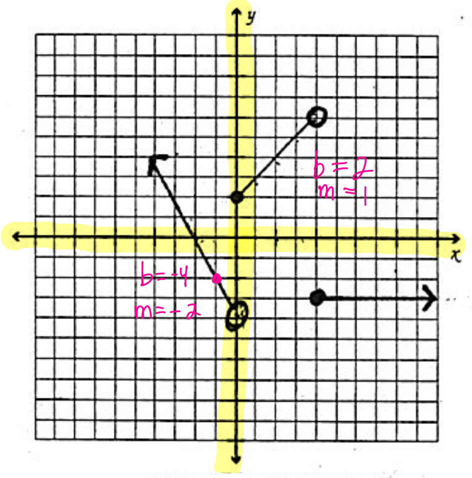
Do Now:

1[illegible]. Write a piecewise function for the graph



$$f(x)=\begin{cases} -2x-4 & \text{if} \quad x<0 \\ x+2 & \text{if} \quad 0\le x<4 \\ -3 & \text{if} \quad x\ge 4 \end{cases}$$

Midterm Review Packet #s 18–29

⑱
$$\begin{array}{rl} & \quad x^2 - 7 \\ x^2+2 & \overline{)\, x^4 + 0x^3 - 5x^2 + 6x - 7} \\ & \underline{-x^4 \qquad\quad \mp 2x^2} \\ & \qquad\qquad -7x^2 + 6x - 7 \\ & \qquad\qquad \underline{\overset{+}{-}7x^2 \qquad \pm 14} \\ & \qquad\qquad\qquad 6x + 7 \end{array}$$
remainder

⑲
$$\begin{array}{r|rrrrr} 3 & 1 & 0 & 0 & -5 & 10 \\ & & 3 & 9 & 27 & 66 \\ \hline & 1 & 3 & 9 & 22 & 76 \end{array}$$

$x^3 + 3x^2 + 9x + 22 + \frac{76}{x-3}$

⑳
$$\begin{array}{r|rrrr} 3 & 1 & 0 & -7 & -6 \\ & & 3 & 9 & 6 \\ \hline & 1 & 3 & 2 & 0 \end{array}$$

$\therefore$ $(x-3)$ is a factor

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

$(x-3)\boxed{(x+2)(x+1)}$ other two factors

㉑ $f(2) = 2^3 - 13(2)^2 + 23(2) - 11 = 8 - 52 + 46 - 11 = -9$

Since $f(2) \neq 0$
$(x-2)$ is not a factor
of $f(x)$

㉒ $f(x) = -3x^2 + 5x + 4x^3 - 6$

$f(x) = 4x^3 - 3x^2 + 5x - 6$

possible rational zeros : $\frac{\pm1, \pm2, \pm3, \pm6}{\pm1, \pm2, \pm4}$

$= \pm1, \pm2, \pm3, \pm6, \pm\frac{1}{2}, \pm\frac{3}{2}, \pm\frac{1}{4}, \pm\frac{3}{4}$

㉓ $f(x) = x^3 - 13x - 12$ poss rational zeros : $\frac{\pm1, \pm2, \pm3, \pm4, \pm12}{\pm1} = \pm1, \pm2, \pm3, \pm4, \pm12$

$f(-1) = (-1)^3 - 13(-1) - 12 = -1 + 13 - 12 = 0$

$$\begin{array}{r|rrrr} -1 & 1 & 0 & -13 & -12 \\ & & -1 & 1 & 12 \\ \hline & 1 & -1 & -12 & 0 \end{array}$$

$(x^2 - x - 12)(x+1)$

$(x-4)(x+3)(x+1)$ complete factorization

㉔ $f(x) = x^3 - 13x - 12$

We found the complete factorization in ㉓, we set that $= 0$ and solve

$(x-4)(x+3)(x+1) = 0$

$x = 4$ | $x = -3$ | $x = -1$ roots are $\{-3, -1, 4\}$

㉕ 16

㉖ $x - 5$

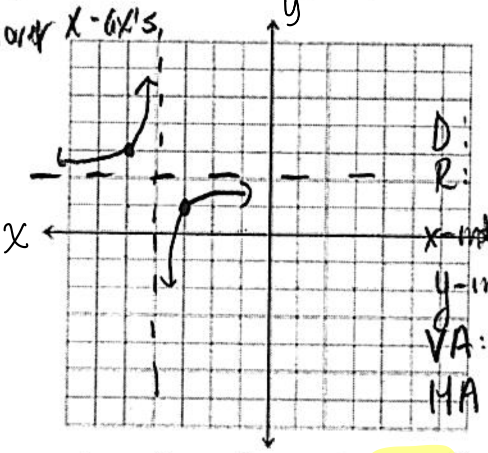
⑧

27. Graph the following using a minimum of 2 points. For each graph, state the domain, range, intercepts, and the equations of any asymptotes.

a. $y=-\frac{1}{(x+4)}+2$

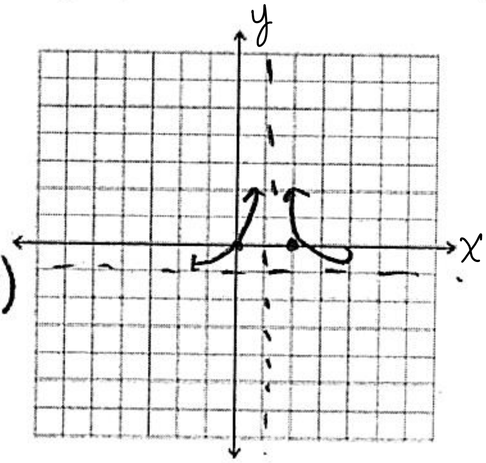
b. $y=\frac{1}{(x-1)^2}-1$

left 4
reflect over x-axis,
↑ 2



D: $x \neq -4$
R: $y \neq 2$
x-int $(-7/2, 0)$
y-int $(0, 1^3/4)$
VA: $x=-4$
HA $y=2$

$(1,1) \rightarrow (-3,1) \rightarrow (-3,-1)$, $(-3,1)$
$(-1,-1) \rightarrow (-5,-1) \rightarrow (-5,1)$, $(-5,3)$



right 1 ↓1

$(1,1) \rightarrow (2,1) \rightarrow (2,0)$
$(-1,1) \rightarrow (0,1) \rightarrow (0,0)$

D: $x \neq 1$
R: $y > -1$
x-int $(0,0)$, $(2,0)$
y-int $(0,0)$
VA $x=1$
HA $y=-1$

28. Fill in the chart:

Reduced	Function	Hole(s)	Vertical Asymptote(s)	Horizontal Asymptote	Oblique Asymptote	x-intercept(s)	y-intercept
$y=\frac{-1}{x+5}$	$y=\frac{\cancel{5-x}}{x^2-25}$ $(\cancel{x-5})(x+5)$	$(5, -\frac{1}{10})$	$x=-5$	$y=0$	none	none	$(0, -\frac{1}{5})$
$y=\frac{2x^3}{x^2+1}$	$y=\frac{2x^{\cancel{4}3}}{x^3+x}$ $\cancel{x}(x^2+1)$	$(0,0)$	none	none	$y=2x$	none	none

x and y intercept would be a (0,0) but there is a hole there

* x-int for 27a

$0=-\frac{1}{(x+4)}+2$

$-2=\frac{-1}{(x+4)}$

$2=\frac{1}{x+4}$

$2x+8=1$

$2x=-7$

$x=-7/2$ or -3.5

㉘

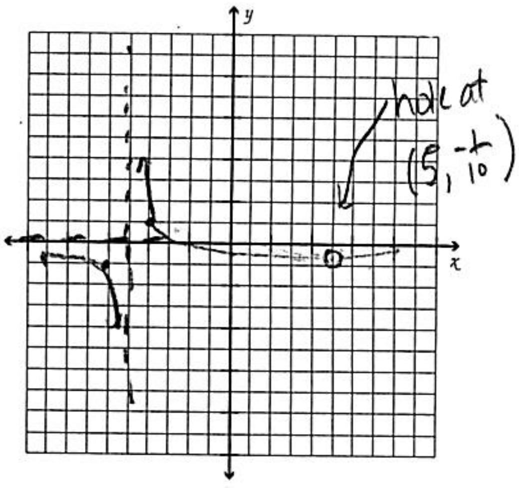
$y=\frac{-1}{x+5}$

left 5

reflect over x

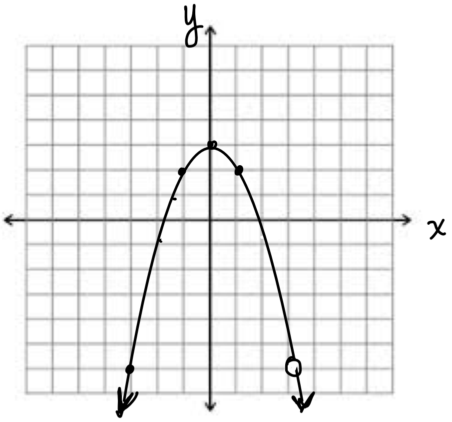
y-intercept

$y=\frac{-1}{0+5}=\frac{-1}{5}$



29. Graph the following using a minimum of 2 points. For each graph, state the domain, range, coordinates of any holes or intercepts, and the equations of any asymptotes.

a. $y = \dfrac{x^3 - 3x^2 - 3x + 9}{3 - x}$ b. $y = \dfrac{x+1}{x^2 + 4x + 3}$



$$y = \frac{x^2(x-3) - 3(x-3)}{3-x}$$

$$y = \frac{(x^2-3)\overset{-1}{\cancel{(x-3)}}}{\cancel{3-x}}$$

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

$$y = -x^2+3$$

x^2 reflected over x-axis ↑3

(-1, 1)	(-1, -1)	(-1, 2)
(0, 0)	(0, 0)	(0, 3)
(1, 1)	(1, -1)	(1, 2)

hole @ (3, -6)

VA: none

HA: none

OA: none

D: $\{x \mid x \neq 3\}$

R: $\{y \mid y \leq 3\}$

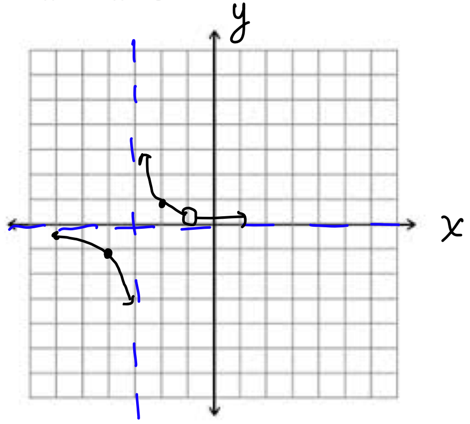
$0 = -x^2+3$

$x^2 = 3$

$x = \pm\sqrt{3}$

x-int: $(\pm\sqrt{3}, 0)$

y-int: (0, 3)



$$y = \frac{\cancel{x+1}}{\cancel{(x+1)}(x+3)}$$

RF: $y = \dfrac{1}{x+3}$

hyperbola left 3

(-1, -1)	(-4, -1)
(1, 1)	(-2, 1)

hole: $(-1, \frac{1}{2})$

VA: $x = -3$

HA: $y = 0$

OA: none

D: $\{x \mid x \neq -3, -1\}$

R: $\{y \mid y \neq 0, \frac{1}{2}\}$

x-int: none

y-int: $(0, \frac{1}{3})$