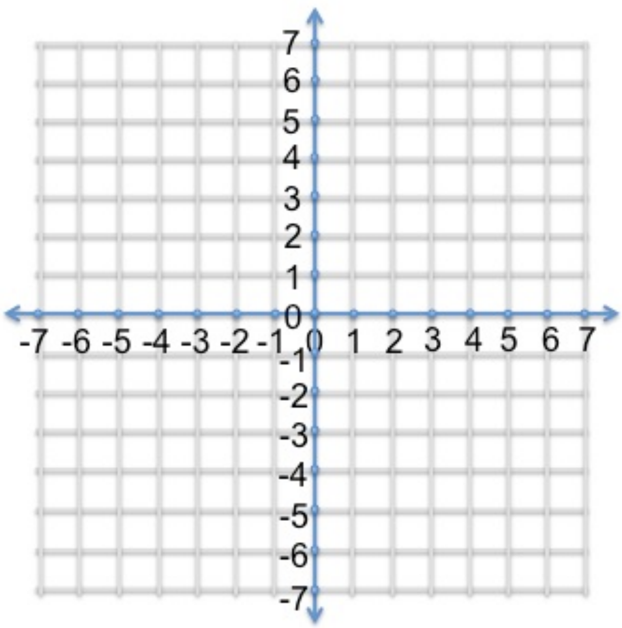
Warm-up 10.5.15 -10.6.15

Lesson 11 Rational Functions

Fill the table and Graph $y = \frac{1}{x}$



X	Y
-4	
-2	
-1	
-.5	
0	
.5	
1	
2	
3	

Rational Functions

A ***<u>Rational Function</u>*** is a function whose rule can be written as a ratio of two polynomials.

Rational Functions have Asymptotes.

<u>Asymptotes</u> are lines that the graph approaches as <u>*x*</u> becomes very large or small.

Horizontal Asymptote are when y=
Vertical Asymptote are when x=

What were the Asymptotes for $y = \frac{1}{x}$?

Consider this to be a parent function. Our goal is to find out what the transformations are

Describe the transformations. State the domain and range. Identify the asymptotes.
$As\ x \to \infty, y \to$
$As\ x \to\ -\infty, y \to$

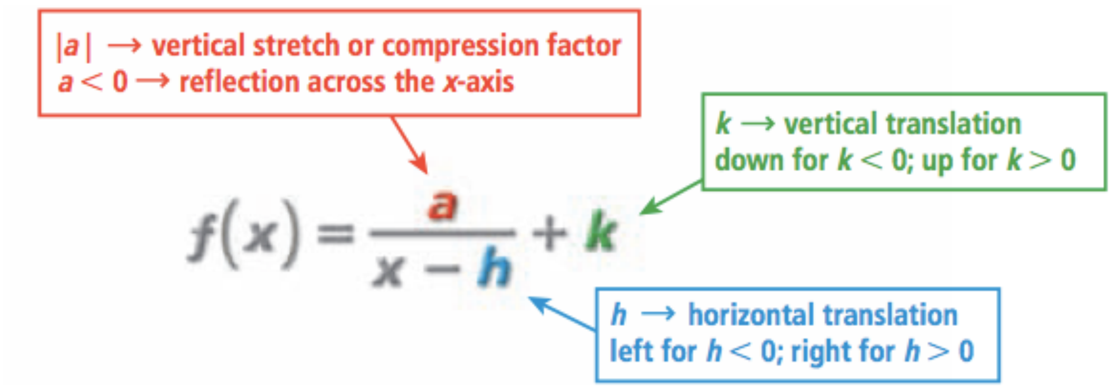
1) $y = \frac{1}{x-2}$

2) $y = \frac{1}{x} - 3$

3) $y = \frac{1}{x+2} + 1$

4) $y = \frac{3}{x}$

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



We Try:
Describe the transformations. State the domain and range. Identify the asymptotes.

$As\ x \to \infty, y \to$

$As\ x \to\ -\infty, y \to$

1) $y = \frac{1}{x-5} + 6$

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

3) $y = \frac{4}{x-3} + 2$

You try:
Describe the transformations. State the domain and range. Identify the asymptotes.
$As\ x \to \infty, y \to$
$As\ x \to\ -\infty, y \to$

Left talk, Right write on whiteboard.
1) $y = \frac{1}{x-2} + 4$

Right talk, Left write in notebook
2) $y = \frac{-2}{x}$

3) $y = \frac{3}{x+2} + 1$

Lesson 11P1 HW Pg. 185 #1,5,7,8,9,21-27

Closure: Stand up hand up!

Older person: Explain how you would shift y= $\frac{1}{x}$ down 3 units.

Younger person: Explain how you would shift $y = \frac{1}{x} left\ 2\ units$.

Find another partner.

Taller person: Explain how you would shift $y = \frac{1}{x} + 2\ up\ 1\ unit$.

Shorter person: Explain how you would shift $y = \frac{1}{x-2}\ right\ 1\ unit$.

Warm-up
10.6.15

1) $Factor\ \ x^2 + 5x + 6$

2) $Divide$:$(n^3 + 7n^2 + 14n + 3) \div (n + 2)$

3) Divide: $(v^3 - 2v^2 - 14v - 5) \div (v + 3)$

Graphing Rational Functions with Vertical Asymptotes

Identify the zeros and vertical asymptotes of $f(x) = \frac{x^2 - 2x - 3}{x - 2}$. Then graph.

Step 1 Find the zeros and vertical asymptotes.

$f(x) = \frac{(x+1)(x-3)}{x-2}$ — *Factor the numerator.*

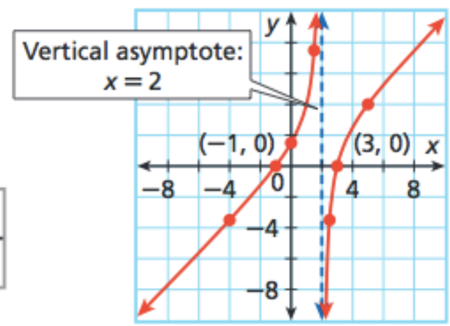
Zeros: -1 and 3 — *The numerator is 0 when $x = -1$ or $x = 3$.*

Vertical asymptote: $x = 2$ — *The denominator is 0 when $x = 2$.*

Step 2 Graph the function.

Plot the zeros and draw the asymptote. Then make a table of values to fill in missing points.

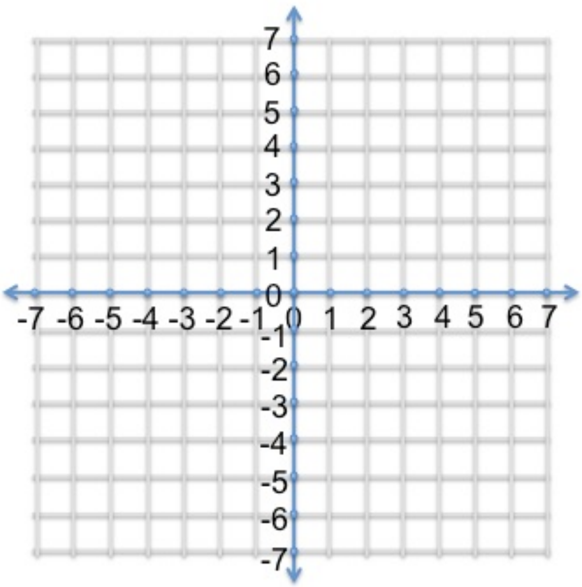
x	−4	−1	0	1.5	2.5	3	5
y	−3.5	0	1.5	7.5	−3.5	0	4



$$y = \frac{x^2 + 5x + 6}{x - 1}$$

Rational Function	$y = \frac{x^2 + 5x + 6}{x - 1}$
Factor	$y = \frac{(x+3)(x+2)}{x-1}$
Identify 0's,	X=-3,-2
Identify Vertical Asymptotes (undefined values)	X=1

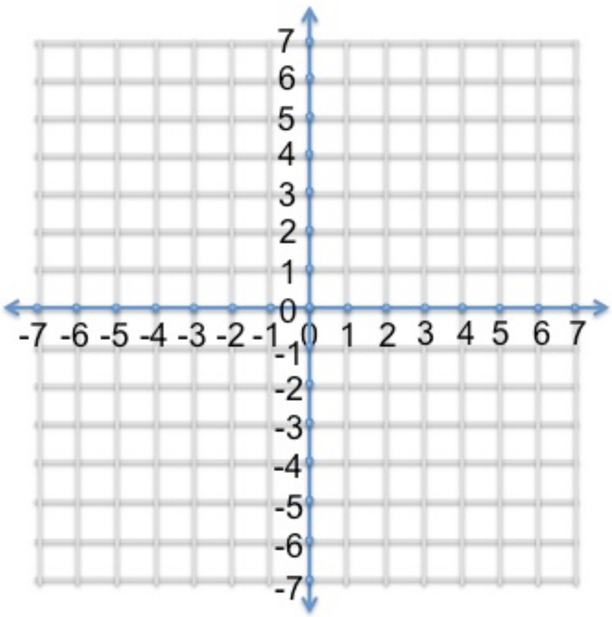
Create table and plot points around the vertical asymptote



x	y
-.5	
0	
.5	
1	
1.5	
3	
5	

We try:
Graph and identify the zeroes and vertical asymptotes of
$y = \frac{x^2+7x+6}{x+3}$.

Rational Function	$y = \frac{x^2+7x+6}{x+3}$.
Factor	
Identify 0's,	

<table>
<tr><td>Identify Vertical Asymptotes (undefined values)</td><td></td></tr>
<tr><td>Create table and plot points

</td><td><table>
<tr><td>x</td><td>y</td></tr>
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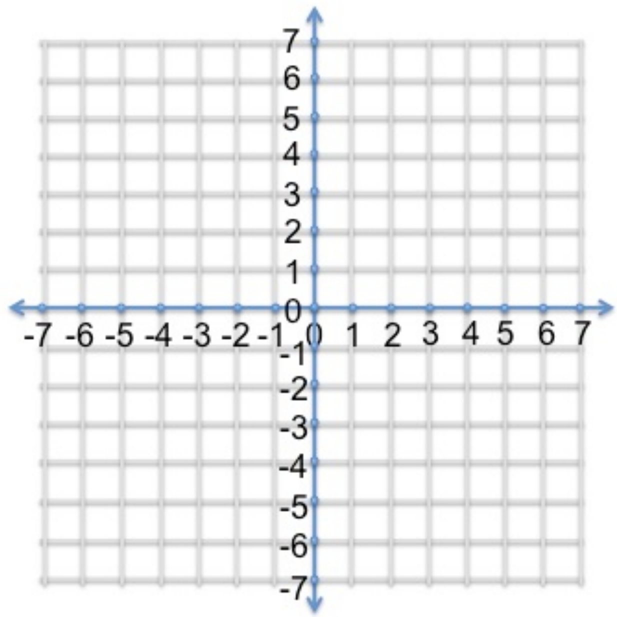
Graph and identify the zeroes and vertical asymptotes of $y = \frac{x^2-1}{x-2}$

Rational Function	$y = \dfrac{x^2 - 1}{x - 2}$
Factor	
Identify 0's,	

Identify Vertical Asymptotes (undefined values)	
Create table and plot points	



x	y

You try:
Graph and identify the zeroes and vertical asymptotes of $y = \frac{x^2+4x}{x+2}$.

The Special Cases!

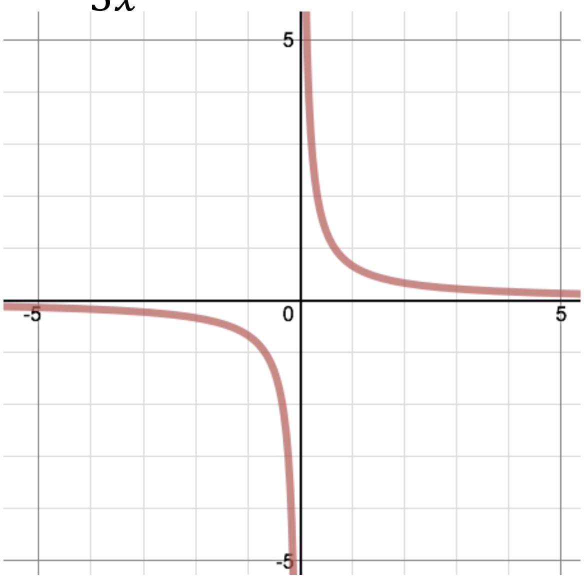
Let $f(x) = \frac{p(x)}{q(x)}$

Case #1

If the degree of **p** < degree of **q**, the horizontal asymptote is $y = 0$.

Example:

$$y = \frac{2x}{3x^2}$$



Case #2

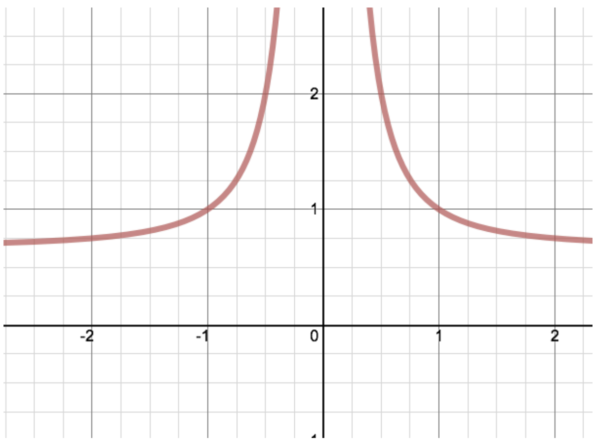
If the degree of **p** = degree of **q**, the horizontal asymptote is

$y = \frac{leading\ coefficient\ of p}{leading\ coefficient\ of\ q}$.

Example

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

horizontal asymptote : $y = \frac{2}{3}$

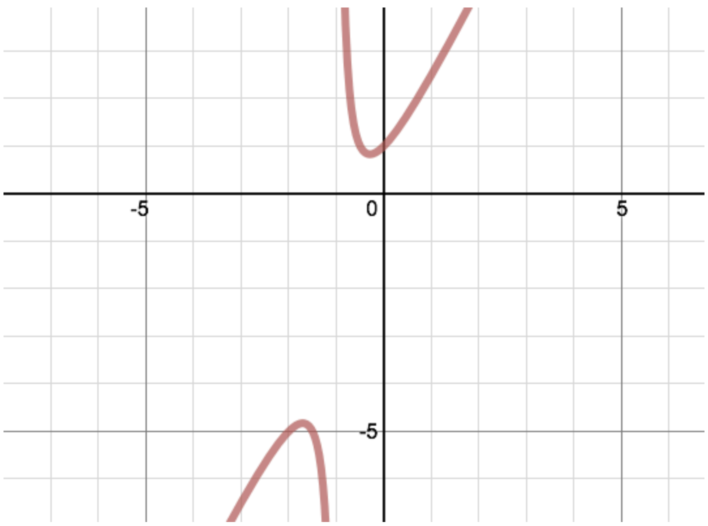


Case #3

If the degree of **p** =**(**degree of **q)+1**, there is a slant asymptote.

Example

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



To find the slant asymptote, divide $p(x) by\ q(x)$ and graph the quotient without remainders.

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

$$(2x^2 + 2x + 1) \div (x + 1)$$

We try:
Identify the zeroes and asymptotes of each function.

1) $y = \frac{x^2-6x+5}{x-2}$

2)$y = \frac{5x+2}{x+1}$

You try:
Identify the zeroes and asymptotes of each function.

Left Talk, Right Write in notebook.

$$y = \frac{x^2 - 5x - 6}{x + 2}$$

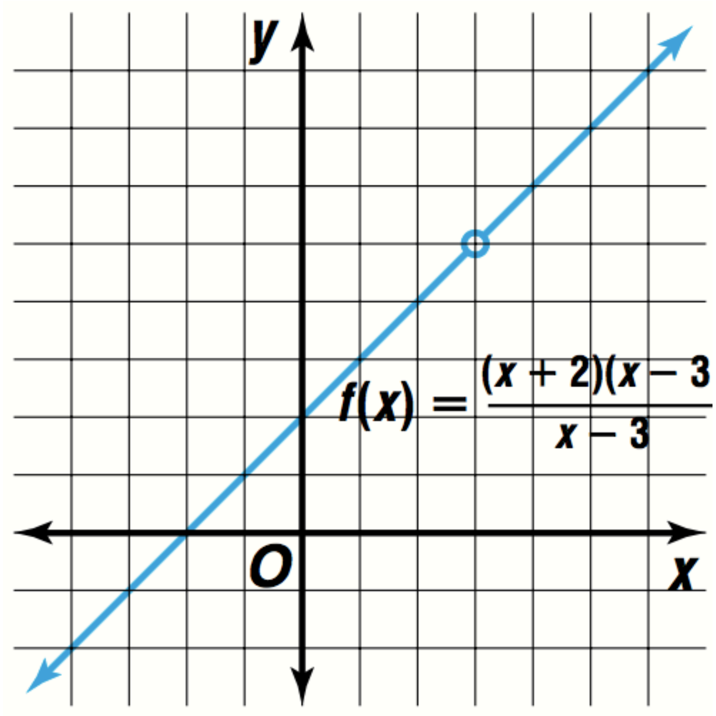
Right Talk, Left write in notebook.

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

HOLES

What is a hole?

What do you think a hole in a graph means?



$f(x) = \frac{(x+2)(x-3)}{x-3} = \frac{x^2-x-6}{x-3}$

Where was the hole located? What do you think the relationship is?

A hole is when there is a common factor on the numerator and denominator of a rational fraction.

I Do:

$$f(x) = \frac{(x^2 + 5x + 4)}{x + 4}$$

Factor	$f(x) = \frac{(x+4)(x+1)}{x+4}$
Identify hole by setting canceled factor to 0	$x + 4 = 0$ $x = -4$
Cancel out factors	$f(x) = (x + 1)$
Graph the leftover function and insert hole.	

We Do: $f(x) = \frac{-x^2+x}{x-1}$

Factor	$f(x) =$
Identify hole by setting canceled factor to 0	

Cancel out factors	
Graph the leftover function and insert hole.	

Closure

Exit Slip

Go find your 6 o clock partner. On ONE piece of paper graph and label the zeros, asymptotes, and holes.

$$f(x) = \frac{(x^2 + 6x + 7)}{x + 1}$$