Monday 2/3/2020

1. Grab Notes, Calc.
2. Begin warm-up
3. Rational Graph Notes (VA,X-Int & Holes)
4. Partner Swap, Practice

S.W.B.A.T. find the horizontal asymptote and y-intercept of a rational function...

I.O.T. accurately graph a rational function.

**Topic:** Rational Graphs – HA, Y-INT **Name:** ________________

**What am I learning today?** **Date:** ________________

________________________________________________

________________________________________________

## Warm-Up

m | a
-18 | -11
-9, -2

$= \frac{x-9}{x+4}$ $\frac{-7}{6}$

*Find the following characteristics.*

1. $\frac{x^2-11x+18}{x^2+2x-8} = \frac{(x-9)\cancel{(x-2)}}{(x+4)\cancel{(x-2)}}$

| Hole(s) | VA | X-Int |
|---|---|---|
| $x-2=0$<br>$x=2$<br>$\boxed{(2,-\frac{7}{6})}$ | $x+4=0$<br>$\boxed{x=-4}$ | $x-9=0$<br>$x=9$<br>$\boxed{(9,0)}$ |

2. $\frac{x^2+4x}{x^2+10x+24} = \frac{x\cancel{(x+4)}}{(x+6)\cancel{(x+4)}}$

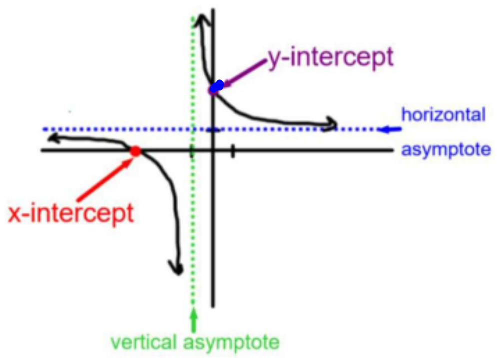
| Hole(s) | VA | X-Int |
|---|---|---|
| $x+4=0$<br>$x=-4$<br>$\boxed{(-4,-2)}$ | $x+6=0$<br>$\boxed{x=-6}$ | $x=0$<br>$\boxed{(0,0)}$ |

## Characteristics of a Rational Graph

Horizontal Asymptote

Y-Intercepts

Rational Functions and Asymptotes




**Horizontal Asymptote**
A horizontal line that the graph approaches but does not cross.

**Y-intercept**
A point where the graph crosses the y-axis.

## Horizontal Asymptote

To find the horizontal asymptote:
1. Find the horizontal asymptote BEFORE Factor.
2. State the degree of the NUMERATOR and the DENOMINATOR.
3. The horizontal asymptote will be determined by the following scenarios:

If the degree...

a) Numerator is LARGER than the denominator Numerator Greater
num. > Den. H.A. = NONE

b) Numerator is SMALLER than the denominator
num. < Den. H.A.: $y = 0$

c) Numerator is EQUAL to the denominator
num. = den. H.A.: $y = \frac{\textit{leading coefficient of the numerator}}{\textit{leading coefficient of denominator}}$ $\boxed{y=4}$

Example: $f(x) = \frac{x^3+1}{4x^2}$
degree of num. = 3
den. = 2
$\boxed{H.A. = none}$ 3 > 2

Example: $f(x) = \frac{2x^2}{x^5}$
num. = 2
den. = 5
2 < 5 $\boxed{H.A.: y=0}$

Example: $f(x) = \frac{4x+3}{x-1}$
num. = 1 1=1
den. = 1
$y = \frac{4}{1} = 4$

**Topic:** Rational Graphs – HA, Y-INT **Date:** ________________

## Y-INTERCEPT

To find the y-intercept:

1. Substitute zero in for x in the original function and simplify.
2. Write your y-intercept as a coordinate.
3. When graphing, plot the y-intercept(s) on the y - axis.

Example: $f(x) = \frac{x^2 - 11x + 18}{x^2 + 2x - 8} = \frac{0^2 - 11(0) + 18}{0^2 + 2(0) - 8} = \frac{18}{-8} = -\frac{9}{4}$

$\boxed{(0, -\frac{9}{4})}$

## You Try

For each example, find the horizontal asymptote and the y-intercept.

1. $f(x) = \frac{3x^2-5x-14}{x^2+7x+10} = \frac{3(0)^2-5(0)-14}{0^2+7(0)+10}$

| H.A. | Y-INT |
|---|---|
| num.=2<br>den.=2<br>2=2<br>$y=\frac{3}{1}=3$<br>$\boxed{y=3}$ | $\frac{-14}{10} = -\frac{7}{5}$<br>$(0, -\frac{7}{5})$ |

2. $f(x) = \frac{x-5}{2} = \frac{0-5}{2} = -\frac{5}{2}$

| H.A. | Y-INT |
|---|---|
| num.=1<br>den.=0<br>1>0<br>$\boxed{\text{H.A: none}}$ | $\boxed{(0, -\frac{5}{2})}$ |

3. $f(x) = \frac{x-1}{x^2+3x-10}$

| H.A. | Y-INT |
|---|---|
| num.=1<br>den.=2<br>1<2<br>$\boxed{\text{H.A: } y=0}$ | $\frac{0-1}{0^2+3(0)-10} = \frac{-1}{-10}$<br>$\boxed{(0, \frac{1}{10})}$ |

4. $f(x) = \frac{x^2+x-2}{x^2-x-6}$

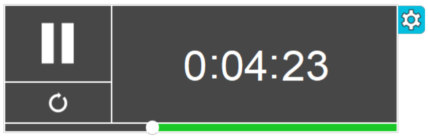
| H.A. | Y-INT |
|---|---|
| num.=2<br>den.=2<br>2=2<br>$y=\frac{1}{1}=1$<br>$\boxed{y=1}$ | $\frac{0^2+0-2}{0^2-0-6} = \frac{-2}{-6} =$<br>$\boxed{(0, \frac{1}{3})}$ |

EX) Find all of the following characteristics

$f(x) = \frac{2x^2 - 32}{x^2 + 6x + 8} = \frac{2(x^2-16)}{(x+4)(x+2)} = \frac{2(x-4)\cancel{(x+4)}}{\cancel{(x+4)}(x+2)} = \frac{2(x-4)}{(x+2)}$

| H.A. | HOLES | V.A. | X-INT | Y-INT |
|---|---|---|---|---|
| num.=2<br>den.=2<br>2=2<br>$y=\frac{2}{1}=2$<br>$\boxed{y=2}$ | $x+4=0$<br>$-4 \quad -4$<br>$\boxed{x=-4}$<br>$\frac{2(-4-4)}{-4+2} = \frac{2(-8)}{-2} = \frac{-16}{-2} = 8$<br>$\boxed{(-4, 8)}$ | $x+2=0$<br>$\boxed{x=-2}$ | $\cancel{2 \neq 0}$<br>$x-4=0$<br>$x=4$<br>$\boxed{(4,0)}$ | $\frac{2(0)^2-32}{0^2+6(0)+8} = \frac{-32}{8} = -4$<br>$\boxed{(0, -4)}$ |

**Summary**
Summarize the lesson in your own words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**Graphing Rational Functions**

| **Term/Process** | **Definition** | **What to Do** | **Example:** $f(x)=\frac{1x^2+6x}{1x^2+10x+24}$ |
|---|---|---|---|
| **Horizontal Asymptote** | A horizontal **line** the graph gets close to but does not touch | Determine the degree of the numerator (top) and the denominator (bottom)<br>**a.** if the degree of the numerator is GREATER, **no HA**<br>**b.** if the degree of the numerator is LESS, **y = 0 is HA**<br>**c.** if the degree of the numerator = the degree of the denominator, DIVIDE the **leading coefficients** | HA<br>num.=2 2=2<br>den.=2<br>$y=\frac{1}{1}=1$ $\boxed{y=1}$<br>FACTOR & SIMPLIFY<br>$\frac{x\cancel{(x+6)}}{\cancel{(x+6)}(x+4)}=\boxed{\frac{x}{x+4}}$ |
| **Hole** | A point on the graph where the function is undefined (bottom equals zero) but it is not a vertical asymptote<br>Coordinate point: (x, y) | Factor the top and bottom and cancel any matching factors. That cancelled factor is the hole. Set equal to zero and solve. To find the "y", plug the "x" into the simplified equation. | HOLE<br>$x+6=0$<br>$x=-6$<br>$\frac{-6}{-6+4}=\frac{-6}{-2}$<br>3<br>$\boxed{(-6,3)}$ |
| **Vertical Asymptote** | A vertical **line** the graph gets close to but does not touch | Set the denominator (bottom) equal to zero and solve. | VA<br>$x+4=0$<br>$\boxed{x=-4}$ |
| **X-Intercept (Zeros)** | Where the graph crosses the x-axis.<br>Coordinate point: (#,0) | Set the numerator (top) equal to zero and solve. | X-INT<br>$x=0$<br>$\boxed{(0,0)}$ |
| **Y-Intercept** | Where the graph crosses the y-axis.<br>Coordinate point: (0,#) | Plug zero in for x in the original function and simplify. | Y-INT<br>$\frac{0^2+6(0)}{0^2+10(0)+24}=\frac{0}{24}=0$<br>$\boxed{(0,0)}$ |