#15) Def of HA:

(a) as $x \to \infty$ or $x \to -\infty$ y gets closer and closer to some value

then Table "C" & "D" are HA

(b) Def of VA. as $x \to a$ $y \to \pm\infty$

then Table A & B are V.A

(c) (i) as $x \to \infty$ $f(x) \to 4.25$

(ii) as $x \to -\infty$ $f(x) \to 4.25$

(iii) as $x \to -3^+$ $f(x) \to -\infty$

(iv) as $x \to -3^-$ $f(x) \to +\infty$

(v) $y = 4.25$

(vi) $x = -3$

$h(x) = \dfrac{\quad}{x(x-2)}$

#16 a) All Reals except 0, and 2

b) as $x \to -\infty$; $h(x) \to 3$

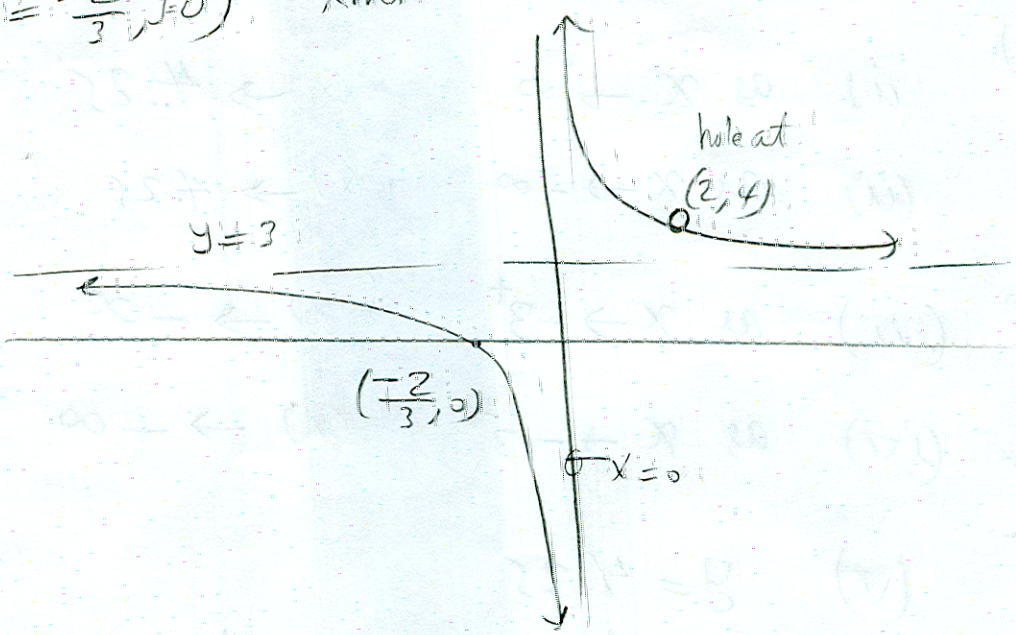
c) V.A $x = 0$

d) $y = 3$ H.A

hole e) when $x = 2$, $y = \frac{8}{2} = 4$ $(2, 4)$

f) $(x = -\frac{2}{3}, y = 0)$ x-int

g)



h) Range

$(-\infty, 3) \cup (3, 4) \cup (4, \infty)$

Range: $\{y \mid y \neq 3, y \neq 4\}$

#17 $N(t) = \frac{20(4+3t)}{1+0.05t}$; $0 \le t$

a) $t=5$; 304000 fish

$t=10$; 453,333 fish

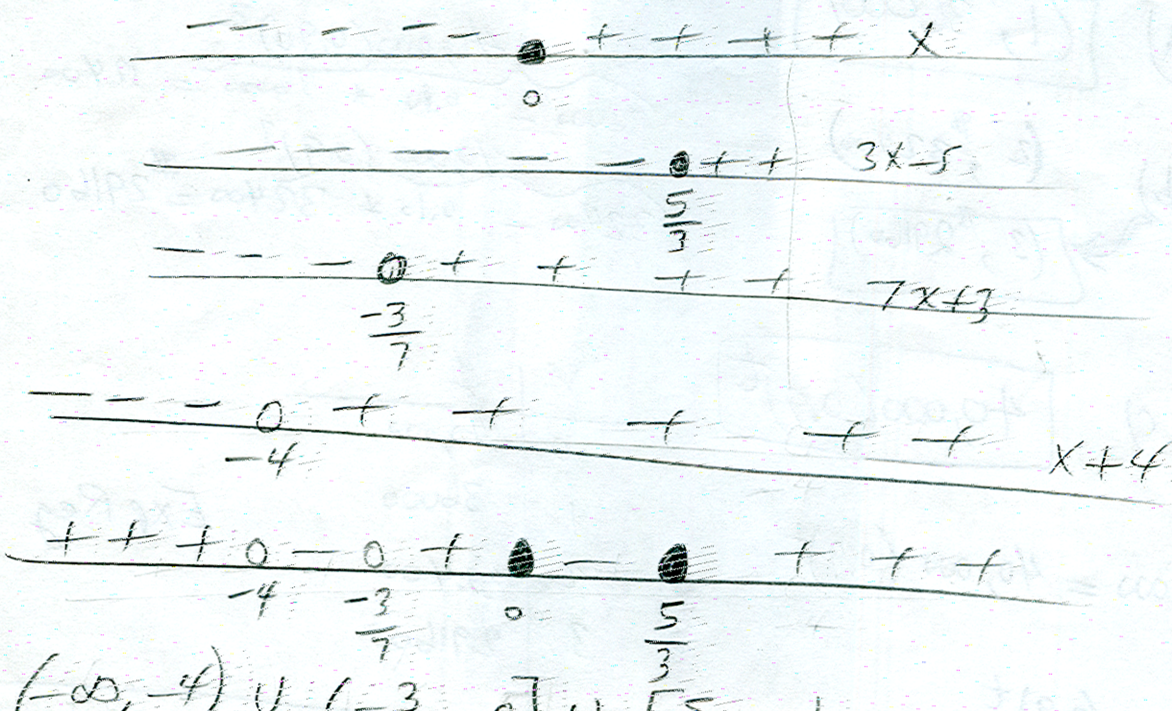
$t=25$; 702,222 fish

b) 1200,000 fish

11.A as $x \to \infty$ $y \to \frac{20 * 3}{0.05} = 1200$ thousand

$= 1200,000$ fish

#18 $f(x) = \frac{x(3x-5)}{(7x+3)(x+4)} \ge 0$



$(-\infty, -4) \cup (-\frac{3}{7}, 0] \cup [\frac{5}{3}, \infty)$

#19 a) Solve for x

$$\frac{1}{32} = 2^{1-4x}$$

$$2^{-5} = 2^{1-4x}$$

$$-5 = 1-4x \implies -4x = -6$$

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

b) Simplify $e^{\ln x^2 + \ln 5}$

$$= e^{\ln x^2} \cdot e^{\ln 5} = x^2 \cdot 5 = 5x^2$$

#20

a) $(0, \$40{,}000)$

$(1, \$36000)$

$40{,}000 - 0.10 * 40{,}000 = \$36000$ (i.e. $40{,}000(0.9)$)

b) $(2, \$32400)$

$(3, \$29160)$

$36000 - 0.10 * 36000 = 32400$ (i.e. $40{,}000(0.9)^2$)

$32400 - 0.10 * 32400 = \$29160$ (i.e. $40{,}000(0.9)^3$)

c) $40{,}000(0.9)^t$

x	y
0	40,000
1	36000
2	32400
3	29160

Exp Reg

$y = ab^x = 40{,}000(0.9)^x$

d) $20{,}000 = 40{,}000(0.9)^t$

$\frac{1}{2} = (0.9)^t$

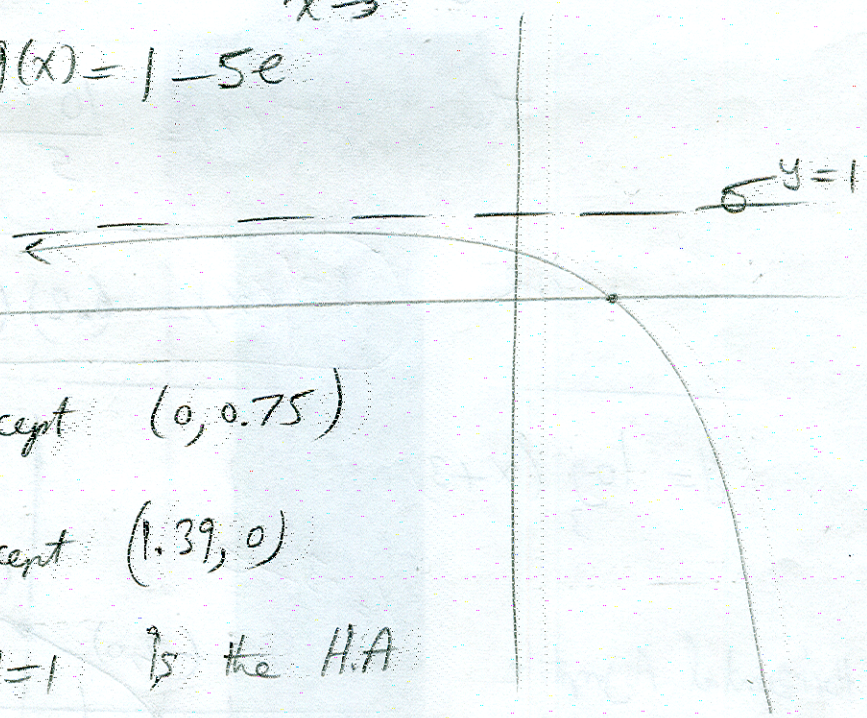
$t = \frac{\ln(0.5)}{\ln 0.9} = 6.6$ years

#21

x	-2	-1	0	1	2	3
$f(x)$	-3	-1	0	6	5	7

x	-3	-1	0	6	5	7
$f^{-1}(x)$	-2	-1	0	1	2	3

#22 Graph $g(x) = 1 - 5e^{x-3}$



y intercept $(0, 0.75)$

x intercept $(1.39, 0)$

So, $y=1$ is the H.A

Domain all Reals

Range $y < 1$

#23 $y = f(x) = \frac{1}{3}\log(5x)$

$x = \frac{1}{3}\log(5y)$

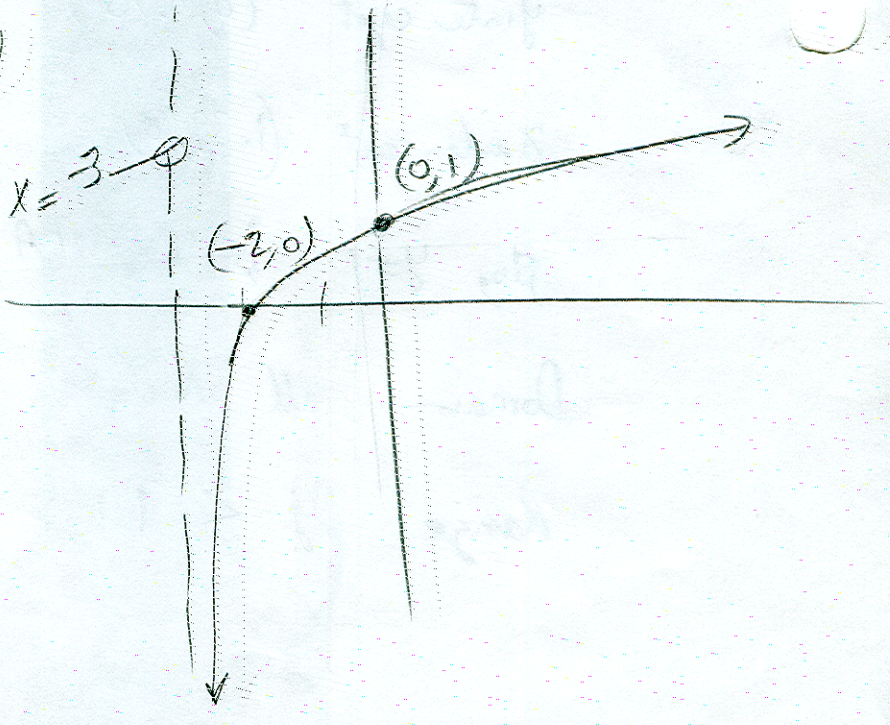
$3x = \log(5y)$

$10^{3x} = 5y \Rightarrow y = \frac{10^{3x}}{5}$

thus $f^{-1}(x) = \frac{10^{3x}}{5}$

OR $f^{-1}(x) = (.2)(10)^{3x}$

#24 $y = \log_3(x+3)$



No Horizontal Asymptote

V.A $x = -3$

x intercept $(-2,0)$

y intercept $(0,1)$

#25 Solve for x

$$\log_5(8-18x) - 2\log_5 x = 1$$

$$\log_5\left(\frac{8-18x}{x^2}\right) = 1$$

$$\frac{8-18x}{x^2} = 5^1 \Rightarrow 8-18x = 5x^2$$

thus $5x^2+18x-8=0$

$(5x-2)(x+4)=0$

$5x=2$ $\quad$ ~~$x=-4$~~

$x=\frac{2}{5}$ $\quad$ extraneous sln.

#26 $y=\log_5 40 \Rightarrow 5^y = 40$

$$y=\frac{\log 40}{\log 5} = 2.292$$

#27 a) $P(t) = Ce^{Kt}$

P = Population, t = time in years

Pop. Triples every 23 years

$3\not{C} = \not{C}e^{K(23)} \Rightarrow \frac{\ln 3}{23} = K$

$K = 0.0477$

$= 4.8\%$

(b) $A = Pe^{Kt}$

(i) $K = 0.0477$ from before $= 4.8\%$

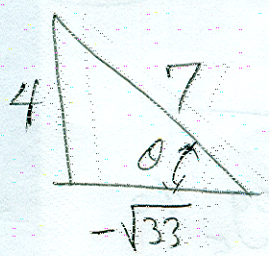
(ii) $A = 10{,}000\, e^{0.048 * 50}$ #

$= 109948$

#28 If $\sin\theta = \frac{4}{7}$

$\frac{\pi}{2} < \theta < \pi$

Quad II



a) $\tan\theta = \frac{4}{-\sqrt{33}} = \frac{-4\sqrt{33}}{33}$

b) $\sec\theta = \frac{1}{\cos\theta} = \frac{7}{-\sqrt{33}} = \frac{-7\sqrt{33}}{33}$

c) $\cos(\theta + \frac{\pi}{2}) = \cos\theta \cos\frac{\pi}{2} - \sin\theta \sin\frac{\pi}{2} = -\sin\theta = -\frac{4}{7}$

d) $\csc(2\theta) = \frac{1}{\sin 2\theta} = \frac{1}{2\sin\theta\cos\theta} = \frac{1}{2(\frac{4}{7})(\frac{-\sqrt{33}}{7})} = \frac{49}{-8\sqrt{33}} = \frac{-49\sqrt{33}}{264}$

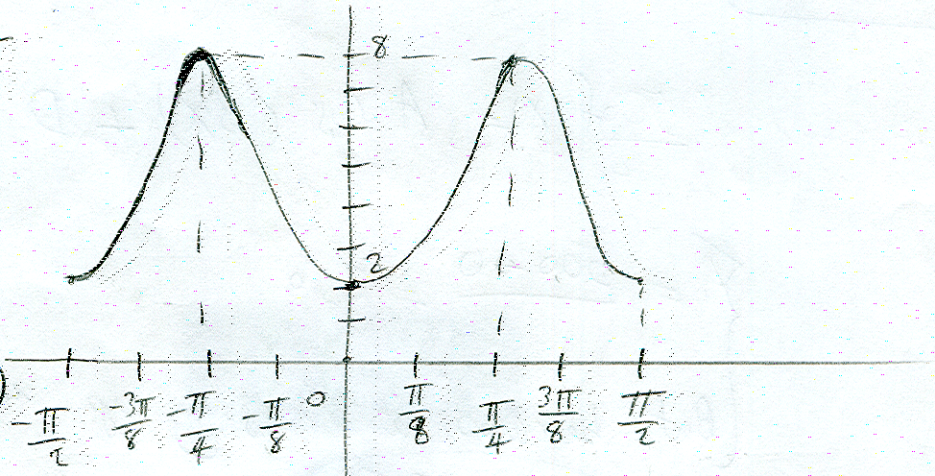
#29 Graph $F(x) = -3\cos(4x) + 5$

a) Period $= \frac{2\pi}{4} = \frac{\pi}{2}$

b) $[2, 8]$ Range

c) Amp $= 3$

d) None (Phase shift)



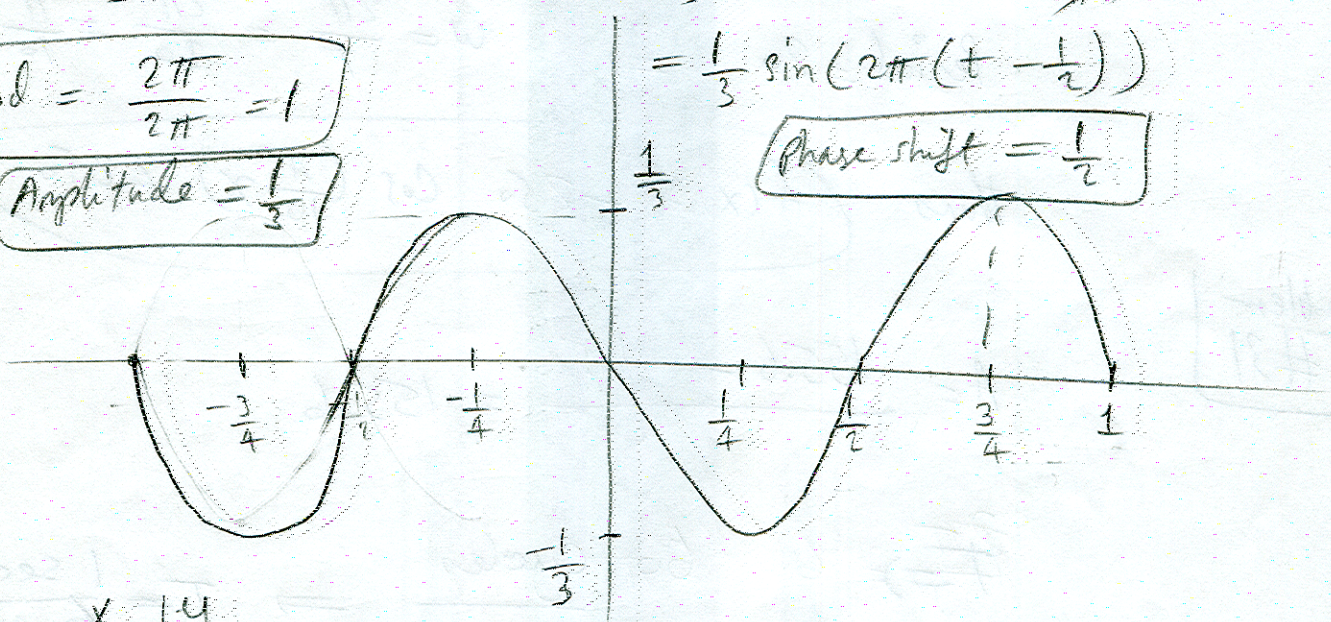
$G(x) = \frac{1}{3}\sin(2\pi t - \pi) = \frac{1}{3}\sin\left(2\pi\left(t - \frac{\pi}{2\pi}\right)\right)$

$= \frac{1}{3}\sin(2\pi(t - \frac{1}{2}))$

Period $= \frac{2\pi}{2\pi} = 1$

Amplitude $= \frac{1}{3}$

Phase shift $= \frac{1}{2}$



x	y
-1	0
-0.75	$-\frac{1}{3}$
-0.5	0
-0.25	$0.33 = \frac{1}{3}$
0	0
$\frac{1}{4}$	$-\frac{1}{3}$
$\frac{1}{2}$	0

a) period $= 1$

b) $\left[-\frac{1}{3}, \frac{1}{3}\right]$ Range

c) $\frac{1}{3}$ = Amp

d) $\frac{1}{2}$ Phase shift

Problem #30

$$f(x) = A\cos(Bx) + D$$

$$A = \frac{500 - 0}{2} = 250$$

But because it is going up instead of down use $\ominus$

$$\therefore A = -250$$

$$D = \frac{500 + 0}{2} = 250$$

$$\text{Period} = 20 \Rightarrow \omega = \frac{2\pi}{T} = \frac{2\pi}{20} = \frac{\pi}{10}$$

$$\text{thus } f(x) = -250\cos\left(\frac{\pi}{10}x\right) + 250$$

Problem #31

$$A = \frac{155.6 - -155.6}{2} = 155.6$$

$$f = 60\ \frac{\text{cycles}}{\text{sec}} \Rightarrow T = \frac{1\ \text{sec}}{60\ \text{cycles}}$$

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{\frac{1}{60}} = 120\pi$$

$$f(t) = A\cos(\omega t)$$

$$f(t) = 155.6\cos(120\pi t)$$