}{(y-3)(y+3)}=0$ $\frac{(y+8)\cancel{(y-3)}}{\cancel{(y-3)}(y+3)}=0$ $\boxed{y=-8}$
9. $\sqrt{2x+1}+x=7$ $\sqrt{2x+1}=7-x$ $2x+1=(7-x)^2$ $2x+1=49-14x+x^2$ $x^2-16x+48=0$ $(x-12)(x-4)=0$ $\boxed{x=4},\cancel{12}$	**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.

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

17.

$$3x+19\geq 5x-15$$
$$34\geq 2x$$
$$17\geq x$$
$$\boxed{(-\infty,17]}$$

19.

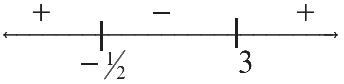
$$\frac{2}{5}<\frac{x+8}{4}\leq\frac{1}{2}$$
$$8<5(x+8)\leq 10$$
$$-32<5x\leq -30$$
$$-\frac{32}{5}<x\leq -6$$
$$\boxed{\left(-\frac{32}{5},-6\right]}$$

21.

$$3p^2-p-4\geq 0$$
$$(3p-4)(p+1)\geq 0$$
$$\text{CP's: } p=\tfrac{4}{3},-1$$
$$\boxed{(-\infty,-1]\cup\left[\tfrac{4}{3},\infty\right)}$$

23.

$$\frac{x-3}{2x+1}\leq 0$$
$$\text{CPs: } x=-\tfrac{1}{2},3$$



$$\boxed{\left(-\tfrac{1}{2},3\right]}$$

25. Let $x=$ height of piling

Sand: $\frac{1}{4}x$

Water: 150

Air: $\frac{3}{5}x$

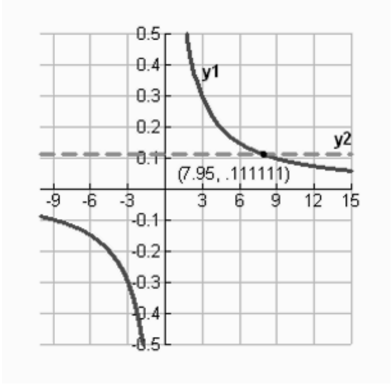
$$\frac{1}{4}x+150+\frac{3}{5}x=x$$
$$\text{LCD}=20$$
$$5x+3000+12x=20x$$
$$3x=3000$$
$$\boxed{x=1000\text{ ft}}$$

27. Let $x=$ number of minutes in excess of 600

$$\text{Charges}=49+0.17x$$
$$53.59\leq 49+0.17x\leq 69.74$$
$$4.59\leq 0.17x\leq 20.74$$
$$27\leq x\leq 122$$
$$+600\text{ base}$$
$$\boxed{627\leq x\leq 722}$$

29.

$$y1 = \frac{1}{0.75x} - \frac{0.45}{x}$$
$$y2 = \frac{1}{9}$$
$$\boxed{x = 7.95}$$



Chapter 1 Cumulative Review---

1.

$$\begin{aligned} 5\cdot(7-3\cdot 4+2) &= 5\cdot(7-12+2) \\ &= 5\cdot(-5+2) \\ &= 5\cdot(-3) = \boxed{-15} \end{aligned}$$

3.

$$\frac{\left(x^2y^{-2}\right)^3}{\left(x^2y\right)^{-3}} = \frac{x^6y^{-6}}{x^{-6}y^{-3}} = \boxed{\frac{x^{12}}{y^3}}$$

5.

$$\begin{aligned} x^2(x+5)(x-3) &= x^2(x^2+2x-15) \\ &= \boxed{x^4+2x^3-15x^2} \end{aligned}$$

7.

$$\begin{aligned} 2a^3+2000 &= 2\left(a^3+\underbrace{1000}_{=10^3}\right) \\ &= \boxed{2(a+10)\left(a^2-10a+100\right)} \end{aligned}$$

9.

$$\begin{aligned} \frac{6x}{x-2} - \frac{5x}{x+2} &= \frac{6x(x+2)-5x(x-2)}{x^2-4} \\ &= \frac{6x^2+12x-5x^2+10x}{x^2-4} \\ &= \boxed{\frac{x^2+22x}{x^2-4}} \end{aligned}$$

where $x \neq -2, 2$

11.

$$\begin{aligned} \tfrac{2}{7}x &= \tfrac{1}{8}x+9 \\ 16x &= 7x+504 \\ 9x &= 504 \\ \boxed{x} & \boxed{= 56} \end{aligned}$$

13.

$$\frac{6x}{5}-\frac{8x}{3}=4-\frac{7x}{15}$$
$$18x-40x=60-7x$$
$$-22x=60-7x$$
$$-15x=60$$
$$\boxed{x=-4}$$

15.

<u>Tim rate</u>: 1/9 job in one hour

<u>Chelsea and Tim combined rate</u>:

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 $\boxed{\text{11.25 hours}}$ 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.

$$\sqrt{4-x}=x-4$$
$$4-x=(x-4)^2$$
$$4-x=x^2-8x+16$$
$$x^2-7x+12=0$$
$$(x-4)(x-3)=0$$
$$x=\cancel{3},\boxed{4}$$

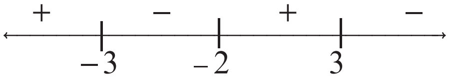
21.

$$0<4-x\le 7$$
$$-4<-x\le 3$$
$$4>x\ge -3$$
$$\boxed{[-3,4)}$$

23.

$$\frac{x+2}{9-x^2}\ge 0$$
$$\frac{x+2}{(3-x)(3+x)}\ge 0$$

CPs: $x=-2,\pm 3$



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

25.

$$\left|\frac{1}{5}x+\frac{2}{3}\right|=\frac{7}{15}$$

$$\frac{|3x+10|}{15}=\frac{7}{15}$$

$$|3x+10|=7$$

$$3x+10=7 \quad \text{or} \quad 3x+10=-7$$

$$3x=-3 \qquad\qquad 3x=-17$$

$$\boxed{x=-1} \qquad\qquad \boxed{x=-\tfrac{17}{3}}$$

27.

$$y1=\left|\frac{3x}{x-2}\right|$$

$$y2=1$$

Find when $y1 < y2$

$$\boxed{(-1,\tfrac{1}{2})}$$