Section 1.2

3.) $$x^2 + y^2 = 4$$

(a.) $(1, -\sqrt{3})$: $1 + 3 = 4$ YES

(b.) $(\frac{1}{2}, -1)$: $\frac{1}{4} + 1 = 4$ NO

(c) $(\frac{3}{2}, \frac{7}{2})$: $\frac{9}{4} + \frac{49}{4} = \frac{58}{4} = 4$ NO

5.) $$x^2 - xy + 4y = 3$$

(a.) $(0, 2)$: $0 - 0 + 8 = 3$ NO

(b.) $(-2, -\frac{1}{6})$: $4 - \frac{1}{3} - \frac{4}{6} = 3$ YES

(c.) $(3, -6)$: $9 + 18 - 24 = 3$ YES

7.) (e) 8.) (b)

9.) (c) 10.) (f)

11.) (a) 12.) (d)

13.) $2x - y - 3 = 0$ $\begin{cases} x\text{-int.}: & y = 0 \to 2x - 3 = 0 \to x = 3/2 ; \\ y\text{-int.}: & x = 0 \to -y - 3 = 0 \to y = -3 \end{cases}$

15.) $y = x^2 + x - 2$ $\begin{cases} x\text{-int.}: & y = 0 \to 0 = (x-1)(x+2) \to x = 1,\ x = -2 ; \\ y\text{-int.}: & x = 0 \to y = -2 \end{cases}$

18.) $y^2 = x^3 - 4x$ $\begin{cases} x\text{-int.}: & y = 0 \to 0 = x^3 - 4x = x(x-2)(x+2) \to \\ & x = 0,\ x = 2,\ x = -2 ; \\ y\text{-int.}: & x = 0 \to y^2 = 0 \to y = 0 \end{cases}$

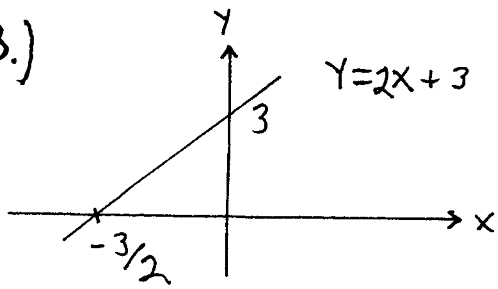
20.) $y = \dfrac{x^2 + 3x}{(3x+1)^2} \longrightarrow$

x-int.: $Y=0 \rightarrow 0 = \dfrac{x^2+3x}{(3x+1)^2} \rightarrow x^2 + 3x = 0 \rightarrow$

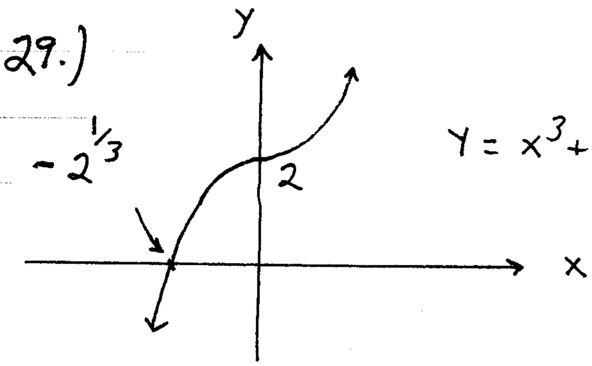
$x(x+3) = 0 \longrightarrow$ $x=0,\ x=-3$;

Y-int.: $x=0 \rightarrow Y = \dfrac{0}{1^2} = 0 \longrightarrow$ $Y=0$

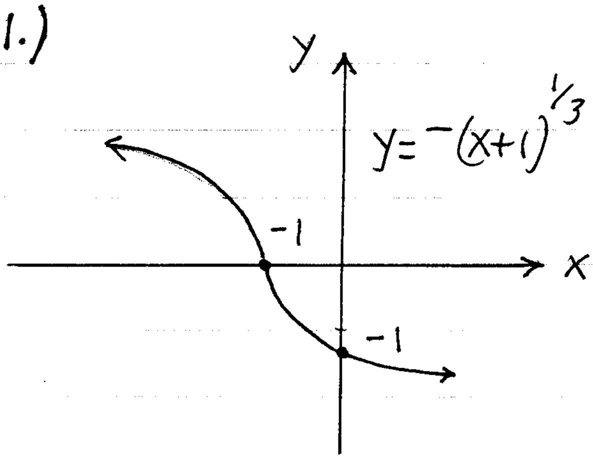
23.) $Y=2x+3$



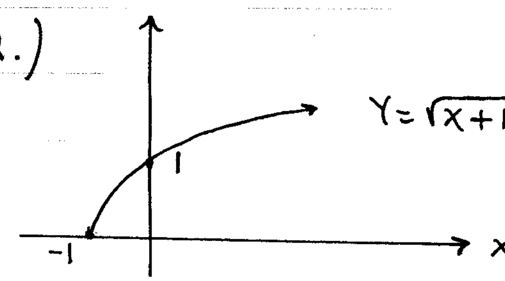
29.) $Y = x^3 + 2$



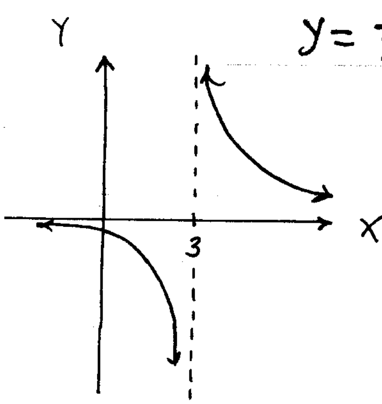
31.) $y = -(x+1)^{1/3}$



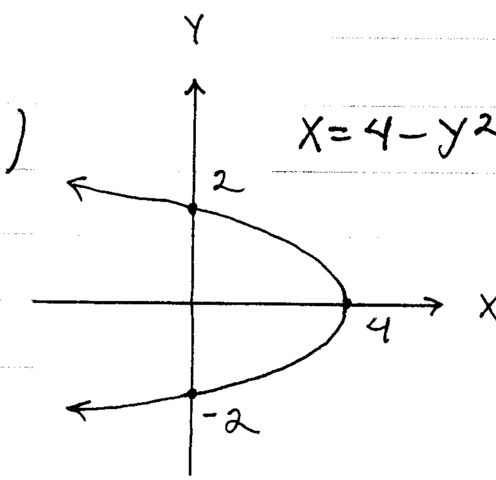
32.) $Y = \sqrt{x+1}$



35.) $y = \dfrac{1}{x-3}$



38.) $X = 4 - y^2$



41.) $(x-2)^2 + (y-(-1))^2 = 4^2 \rightarrow$

$(x-2)^2 + (y+1)^2 = 16.$

44.) $(x-3)^2 + (y-(-2))^2 = r^2$ and $x=-1, y=1 \rightarrow$

$16 + 9 = r^2 \rightarrow r = 5$ and $(x-3)^2 + (y+2)^2 = 25$

46.) $(-4,-1)$ and $(4,1)$: midpt. $\left(\frac{-4+4}{2}, \frac{-1+1}{2}\right) = (0,0)$

is center ; diameter $\sqrt{(4-(-4))^2 + (1-(-1))^2} = \sqrt{68} = 2\sqrt{17}$

so radius $r = \sqrt{17}$, then circle is

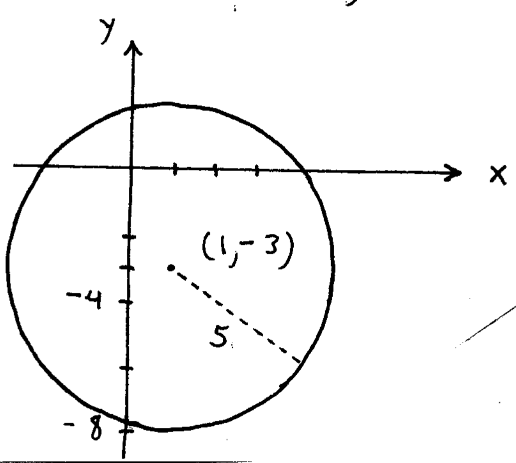
$(x-0)^2 + (y-0)^2 = (\sqrt{17})^2$ or $x^2 + y^2 = 17$.

48.) $x^2 + y^2 - 2x + 6y - 15 = 0 \rightarrow (x^2 - 2x \quad) + (y^2 + 6y \quad) = 15$

$\rightarrow (x^2 - 2x + 1) + (y^2 + 6y + 9) = 15 + 1 + 9 \rightarrow$

$(x-1)^2 + (y+3)^2 = 5^2 \rightarrow$ center : $(1,-3)$

radius : 5



53.) $16x^2+16y^2+16x+40y-7=0 \rightarrow$

$(16x^2+16x \quad) + (16y^2+40y \quad) = 7 \rightarrow$

$16(x^2+x \quad) + 16(y^2+\frac{5}{2}y \quad) = 7 \rightarrow$

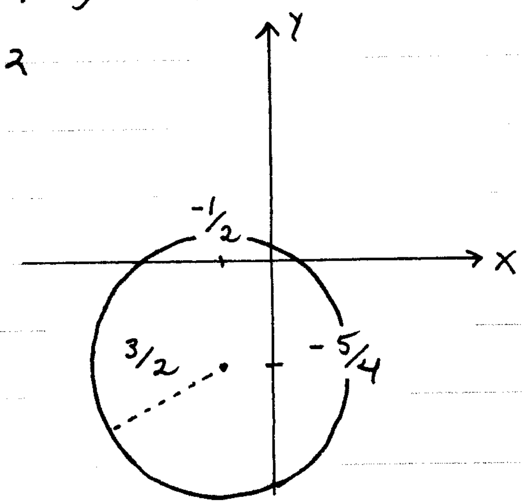
$(x^2+x \quad) + (y^2+\frac{5}{2}y \quad) = 7/16 \rightarrow$

$(x^2+x+1/4) + (y^2+\frac{5}{2}y+\frac{25}{16}) = \frac{7}{16}+\frac{1}{4}+25/16 \rightarrow$

$(x+\frac{1}{2})^2+(y+\frac{5}{4})^2 = \frac{36}{16} = \frac{9}{4} = (\frac{3}{2})^2$

$\rightarrow$ center : $(-1/2, -5/4)$

radius : $3/2$

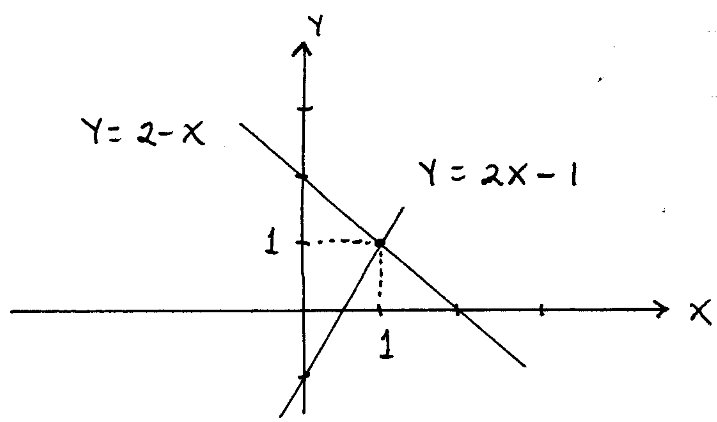


55.)

$$\left.\begin{array}{l} y = 2-x \\ y = 2x-1 \end{array}\right\} \rightarrow$$

$2-x = 2x-1 \rightarrow 3 = 3x \rightarrow$

$x=1$ and $y=1$



59.) $\left.\begin{array}{l} y = x^3 \\ y = 2x \end{array}\right\} \rightarrow x^3 = 2x$

$\rightarrow x^3 - 2x = 0$

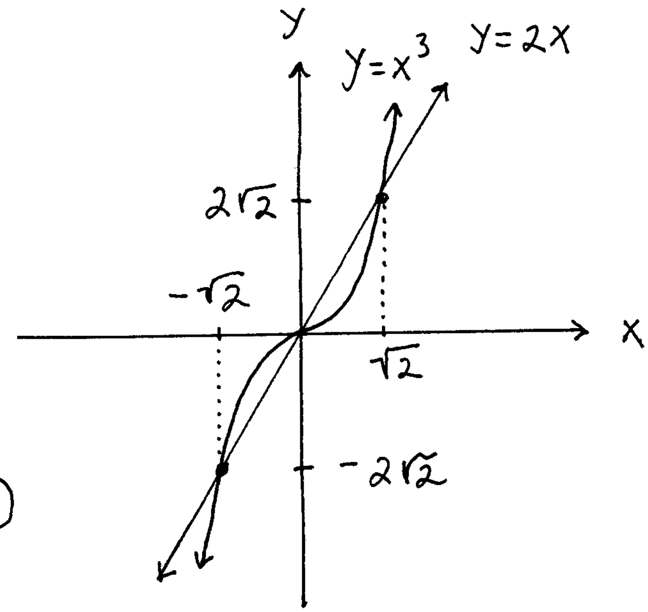
$\rightarrow x(x^2 - 2) = 0$

$\rightarrow x(x - \sqrt{2})(x + \sqrt{2}) = 0$

$x = -\sqrt{2},\ y = -2\sqrt{2}$

$x = \sqrt{2},\ y = 2\sqrt{2}$

$x = 0,\ y = 0$



60.) $\left.\begin{array}{l} Y = \sqrt{x} \\ Y = X \end{array}\right\}$

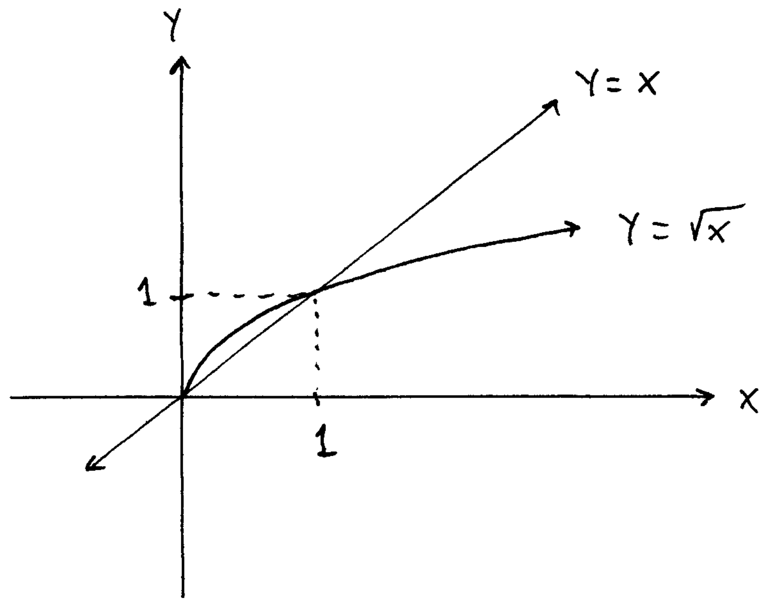
$\sqrt{x} = X \rightarrow$

$\sqrt{x} - X = 0 \rightarrow$

$\sqrt{x}(1 - \sqrt{x}) = 0 \rightarrow$

$X = 1,\ Y = 1$

$X = 0,\ Y = 0$



62.) $\left.\begin{array}{l} Y = x^3 - 2x^2 + x - 1 \\ Y = -x^2 + 3x - 1 \end{array}\right\} \quad x^3 - 2x^2 + x - 1 = -x^2 + 3x - 1 \rightarrow$

$x^3 - x^2 - 2x = 0 \rightarrow x(x^2 - x - 2) = 0 \rightarrow$

$x(x-2)(x+1) = 0 \rightarrow \quad x = 0,\ x = 2,\ x = -1$ then

points of intersection are

$X=0,\ Y=-1$

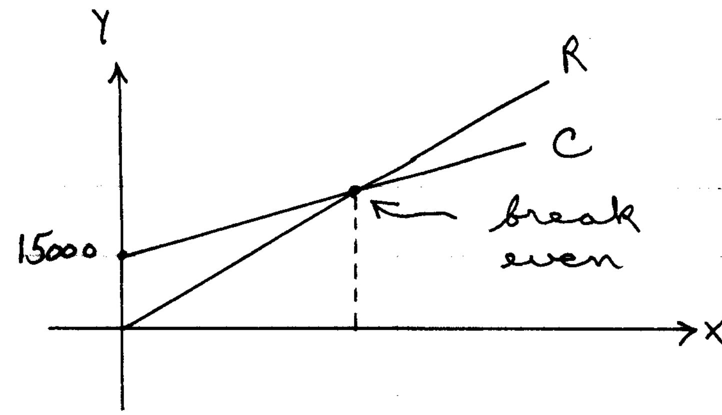
$X=2,\ Y=1$ and

$X=-1,\ Y=-5$

63.) x : number of products

(a) cost $C = 15{,}000 + 11.8X$

revenue $R = 19.3X$



(b) $\left.\begin{array}{l} C = 15{,}000 + 11.8X \\ R = 19.3X \end{array}\right\} \rightarrow$

$15{,}000 + 11.8X = 19.3X \rightarrow$

$15{,}000 = 7.5X \rightarrow$ $X = 2000$ products

(c) profit $P = R - C \rightarrow$

$P = 19.3x - (15{,}000 + 11.8X) = 7.5X - 15{,}000$; if $P = \$1000$

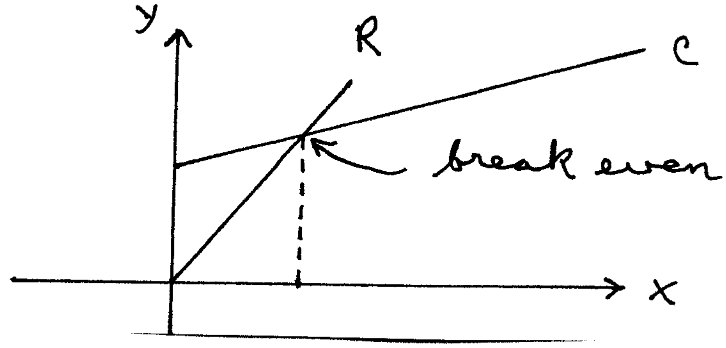
then $1000 = 7.5X - 15{,}000 \rightarrow 16000 = 7.5X \rightarrow$

$X \approx 2134$ products

66.) $\left.\begin{array}{l} C = 6X + 500{,}000 \\ R = 35X \end{array}\right\}$ break even $\rightarrow$ $C = R$

$\rightarrow$ $6X + 500{,}000 = 35X$ $\rightarrow$ $500{,}000 = 29X$ $\rightarrow$

$X = 17{,}242$ items



Section 1.3

2.) slope $= \frac{\text{rise}}{\text{run}} = \frac{8-0}{6-2} = \frac{8}{4} = 2$

5.) slope $= \frac{2-(-4)}{5-3} = \frac{6}{2} = 3$

6.) slope $= \frac{2-2}{1-(-2)} = \frac{0}{3} = 0$

8.) $\frac{-2-(-10)}{11/3 - 11/3} = \frac{8}{0}$ so slope is undefined

14.) $\frac{4-(-5)}{5/6-(-3/2)} = \frac{9}{14/6} = 9 \cdot \frac{3}{7} = \frac{27}{7}$

15.) $\frac{\frac{5}{2}-\left(\frac{-5}{6}\right)}{\frac{2}{3}-\frac{1}{4}} = \frac{\frac{20}{6}}{\frac{5}{12}} = \frac{10}{3} \cdot \frac{12}{5} = 8$

21.) $y = mx + b \rightarrow y = -3x + b$ and $x = 1, y = 7 \rightarrow$
$7 = -3 + b \rightarrow b = 10 \rightarrow \underline{y = -3x + 10}$;
points on this line are $(0,10), (2,4), (3,1)$

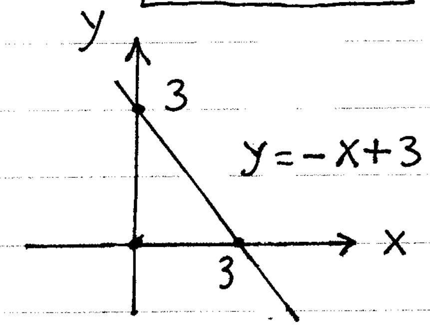
27.) $7x - 5y = 15 \rightarrow -5y = -7x + 15 \rightarrow$
$y = 7/5\,x - 3$ so slope is $7/5$ and
y-int. is -3

31.) $x = 4$ (vertical line) so slope is undefined and there is no y-int.

34.) $y + 1 = 0 \rightarrow y = -1$ (horizontal line) so slope is zero and y-int. is -1

38.) slope $= \dfrac{6-2}{-3-1} = \dfrac{4}{-4} = -1$ and $x=1, y=2 \rightarrow$

$y=-x+b \rightarrow 2=-1+b \rightarrow b=3 \rightarrow \boxed{y=-x+3}$



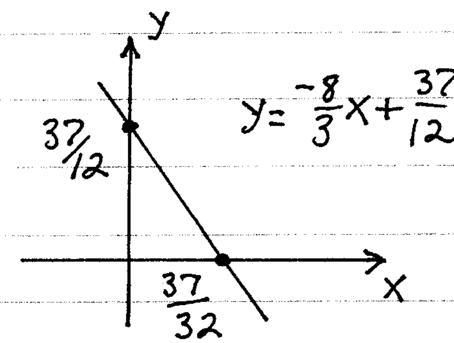
44.) slope $= \dfrac{\frac{3}{4}-\left(\frac{-1}{4}\right)}{\frac{7}{8}-\frac{5}{4}} = \dfrac{1}{-\frac{3}{8}} = \dfrac{-8}{3}$

then $y=mx+b \rightarrow y=\frac{-8}{3}x+b$

and $x=7/8, y=3/4 \rightarrow$

$3/4 = -\frac{8}{3}(7/8)+b \rightarrow \frac{3}{4}+\frac{7}{3}=b \rightarrow$

$b=\frac{37}{12} \rightarrow \boxed{y=\frac{-8}{3}x+\frac{37}{12}}$



47.) $y=mx+b$ and $m=3/4$,

y-int. $=3$ so $\boxed{y=3/4\,x+3}$

50.) slope is undefined so vertical line, and point is $(0,4)$ so line is $\boxed{x=0}$.

51.) $y=mx+b$ and $m=0 \rightarrow y=b$ and

pt. $x=-2, y=7 \rightarrow 7=b$ so line is $\boxed{y=7}$.

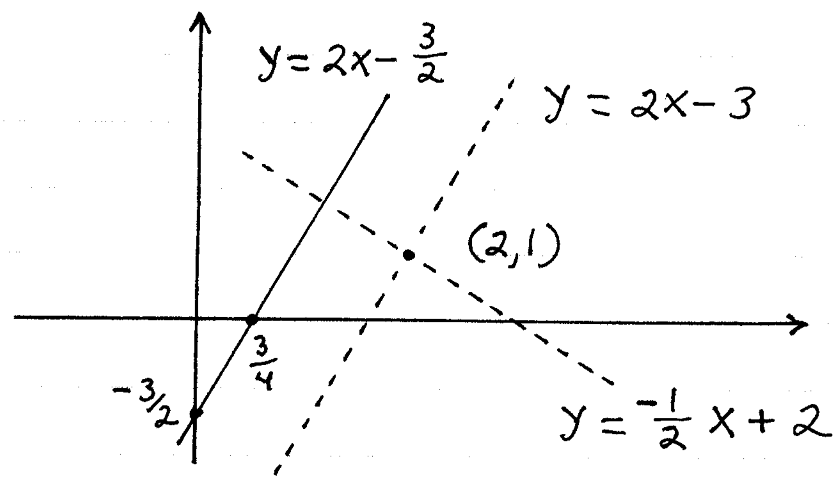
64.) $4x-2y=3 \rightarrow -2y=-4x+3 \rightarrow$

$\underline{y=2x-3/2}$ so slope is 2;

a.) parallel line : $y=mx+b \rightarrow$

$y = 2x + b$ and $x = 2, y = 1 \rightarrow 1 = 4 + b \rightarrow b = -3$
$\rightarrow \boxed{y = 2x - 3}$

b.) $\perp$ line : $y = mx + b$ and $m = -1/2 \rightarrow$
$y = \frac{-1}{2}x + b$ and $x = 2, y = 1 \rightarrow 1 = -1 + b \rightarrow$
$b = 2 \rightarrow \boxed{y = \frac{-1}{2}x + 2}$



67.) $y + 3 = 0 \rightarrow y = -3$

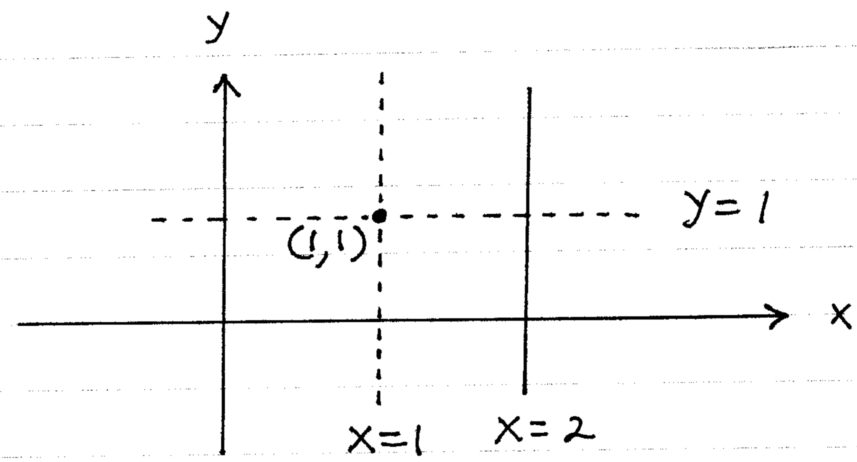
a.) parallel line : $y = b$ and $x = -1, y = 0 \rightarrow$
$b = 0 \rightarrow \boxed{y = 0}$

b.) $\perp$ line : $x = k$ and $x = -1, y = 0 \rightarrow$
$k = -1 \rightarrow \boxed{x = -1}$

69.) $x - 2 = 0 \rightarrow x = 2$

a.) parallel line : $x = k$ and $x = 1, y = 1 \rightarrow$
$\boxed{x = 1}$

b.) $\perp$ line : $y = b$ and $x = 1, y = 1 \rightarrow$
$\boxed{y = 1}$

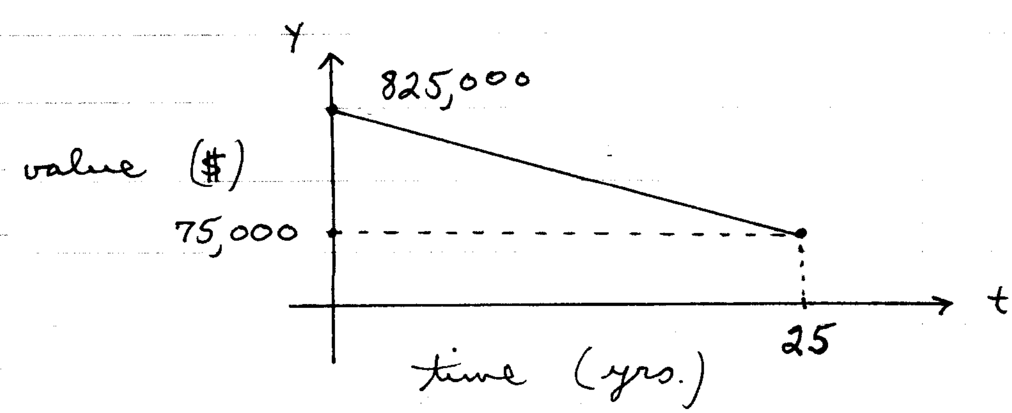


81.) $F = mC + b$ and point $C=0,\ F=32 \to$
$32 = m(0) + b \to b = 32 \to F = mC + 32$ and
point $C=100,\ F=212 \to 212 = m(100) + 32 \to$
$m = \frac{180}{100} = \frac{9}{5} \to \boxed{F = \frac{9}{5}C + 32}$

82.) a.) $F = \frac{9}{5}C + 32$ and $F = 102.5 \to$
$102.5 = \frac{9}{5}C + 32 \to C = \frac{5}{9}(102.5 - 32) \approx 39.2°C$
b.) $F = \frac{9}{5}C + 32$ and $F = 74 \to$
$74 = \frac{9}{5}C + 32 \to C = \frac{5}{9}(42) \approx 23.3°C$

83.) Cost $C = 150 + 0.34X$

86.)



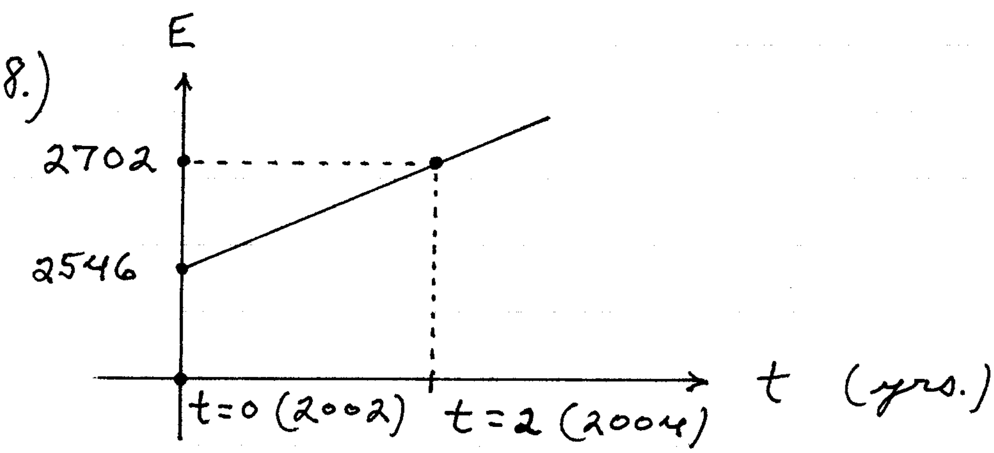
Use points $(0, \$825{,}000)$ and $(25, \$75{,}000)$:

slope $m = \dfrac{825{,}000 - 75{,}000}{0 - 25} = -30{,}000$,

y-intercept $b = 825{,}000$ so

$$\boxed{Y = -30{,}000\,t + 825{,}000}.$$

88.)



E-int. is 2546 ; slope is

$\dfrac{2702 - 2546}{2 - 0} = 78$ so $E = mt + b \rightarrow$

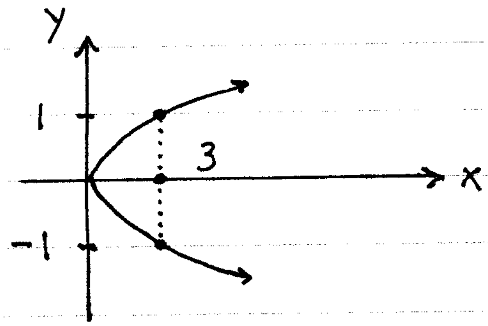
$$\boxed{E = 78t + 2546};$$

if $t = 6$ yrs. (2008) then enrollment

$$E = 78(6) + 2546 = \boxed{3014}.$$

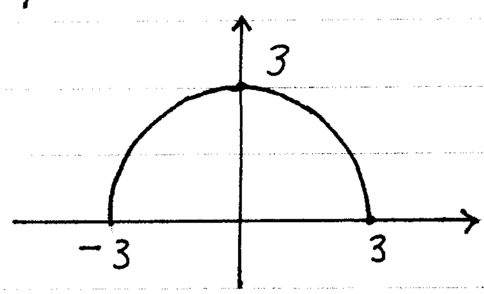
Section 1.4

2.) $x + y^2 = 4 \rightarrow x = 4 - y^2$, if $y = 1$ then $x = 3$ and if $y = -1$ then $x = 3$ so y is NOT a function of x



5.) $x^2 + y = 4 \rightarrow y = 4 - x^2$
so y IS a function of x

8.) $x^2 y - x^2 + 4y = 0 \rightarrow (x^2+4)y - x^2 = 0 \rightarrow$
$(x^2+4)y = x^2 \rightarrow y = \dfrac{x^2}{x^2+4}$ so y IS a function of x



12.) $y = \sqrt{9 - x^2} \rightarrow$
$y^2 = 9 - x^2 \rightarrow x^2 + y^2 = 3^2$
(semi-circle of radius 3, center $(0,0)$)
Domain : $-3 \leq x \leq 3$
Range : $0 \leq y \leq 3$

17.) Domain : $-\infty < x < \infty$ or $(-\infty, \infty)$
Range : $-\infty < y < \infty$ or $(-\infty, \infty)$

18.) Domain : $x \geq 3/2$ or $[3/2, \infty)$
Range : $y \geq 0$ or $[0, \infty)$

19.) Domain : $-\infty < x < \infty$ or $(-\infty, \infty)$

Range: $y \le 4$ or $(-\infty, 4]$

22.) $f(x) = x^2 - 2x + 2$

a.) $f(\frac{1}{2}) = (\frac{1}{2})^2 - 2(\frac{1}{2}) + 2 = \frac{1}{4} - 1 + 2 = \frac{5}{4}$

b.) $f(-1) = (-1)^2 - 2(-1) + 2 = 1 + 2 + 2 = 5$

c.) $f(c+2) = (c+2)^2 - 2(c+2) + 2$

$= c^2 + 4c + \cancel{4} - 2c - \cancel{4} + 2 = c^2 + 2c + 2$

d.) $f(x + \Delta x) = (x + \Delta x)^2 - 2(x + \Delta x) + 2$

$= x^2 + 2x \cdot \Delta x + (\Delta x)^2 - 2x - 2 \cdot \Delta x + 2$

23.) $g(x) = 1/x$

a.) $g(2) = 1/2$

b.) $g(1/4) = 1/\tfrac{1}{4} = 4$

c.) $g(x+4) = \frac{1}{x+4}$ (NOT $\frac{1}{x} + 4$!)

d.) $g(x + \Delta x) - g(x) = \frac{1}{x + \Delta x} - \frac{1}{x}$

$= \frac{x - (x + \Delta x)}{x(x + \Delta x)} = \frac{\cancel{x} - \cancel{x} - \Delta x}{x(x + \Delta x)} = \frac{-\Delta x}{x(x + \Delta x)}$

26.) $h(x) = x^2 - x + 1 \longrightarrow$

$\frac{h(2 + \Delta x) - h(2)}{\Delta x} = \frac{(2 + \Delta x)^2 - (2 + \Delta x) + 1 - 3}{\Delta x}$

$= \frac{\cancel{4} + 4 \cdot \Delta x + (\Delta x)^2 - \cancel{2} - \Delta x - \cancel{2}}{\Delta x} = \frac{3 \cdot \Delta x + (\Delta x)^2}{\Delta x}$

$= \frac{\cancel{\Delta x}(3 + \Delta x)}{\cancel{\Delta x}} = 3 + \Delta x$

27.) $g(x) = \sqrt{x+3} \rightarrow$

$$\frac{g(x+\Delta x) - g(x)}{\Delta x} = \frac{\sqrt{x+\Delta x+3} - \sqrt{x+3}}{\Delta x}$$

$$= \frac{\sqrt{x+\Delta x+3} - \sqrt{x+3}}{\Delta x} \cdot \frac{\sqrt{x+\Delta x+3} + \sqrt{x+3}}{\sqrt{x+\Delta x+3} + \sqrt{x+3}}$$

$$= \frac{(\cancel{x}+\Delta x+\cancel{3}) - (\cancel{x}+\cancel{3})}{\Delta x \cdot \left[\sqrt{x+\Delta x+3} + \sqrt{x+3}\right]} = \frac{\cancel{\Delta x}}{\cancel{\Delta x} \cdot \left[\sqrt{x+\Delta x+3} + \sqrt{x+3}\right]}$$

$$= \frac{1}{\sqrt{x+\Delta x+3} + \sqrt{x+3}}$$

30.) $f(x) = \frac{1}{x+4} \longrightarrow$

$$\frac{f(x+\Delta x) - f(x)}{\Delta x} = \frac{\frac{1}{x+\Delta x+4} - \frac{1}{x+4}}{\frac{\Delta x}{1}}$$

$$= \frac{\cancel{x}+\cancel{4} - (\cancel{x}+\Delta x+\cancel{4})}{(x+\Delta x+4)(x+4)} \cdot \frac{1}{\Delta x} = \frac{-\cancel{\Delta x}}{(x+\Delta x+4)(x+4) \cdot \cancel{\Delta x}}$$

$$= \frac{-1}{(x+\Delta x+4)(x+4)}$$

31.) If $x=0$ then $y = \pm 3$ so y is NOT a function of x

32.) $x - xy + y + 1 = 0 \rightarrow (-x+1)y = -x-1 \rightarrow$

$y = \frac{-x-1}{-x+1}$ so y IS a function of x

36.) $f(x) = 2x-5, \quad g(x) = 2-x$

a.) $f(x)+g(x) = (2x-5)+(2-x) = x-3$

b.) $f(x)\cdot g(x) = (2x-5)(2-x)$

$= 4x-2x^2-10+5x = -2x^2+9x-10$

c.) $\dfrac{f(x)}{g(x)} = \dfrac{2x-5}{2-x}$

d.) $f(g(x)) = f(2-x) = 2(2-x)-5$

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

e.) $g(f(x)) = g(2x-5) = 2-(2x-5)$

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

38.) $f(x) = x^2+5$, $g(x) = \sqrt{1-x}$

a.) $f(x)+g(x) = x^2+5+\sqrt{1-x}$

b.) $f(x)\cdot g(x) = (x^2+5)\sqrt{1-x}$

c.) $\dfrac{f(x)}{g(x)} = \dfrac{x^2+5}{\sqrt{1-x}}$

d.) $f(g(x)) = f(\sqrt{1-x}) = (\sqrt{1-x})^2+5$

$= 1-x+5 = 6-x$

e.) $g(f(x)) = g(x^2+5) = \sqrt{1-(x^2+5)}$

$= \sqrt{-4-x^2}$ which is not defined for any x-values

39.) $f(x) = 1/x$, $g(x) = 1/x^2$

a.) $f(x)+g(x) = \dfrac{1}{x}+\dfrac{1}{x^2} = \dfrac{x}{x^2}+\dfrac{1}{x^2} = \dfrac{x+1}{x^2}$

b.) $f(x)\cdot g(x) = \dfrac{1}{x}\cdot\dfrac{1}{x^2} = \dfrac{1}{x^3}$

c.) $\dfrac{f(x)}{g(x)} = \dfrac{1}{x}\Big/\dfrac{1}{x^2} = \dfrac{1}{x}\cdot\dfrac{x^2}{1} = x$

d.) $f(g(x)) = f\left(\frac{1}{x^2}\right) = \frac{1}{\left(\frac{1}{x^2}\right)} = x^2$

e.) $g(f(x)) = g\left(\frac{1}{x}\right) = \frac{1}{\left(\frac{1}{x}\right)^2} = \frac{1}{\frac{1}{x^2}} = x^2$

42.) $f(x) = 1/x$, $g(x) = x^2 - 1$

a.) $f(g(2)) = f(3) = 1/3$

b.) $g(f(2)) = g(1/2) = (1/2)^2 - 1 = \frac{1}{4} - 1 = -3/4$

c.) $f(g(1/\sqrt{2})) = f(-1/2) = \frac{1}{-1/2} = -2$

d.) $g(f(1/\sqrt{2})) = g(\sqrt{2}) = (\sqrt{2})^2 - 1 = 2 - 1 = 1$

e.) $f(g(x)) = f(x^2 - 1) = \frac{1}{x^2 - 1}$

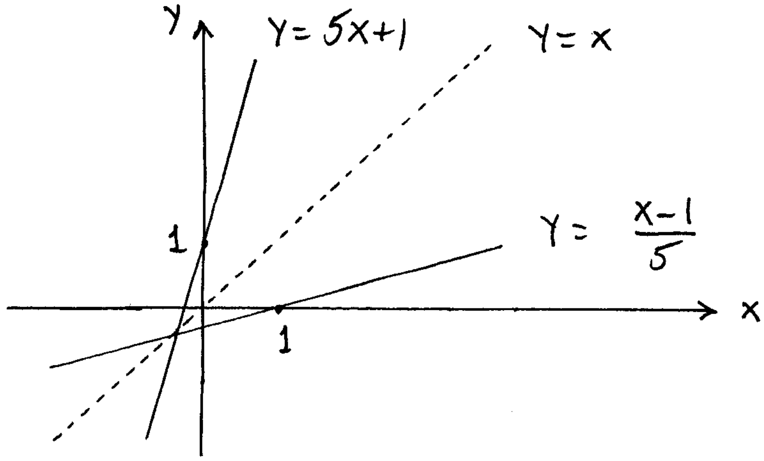
f.) $g(f(x)) = g\left(\frac{1}{x}\right) = \left(\frac{1}{x}\right)^2 - 1 = \frac{1}{x^2} - 1$

47.) $f(x) = 5x + 1$, $g(x) = \frac{x-1}{5}$

a.) $f(g(x)) = f\left(\frac{x-1}{5}\right) = 5\left(\frac{x-1}{5}\right) + 1 = x - 1 + 1 = x$

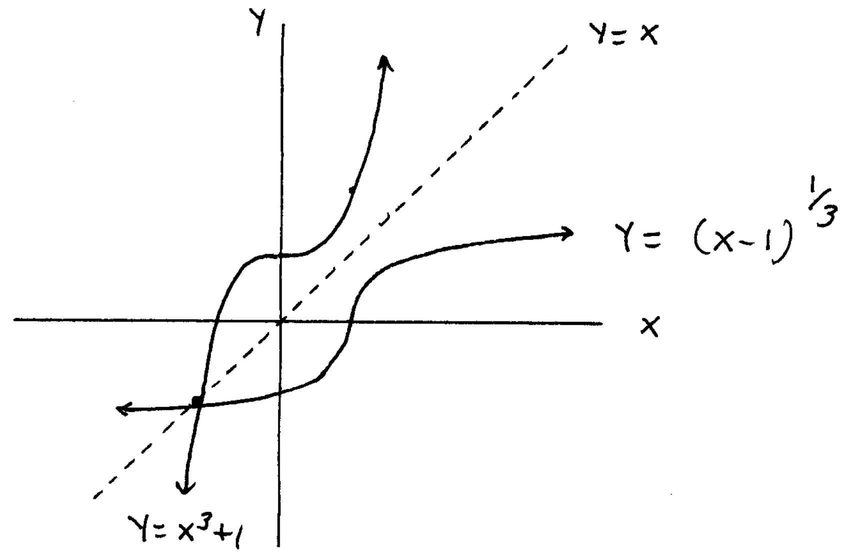
and $g(f(x)) = g(5x+1) = \frac{(5x+1) - 1}{5} = \frac{5x}{5} = x$

b.)

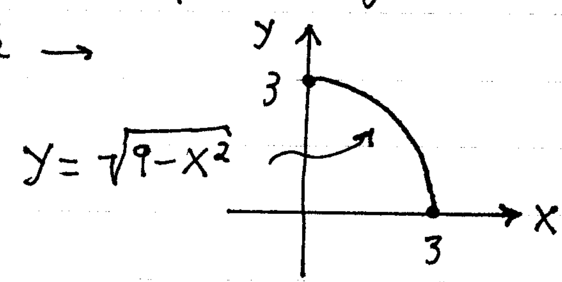


54.) $y = x^3 + 1 \rightarrow$ (switch variables) $\rightarrow$
$x = y^3 + 1 \rightarrow y^3 = x - 1 \rightarrow y = (x-1)^{1/3} \rightarrow$
$f^{-1}(x) = (x-1)^{1/3}$.

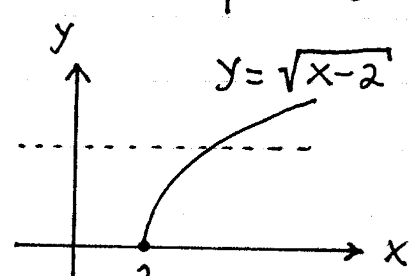
$x \rightarrow f^{-1}(x) = (x-1)^{1/3}$:



55.) $y = \sqrt{9-x^2}$ and $0 \le x \le 3 \rightarrow$ (switch variables) $\rightarrow x = \sqrt{9-y^2} \rightarrow x^2 = 9 - y^2 \rightarrow$
$y^2 = 9 - x^2 \rightarrow y = \pm\sqrt{9-x^2} \rightarrow$
$y = +\sqrt{9-x^2}$ so
$f^{-1}(x) = \sqrt{9-x^2}$

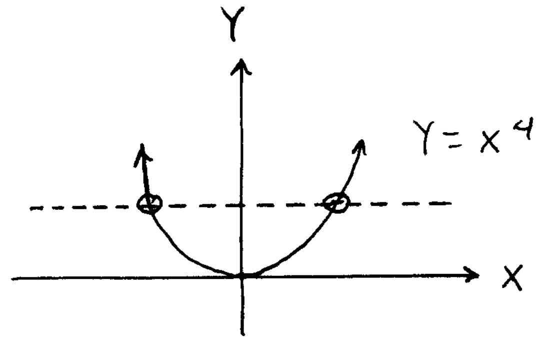


60.) y is 1-1 : $y = \sqrt{x-2} \rightarrow$
$x = \sqrt{y-2} \rightarrow x^2 = y - 2 \rightarrow$
$y = x^2 + 2 \rightarrow f^{-1}(x) = x^2 + 2$



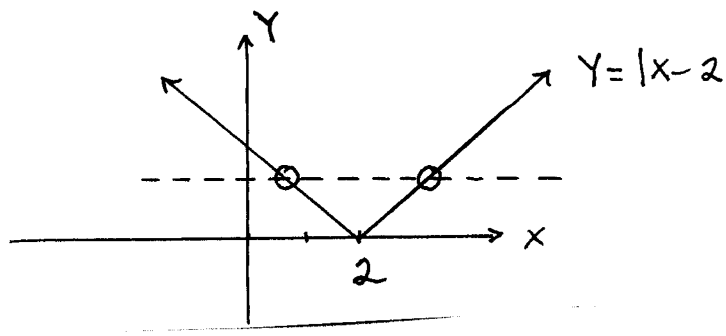
62.) $f(x) = x^4$

is not 1-1 so does <u>not</u> have an inverse.



63.) $f(x) = |x-2|$

is not 1-1 so does <u>not</u> have an inverse.



70.) x is number of games sold:

(a) cost $C = 6000 + .95x$

(b) average cost per game

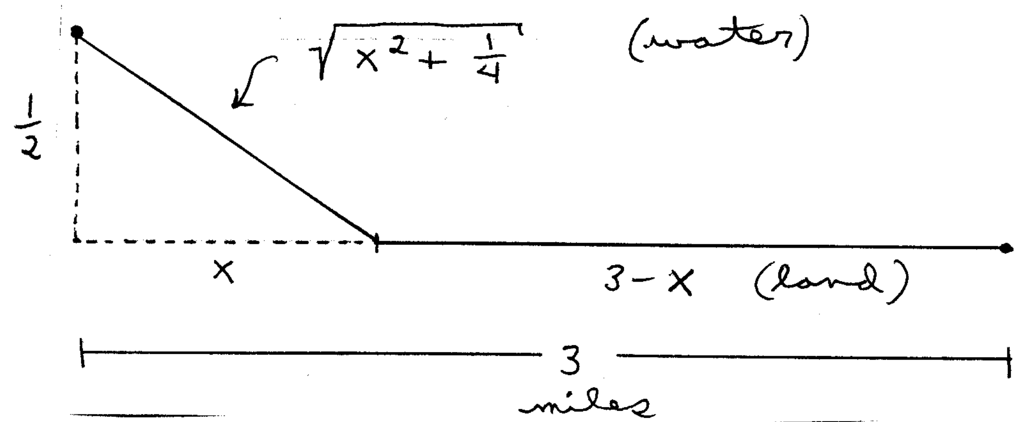
$$\overline{C} = \frac{C}{x} = \frac{6000}{x} + .95$$

(c) If average cost is below selling price, then $\frac{6000}{x} + .95 < 1.69 \rightarrow \frac{6000}{x} < .74 \rightarrow$

$\frac{6000}{.74} < x \rightarrow x > 8108.1$ so

$x = 8109$ games must be sold.

72.)



water cost : $\$15/ft. = \left(\$15/ft.\right)\left(5280\ ft./mi.\right)$

$= \$79,200\ /mi.$,

land cost : $\$10/ft. = \left(\$10/ft.\right)\left(5280\ ft./mi\right)$

$= \$52,800\ /mi.$; then

total cost $C = C_{water} + C_{land} \rightarrow$

$$C = (79,200)\sqrt{x^2+\frac{1}{4}} + (52,800)(3-x).$$

75.) X is number of units : If $0 \le X \le 100$ then price/unit is \$90 . If $X > 100$ then price/unit is $90 - .01(X-100) = 91 - .01X$ until $91 - .01X = 75 \rightarrow 16 = .01X \rightarrow X = 1600$ units.

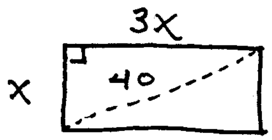
(a) price/unit $p = \begin{cases} 90 & \text{for } 0 \le X \le 100 \\ 91 - .01X & \text{for } 101 \le X \le 1599 \\ 75 & \text{for } X \ge 1600 \end{cases}$.

(b) total profit $P =$ Revenue $-$ Cost

$$P = \begin{cases} 90X - 60X & \text{for } 0 \le X \le 100 \\ (91 - .01X)X - 60X & \text{for } 101 \le X \le 1599 \\ 75X - 60X & \text{for } X \ge 1600 \end{cases}$$

$$= \begin{cases} 30X & \text{for } 0 \le X \le 100 \\ 31X - .01X^2 & \text{for } 101 \le X \le 1599 \\ 15X & \text{for } X \ge 1600 \end{cases} .$$

Worksheet 1

1.) 

Let x : width , 3x : length then

$x^2 + (3x)^2 = 40^2 \rightarrow x^2 + 9x^2 = 1600 \rightarrow$

$10x^2 = 1600 \rightarrow x^2 = 160 \rightarrow x = \sqrt{160} = 4\sqrt{10}$ cm.

and $3x = 12\sqrt{10}$ cm.

2.) a.) $x - 3 = 7$ or $(x-10)^2 = 0$ etc.

b.) $(x-2)(x-10) = 0$ has solutions $x = 2$, $x = 10$

3.) If $x - 4$ is a factor of $x^2 + Ax + 8$, then $x = 4$ is a solution of $x^2 + Ax + 8 = 0 \rightarrow$

$4^2 + 4A + 8 = 0 \rightarrow 4A + 24 = 0 \rightarrow A = -6$.

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

$2x^2 - 5x + 6 - \cancel{\frac{15}{x}} = x^2 + 5x - 3 - \cancel{\frac{15}{x}} \rightarrow x^2 - 10x + 9 = 0 \rightarrow$

$(x-1)(x-9) = 0 \rightarrow x = 1, x = 9$

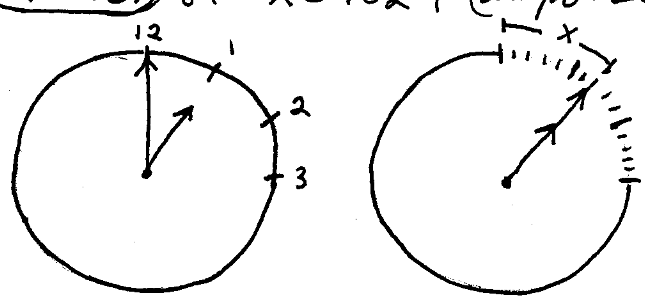
5.) Let x : integer then $x + \sqrt{x} = 992 \rightarrow$

$\sqrt{x} = 992 - x \rightarrow (\sqrt{x})^2 = (992 - x)^2 \rightarrow \cdots \rightarrow$

$x^2 - 1985x + 984{,}064 \rightarrow$ (quadratic formula)

$$x = \frac{1985 \pm \sqrt{(1985)^2 - 4(1)(984{,}064)}}{2} = \frac{1985 \pm 63}{2} \rightarrow$$

$x = 961$ or $x = 1024$ (impossible, why?)

6.) 

count the minute marks $x \rightarrow$

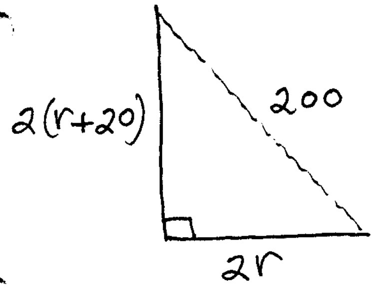
Big hand		Little hand
x	$=$	$5 + \left(\frac{x}{60}\right)5$

$\rightarrow x = 5 + \frac{1}{12}x \rightarrow \frac{11}{12}x = 5 \rightarrow x = \frac{60}{11} \approx 5.454$ min $\rightarrow$

hands meet at 1 hr., 5 min., 27 sec.

7.) Distance = Rate × Time ($D = RT$)

Let r: Juan's rate, $r+20$: Denise's rate, after 2 hrs.: by Pythagorean Theorem



$(2r+40)^2 + (2r)^2 = 200^2 \rightarrow$

$4r^2 + 160r + 1600 + 4r^2 = 40{,}000 \rightarrow$

$8r^2 + 160r - 38{,}400 = 0 \rightarrow$

$r^2 + 20r - 4800 = 0 \rightarrow$ (quadratic formula)

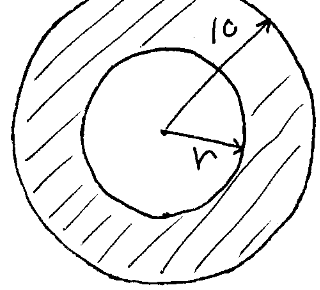
$$r = \frac{-20 \pm \sqrt{(20)^2 - 4(1)(-4800)}}{2} = \frac{-20 \pm 140}{2} = 60 \text{ or } -80 \text{ so}$$

Denise's rate $= r + 20 = 80$ mph

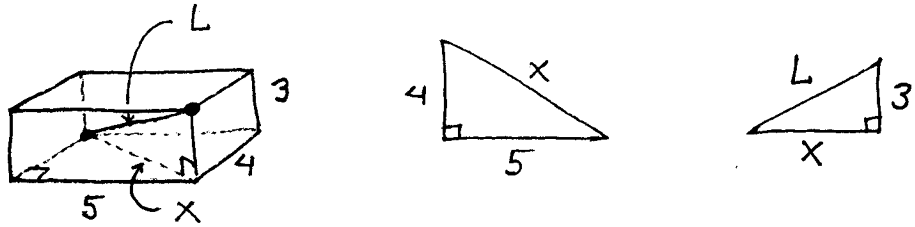
8.) $\pi(10)^2 - \pi r^2 = 0.75(\pi r^2) \rightarrow$

$100\cancel{\pi} = 1.75\cancel{\pi} r^2 \rightarrow 100 = \frac{7}{4} r^2 \rightarrow$

$r^2 = \frac{400}{7} \rightarrow r = \sqrt{\frac{400}{7}} \approx 7.56$



9.)



$4^2 + 5^2 = x^2 \rightarrow x^2 = 41$ and $x^2 + 3^2 = L^2 \rightarrow$

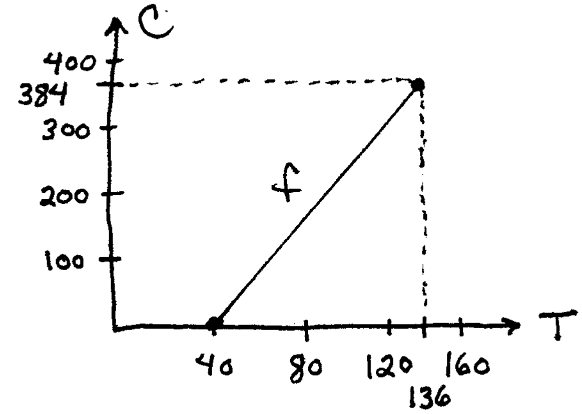
$L^2 = 50 \rightarrow L = \sqrt{50} \approx 7.07$

10.) a.) domain: $40 \le T \le 136$

range: $0 \le C \le 384$

b.) $C = 4T - 160 \rightarrow$

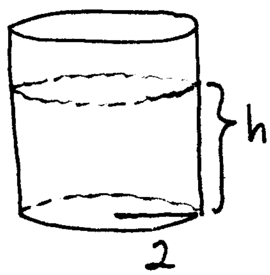
$T = \frac{1}{4}(C + 160) = f^{-1}(C)$



c.) $T = 95°F \rightarrow C = 220$ chirps/min.

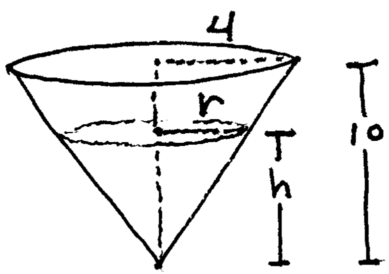
d.) $C = 30$ chirps/min. $\rightarrow T = 47.5°F$

SA1: Volume of H_2O is $\dfrac{2000 \text{ lbs.}}{62.5 \text{ lbs./ft.}^3} = 32 \text{ ft.}^3$



cylinder: $\pi(2)^2 h = 32 \rightarrow$

$h = \dfrac{8}{\pi}$ ft. ≈ 2.546 ft.



cone: $\frac{1}{3}\pi r^2 h = 32$ and

$\dfrac{r}{h} = \dfrac{4}{10} \rightarrow r = \dfrac{2}{5}h$ so

$\frac{1}{3}\pi\left(\frac{2}{5}h\right)^2 h = 32 \rightarrow$

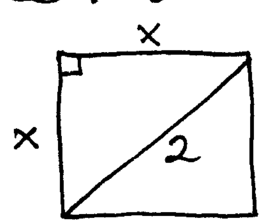
$\dfrac{4}{75}\pi h^3 = 32 \rightarrow h^3 = \dfrac{600}{\pi} \rightarrow h = \left(\dfrac{600}{\pi}\right)^{1/3}$ ft.

≈ 5.759 ft.

SA3: large circle: $C = 4\pi = 2\pi r \rightarrow r = 2$ in.

small circle: diameter $= 2$ in.

square:



$x^2 + x^2 = 2^2 \rightarrow$

$2x^2 = 4 \rightarrow$

$x^2 = 2$ so

area $= x^2 = 2$ in.^{2}