

Section 1.3

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

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

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

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

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

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

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

$$27.) \quad 7x - 5y = 15 \rightarrow -5y = -7x + 15 \rightarrow \\ y = \frac{7}{5}x - 3 \text{ so slope is } \frac{7}{5} \text{ and } \\ y\text{-int. is } -3$$

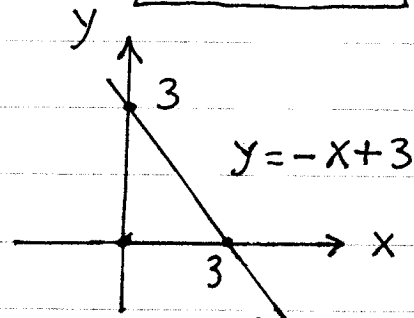
$$31.) \quad x = 4 \text{ (vertical line) so slope is } \\ \text{undefined and there is no } y\text{-int.}$$

$$34.) \quad y + 1 = 0 \rightarrow y = -1 \text{ (horizontal line) so}$$

slope is zero and y-int. is -1

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

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



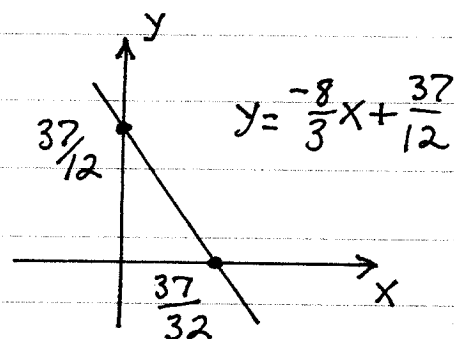
44.) slope = $\frac{\frac{3}{4} - (-\frac{1}{4})}{\frac{7}{8} - \frac{5}{4}} = \frac{1}{-\frac{3}{8}} = -\frac{8}{3}$

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

and $x = \frac{7}{8}, y = \frac{3}{4} \rightarrow$

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

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



47.) $y = mx + b$ and $m = \frac{3}{4}$,

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

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

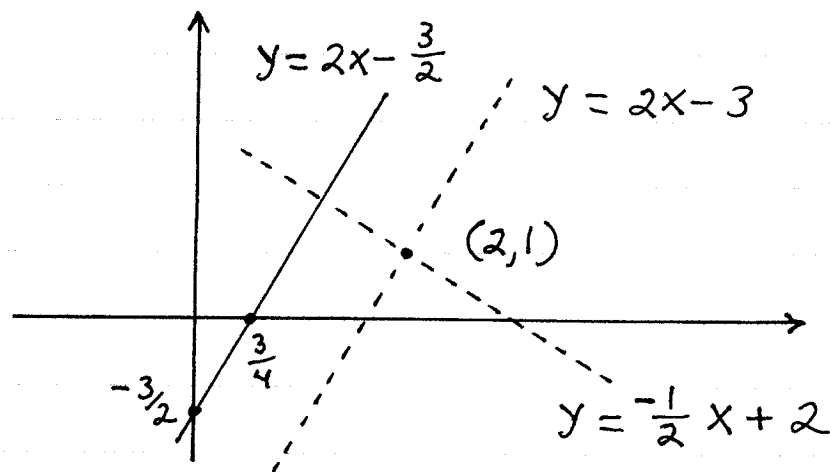
$y = 2x - \frac{3}{2}$ so slope is $\textcircled{2}$;

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

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

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

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



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

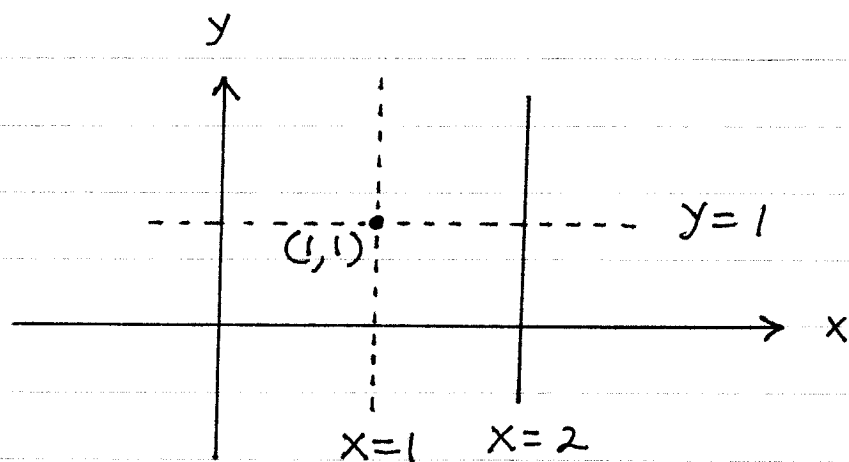
a.) parallel line : $y = b$ and $x = -1, y = 0 \rightarrow$
 $b = 0 \rightarrow \boxed{y = 0}$

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 $x = 1, y = 1 \rightarrow$
 $\boxed{x = 1}$

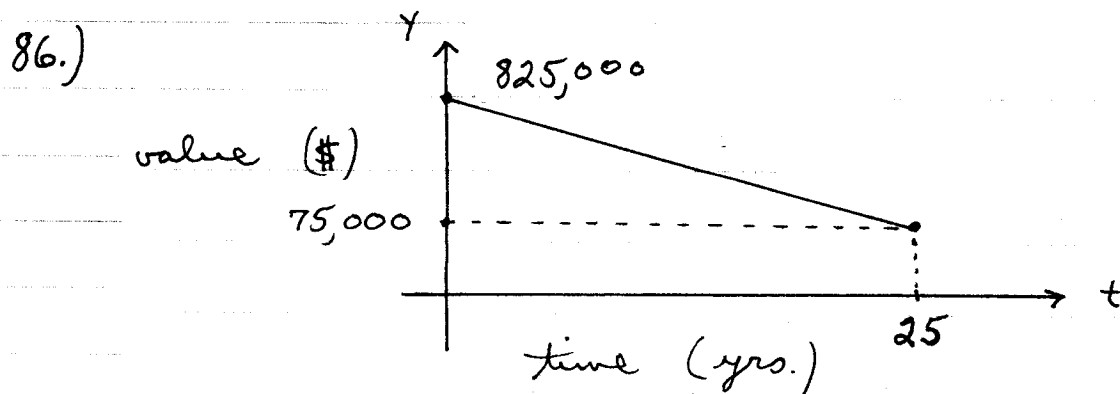
b.) $\perp$ line : $y = b$ and $x = 1, y = 1 \rightarrow$
 $\boxed{y = 1}$



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

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

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

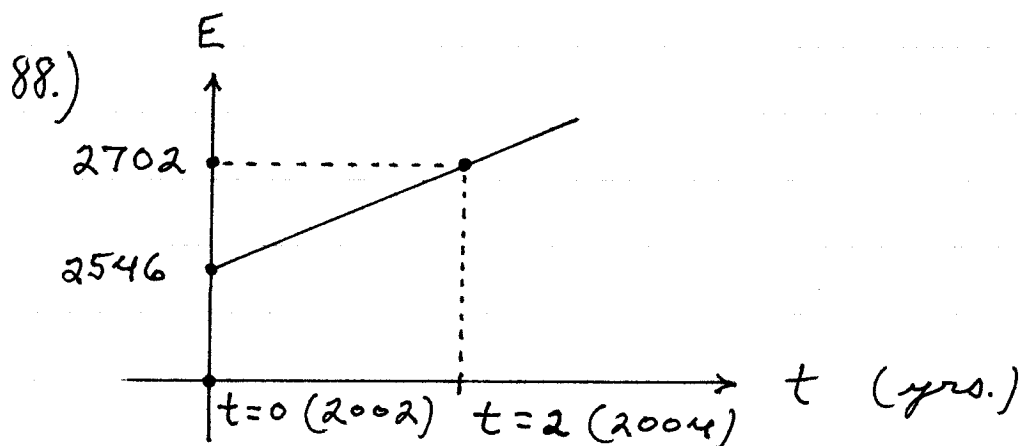


Use points $(0, \$825,000)$ and $(25, \$75,000)$:

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

y-intercept $b = 825,000$ so

$$Y = -30,000t + 825,000$$



E -int. is 2546 ; slope is

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

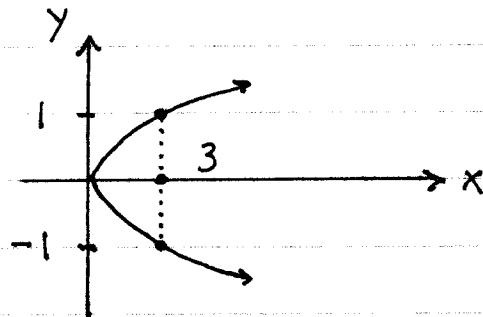
$$E = 78t + 2546$$

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

$$E = 78(6) + 2546 = 3014$$

Section 1.4

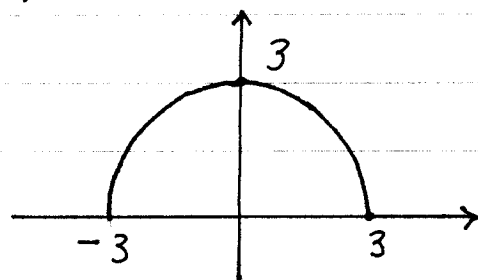
- 2.) $x + y^2 = 4 \rightarrow x = 4 - y^2$, if $y = 1$ then $x = 3$ and if $y = -1$ then $x = 3$ so y is NOT a function of x



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

- 8.) $x^2 y - x^2 + 4y = 0 \rightarrow (x^2 + 4)y - x^2 = 0 \rightarrow$
 $(x^2 + 4)y = x^2 \rightarrow y = \frac{x^2}{x^2 + 4}$ 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 : $x \geq \frac{3}{2}$ or $[\frac{3}{2}, \infty)$

Range : $y \geq 0$ or $[0, \infty)$

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

Range: $y \leq 4$ 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.) $f(c+2) = (c+2)^2 - 2(c+2) + 2$
 $= c^2 + 4c + 4 - 2c - 4 + 2 = c^2 + 2c + 2$

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.) $g(x) = \frac{1}{x}$

a.) $g(2) = \frac{1}{2}$

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

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

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

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

$$\begin{aligned} \frac{h(2+\Delta x) - h(2)}{\Delta x} &= \frac{(2+\Delta x)^2 - (2+\Delta x) + 1 - 3}{\Delta x} \\ &= \frac{4 + 4 \cdot \Delta x + (\Delta x)^2 - 2 - \Delta x - 2}{\Delta x} = \frac{3 \cdot \Delta x + (\Delta x)^2}{\Delta x} \\ &= \frac{\Delta x (3 + \Delta x)}{\Delta x} = 3 + \Delta x \end{aligned}$$

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

$$\begin{aligned} \frac{g(x+\Delta x) - g(x)}{\Delta x} &= \frac{\sqrt{x+\Delta x+3} - \sqrt{x+3}}{\Delta x} \\ &= \frac{\sqrt{x+\Delta x+3} - \sqrt{x+3}}{\Delta x} \cdot \frac{\sqrt{x+\Delta x+3} + \sqrt{x+3}}{\sqrt{x+\Delta x+3} + \sqrt{x+3}} \\ &= \frac{(x+\Delta x+3) - (x+3)}{\Delta x \cdot [\sqrt{x+\Delta x+3} + \sqrt{x+3}]} = \frac{-\Delta x}{\Delta x \cdot [\sqrt{x+\Delta x+3} + \sqrt{x+3}]} \\ &= \frac{1}{\sqrt{x+\Delta x+3} + \sqrt{x+3}} \end{aligned}$$

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

$$\begin{aligned} \frac{f(x+\Delta x) - f(x)}{\Delta x} &= \frac{\frac{1}{x+\Delta x+4} - \frac{1}{x+4}}{\Delta x} \\ &= \frac{\frac{x+4 - (x+\Delta x+4)}{(x+\Delta x+4)(x+4)}}{\Delta x} = \frac{-\Delta x}{(x+\Delta x+4)(x+4) \cdot \Delta x} \\ &= \frac{-1}{(x+\Delta x+4)(x+4)} \end{aligned}$$

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

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

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

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

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

$$b.) f(x) \cdot g(x) = (2x-5)(2-x) \\ = 4x - 2x^2 - 10 + 5x = -2x^2 + 9x - 10$$

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

$$d.) f(g(x)) = f(2-x) = 2(2-x) - 5 \\ = 4 - 2x - 5 = -2x - 1$$

$$e.) g(f(x)) = g(2x-5) = 2 - (2x-5) \\ = 2 - 2x + 5 = 7 - 2x$$

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

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

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

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

$$d.) f(g(x)) = f(\sqrt{1-x}) = (\sqrt{1-x})^2 + 5 \\ = 1 - x + 5 = 6 - x$$

$$e.) g(f(x)) = g(x^2 + 5) = \sqrt{1 - (x^2 + 5)} \\ = \sqrt{-4 - x^2} \quad \text{which is not defined for any } x\text{-values}$$

$$39.) f(x) = \frac{1}{x}, \quad g(x) = \frac{1}{x^2}$$

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

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

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

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

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

$$42.) f(x) = \frac{1}{x}, \quad g(x) = x^2 - 1$$

$$a.) f(g(2)) = f(3) = \frac{1}{3}$$

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

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

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

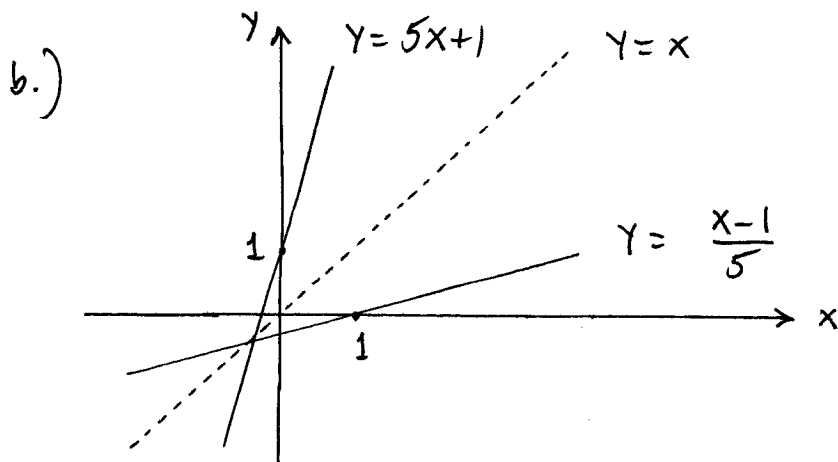
$$e.) f(g(x)) = f(x^2 - 1) = \frac{1}{x^2 - 1}$$

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

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

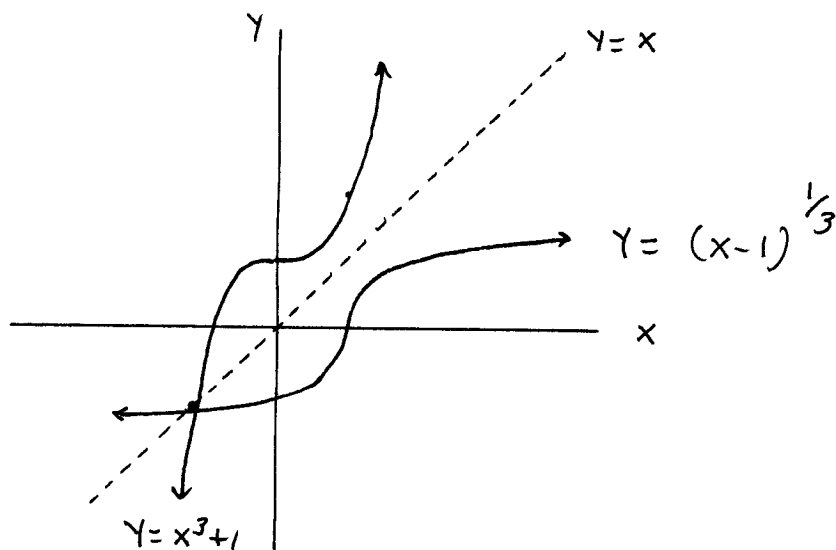
$$a.) f(g(x)) = f\left(\frac{x-1}{5}\right) = 5\left(\frac{x-1}{5}\right) + 1 = x - 1 + 1 = x$$

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

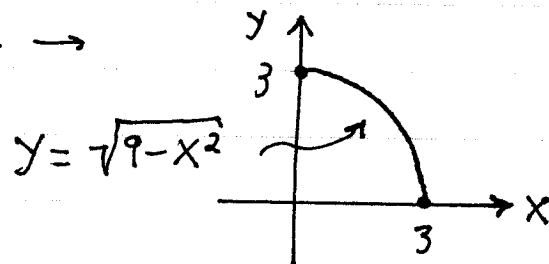


54.) $y = x^3 + 1 \rightarrow$ (switch variables) $\rightarrow$
 $x = y^3 + 1 \rightarrow y^3 = x - 1 \rightarrow y = (x - 1)^{1/3} \rightarrow$
 $f^{-1}(x) = (x - 1)^{1/3}.$

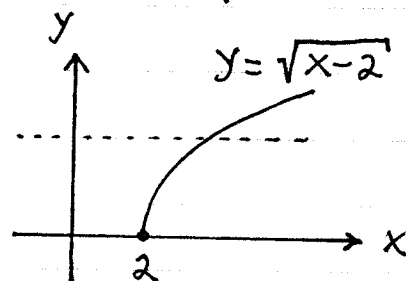
$x \rightarrow f^{-1}(x) = (x - 1)^{1/3} :$



55.) $y = \sqrt{9 - x^2}$ and $0 \leq x \leq 3 \rightarrow$ (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
 $f^{-1}(x) = \sqrt{9 - x^2}$

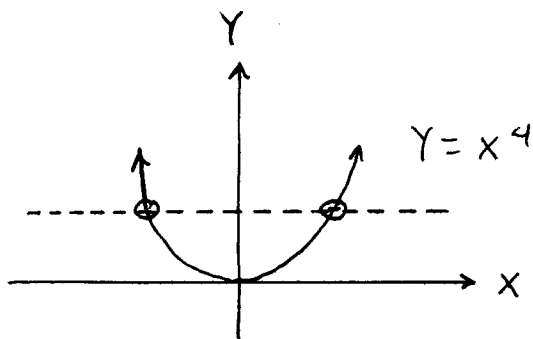


60.) y is 1-1 : $y = \sqrt{x - 2} \rightarrow$
 $x = y^2 + 2 \rightarrow x^2 = y - 2 \rightarrow$
 $y = x^2 + 2 \rightarrow f^{-1}(x) = x^2 + 2$



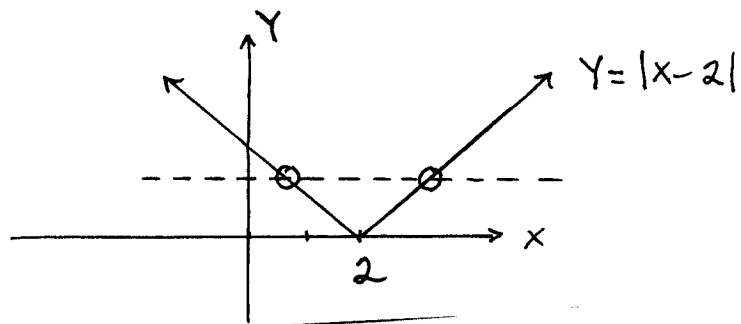
62.) $f(x) = x^4$

is not 1-1 so
does not have
an inverse.



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

is not 1-1 so
does not have
an inverse.



70.) x is number of games sold :

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

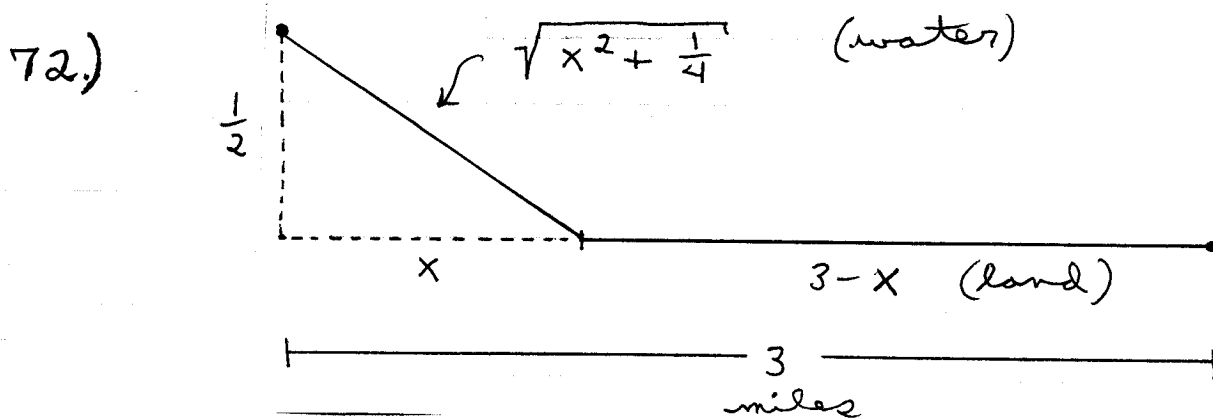
(b) average cost per game

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

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

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

$x = 8109$ games must be sold.



$$\begin{aligned} \text{water cost : } \$15/\text{ft.} &= \left(\$15/\text{ft.} \right) \left(\frac{5280 \text{ ft.}}{\text{mi.}} \right) \\ &= \$79,200 / \text{mi.} \end{aligned}$$

$$\begin{aligned} \text{land cost : } \$10/\text{ft.} &= \left(\$10/\text{ft.} \right) \left(\frac{5280 \text{ ft.}}{\text{mi.}} \right) \\ &= \$52,800 / \text{mi.} ; \text{ then} \end{aligned}$$

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

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

75.) X is number of units : If $0 \leq X \leq 100$
 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.

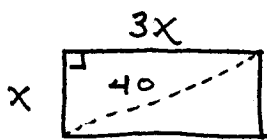
$$(a) \text{ price/unit } p = \begin{cases} 90 & \text{for } 0 \leq X \leq 100 \\ 91 - .01X & \text{for } 101 \leq X \leq 1599 \\ 75 & \text{for } X \geq 1600 \end{cases}$$

(b) total profit $P = \text{Revenue} - \text{Cost}$

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

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

Worksheet 1

- 1.)  Let x : width, $3x$: length then
 $x^2 + (3x)^2 = 40^2 \rightarrow x^2 + 9x^2 = 1600 \rightarrow$
 $10x^2 = 1600 \rightarrow x^2 = 160 \rightarrow x = \sqrt{160} = 4\sqrt{10} \text{ cm.}$
 and $3x = 12\sqrt{10} \text{ cm.}$

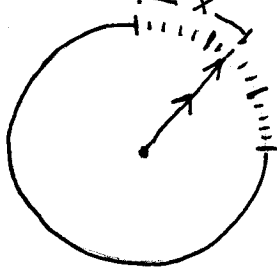
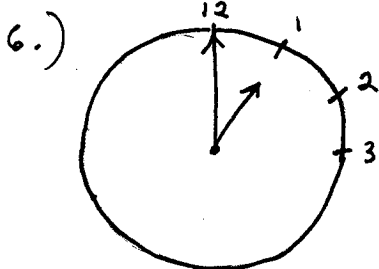
- 2.) a.) $x-3=7$ or $(x-10)^2=0$ etc.
 b.) $(x-2)(x-10)=0$ has solutions $x=2, x=10$

- 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.) $(x+\frac{3}{x})(2x-5) = (x-\frac{3}{x})(x+5) \rightarrow$
 $2x^2-5x+6-\frac{15}{x} = x^2+5x-3-\frac{15}{x} \rightarrow x^2-10x+9=0 \rightarrow$
 $(x-1)(x-9)=0 \rightarrow x=1, x=9$

- 5.) Let x : integer then $x+\sqrt{x}=992 \rightarrow$
 $\sqrt{x}=992-x \rightarrow (\sqrt{x})^2=(992-x)^2 \rightarrow \dots \rightarrow$
 $x^2-1985x+984,064 \rightarrow$ (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?)



count the minute marks $x \rightarrow$

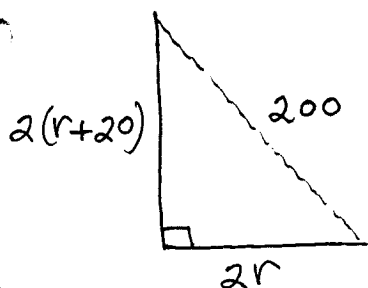
$$\begin{array}{cc} \text{Big hand} & \text{Little hand} \\ x & = 5 + (\frac{x}{60})5 \end{array}$$

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

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

7.) Distance = Rate $\times$ Time ($D = RT$)

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



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

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

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

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

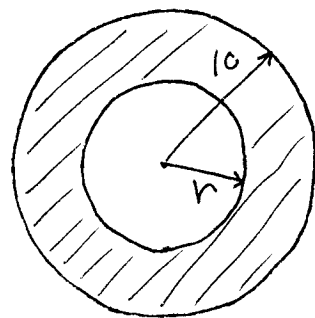
$$r = \frac{-20 \pm \sqrt{(20)^2 - 4(1)(-4800)}}{2} = \frac{-20 \pm 140}{2} = 60 \text{ or } -80 \text{ so}$$

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

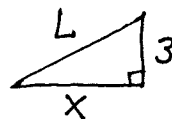
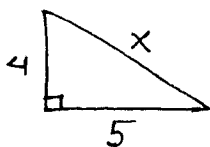
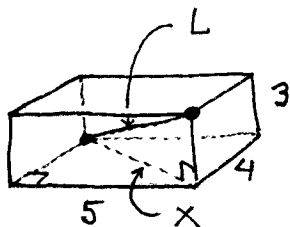
8.) $\pi(10)^2 - \pi r^2 = 0.75(\pi r^2) \rightarrow$

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

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



9.)



$$4^2 + 5^2 = x^2 \rightarrow x^2 = 41 \text{ and}$$

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

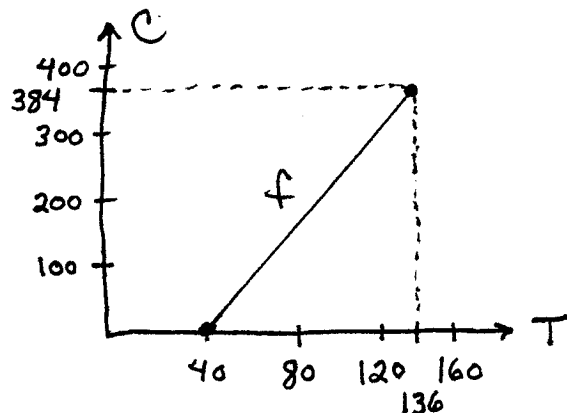
$$x^2 + 3^2 = L^2 \rightarrow$$

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

range: $0 \leq C \leq 384$

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

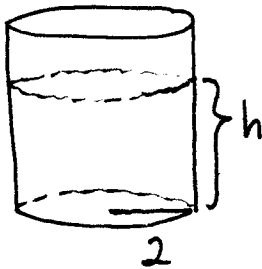
$$T = \frac{1}{4}(C + 160) = f^{-1}(C)$$



c.) $T = 95^\circ\text{F} \rightarrow C = 220 \text{ chirps/min.}$

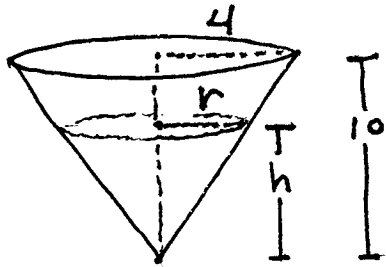
d.) $C = 30 \text{ chirps/min.} \rightarrow T = 47.5^\circ\text{F}$

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



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

$h = \frac{8}{\pi} \text{ ft.} \approx 2.546 \text{ ft.}$



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

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

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

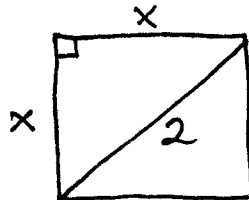
$\frac{4}{75} \pi h^3 = 32 \rightarrow h^3 = \frac{600}{\pi} \rightarrow h = \left(\frac{600}{\pi}\right)^{1/3} \text{ ft.}$

$\approx 5.759 \text{ ft.}$

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

small circle: diameter = 2 in. $\uparrow$

square:



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

$2x^2 = 4 \rightarrow$

$x^2 = 2$ so

area = $x^2 = 2 \text{ in}^2$