Classwork from yesterday

1. What is the general form of the Reciprocal Family of functions:

page 495 $y = \dfrac{a}{x-h} + k$ $\quad y = a \cdot \dfrac{1}{x-h} + k$

Previously studied functions:

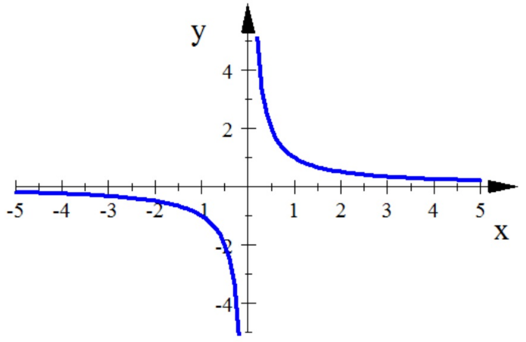
$y = a|x-h| + k \qquad y = a(x-h)^2 + k$

$y = a\sqrt{x-h} + k$

$a, h,$ and k represent the same thing in all of these equations!

2. a)Graph the Parent Reciprocal Function: $Y_1 = \frac{1}{x}$ using the following window:

$X_{\min} = -5 \quad X_{\max} = 5 \quad Y_{\min} = -5 \quad Y_{\max} = 5$

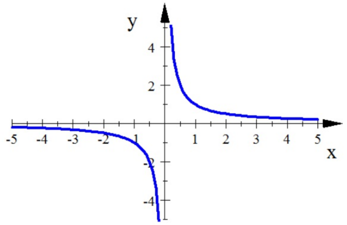


b) The graph has two parts. Explain why there is a break in the graph when x=0.

$Y_1 = \dfrac{1}{x}$

The equation is undefined when x=0, therefore, you are never allowed to use this value and the graph can't exist there.

x=0 is a restriction



c) $x = 0$ is called a Vertical Asymptote (VA).

i. Describe what the graph does as you get closer to the VA from the left side.

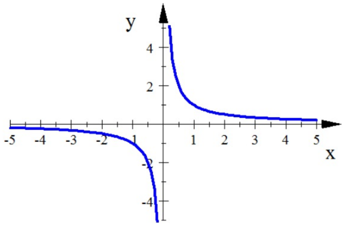
As x approaches zero from the left, y becomes very big negative.

The graph goes down as you get close to the y-axis on the left side.

ii. Describe what the graph does as you get closer to the VA from the right side.

As x approaches zero from the right, y becomes very big positive.

The graph goes up as you get close to the y-axis on the right side.



3. a) What is each part of the graph called?

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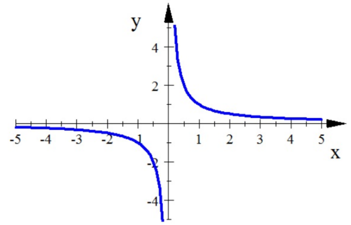
Branches



b) Where are these two parts of the graph located?

Quadrants I and III

Given this equation $y = \frac{1}{x}$ explain why the branches are in these quadrants.

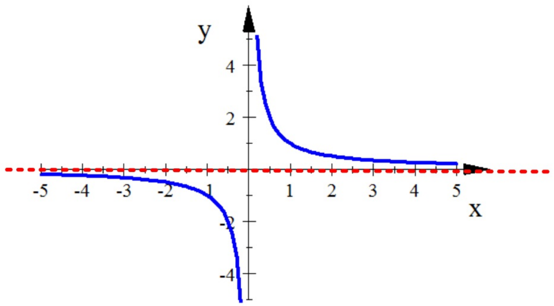
Substituting different values for x into the equation leads to the following:

When x is positive y is also positive - 1st Quadrant

When x is negative y is also negative - 4th Quadrant

4. What is the equation of the Horizontal Asymptote?

HA: y=0 (x-axis)



As you move farther left and right on the graph (bigger positive and bigger negative values for x) y becomes smaller and smaller but will never actually equal zero.
This means at the left and right ends of the graph it will get really close to the line y=o (x-axis) but never reach it.

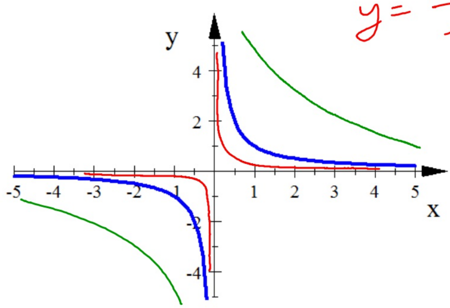
5. Keep $Y_1 = \frac{1}{x}$. Now graph $Y_2 = \frac{a}{x}$ trying different values of a, but keeping it positive. Explain what changing the value of a does to the graph.

$y = \frac{5}{x}$

$y = \frac{0.5}{x}$

Larger values of a push the branches "farther" from the origin.

Smaller value of a bring the branches "closer" to the origin.

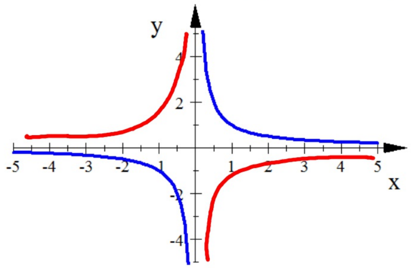


6. Keep $Y_1 = \frac{1}{x}$. Now graph $Y_2 = \frac{a}{x}$ using a negative value of a. What happens to the graph when a is negative?

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

Negative values of a make the graph upside down (x-axis reflection).

The branches are in Quadrants II and IV.

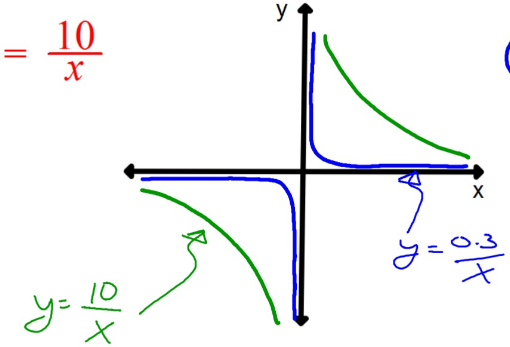


graph is upside down

Without using a graphing calculator sketch the graph of each in the same x-y plane. Label the graphs with their equations.

$y = \frac{10}{x}$

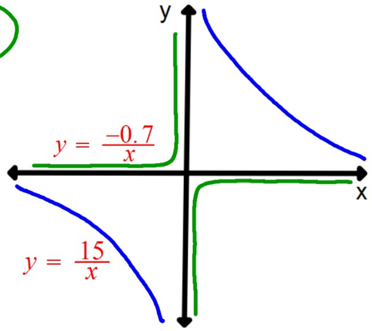
$y = \frac{0.3}{x}$



Without using a graphing calculator sketch the graph of each in the same x-y plane. Label the graphs with their equations.

$y = \frac{-0.7}{x}$

$y = \frac{15}{x}$



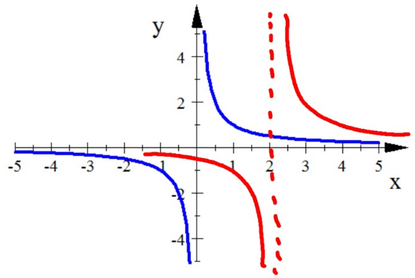
7. Keep $Y_1 = \frac{1}{x}$ but graph using a Standard Window. Now graph $Y_2 = \frac{1}{x-h}$, trying different values of h, both positive and negative. Explain what changing the value of h does to the graph.

h represents Horizontal Translation.

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

This changes the location of the Vertical Asymptote.

VA: x = h



Graph moved 2 right

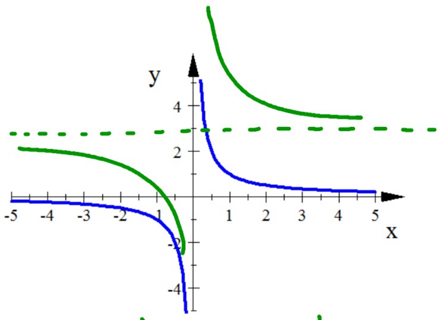
8. Keep $Y_1 = \frac{1}{x}$ with a Standard Window. Now graph $Y_2 = \frac{1}{x} + k$, trying different values of k, both positive and negative. Explain what changing the value of k does to the graph.

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

k represents Vertical Translation.

This changes the location of the Horizontal Asymptote.

HA: y = k



graph moved up 3

$$Y_1 = \frac{28.6}{x-47} + 73$$

What do you think the Vertical and Horizontal Asymptotes of this function are?

47 right

73 up

VA: $x = 47$

HA: $y = 73$

$$y = a(x-h)^2 + k \qquad y = a|x-h| + k$$

$$y = a\sqrt{x-h} + k$$

a: Vertical Stretch or Shrink Factor
if a<0 there is an x-axis reflection (Upside Down)

h: Horizontal Translation

k: Vertical Translation

Vertex for the Quadratic and Absolute Value functions is (h, k).
The starting point for the Square Root function is (h,k)

$$y = \frac{a}{x-h} + k$$

The larger a is... the farther the branches are from the origin
The smaller a is...the closer the branches are to the origin

a: Vertical Stretch or Shrink Factor
if a<0 there is an x-axis reflection (Upside Down)

a>0: branches are in Quadrants I & III
a<0: branches are in Quadrants II & IV

h: Horizontal Translation

Vertical Asymptote becomes: x = h

k: Vertical Translation

Horizontal Asymptote becomes: y = k

the Asymptotes will cross at the point (h,k)

What are the two asymptotes for each reciprocal function?

1. $y = \frac{30}{x-7} + 2$

HA: $y = 2$

VA: $x = 7$

2. $y = \frac{-0.3}{x+5} - 8$

HA: $y = -8$

VA: $x = -5$

Write an equation for the translation of $y = \frac{3}{x}$ that has the given asymptotes.

1. y = 4 and x = -3

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

2. y = 0 and x = 9

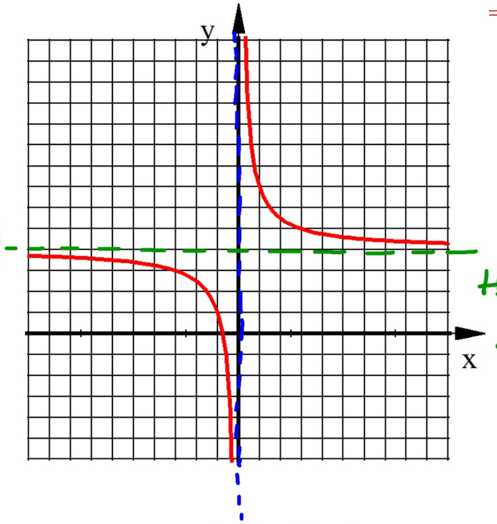
$y = \frac{3}{x-9}$

3. y = -5 and x = 0

$y = \frac{3}{x} - 5$

$= \frac{3}{x}$, write the equation of each

a)



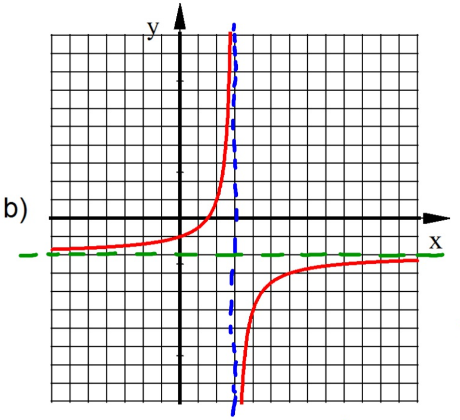
HA $y = 4$

VA $x = 0$

EQ: $y = \frac{3}{x} + 4$

Branches in Quad I & III so a is pos

b)



HA $y = -2$

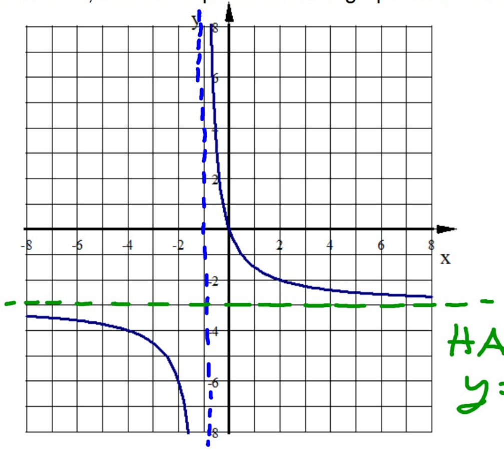
VA $x = 3$

EQ: $y = \frac{-3}{x-3} - 2$

Branches in Quad II & IV

For 1 and 2, write the equation of each graph which are tranformations of the equation: $y = \frac{3}{x}$

1.

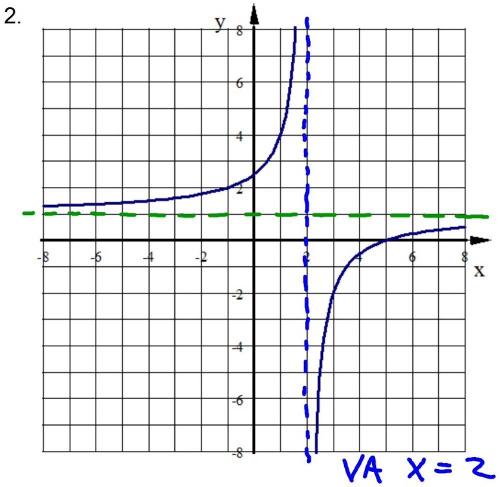


EQ:

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

Branches are in Quad I & III so a is pos

2.



EQ:

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

Branches in Quad II & IV

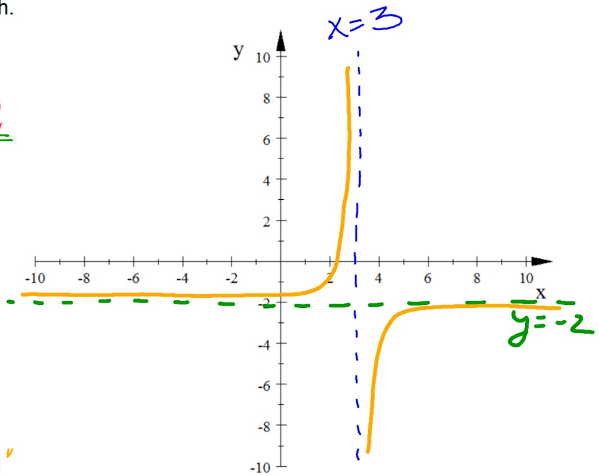
For 3 and 4, sketch the graph of each.
Show asymptotes as dashed lines.

3. $y = \frac{-0.1}{x-3} - 2$

VA x = 3

HA y = -2

Branches in Quad II & IV & are close to the "origin"

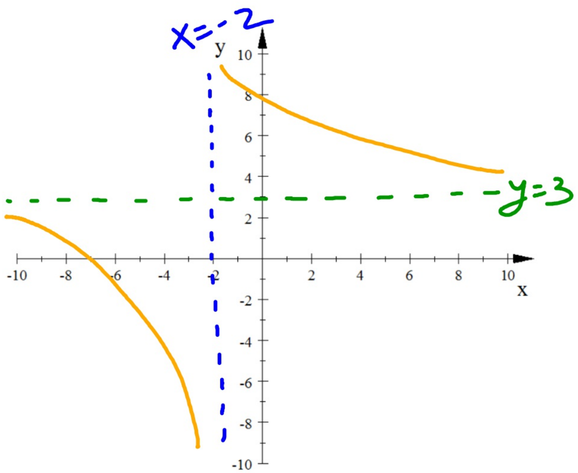


4. $y = \frac{15}{x+2} + 3$

VA x = -2

HA y = 3

Branches far from "origin" in Quad I & III



Write the equation of each transformation of the reciprocal function:

1. 5 units left, twice as tall, branches are in quadrants I and III

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

2. 8 units up, half as tall, branches are in quadrants II and IV

$$y = \frac{-.5}{x} + 8$$

3. 3 units right, 2 units down, branches are in quadrants II and IV

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

You can now finish Hwk #3

Practice Sheet Sec 9-2

Graphs of Reciprocal Functions

Due tomorrow.