

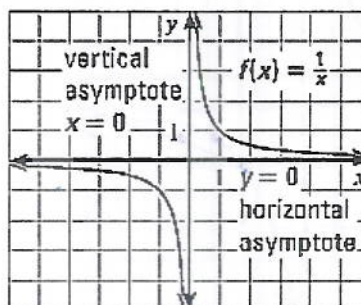
Objective: Will graph rational functions.

KEY CONCEPT

Parent Function for Simple Rational Functions

The graph of the parent function $f(x) = \frac{1}{x}$ is a *hyperbola*, which consists of two symmetrical parts called *branches*. The domain and range are all nonzero real numbers.

Any function of the form $g(x) = \frac{a}{x}$ ($a \neq 0$) has the same asymptotes, domain, and range as the function $f(x) = \frac{1}{x}$.



KEY CONCEPT

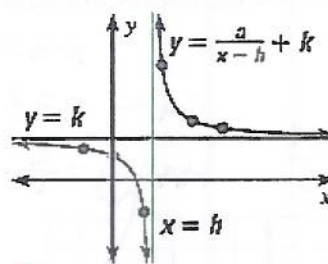
Graphing Translations of Simple Rational Functions

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

STEP 1 Draw the asymptotes $x = h$ and $y = k$.

STEP 2 Plot points to the left and to the right of the vertical asymptote.

STEP 3 Draw the two branches of the hyperbola so that they pass through the plotted points and approach the asymptotes.

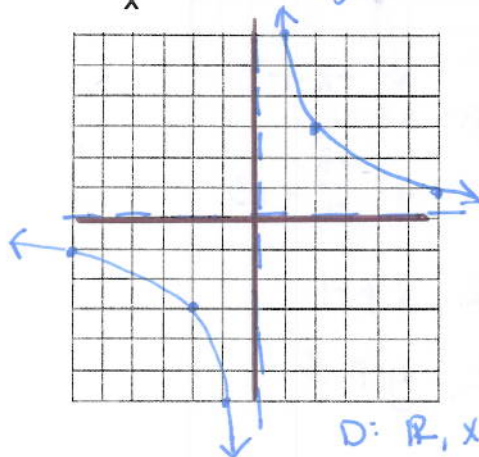


VA: set denominator = 0, solve for x

Graph the function, identify the asymptotes, and state the domain and range. Compare the graph with the parent graph $y = \frac{1}{x}$.

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

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

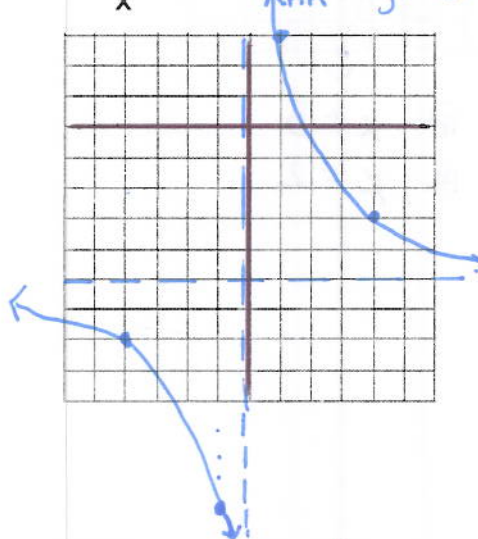


x	y
2	3
6	1
-2	-3
-6	-1

D: $\mathbb{R}, x \neq 0$
R: $\mathbb{R}, y \neq 0$

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

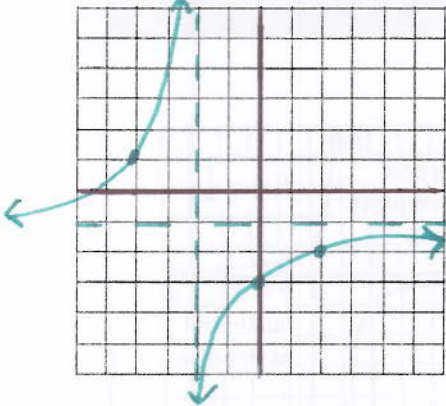
VA: $x=0$
HA: $y=-5$



x	y
1	3
4	-3
-1	-13
-4	-7

3.

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



$$VA: x = -2 \quad (x+2=0)$$

$$HA: y = -1$$

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

$$R: y \in \mathbb{R}, y \neq -1$$

x	y
0	-3
2	-2
-4	1

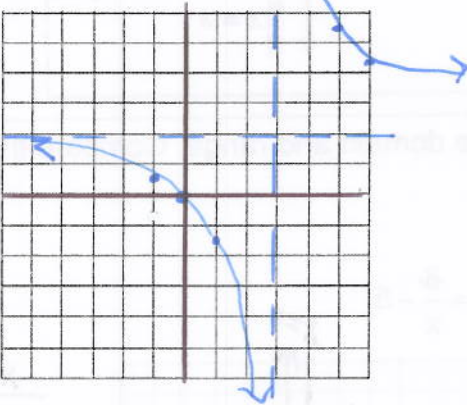
OTHER RATIONAL FUNCTIONS All rational functions of the form $y = \frac{ax+b}{cx+d}$ also have graphs that are hyperbolas.

- The vertical asymptote of the graph is the line $x = -\frac{d}{c}$ because the function is undefined when the denominator $cx + d$ is zero. *Set denominator = 0,*
- The horizontal asymptote is the line $y = \frac{a}{c}$. *coefficients of x num solve for x*

4.

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

$$VA: x-3=0$$



$$VA: x = 3$$

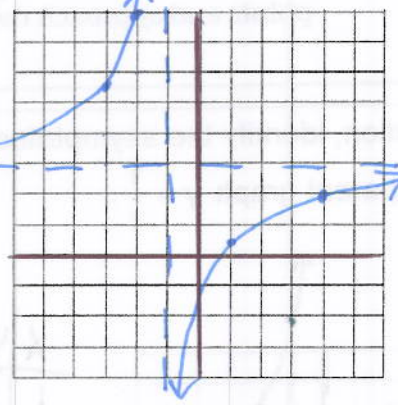
$$HA: y = \frac{2}{1} = 2$$

$$D: \mathbb{R}, x \neq 3$$

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

5.

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



$$VA: -x-1=0$$

$$x = -1$$

$$HA: y = \frac{-3}{-1} = 3$$

$$D: \mathbb{R}, x \neq -1$$

$$R: \mathbb{R}, y \neq 3$$