

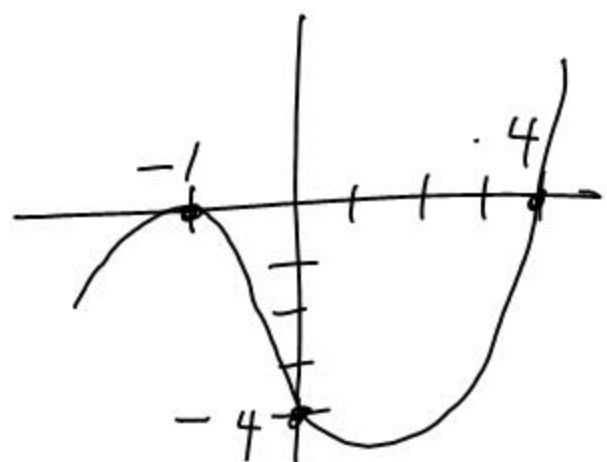
Sketch  $y = x^3 - 2x^2 - 7x - 4$

$$\begin{array}{r} \downarrow \quad 1 \quad -2 \quad -7 \quad -4 \\ \quad \quad \quad 1 \quad -1 \\ \hline 1 \quad -1 \quad -8 \end{array}$$

$$\begin{array}{r} \downarrow \quad 1 \quad -2 \quad -7 \quad -4 \\ \quad \quad \quad -1 \quad 3 \quad 4 \\ \hline 1 \quad -3 \quad -4 \quad \underline{0} \end{array}$$

$$(x+1)(x^2 - 3x - 4)$$

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



#2

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

$$a(0+1)(0-2)^2 = 2$$

$$a = +\frac{1}{2}$$

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

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

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

$$x^2 - 4x + 4$$

$$\frac{1}{2}(x^3 - 3x^2 + 4)$$

# Graphing Rational Functions

Rational function =  $\frac{\text{polynomial}}{\text{polynomial}}$

Ex.  $y = \frac{x+1}{x-2}$

(1) vertical asymptote(s)  $x=2$   
what makes the denominator zero?

(2) Horizontal asymptote  $y=1$   
What happens when  $x$  is really large?

(3) x-intercept(s)  $-1$   
put in 0 for  $y$ . solve for  $x$ .

(4) y-intercept  $-\frac{1}{2}$   
put in 0 for  $x$ .

solve for  $y$

$$y = \frac{0+1}{0-2} = -\frac{1}{2}$$

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

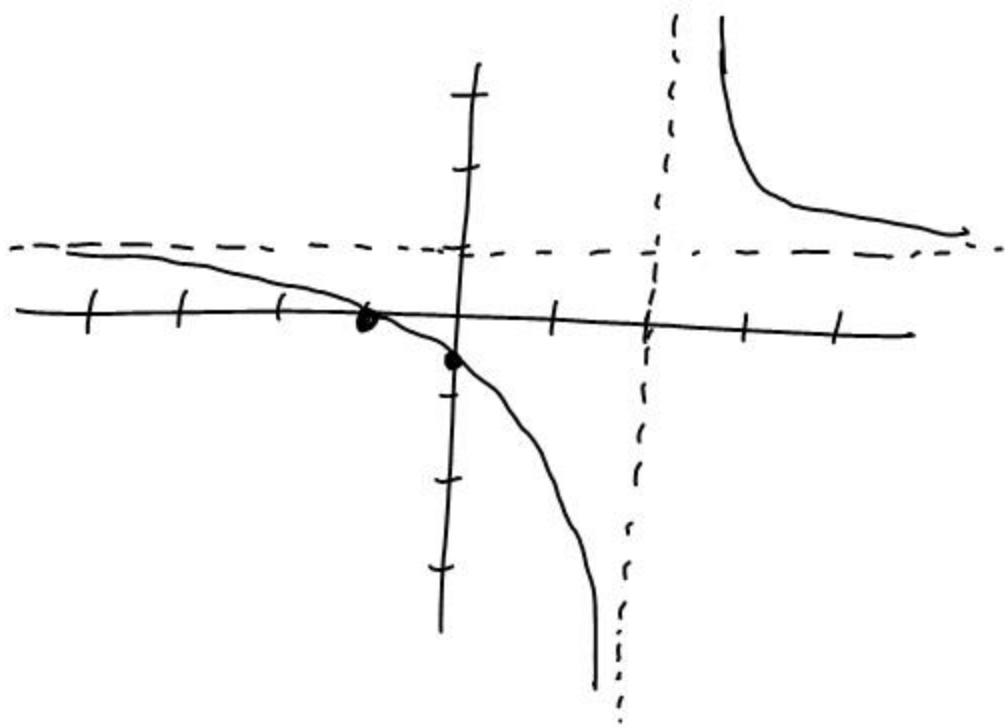
$$0 = x+1$$

$$-1 = x$$

$$\frac{1003}{1000} = 1.003$$

$$\frac{1,000,003}{1,000,000} = 1.000003$$

$$y = \frac{x+1}{x-2}$$



Ex.  $y = \frac{x+2}{x^2-1}$

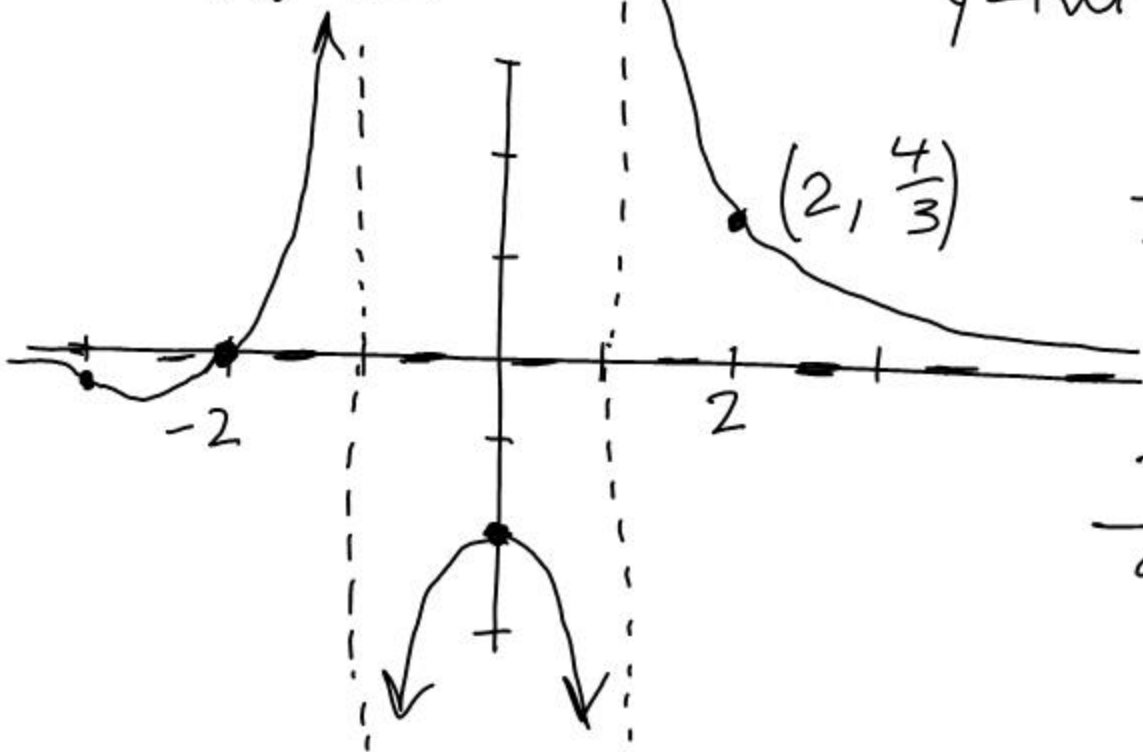
VA  $\frac{x = \pm 1}{}$

HA  $\frac{y = 0}{}$

x-int  $\frac{-2}{}$

y-int  $\frac{-2}{}$

bigger power  
on the bottom



$$\frac{2+2}{2^2-1} = \frac{4}{3}$$

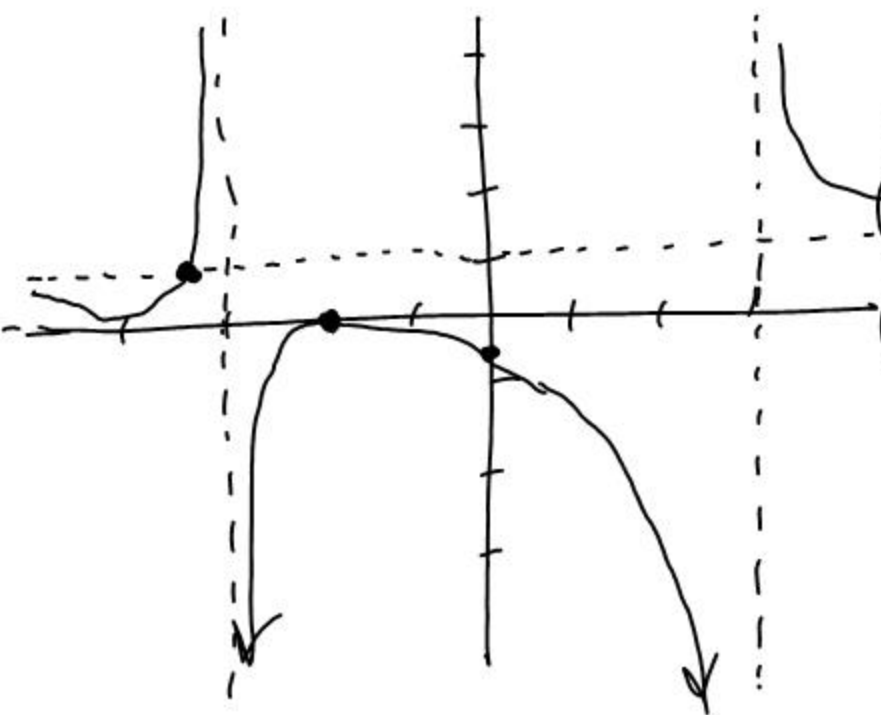
$$\frac{-3+2}{9-1} = -\frac{1}{8}$$

Ex.  $y = \frac{1x^2 + 4x + 4}{1x^2 - 9}$       VA  $\frac{x = \pm 3}{y = 1}$

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

x-int  $\frac{-2}{-2}$

y-int  $\frac{-\frac{4}{9}}$



When the top + bottom powers are equal, the HA is the ratio of leading coefficients

Does the graph cross its H.A.?

$$\frac{x^2 + 4x + 4}{x^2 - 9} = 1 \quad \leftarrow \text{H.A.}$$

$$\cancel{x^2} + 4x + 4 = \cancel{x^2} - 9$$

$$4x = -13$$

The graph crosses the HA here  $\rightarrow x = \frac{-13}{4}$

# Classwork, Sketch

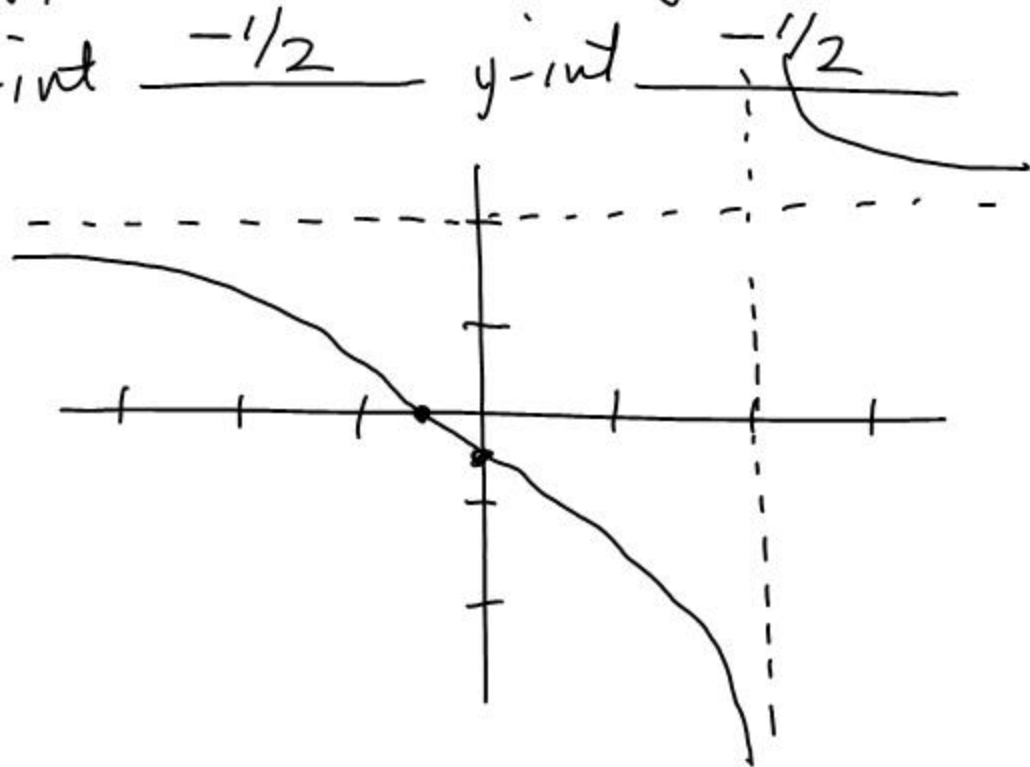
$$\textcircled{1} y = \frac{2x+1}{x-2}$$

$$\textcircled{2} y = \frac{x+1}{x^2-4}$$

$$\textcircled{3} y = \frac{x^2-9}{x^2-25}$$

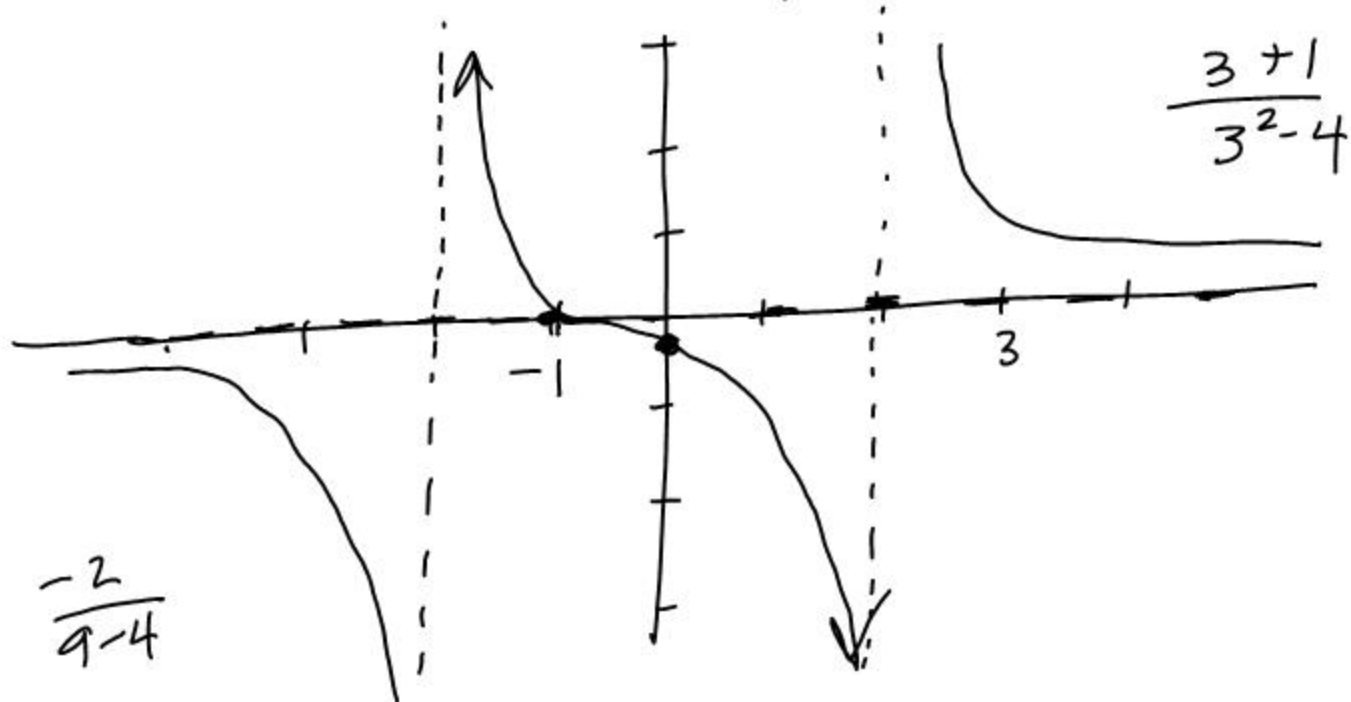
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$$\textcircled{1} \text{ VA } \underline{x=2} \quad \text{HA } \underline{y=2}$$
$$x\text{-int } \underline{-1/2} \quad y\text{-int } \underline{-1/2}$$



(2) VA  $\frac{x = \pm 2}{x\text{-int } -1}$

HA  $\frac{y = 0}{y\text{-int } -1/4}$



HW see website  
# 1-6