## 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 $\frac{1}{a^{\prime}}$ 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 $\mathbf{x}$ 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
3. Asymptotes will be at domain restrictions, that is where $\mathbf{x}$ 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

| $x$ | $y$ |
| :--- | :--- |
| -4 |  |
| -2 |  |
| -1 |  |
| $-1 / 2$ |  |
| $-1 / 4$ |  |
| 0 |  |
| $1 / 4$ |  |
| $1 / 2$ |  |
| 1 |  |
| 2 |  |
| 4 |  |

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

$$
x=4 \text { amd } y=-1
$$

$$
x=-1 \text { and } y=3
$$

