

Lesson 9-2 The Reciprocal Function Family

We all know what the reciprocal of a number is: one over the number, the reciprocal of a is $\frac{1}{a}$, the reciprocal of 5 is $\frac{1}{5}$. Well, functions like inverse variations, are in a reciprocal form, hence we call these functions **reciprocal functions**. Generally speaking we will see the x variable in the denominator.

Parent function $f(x) = \frac{1}{x}$.

- General form of the reciprocal function is: $f(x) = \frac{a}{x-h} + k$
(note $x \neq h$, as the denominator will be zero or $f(x)$ is undefined.)
- Here again are h and k which translate the parent function.

Graphing

Graph $y = \frac{8}{x}$

Identify vertical and horizontal asymptotes.

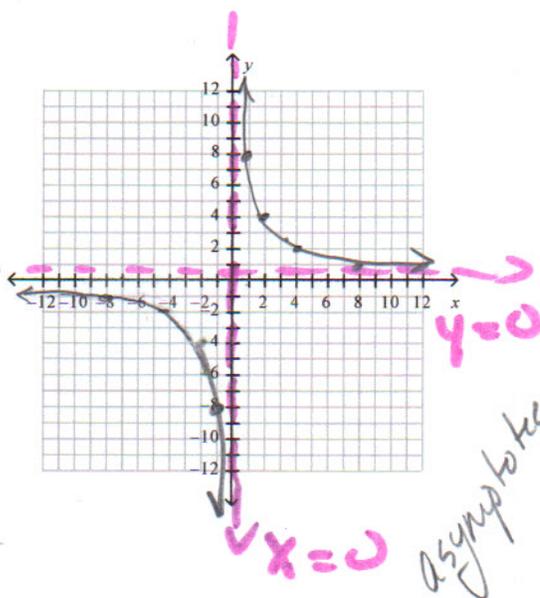
Domain and Range

1. Make a table of values that include both positive and negative values
2. Graph the points and sketch the curve
3. Asymptotes will be at domain restrictions, that is where x cannot be equal to zero is a vertical asymptote.

No matter how big or small x becomes, y will never be equal to zero, hence, the horizontal asymptote.

x	y
0	undef
1	8
2	4
4	2
8	1

x	y
-1	-8
-2	-4
-4	-2
-8	-1



Asymptotes

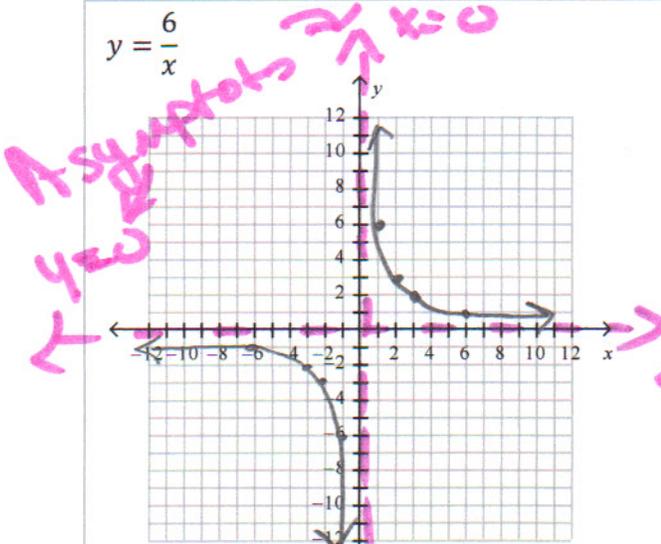
Often we can see on the graph what the asymptotes are, but how can we look at the equation and determine the asymptotes? Let's take a look at that general form of a reciprocal function; the " h and k " are significant:

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

- The denominator cannot be equal to zero, so set it to zero and solve for x .
- At $x = h$ we have a vertical asymptote
- $y = k$ a horizontal asymptote.
- So by putting the function into our general form, we can pluck off the asymptotes.

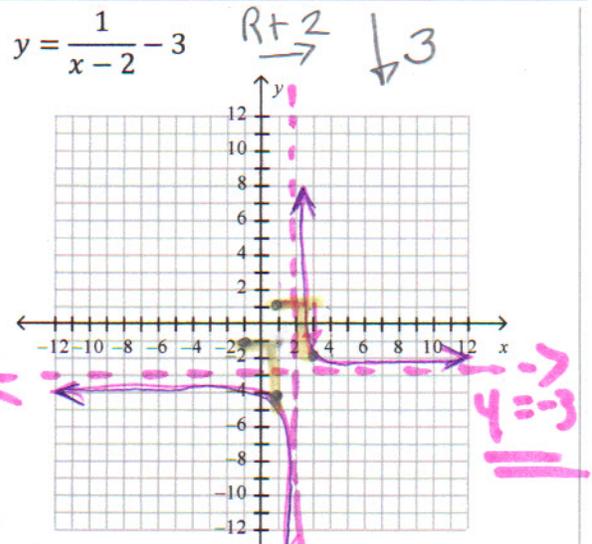
Sketch the graph and identify the asymptotes

$$y = \frac{6}{x}$$



x	-6	-3	-2	-1	1	2	3	6
y	-1	-2	-3	-6	6	3	2	1

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



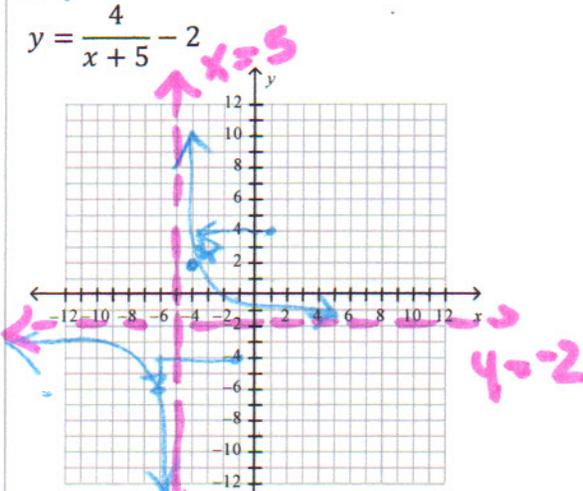
Movements

x	y
-1	-1
-1	-1

$\rightarrow 2$
 $\downarrow 3$

$x=2$

$$y = \frac{4}{x+5} - 2$$

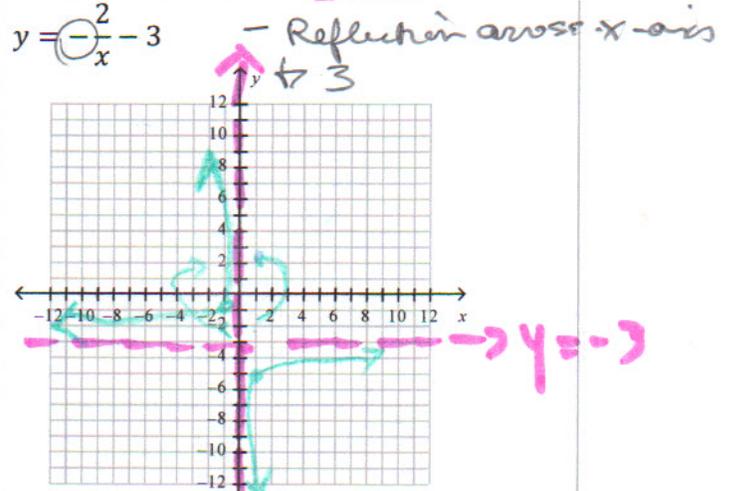


$y = \frac{4}{x}$

x	y
1	4
-1	-4

$\leftarrow 5$
 $\downarrow 2$

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



x	y
1	2
-1	-2

Reflect
 $\downarrow 3$

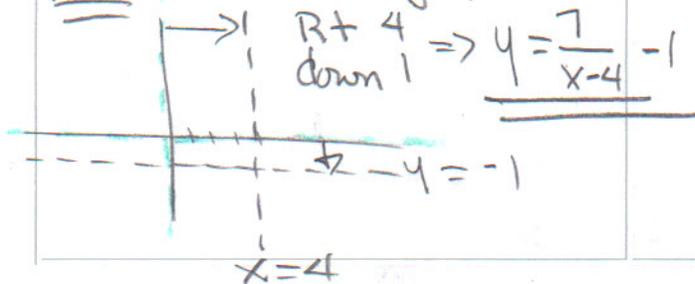
$x=0$

Write an equation for the translation of $y = \frac{7}{x}$

Asymptotes are located at:

$x = 4$ and $y = -1$

Picture where did asymptotes move?



$x = -1$ and $y = 3$

left 1
 up 3

$y = \frac{7}{x+1} + 3$

