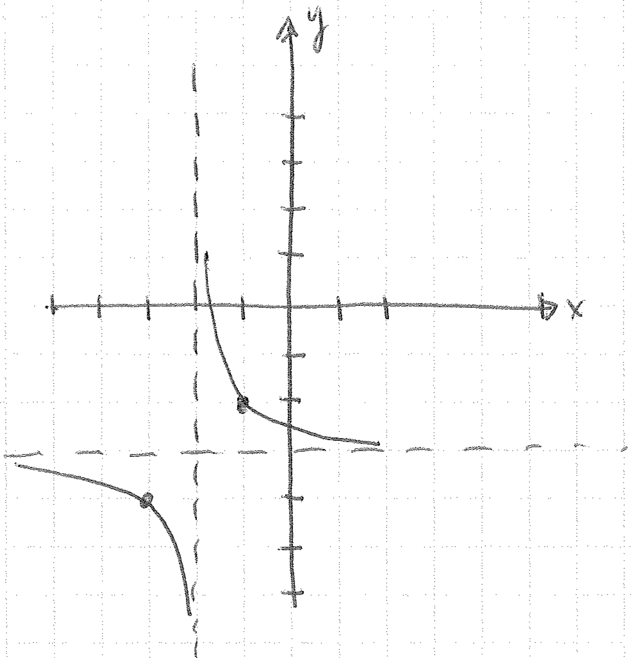
① $f(x) = \frac{1}{x+2} - 3$

parent function: $y = \frac{1}{x}$

Transformation: Left 2, Down 3 ... or $(x,y) \to (x-2, y-3)$

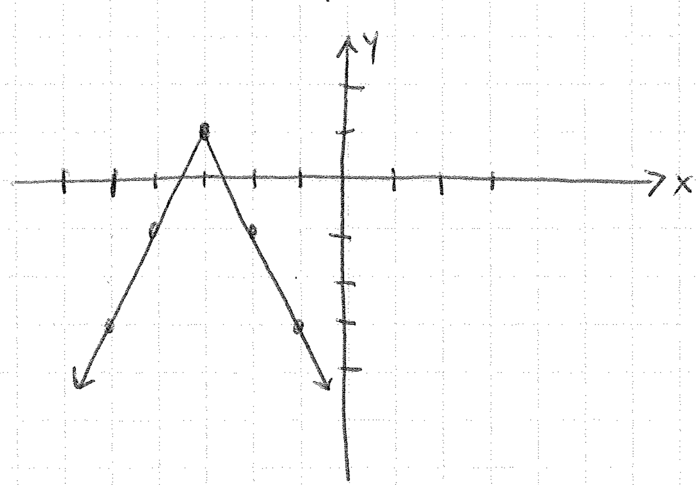


Be sure to graph the VA & HA

② $f(x) = -2|x+3| + 1$

parent function: $y = |x|$

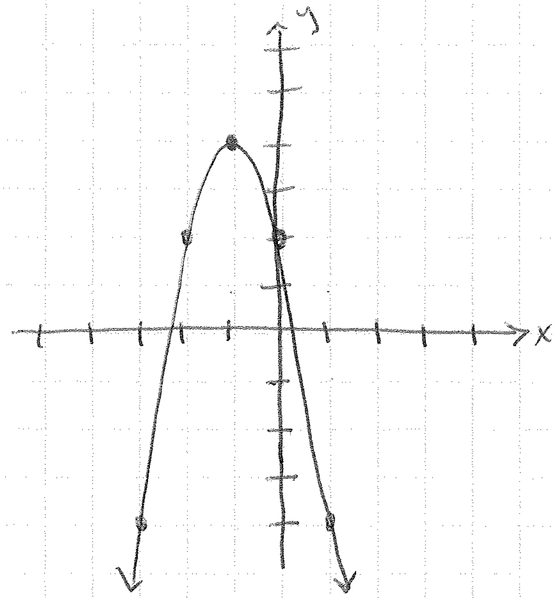
Transformation: Reflect over x-axis
Vertically stretch by a factor of 2
Left 3
Up 1



③ $f(x) = -2(x+1)^2 + 4$

parent function: $y = x^2$

Transformation: Reflect over x-axis
Vertically stretched by a factor of 2
Left 1
Up 4



④ $f(x) = x^2 + 8x + 11$ To use transformation rules, write in vertex form...

vertex: x-value $= -b/2a$

$x = -8/2(1) = -4$

$y = (-4)^2 + 8(-4) + 11$

$y = 16 - 32 + 11$

$y = -5$

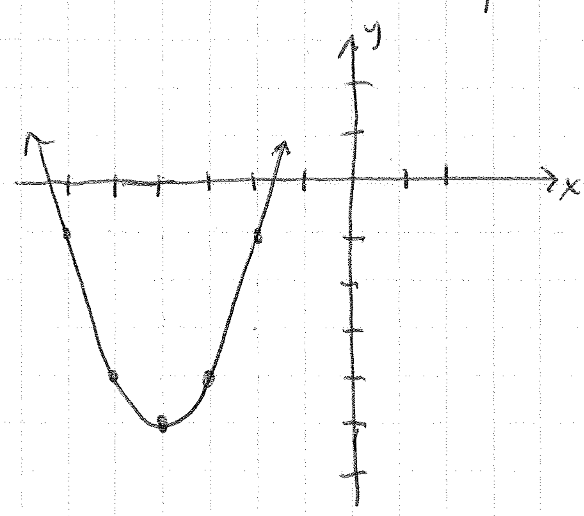
vertex $= (-4, -5)$

vertex form: use same "a" value

$y = (x+4)^2 - 5$

parent function: $y = x^2$

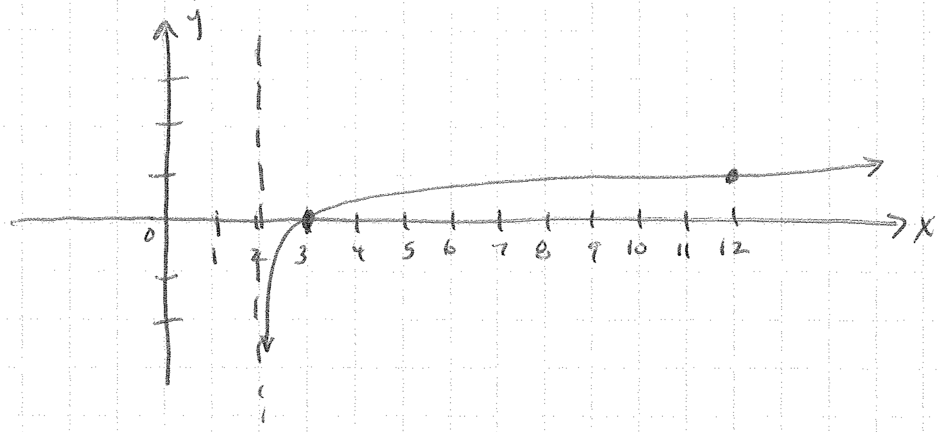
Transformation: Left 4, Down 5



⑤ $f(x) = \log(x-2)$

parent function: $y = \log x$

Transformation: Right 2



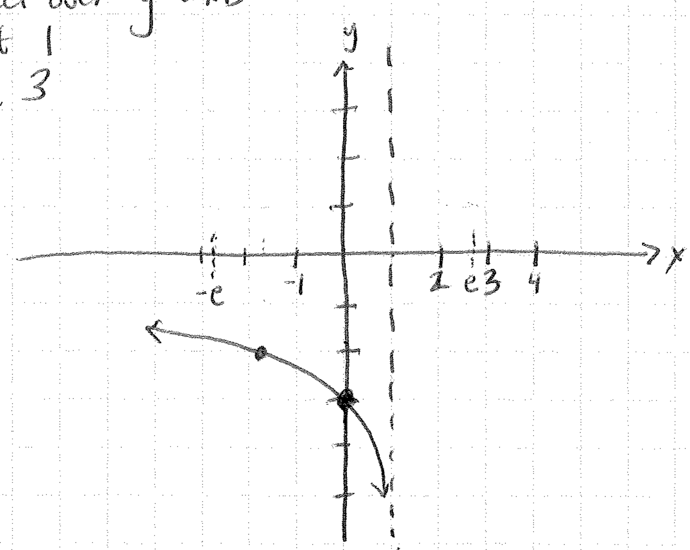
⑥ $f(x) = \ln(1-x) - 3$

Parent function: $y = \ln x$

Transformation: REWRITE $f(x) = \ln(-x+1) - 3$

$f(x) = \ln(-(x-1)) - 3$

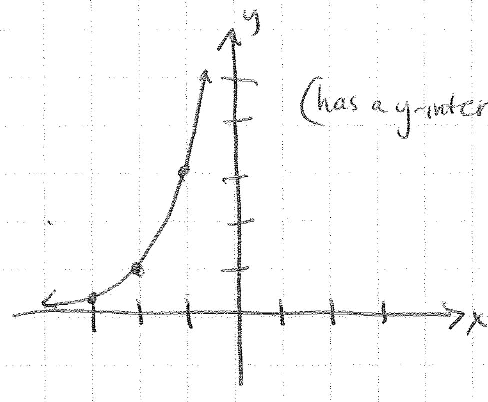
Reflect over y-axis
Right 1
Down 3



(7) $f(x) = 3^{x+2}$

Parent Function: $y = 3^x$

Transformation: Left 2



(has a y-intercept of 9)

⑧ $2(5-2y)-3(1-y) \geq y+1$

$10-4y-3+3y \geq y+1$

$7-y \geq y+1$

$6 \geq 2y$

$$\boxed{\begin{array}{c} 3 \geq y \\ (-\infty, 3] \end{array}}$$

⑨ $\dfrac{x-2}{3} + \dfrac{x+5}{2} = \dfrac{1}{3}$ LCD = 6

$6\left(\dfrac{x-2}{3} + \dfrac{x+5}{2} = \dfrac{1}{3}\right)$

$2(x-2) + 3(x+5) = 2$

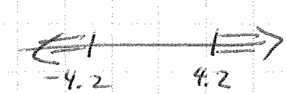
$2x-4+3x+15 = 2$

$5x+11 = 2$

$5x = -9$

$\boxed{x = -9/5}$

⑩ $|2x-5| > 4.2$



$2x-5 < -4.2$ OR $2x-5 > 4.2$

$2x < .8$ $2x > 9.2$

$x < .4$ OR $x > 4.6$

$(-\infty, .4) \cup (4.6, \infty)$

(11) $|-x+4| - 3 \leq 7$

$$|-x+4| \leq 10$$

$$-10 \leq -x+4 \leq 10$$

$$-14 \leq -x \leq 6$$

$$\boxed{14 \geq x \geq -6 \qquad [-6, 14]}$$

(12) $\dfrac{3x}{x+1} + \dfrac{5}{x-2} = \dfrac{15}{x^2-x-2}$

$$\left[\frac{3}{x+1} + \frac{5}{x-2} = \frac{15}{(x-2)(x+1)}\right](x-2)(x+1) \quad LCD = (x-2)(x+1)$$

$$3(x-2) + 5(x+1) = 15$$

$$3x - 6 + 5x + 5 = 15$$

$$8x - 1 = 15$$

$$8x = 16$$

$$\cancel{x = 2}$$

$\hookrightarrow$ EXTRANEOUS!

BUT... $x \neq 2$ since that would make 2 of the original fractions undefined.

$\boxed{\therefore \text{ there are No solutions!}}$

(13) $4x^2 - 7x + 5 = 0$

$$x = \frac{7 \pm \sqrt{49 - 4(4)(5)}}{2(4)}$$

$$x = \frac{7 \pm \sqrt{49 - 80}}{8}$$

$$x = \frac{7 \pm \sqrt{-31}}{8}$$ no real solutions...

$$\underline{x = \frac{7}{8} \pm \frac{\sqrt{31}}{8} i}$$

(14) $-3 \leq 1 - 2x < 7$

$-4 \leq -2x < 6$

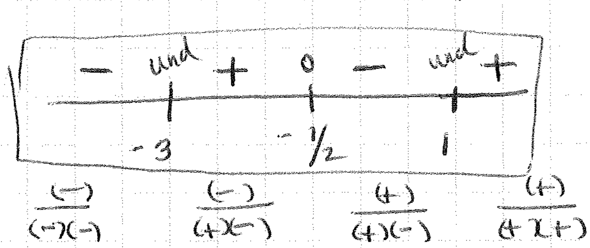
$2 \geq x > -3$

$(-3, 2]$

(15) $\dfrac{2x+1}{(x+3)(x-1)} \leq 0$

$x = -\frac{1}{2}$ makes the numerator $= 0$

$x = -3$ & $x = 1$ make the denominator $= 0$

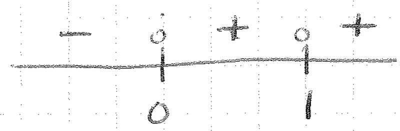


$$\boxed{(-\infty, -3) \cup [-\tfrac{1}{2}, 1)}$$

(16) $x^3 - 2x^2 + x \geq 0$

$x(x^2 - 2x + 1) \geq 0$

$x(x-1)(x-1) \geq 0$



$[0, 1] \cup [1, \infty)$

since 1 is included on both sides a better solution is

$\boxed{[0, \infty)}$

(17) $\dfrac{2}{x+1} - \dfrac{3}{x-5} > 0$

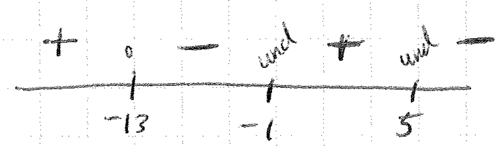
$\dfrac{2(x-5)}{(x+1)(x-5)} - \dfrac{3(x+1)}{(x+1)(x-5)} > 0$

$\dfrac{2x - 10 - 3x - 3}{(x+1)(x-5)} > 0$

$\dfrac{-x-13}{(x+1)(x-5)} > 0$

equation $= 0$ when $x = -13$

equation is undefined when $x = -1$ & $x = 5$



$\boxed{(-\infty, -13) \cup (-1, 5)}$

(18) $$\frac{(uv^{-2})^{-3}}{u^{-5}v^{2}} = \frac{u^{-3}v^{6}}{u^{-5}v^{2}} = \frac{u^{5}v^{6}}{u^{3}v^{2}} = \boxed{u^{2}v^{4}}$$

(19) $$\frac{4a^{3}b}{a^{2}b^{3}} \cdot \frac{3b^{2}}{2a^{2}b^{4}} = \frac{12a^{3}b^{3}}{2a^{4}b^{7}} = \boxed{\frac{6}{ab^{4}}}$$

(20) Given the line $5x - y = 7$, solve for y ...

~~the~~ $-y = 7 - 5x$

$y = -7 + 5x$ ... the slope of this line $= 5$

a) Parallel means same slope ... Slope $= 5$
Point $= (3, -4)$

$y + 4 = 5(x - 3)$

$y + 4 = 5x - 15$

$\boxed{-5x + y + 19 = 0}$

b) Perpendicular means Slope $= -1/5$

$y + 4 = -\frac{1}{5}(x - 3)$

$y + 4 = -\frac{1}{5}x + \frac{3}{5}$

$5\left(y + 4 = -\frac{1}{5}x + \frac{3}{5}\right)$

$5y + 20 = -x + 3$

$\boxed{x + 5y + 17 = 0}$

(21) $f(x) = \sqrt{x^2+3}$

Inside a square must ALWAYS be Positive

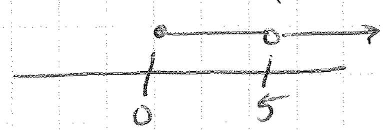
No matter what x you plug in, x^2+3 is ALWAYS positive.

$\therefore$ Domain $= \mathbb{R}$

$(-\infty, \infty)$

(22) $f(x) = \dfrac{\sqrt{x}}{x-5}$

No "0" in the denominator, so $x \neq 5$
No "negatives" inside a $\sqrt{\ }$, so $x \geq 0$



$\boxed{[0, 5) \cup (5, \infty)}$

(23) $f(x) = 3x^3 - 2x$

To prove odd or even, Plug in "$-x$"

$f(-x) = 3(-x)^3 - 2(-x)$
$f(-x) = 3(-x^3) - 2(-x)$
$f(-x) = -3x^3 + 2x$

$f(-x) = -f(x) \therefore f(x)$ is ODD

(24) $f(x) = -2x^4 - 4x + 7$

$f(-x) = -2(-x)^4 - 4(-x) + 7$
$f(-x) = -2x^4 + 4x + 7$

Since $f(-x) \neq f(x)$ & $f(-x) \neq -f(x)$, $f(x)$ is <u>Neither</u>

25 $(f \circ h)(4) = f(h(4))$

$= f(\sqrt{4+5})$

$= f(3)$

$= (3-4)^2$

$= (-1)^2$

$\boxed{= 1}$

26 $g(f(x)) = g((x-4)^2)$

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

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

$= 2x^2-16x+32-3$

$\boxed{= 2x^2-16x+29}$

27 $f + g = (x-4)^2 + (2x-3)$

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

$\boxed{= x^2-6x+13}$

28 $fg = (x-4)^2(2x-3)$

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

$= 2x^3-3x^2-16x^2+24x$
$+32x-48$

$\boxed{= 2x^3-19x^2+56x-48}$

29 $f(x) = x^3+2$

$y = x^3+2$

switch x & y $\Rightarrow$ $x = y^3+2$

$x-2 = y^3$

$\sqrt[3]{x-2} = y$

$\boxed{\sqrt[3]{x-2} = f^{-1}(x)}$

(30) SHOW $f(g(x)) = x$ & $g(f(x)) = x$

$$f(g(x)) = f\left(\frac{x-8}{2}\right) = 2\left(\frac{x-8}{2}\right) + 8$$

$$= x - 8 + 8$$

$$= x$$

$$g(f(x)) = g(2x+8) = \frac{(2x+8) - 8}{2}$$

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

$$= x$$

Do 1 STEP @ A TIME!

(31) $\lim_{x \to \infty} f(x) = -\infty$ $\quad \lim_{x \to -\infty} f(x) = \infty$

(32) $\lim_{x \to \infty} f(x) = \infty$ $\quad \lim_{x \to -\infty} f(x) = \infty$

(33) $f(x) = 3x^2 + 2x - 5$

$f(x) = (3x+5)(x-1) = 0$

when $3x + 5 = 0$ OR $x - 1 = 0$

$3x = -5$

$\boxed{x = -5/3}$ $\quad \boxed{x = 1}$

(34) $f(x) = x^3 - 36x$

$f(x) = x(x^2 - 36) = x(x+6)(x-6) = 0$ when

$\boxed{x = 0 \quad x = -6 \text{ or } x = 6}$

(35) $f(x) = x^3 - x^2 - x - 2$

$x = 2$ is a zero (given)

$$\begin{array}{r|rrrr} 2 & 1 & -1 & -1 & -2 \\ & & 2 & 2 & 2 \\ \hline & 1 & 1 & 1 & 0 \end{array}$$

$$x^2 + x + 1 = 0$$

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

$\boxed{\text{zeros}}$ $\boxed{x = 2, \; x = \frac{-1 \pm \sqrt{3}\, i}{2}}$

$\boxed{\text{FACTORS}}$ $\boxed{(x-2)\underbrace{(x^2 + x + 1)}}$

an irreducible quadratic factor

(36) $f(x) = x^4 + 3x^3 - 3x^2 + 3x - 4$ given $x = 1$ & $x = -4$ are zeros

$$\begin{array}{r|rrrrr} 1 & 1 & 3 & -3 & 3 & -4 \\ & & 1 & 4 & 1 & 4 \\ \hline -4 & 1 & 4 & 1 & 4 & 0 \\ & & -4 & 0 & -4 & \\ \hline & 1 & 0 & 1 & 0 & \end{array}$$

$$x^2 + 1 = 0$$

$$x^2 = -1$$

$$x = \pm i$$

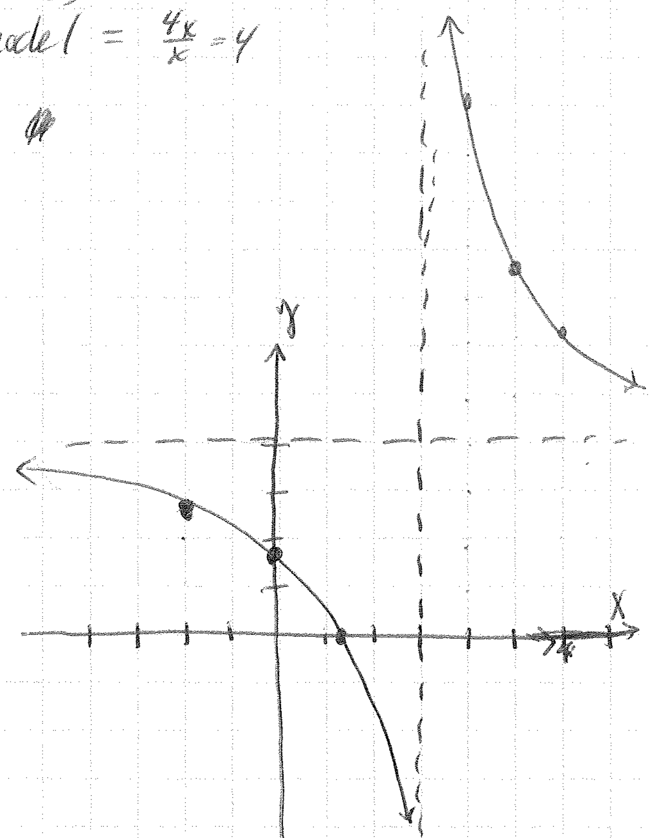
$\boxed{\text{zeros}}$ $\boxed{x = 1, \; x = -4, \; x = \pm i}$

$\boxed{\text{factors}}$

$\boxed{(x-1)(x+4)(x^2+1)}$

(37) $g(x) = \dfrac{4x-5}{x-3}$

a) VA: $x=3$ (makes denominator $=0$)
HA: $y=4$ end behavior model $= \frac{4x}{x} = 4$



b) x-intercept: $0 = 4x-5$

$5 = 4x$

$5/4 = x$

$\boxed{(5/4, 0)}$

y-intercept: $y = \frac{0-5}{0-3} = 5/3$

$(0, 5/3)$

c) Domain: $(-\infty, 3) \cup (3, \infty)$

x	y
-2	13/5
4	11
5	15/2
6	19/3

(38) $g(x) = \dfrac{2x^2}{x^2 - x - 6} = \dfrac{2x^2}{(x-3)(x+2)}$

a) VA: $x = 3$ and $x = -2$

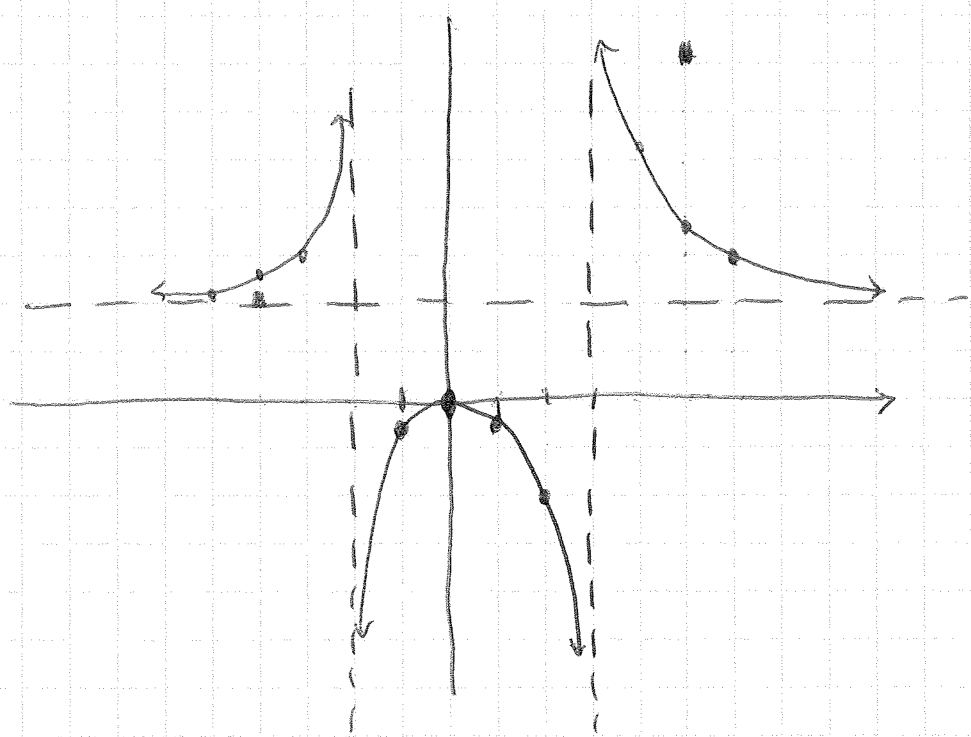
HA: $y = 2$

b) x-int: $0 = 2x^2$

$0 = x$ $\quad (0,0)$

y-int: $(0,0)$ also..

c) Domain: $(-\infty, -2) \cup (-2, 3) \cup (3, \infty)$



x	y	
-1	$-1/2$	$\frac{2}{(-4)(1)}$
2	-2	$8/(-1)(4)$
1	$-1/3$	$\frac{2}{(-2)(3)}$
4	$16/3$	$32/(1)(6)$
5	$25/7$	$\frac{50}{(2)(7)}$
6	3	$\frac{72}{3 \cdot 8}$
-3	3	$18/(-6)(-1)$
-4	$16/7$	$\frac{32}{-7(-2)}$
-5	$25/12$	$\frac{50}{-8(-3)}$

(39) a) $\log_{11} 11^4 = 4$

b) $\log_5 1 = 0$

c) $\ln \frac{1}{e} = \ln e^{-1} = -1$

d) $\log \sqrt[4]{10} = \log 10^{1/4} = 1/4$

e) $\log_9 \frac{1}{27} = x$

$9^x = \frac{1}{27}$

$3^{2x} = 3^{-3}$

$2x = -3$

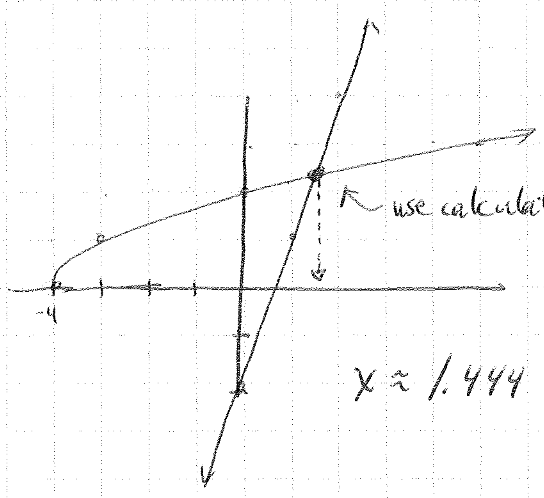
$x = \boxed{-3/2}$

f) $3^{\log_3 7} = 7$

(40) $3x - 2 = \sqrt{x+4}$

$Y_1 = 3x - 2$

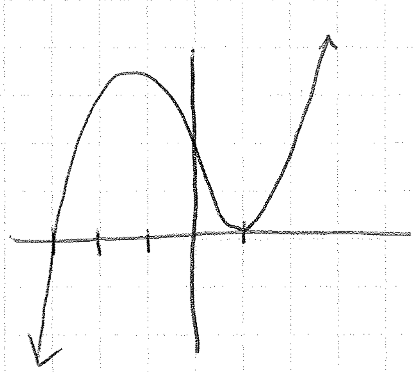
$Y_2 = \sqrt{x+4}$



use calculator ... (calc) (intersection)

$x \approx 1.444$

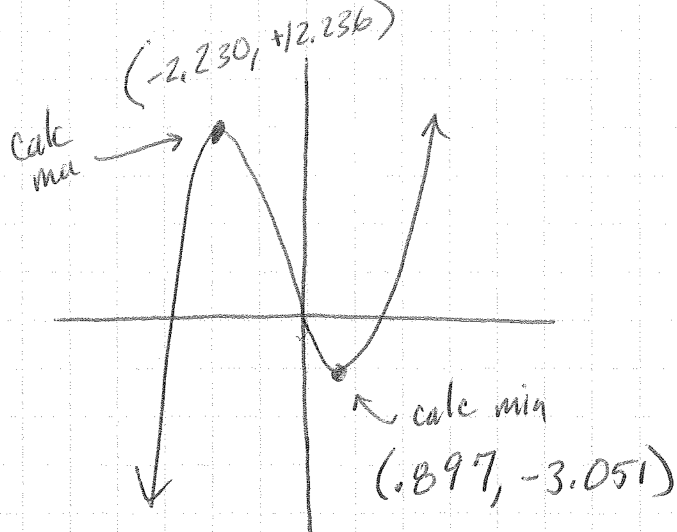
(41) $0 = x^3 + x^2 - 5x + 3$



calc zeros...

$$\boxed{\begin{array}{l} x = 1 \\ x = -3 \end{array}}$$

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



a) Local max = 12.236
Local min = -3.051

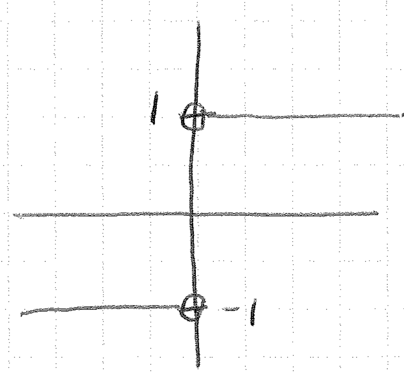
b) Increasing on

$(-\infty, -2.230) \cup (.897, \infty)$

decreasing on

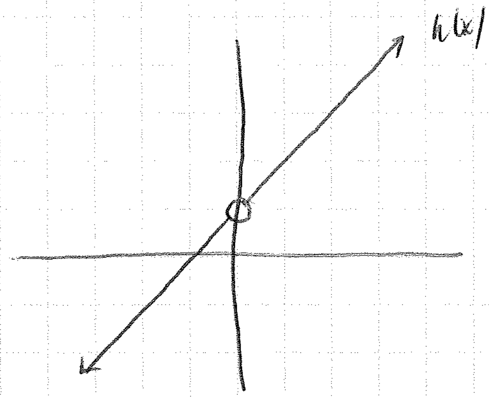
$(-2.230, .897)$

(43) $f(x) = \frac{|x|}{x}$



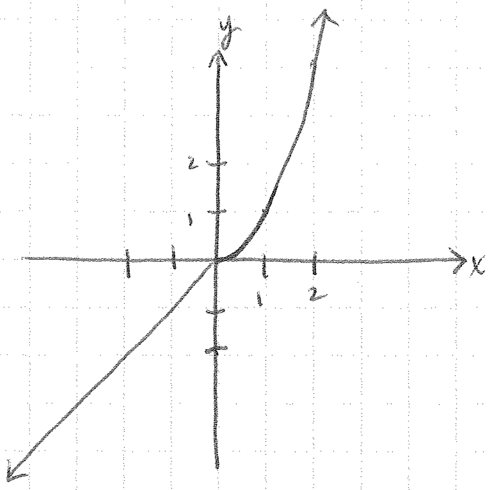
$\boxed{\text{non removable discontinuity at } x=0}$

(44) $h(x) = \frac{x^2+x}{x} = \frac{x(x+1)}{x} = x+1$ But with a hole when $x=0$ $(0,1)$



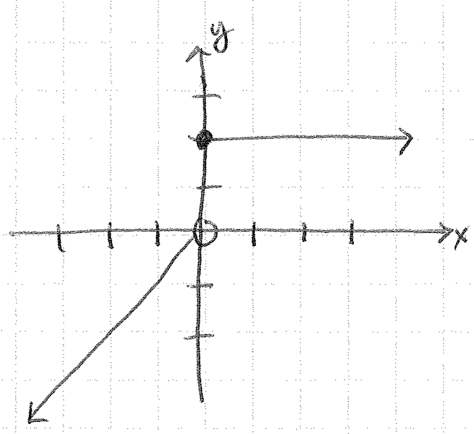
$\boxed{\text{Removable Discontinuity at } x=0}$

(45) $f(x) = \begin{cases} x & \text{if } x \le 0 \\ x^2 & \text{if } x > 0 \end{cases}$



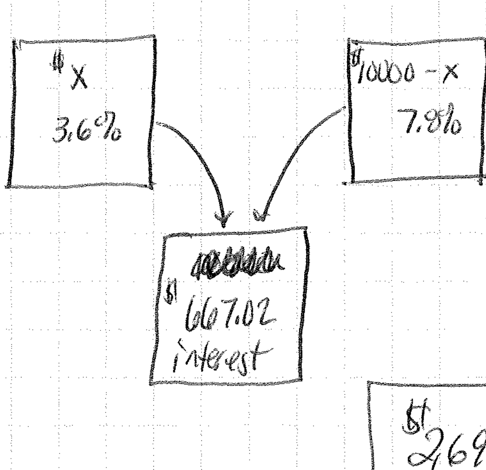
$\boxed{\text{Continuous at } x=0}$

(46) $f(x) = \begin{cases} -|x| & \text{if } x < 0 \\ 2 & \text{if } x \ge 0 \end{cases}$



$\boxed{\text{Not continuous at } x=0}$

(47)



$.036x + .078(10000 - x) = 667.02$

$.036x + 780 - .078x = 667.02$

$-.042x = -112.98$

$x = 2690$

$\boxed{\begin{array}{l} \$2690 \ @\ 3.6\% \\ \$7,310 \ @\ 7.8\% \end{array}}$

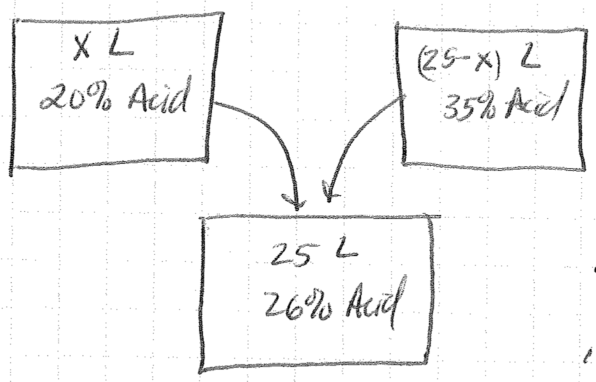
(48) x = Salary before ~~increase~~ decrease

"a 3.5% pay decrease means he ~~[illegible]~~ now gets 96.5% of his salary before"

$$.965x = 27985$$

$$\boxed{x = \$29000}$$

(49)



$$.2x + .35(25-x) = .26(25)$$

$$.2x + 8.75 - .35x = 6.5$$

$$-.15x = -2.25$$

$$x = 15$$

$\boxed{\text{15 L of 20\% Acid mixed with 10 L of 35\% Acid}}$

(50) $f(-3) = -2$ Points $(-3,-2)$ & $(4,-8)$

$f(4) = -8$

$$m = \frac{-2+8}{-3-4} = \frac{6}{-7}$$

$$y + 2 = -\frac{6}{7}(x+3)$$

$$7 \cdot \left(y + 2 = -\frac{6}{7}x - \frac{18}{7} \right)$$

$$7y + 14 = -6x - 18$$

$$\boxed{6x + 7y + 32 = 0}$$

(51) R = Resistance
L = Length
D = diameter of wire

$$R = \frac{k \cdot L}{D^2}$$

if $L = 50$, $D = 3$, & $R = 8$

$$8 = \frac{k \cdot 50}{3^2}$$

$$72 = 50k$$

$$1.44 = k$$

$$R = \frac{1.44L}{D^2}$$ if $L = 40$ & $D = 4$, find R

$$R = \frac{1.44(40)}{4^2} = \boxed{3.6}$$

(52) a) $\boxed{y = 231.2039179\, x^{-.2968764553}}$

b) "Put in Y_1" $Y_1(12) = \boxed{110.5634766}$

(53)

$$\begin{array}{r} 3x^2 - 4x + 2 \\ 2x+1 \overline{)\, 6x^3 - 5x^2 + 0x + 9} \\ -(6x^3 + 3x^2) \\ \hline -8x^2 + 0x \\ -(-8x^2 - 4x) \\ \hline 4x + 9 \\ -(4x + 2) \\ \hline 7 \end{array}$$

$$\boxed{\frac{6x^3 - 5x^2 + 9}{2x+1} = 3x^2 - 4x + 2 + \frac{7}{2x+1}}$$

or

$$\boxed{(2x+1)(3x^2 - 4x + 2) + 7 = 6x^3 - 5x^2 + 9}$$

$(2x+1)$ Not a factor of $6x^3 - 5x^2 + 9$ since remainder $\neq 0$.

(54)

5	1	−4	−7	10
		5	5	−10
	1	1	−2	$\boxed{0}$

← since remainder = 0

$(x-5)$ <u>is</u> a factor of

$x^3-4x^2-7x+10$

$$\boxed{\frac{x^3-4x^2-7x+10}{x-5} = x^2+x-2}$$

or

$$\boxed{x^3-4x^2-7x+10 = (x^2+x-2)(x-5)}$$

(55) if $x = 1/3$ is a zero, & leading coefficient is not given, use the following factors

$$y = (3x-1)(x+2)(x-5)$$

$$y = (3x^2+6x-x-2)(x-5)$$

$$y = (3x^2+5x-2)(x-5)$$

$$y = 3x^3-15x^2+5x^2-25x-2x+10$$

$$\boxed{y = 3x^3-10x^2-27x+10}$$

56
a Since $x=2-i$ is a zero, so is $x=2+i$

$(x+1)(x-(2-i))(x-(2+i))$

$(x+1)(x-2+i)(x-2-i)$

$(x+1)((x-2)+i)((x-2)-i)$

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

$(x+1)(x^2-4x+4+1)$

$(x+1)(x^2-4x+5)$

$x^3-4x^2+5x+x^2-4x+5$

$\boxed{x^3-3x^2+x+5}$

b since $4i$ is a zero so is $-4i$

$(x-3)(x+4i)(x-4i)$

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

$x^3+16x-3x^2-48$

$\boxed{x^3-3x^2+16x-48}$

57 $\dfrac{(2+4i)}{(3-2i)} \cdot \dfrac{(3+2i)}{(3+2i)} = \dfrac{6+4i+12i+\cancel{8i^2}^{-8}}{9+4}$

$= \dfrac{-2+16i}{13} = \boxed{-\dfrac{2}{13}+\dfrac{16}{13}i}$

58

$200 = 100\left(1+\frac{.035}{12}\right)^{12t}$

t = years

$2 = (1.002916667)^{12t}$

$\log_{1.002916667}(2) = 12t$

$\dfrac{\log 2}{\log(1.002916667)} = 12t$

$19.833 \approx t$

≈ 19.833 years

OR

$200 = 100\left(1+\frac{.035}{12}\right)^{x}$

x = # of months

$2 = (1.002916667)^{x}$

$x \approx 237.9968401$

months

$\boxed{\text{GRAPHICALLY}}$

Graph $Y_1 = 200$

$Y_2 = 100\left(1+\frac{.035}{12}\right)^{12x}$

Solve for intersection

59. $y = 50(.97)^x$

$25 = 50(.97)^x$

$.5 = (.97)^x$

$\log_{.97}(.5) = x$

$\dfrac{\log(.5)}{\log(.97)} = x$

$22.75657306 = x$

$\boxed{\approx 22.757 \text{ days}}$

60. a) $3000\left(1 + \frac{.065}{52}\right)^{52 \cdot 3} \approx \$3{,}645.49$

b) $3000e^{(.065)(3)} \approx \$3645.93$

61. a) $\log_3 a^2 + \log_3 b = 2\log_3 a + \log_3 b$

b) $\log_3 \frac{a^{1/2}}{bc} = \log_3 a^{1/2} - \log_3(bc)$

$= \frac{1}{2}\log_3 a - (\log_3 b + \log_3 c)$

$\boxed{= \frac{1}{2}\log_3 a - \log_3 b - \log_3 c}$

62 a) $2\log r - \log q + 3\log w = \log r^2 - \log q + \log w^2$

$= \boxed{\log\left(\frac{r^2 w^2}{q}\right)}$

b) $\frac{1}{3}\log 27 - 2\log 4 = \log 27^{1/3} - \log 4^2 = \boxed{\log\left(\frac{3}{16}\right)}$

63. $2(5)^x = 26$

$5^x = 13$

$\log_5 13 = x$

$\frac{\log 13}{\log 5} = x$

$1.593692641 = x$

$\boxed{x \approx 1.594}$

64. $\log x = -2$

$10^{-2} = x$

$\boxed{\frac{1}{100} = x}$

65. $2e^x = 3.4$

$e^x = 1.7$

$\ln(1.7) = x$

$.5306282511 = x$

$\boxed{x \approx .531}$

66. $\log_3(2-3x) + 5 = 9$

$\log_3(2-3x) = 4$

$3^4 = 2-3x$

$81 = 2-3x$

$79 = -3x$

$\boxed{-\frac{79}{3} = x}$

67. $\log(x^2+21x) = 2$

$10^2 = x^2+21x$

$0 = x^2+21x-100$

$0 = (x-4)(x+25)$

$\boxed{x = 4 \text{ or } x = -25}$

68. $\log_2(x-1) - \log_2(2x+3) = 3$

$\log_2\left(\frac{x-1}{2x+3}\right) = 3$

$2^3 = \frac{x-1}{2x+3}$

$8 = \frac{x-1}{2x+3}$

$8(2x+3) = x-1$

$16x+24 = x-1$

$15x = -25$

$x = -25/15 = -5/3$

BUT... $x \neq -5/3$ since it makes the inside of $\log_2(x-1) < 0$ $\boxed{\text{NO SOLUTION}}$