## 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:  $f(x) = \frac{1}{x}$ . Of course reciprocal functions can and will be more complicated so we need to be familiar with the complete form of a reciprocal function which is:  $f(x) = \frac{a}{x-h} + k$  (note the restriction on the domain of  $x \neq h$ ). 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 draw a line
- 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.

This is a lot of points as you get more comfortable, you will be able to reduce the number, but you need at a minimum at least 3 points for each branch.



## 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 and at y = k we have a horizontal asymptote. So by putting the function into our general form, we can pluck off the asymptotes.

Also, if given a parent reciprocal function and asymptotes, we can develop an equation with the given asymptotes *that will be a translation of the parent function*.

Sketch the graph and identify the asymptotes



Write an equation for the translation of 
$$y = \frac{7}{x}$$
Asymptotes are located at:  
 $x = 4 \text{ amd } y = -1$  $x = -1 \text{ and } y = 3$ 

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