1) Solve $\underbrace{16}_{a}x^2 \underbrace{-5}_{b}x \underbrace{+1}_{c} = 0$

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{--5 \pm \sqrt{(-5)^2 - 4(16)(1)}}{2(16)}$$

$$= \frac{5 \pm \sqrt{25-64}}{32}$$

$$= \frac{5}{32} \pm \frac{\sqrt{-39}}{32}$$

$$= \frac{5}{32} \pm i\frac{\sqrt{39}}{32}$$

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2) Solve: $|4x-6| - 2 \le 5$

$ +2 \quad 2$

$$|4x-6| \le 7$$

$$-7 \le 4x-6 \le 7$$

$\quad 6 \qquad +6 \qquad 6$

$$\frac{-1}{4} \le \frac{4x}{4} \le \frac{13}{4}$$

$$-\frac{1}{4} \le x \le 13/4$$

$$\boxed{\left[-\frac{1}{4}, \frac{13}{4}\right]}$$

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3) $\left[\begin{array}{cccc|c} 1 & 1 & -1 & 1 & 5 \\ 0 & -3 & 5 & -1 & 0 \\ 1 & 0 & -3 & -1 & 4 \\ -4 & 3 & 0 & 1 & -2 \end{array}\right]$ ~~R~~ replace row 4 with $\underbrace{4R_1} + \underbrace{R_4}$

$$\begin{array}{rrrrr} 4 & 4 & -4 & 4 & 20 \\ -4 & 3 & 0 & 1 & -2 \\ \hline 0 & 7 & -4 & 5 & 18 \end{array}$$

$$\left[\begin{array}{cccc|c} 1 & 1 & -1 & 1 & 5 \\ 0 & -3 & 5 & -1 & 0 \\ 1 & 0 & -3 & -1 & 4 \\ 0 & 7 & -4 & 5 & 18 \end{array}\right]$$

#4 $A = \begin{bmatrix} 1 & -8 & -7 \\ -1 & -2 & -3 \\ -5 & -5 & -3 \end{bmatrix}$ $B = \begin{bmatrix} -8 & -8 & -6 \\ 8 & 4 & -2 \\ -5 & -2 & 1 \end{bmatrix}$

$$4A - 3B = 4\begin{bmatrix} 1 & -8 & -7 \\ -1 & -2 & -3 \\ -5 & -5 & -3 \end{bmatrix} - 3\begin{bmatrix} -8 & -8 & -6 \\ +8 & 4 & -2 \\ -5 & -2 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} 4 & -32 & -28 \\ -4 & -8 & -12 \\ -20 & -20 & -12 \end{bmatrix} - \begin{bmatrix} -24 & -24 & -18 \\ 24 & 12 & -6 \\ -15 & -6 & 3 \end{bmatrix}$$

$$= \begin{bmatrix} 28 & -8 & -10 \\ -28 & -20 & -6 \\ -5 & -14 & -15 \end{bmatrix} \longrightarrow \downarrow$$

#5 x: March, y: April, z: May $\to$ T: 70

$$x + y + z = 70$$
$$-x + y - z = 14$$
$$-3x + y + z = 2$$

$y = x + z + 14$

$y + z = 2 + 3x$

$$\left[\begin{array}{ccc|c} 1 & 1 & 1 & 70 \\ -1 & 1 & -1 & 14 \\ -3 & 1 & 1 & 2 \end{array}\right]$$

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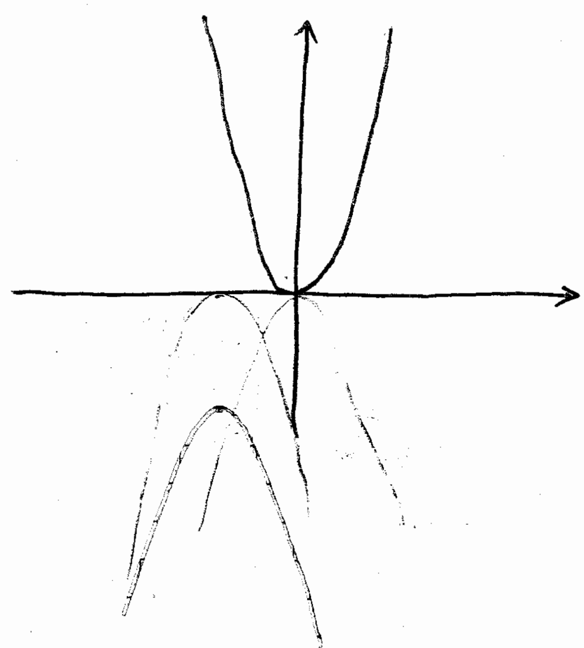
6) $y = x^2$; $f(x) = -(x+2)^2 - 3$



~~#8~~
#7 Find Domain, $f(x) = \frac{x}{\sqrt{x-9}}$

$$x - 9 > 0$$
$$x > 9$$
$$\boxed{(9, \infty)}$$

$h(x) = \sqrt{9-x}$

$$9 - x \geq 0$$
$$-x \geq -9$$
$$x \leq 9 \Rightarrow \boxed{(-\infty, 9]}$$

#8 A projectile is thrown upward so that its distance above the ground after t seconds is $h(t) = -16t^2 + 330t$. After how many second it reach its Maximum height? What is the maximum height?

$$t = \frac{-b}{2a} = -\frac{330}{2(-16)} = \frac{330}{32} \approx 10.3125$$

Maximum height: $h = -16(10.3125)^2 + 330(10.3125)$

$$= 1701.56$$

#9 Find the accumulated value of an investment of \$5000. at 3.5% compounded monthly for 8 years.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$
$$= 5000\left(1 + \frac{.035}{12}\right)^{12\times 8}$$

5000 (1+.035/12)^(12*8)

$$= \$ \cancel{7809.00}$$
$$= \$6612.95$$

#10) Find the inverse of $f(x) = \frac{6}{x+8}$

$$y = \frac{6}{x+8} \Rightarrow x = \frac{6}{y+8}$$

$$x(y+8) = 6$$

$$xy + 8x = 6$$

$$xy = 6 - 8x$$

$$y = \frac{6-8x}{x} \quad \text{or} \quad \frac{-8x+6}{x}$$

** Non-multiple Choice. **

#11 Solve: $\frac{1}{x+7} + \frac{3}{x+4} = \frac{-3}{x^2+11x+28}$

restriction: $\boxed{x \neq -7, -4}$

$$1(x+4) + 3(x+7) = -3$$

$$x + 4 + 3x + 21 = -3$$

$$4x + 25 = -3$$

$$4x = -3 - 25$$

$$4x = -28$$

$$\boxed{x = \frac{-28}{4} = -7}$$

No solution.

Check!!

#12 solve: $\left(\sqrt{3x-2}\right)^2 = (x-4)^2$

$$3x - 2 = x^2 - 8x + 16$$

$$-3x + 2 \qquad -3x + 2$$

$$0 = x^2 - 11x + 18$$

$$x^2 - 11x + 18 = 0 \Rightarrow \boxed{x =} 2, \boxed{9}$$

Check:

$$\cancel{x=2} \Rightarrow \sqrt{3(2)-2} \stackrel{?}{=} 2 - 4 = -2$$

$$x = 9 \Rightarrow \sqrt{3(9)-2} \stackrel{?}{=} 9 - 4$$

$$\sqrt{25} = 5 \checkmark$$

$$\boxed{x = 9} \checkmark$$

#13 Solve $x^2 - 6x - 7 \leq 0$

$$x^2 - 6x - 7 = 0 \Rightarrow x = -1, 7$$

$$[-1, 7]$$

#14 Solve: $\frac{x}{x-3} \geq 0$ restriction $\boxed{x \neq 3}$

$$\frac{x}{x-3} = 0 \Rightarrow \boxed{x = 0}$$

$$\frac{1}{1-3} = -\frac{1}{2}$$

0 1 3

\+ − +

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

#15 Given: $f(x) = 6x - 2$ find $\frac{f(x+h) - f(x)}{h}$

$$f(x+h) = 6(x+h) - 2$$
$$= 6x + 6h - 2$$
$$\frac{f(x+h) - f(x)}{h} = \frac{6x + 6h - 2 - (6x - 2)}{h}$$
$$= \frac{\cancel{6x} + 6h \cancel{- 2} \cancel{- 6x} \cancel{+ 2}}{h}$$
$$= \frac{6\cancel{h}}{\cancel{h}}$$
$$= \boxed{6}$$

#16 $f(x) = 2x - 3$ $g(x) = \sqrt{x+2}$

a) find $f \circ g(x) = f(g(x))$
$$= f(\sqrt{x+2})$$
$$= 2\sqrt{x+2} - 3$$

b) $(f \circ g)(-1) = 2\sqrt{(-1)+2} - 3 = -3$
$$= 2\sqrt{1} - 3$$
$$= \boxed{-1}$$

#17. Solve: $4^{x+4} = 5^{2x+5}$

$\ln 4^{x+4} = \ln 5^{2x+5}$ ln both sides.

$(x+4)\ln 4 = (2x+5)\ln 5$ Power Properties

$x\ln 4 + 4\ln 4 = 2x\ln 5 + 5\ln 5$

$-2x\ln 5 - 4\ln 4 \quad -2x\ln 5 - 4\ln 4$

$x\ln 4 - 2x\ln 5 = 5\ln 5 - 4\ln 4$

$x(\ln 4 - 2\ln 5) = 5\ln 5 - 4\ln 4$

$$\boxed{x = \frac{5\ln 5 - 4\ln 4}{\ln 4 - 2\ln 5}}$$

#18 Solve: $\log x + \log(x+9) = 1$ Product Rule

$\log x(x+9) = 1$ write as an exponential form.

$x(x+9) = 10^1$

$x^2 + 9x = 10$

$x^2 + 9x - 10 = 0$ solve for x

$x = 1, \cancel{-10}$ inside the log has to be positive

Solution: $\boxed{x = 1}$

#19 Expand $\log_b \sqrt[4]{\dfrac{x^3 b^2}{y^4 z^{16}}}$

$\log \sqrt[4]{\dfrac{x^3b^2}{y^4z^{16}}} = \log\left(\dfrac{x^3b^2}{y^4z^{16}}\right)^{1/4}$ Power Rule

$= \frac{1}{4}\log\frac{x^3b^2}{y^4z^{16}}$ Quotient

$= \frac{1}{4}\left[\log x^3b^2 - \log y^4z^{16}\right]$ Product

$= \frac{1}{4}\left[\log x^3 + \log b^2 - (\log y^4 + \log z^{16})\right]$

$= \frac{1}{4}\left[\log_b x^3 + \log_b b^2 - \log_b y^4 - \log_b z^{16}\right]$

$= \frac{1}{4}\left[3\log x + 2 - 4\log_b y - 16\log_b z\right]$

$$= \frac{3}{4}\log x + \frac{1}{2} - \log_b y - 4\log_b z$$

#20) Guassian Elimination

$$\begin{cases} x - y - 5z = -6 \\ y + 3z = 9 \\ x + y + z = 12 \end{cases}$$

$$\left[\begin{array}{ccc|c} 1 & -1 & -5 & -6 \\ 0 & 1 & 3 & 9 \\ 1 & 1 & 1 & 12 \end{array}\right] R_3 - 1R_1 \qquad \begin{array}{cccc} 1 & 1 & 1 & 12 \\ -1 & 1 & 5 & 6 \\ \hline 0 & 2 & 6 & 18 \end{array}$$

$$\left[\begin{array}{ccc|c} 1 & -1 & -5 & -6 \\ 0 & 1 & 3 & 9 \\ 0 & 2 & 6 & 18 \end{array}\right] R_3 - 2R_2 \qquad \begin{array}{cccc} 0 & 2 & 6 & 18 \\ 0 & -2 & -6 & -18 \\ \hline 0 & 0 & 0 & 0 \end{array}$$

$$\left[\begin{array}{ccc|c} 1 & -1 & -5 & -6 \\ 0 & 1 & 3 & 9 \\ 0 & 0 & 0 & 0 \end{array}\right] \begin{array}{l} \rightarrow x - y - 5z = -6 \\ \Rightarrow y + 3z = 9 \Rightarrow \boxed{y = 9 - 3z} \end{array}$$

$$\rightarrow x = -6 + y + 5z$$
$$= -6 + 9 - \underbrace{3z + 5z}$$
$$= 2z + 3$$

$$\boxed{(2z+3, 9-3z, z)}$$

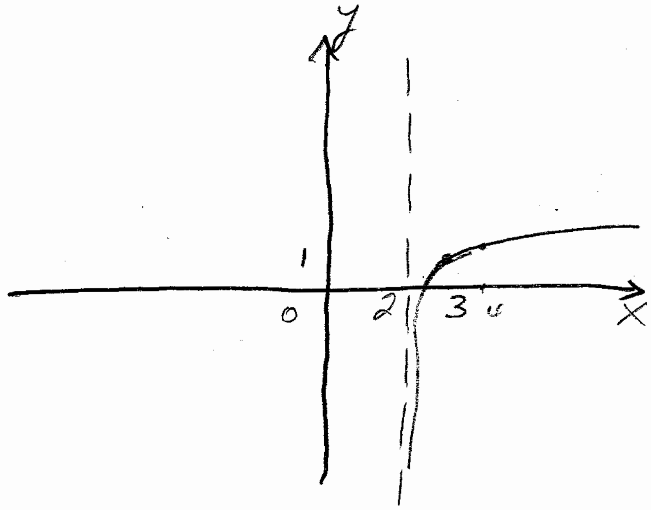
#21 Graph, ~~Asymptote~~ find $f(x) = \log(x-2)+1$

Asymptote : $x = 2$

Domain : $(2, \infty)$

Range : $(-\infty, \infty)$

x	y
2	
2.5	.7
3	$\log(3-2)+1 = 1$
4	$\underbrace{\log(4-2)}_{.3}+1 = 1.3$



$y = e^{(x-1)} + 3$

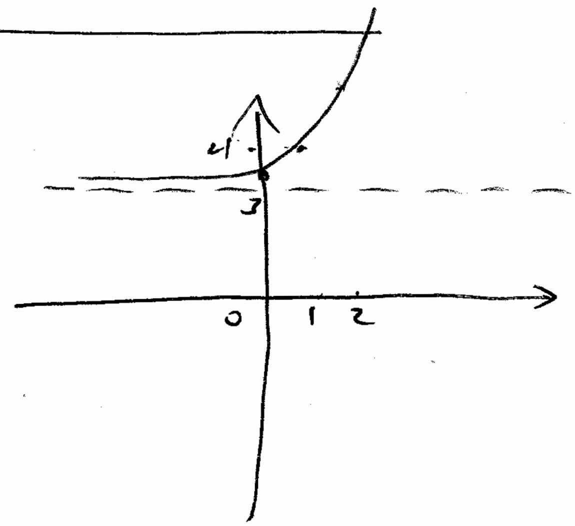
Asymptote : $y = 3$

Domain : $(-\infty, \infty)$

Range : $(3, \infty)$

x	y
0	3.3
1	4
2	5.7

$x - 1 = 0$



#22/ The population of a particular county was 28 million in 1983; in 1990 it was 33 million. The exponential growth function $A = 28e^{kt}$ describes the population of this country t years after 1983. Use the fact that 7 years after 1983 the population increased by 5 million. Find k.

$$A = 28e^{kt}$$

$$33 = 28e^{k(7)}$$ isolate your exponential

$$\frac{33}{28} = e^{7k}$$ ln both sides

$$\ln\frac{33}{28} = \ln e^{7k}$$

$$\ln\frac{33}{28} = 7k$$

$$k = \frac{\ln(33/28)}{7} \approx .023$$ ✓

$$A = \begin{bmatrix} 1 & 0 & 3 \\ -1 & 2 & -2 \\ 0 & -1 & -2 \end{bmatrix} \quad \text{Find } A^{-1}$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 3 & 1 & 0 & 0 \\ -1 & 2 & -2 & 0 & 1 & 0 \\ 0 & -1 & -2 & 0 & 0 & 1 \end{array}\right] R_2 + 1R_1$$

$$\begin{array}{cccccc} -1 & 2 & -2 & 0 & 1 & 0 \\ 1 & 0 & 3 & 1 & 0 & 0 \\ \hline 0 & 2 & 1 & 1 & 1 & 0 \end{array}$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 3 & 1 & 0 & 0 \\ 0 & 2 & 1 & 1 & 1 & 0 \\ 0 & -1 & -2 & 0 & 0 & 1 \end{array}\right] \tfrac{1}{2} R_2$$

$$\begin{array}{cccccc} 0 & \frac{2}{2} & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 0 \end{array}$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 3 & 1 & 0 & 0 \\ 0 & 1 & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & -1 & -2 & 0 & 0 & 1 \end{array}\right] R_3 + R_2$$

$$\begin{array}{cccccc} 0 & -1 & -2 & 0 & 0 & 1 \\ 0 & 1 & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 0 \\ \hline 0 & 0 & -\frac{3}{2} & \frac{1}{2} & \frac{1}{2} & 1 \end{array}$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 3 & 1 & 0 & 0 \\ 0 & 1 & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & -\frac{3}{2} & \frac{1}{2} & \frac{1}{2} & 1 \end{array}\right] -\tfrac{2}{3} R_3$$

$$\begin{array}{ccccc} 0 & 0 & \left(-\frac{3}{2}\right)\left(-\frac{2}{3}\right) & \frac{1}{2}\left(-\frac{2}{3}\right) & \frac{1}{2}\left(-\frac{2}{3}\right) \end{array}$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 3 & 1 & 0 & 0 \\ 0 & 1 & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & 1 & -\frac{1}{3} & -\frac{1}{3} & -\frac{2}{3} \end{array}\right] \begin{array}{l} R_1 - 3R_3 \\ R_2 - \frac{1}{2} R_3 \end{array}$$

$$\begin{array}{cccccc} 1 & 0 & 3 & 1 & 0 & 0 \\ 0 & 0 & -3 & 1 & 1 & 2 \\ \hline \boxed{1} & \boxed{0} & \boxed{0} & \boxed{2} & \boxed{1} & \boxed{2} \end{array} R_1$$

$$\begin{array}{cccccc} 0 & 1 & \frac{1}{2} & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & -\frac{1}{2} & \frac{1}{6} & \frac{1}{6} & \frac{1}{3} \\ \hline 0 & 1 & 0 & \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \end{array}$$

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 2 & 1 & 2 \\ 0 & 1 & 0 & \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ 0 & 0 & 1 & -\frac{1}{3} & -\frac{1}{3} & -\frac{2}{3} \end{array}\right]$$

$$A^{-1} = \begin{bmatrix} 2 & 1 & 2 \\ \frac{2}{3} & \frac{2}{3} & \frac{1}{3} \\ -\frac{1}{3} & -\frac{1}{3} & -\frac{2}{3} \end{bmatrix}$$