

## NOTES: Section 8.2 – Graph Simple Rational Functions

Goals: #1 - I can graph rational functions of the form  $y = \frac{a}{x-h} + k$

#2 - I can graph rational functions of the form  $y = \frac{ax+b}{cx+d}$

Homework: Lesson 8.2 Day 1 & Day 2 Worksheet

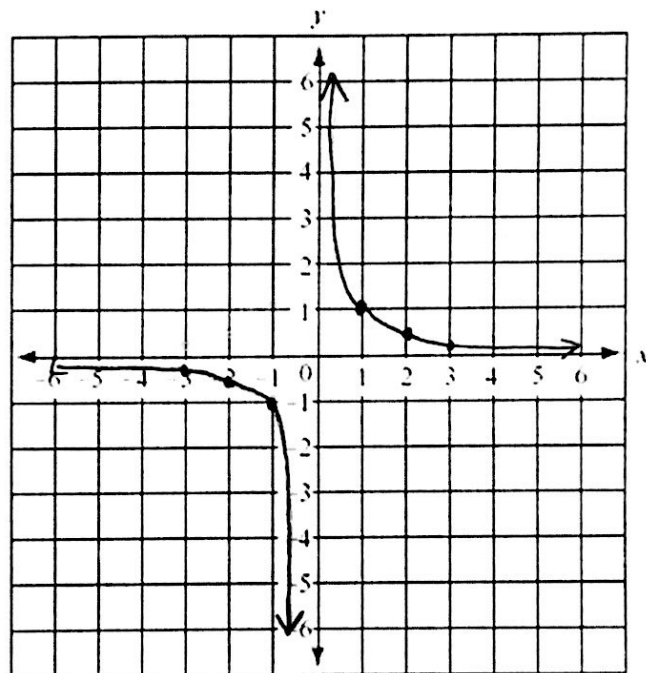


Exploration #1: Work with a partner and answer the following questions.

1. Complete the table of values to graph the following function.

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

x	y
-3	-0.3
-2	-0.5
-1	-1
0	—
1	1
2	0.5
3	0.3



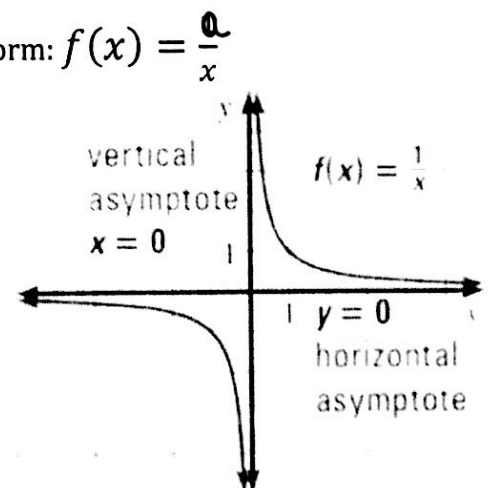
Notes:

A rational function is a function in the form:  $f(x) = \frac{a}{x}$

The shape of this graph is called a hyperbola which consists of two symmetrical branches.

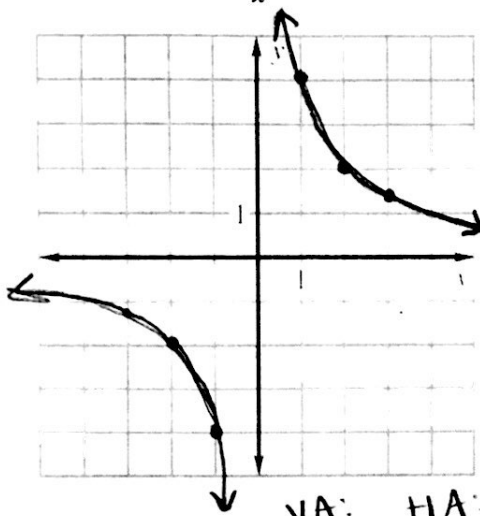
Domain:  $\mathbb{R}, x \neq 0$

Range:  $\mathbb{R}, y \neq 0$



Example #1: Graph the function. Then state the domain, range, and asymptotes.

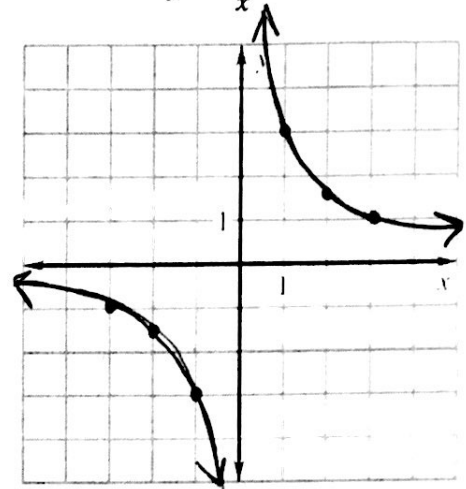
1.  $y = \frac{4}{x}$



X	Y
-3	-1.3
-2	-2
-1	-4
-0.5	-8
0	-
0.5	8
1	4
2	2
3	1.3

VA:  $x=0$     HA:  $y=0$   
 asymptotes:  $x=0$      $y=0$   
 domain:  $\mathbb{R}, x \neq 0$   
 range:  $\mathbb{R}, y \neq 0$

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



X	Y
-3	-1
-2	-1.5
-1	-3
-0.5	-6
0	-
0.5	6
1	3
2	1.5
3	1

VA:  $x=0$     HA:  $y=0$   
 asymptotes:  $x=0$      $y=0$   
 domain:  $\mathbb{R}, x \neq 0$   
 range:  $\mathbb{R}, y \neq 0$

Exploration #2: Work with a partner and answer the following questions.

1. Suppose you had the function  $y = \frac{1}{x}$

a. Describe the transformation:  $y = \frac{1}{x} + 1$

shift up 1

b. How would this shift our horizontal asymptote?

$y=0 \rightarrow y=1$

c. Describe the transformation:  $y = \frac{1}{x+1}$

shift left 1

d. How would this shift our vertical asymptote?

$x=0 \rightarrow x=-1$

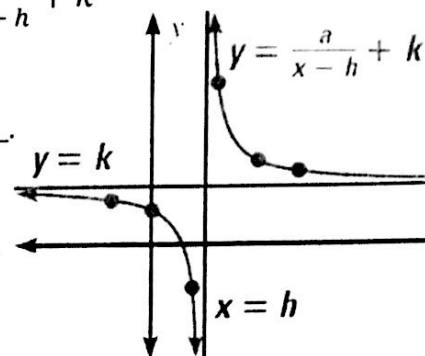
Notes:

To graph a rational function of the form:  $y = \frac{a}{x-h} + k$

Draw the asymptotes:  $x = h$  and  $y = k$ .

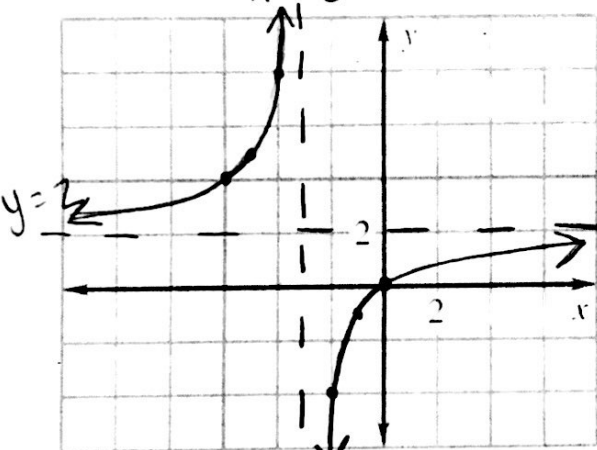
Plot points to the left and right of the vertical asymptote.

Draw the two branches of the hyperbola.



Example #2: Graph the function. Then state the domain, range, and asymptotes.

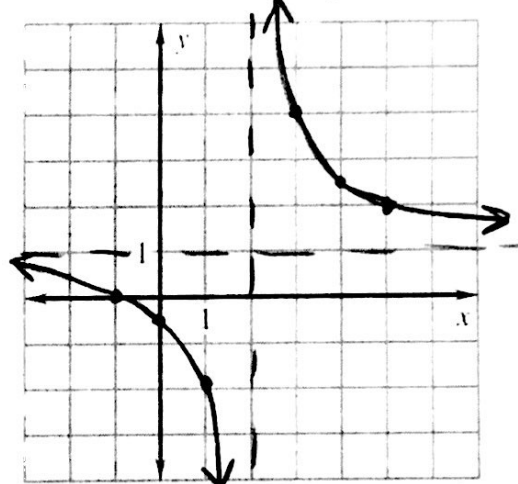
1.  $y = \frac{-6}{x+3} + 2$



x	y
-6	4
-5	5
-4	8
-3	-
-2	-4
-1	-1
0	0

VA:  $x = -3$  HA:  $y = 2$   
 asymptotes:  $x = -3$   $y = 2$   
 domain:  $\mathbb{R}, x \neq -3$   
 range:  $\mathbb{R}, y \neq 2$

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



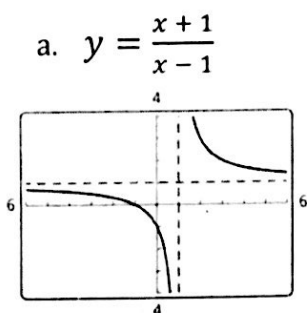
x	y
-1	0
0	-0.5
1	-2
2	-
3	4
4	2.5
5	2

VA:  $x = 2$  HA:  $y = 1$   
 asymptotes:  $x = 2$   $y = 1$   
 domain:  $\mathbb{R}, x \neq 2$   
 range:  $\mathbb{R}, y \neq 1$

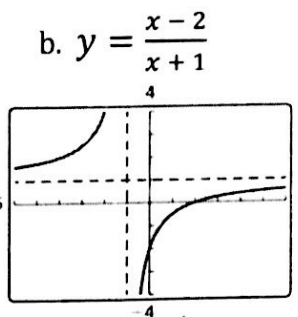
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Exploration #3: Work with a partner and answer the following questions.

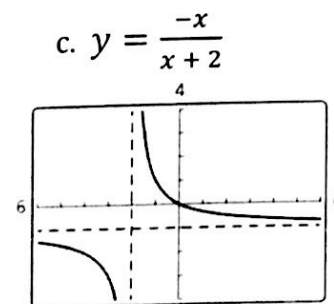
1. The equation of each hyperbola is shown. Find the vertical and horizontal asymptotes.



VA:  $x=1$   
 HA:  $y=1$



VA:  $x=-1$   
 HA:  $y=1$



VA:  $x=-2$   
 HA:  $y=-1$

Notes:

To graph a rational function of the form:  $y = \frac{ax+b}{cx+d}$

Draw the asymptotes:  $x = -\frac{d}{c}$  and  $y = \frac{a}{c}$ .  
 (set DEN = 0)

Plot points to the left and right of the vertical asymptote.

Draw the two branches of the hyperbola.

Example #2: Find the vertical and horizontal asymptote of the graph of the function.

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

VA:  $x=0$   
 HA:  $y=3$

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

VA:  $x = \frac{1}{2}$   
 HA:  $y = \frac{1}{2}$

$$4x - 2 = 0$$

$$4x = 2$$

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

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

VA:  $x = -1$   
 HA:  $y = 3$

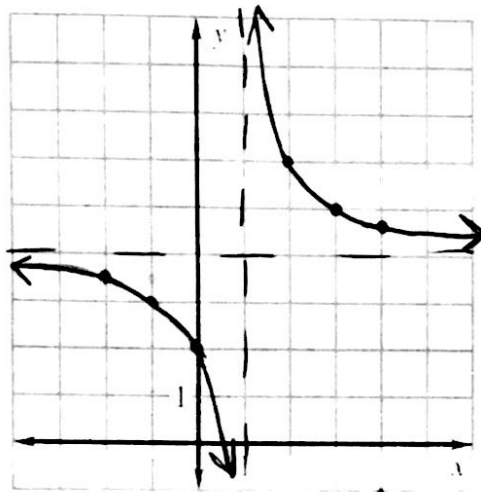
$$-x - 1 = 0$$

$$x = -1$$

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Example #3: Graph the function. Then state the domain, range, and asymptotes.

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



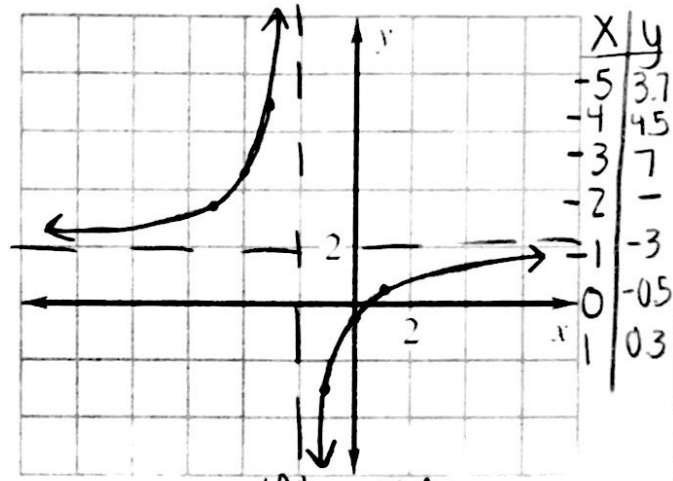
x	y
-2	3.3
-1	3
0	2
1	-
2	6
3	5
4	4.7

asymptotes: VA:  $x = 1$  HA:  $y = 4$

domain:  $\mathbb{R}, x \neq 1$

range:  $\mathbb{R}, y \neq 4$

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



asymptotes: VA:  $x = -2$  HA:  $y = 2$

domain:  $\mathbb{R}, x \neq -2$

range:  $\mathbb{R}, y \neq 2$

$$-x - 2 = 0$$

$$x = -2$$