

8.2 Graph Simple Rational Functions

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

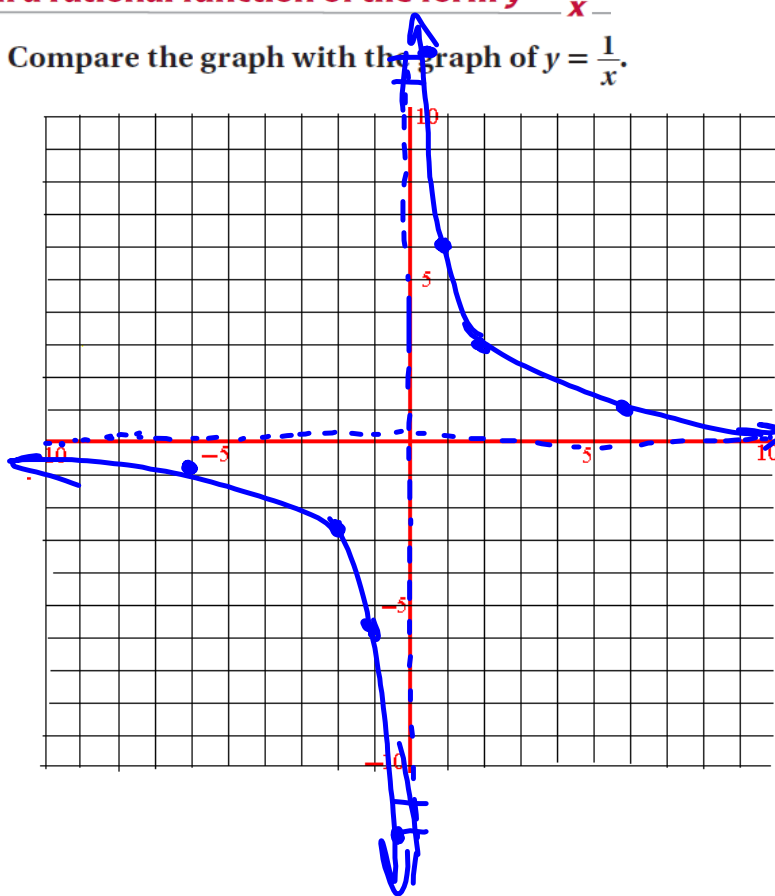
x	y
-2	$-\frac{1}{2}$
-1	-1
$-\frac{1}{2}$	-2
0	undef.
$\frac{1}{2}$	2
1	1
2	$\frac{1}{2}$



EXAMPLE 1 Graph a rational function of the form $y = \frac{a}{x}$.

 Graph the function $y = \frac{6}{x}$. Compare the graph with the graph of $y = \frac{1}{x}$.

x	y
-2	-3
-1	-6
$-\frac{1}{2}$	-12
0	undef.
$\frac{1}{2}$	12
1	6
2	3



EXAMPLE 2 Graph a rational function of the form $y = \frac{a}{x-h} + k$ Graph $y = \frac{-4}{x+2} - 1$. State the domain and range.

$a = -4$

$x = 0$

$\frac{-4}{0+2} - 1 = -3$

$h = -2$

$x = 2$

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

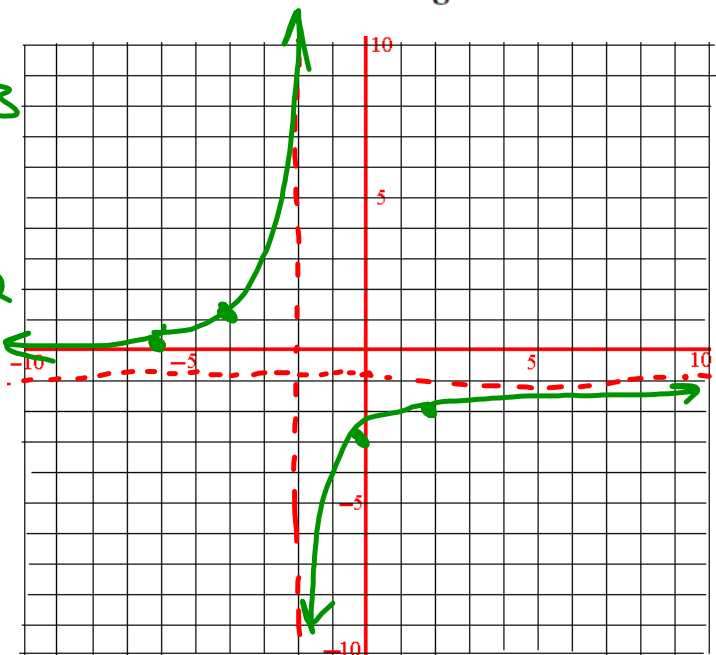
$k = -1$

$x = -4$

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

$x = -6$

$\frac{-4}{-6+2} - 1 = 0$

Dom: $\mathbb{R}; x \neq -2$ Range: $\mathbb{R}; y \neq -1$ 

$x = -2$

Vertical Asymptote(s): _____

$y = -1$

Horizontal Asymptote: _____

EXAMPLE 2 Graph a rational function of the form $y = \frac{a}{x-h} + k$

Graph the function. State the domain and range.

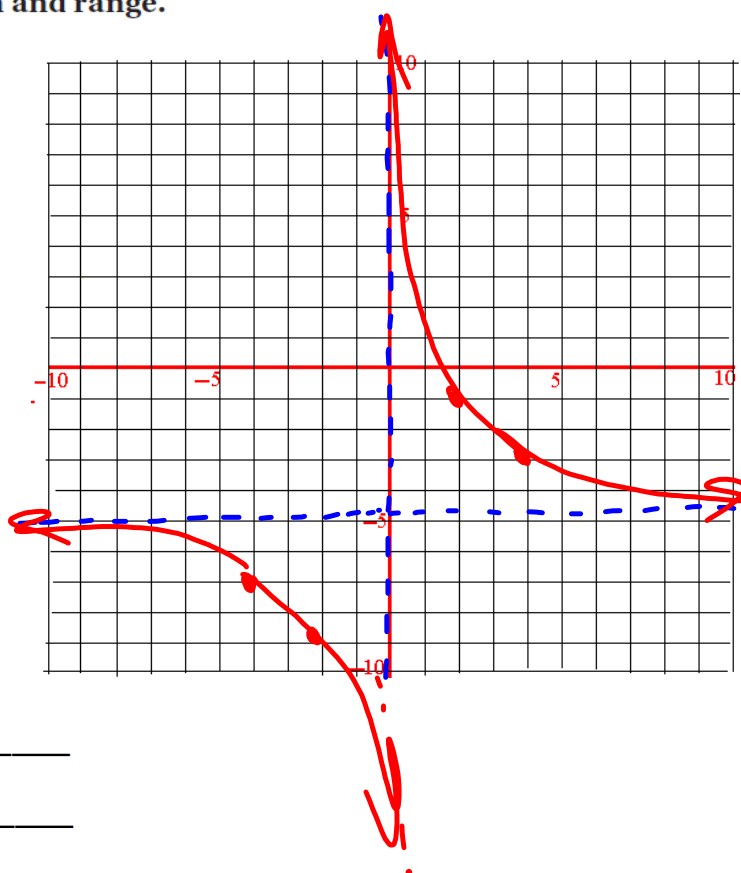
$$y = \frac{8}{x} - 5$$

$$a = 8$$

$$h = 0$$

$$k = -5$$

x	y
2	-1
4	-3
-2	9
-4	17



Vertical Asymptote(s): $x = 0$

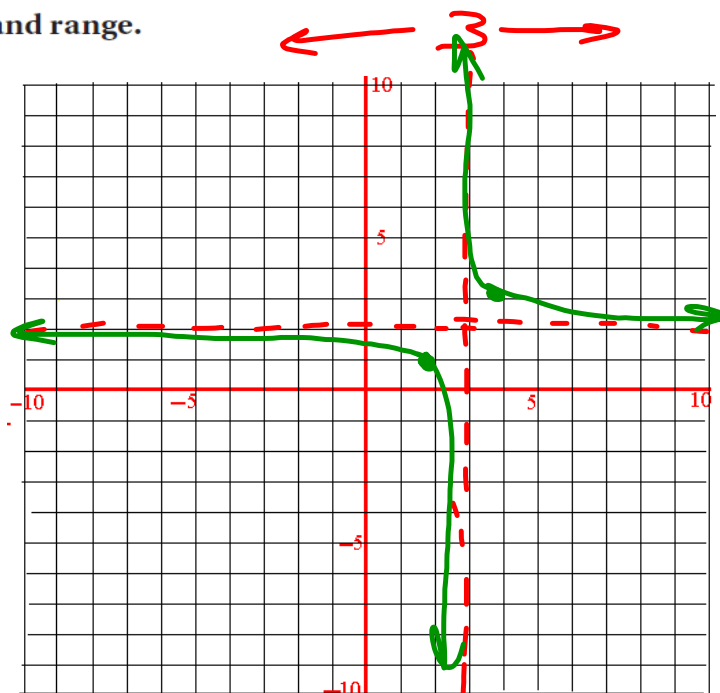
Horizontal Asymptote: $y = -5$

EXAMPLE 2 Graph a rational function of the form $y = \frac{a}{x-h} + k$

Graph the function. State the domain and range.

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

$a = 1$	x	h
$h = 3$	2	k
$k = 2$	4	3
	1	1.5
	8	


 Vertical Asymptote(s): $x = 3$

 Horizontal Asymptote: $y = 2$

STOP HERE!

Take a DEEP BREATH!

Things to remember:

1. Identify the asymptotes (both V.A. and H.A.)
2. Graph the asymptotes
3. Pick a couple of points on either side of the V.A.
4. Draw the smooth curves through the points.
5. SNUGGLE THOSE ASYMPTOTES!!! 😊

EXAMPLE 3 Graph a rational function of the form $y = \frac{ax + b}{cx + d}$.

Graph $y = \frac{2x + 1}{x - 3}$. State the domain and range.

V.A. $x - 3 = 0$

$x = 3$

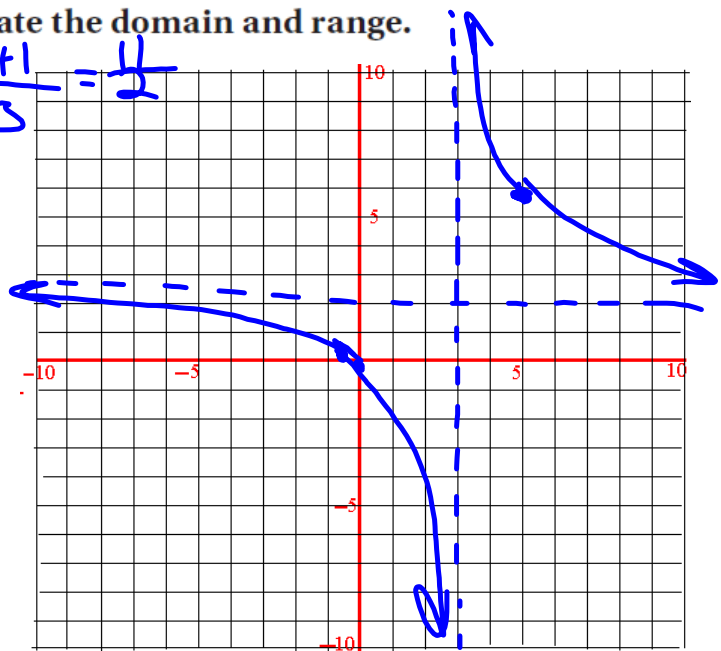
H.A. $y = 2$

X-int: $2x + 1 = 0$

$x = -\frac{1}{2}$
 $(-\frac{1}{2}, 0)$

Y-int: $(0, -\frac{1}{3})$

$\frac{2(5) + 1}{5 - 3} = \frac{11}{2}$



Vertical Asymptote(s): $x = 3$

Horizontal Asymptote: $y = 2$

X-int: $(-\frac{1}{2}, 0)$

Y-int: $(0, -\frac{1}{3})$

EXAMPLE 3 Graph a rational function of the form $y = \frac{ax + b}{cx + d}$

Graph the function. State the domain and range.

$$V.A. \quad f(x) = \frac{-3x + 2}{-x - 1} \quad \frac{-3(-3) + 2}{-(-3) - 1} = \frac{11}{2}$$

$$-x - 1 = 0$$

$$x = -1$$

$$H.A. \quad y = \frac{-3}{-1} = 3$$

x-int

$$-3x + 2 = 0$$

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

y-int

$$\frac{-3(0) + 2}{-(0) - 1} = \frac{2}{-1}$$

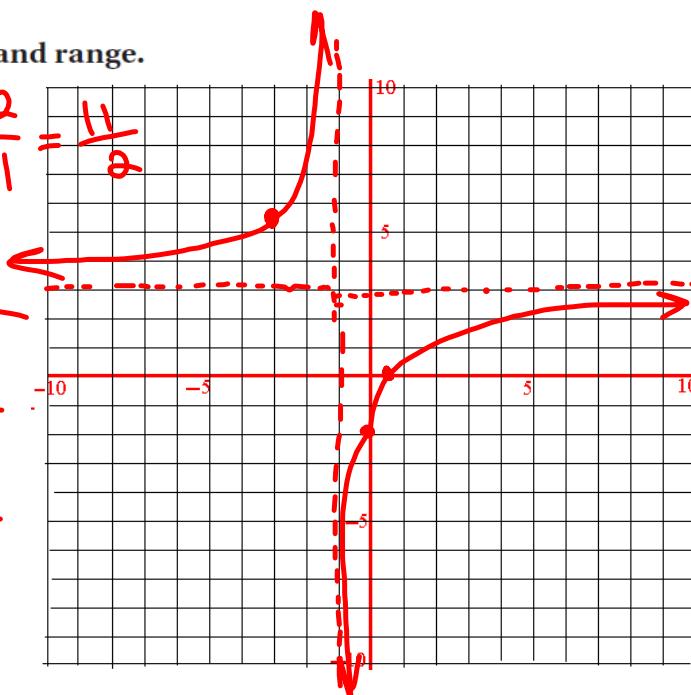
$$(0, -2)$$

Vertical Asymptote(s): $x = -1$

Horizontal Asymptote: $y = 3$

X-int: $(\frac{2}{3}, 0)$

Y-int: $(0, -2)$

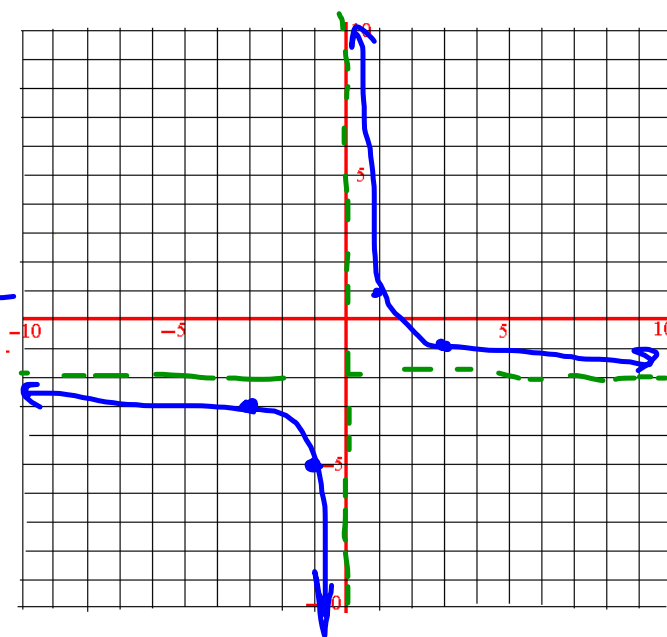


GRAPHING FUNCTIONS Graph the function. State the domain and range.

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

$a = 3$
 $h = 0$
 $k = -2$

x	y
1	1
3	-1
-1	-5
-3	-3



Vertical Asymptote(s): _____

Horizontal Asymptote: _____

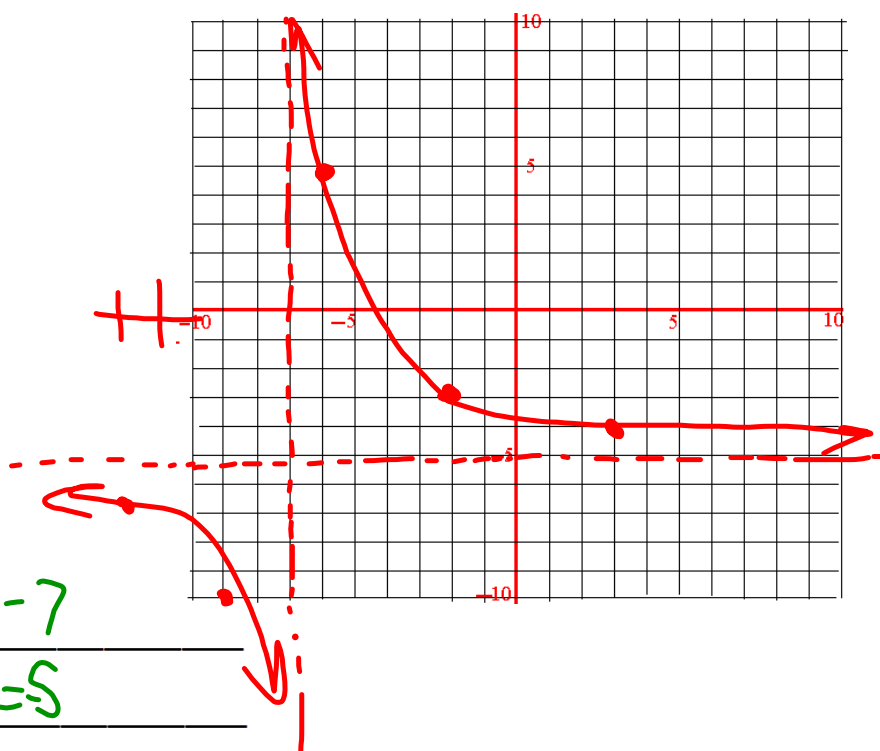
GRAPHING FUNCTIONS Graph the function. State the domain and range.

20. $y = \frac{10}{x+7} - 5$

$a = 10$

$h = -7$

$k = 5$



Vertical Asymptote(s): $x = -7$

Horizontal Asymptote: $y = 5$

GRAPHING FUNCTIONS Graph the function. State the domain and range.

33. $g(x) = \frac{5x}{2x+3}$

$$\frac{5(-3)}{2(-3)+3} = \frac{-15}{-3} = 5$$

V.A. $2x+3=0$
 $x = -\frac{3}{2}$

H.A. $y = \frac{5}{2}$

x-int:

$$5x=0$$

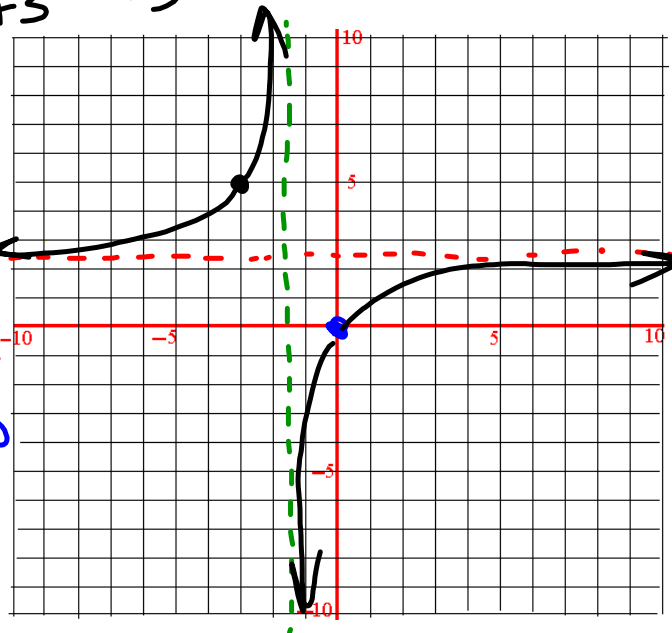
$$x=0$$

$$(0,0)$$

$$\frac{5(0)}{2(0)+3} = \frac{0}{3} = 0$$

$$(0,0)$$

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



Vertical Asymptote(s): _____

Horizontal Asymptote: $y = \frac{5}{2}$ _____

X-int: $(0,0)$ _____

Y-int: $(0,0)$ _____