

9.1

$$\frac{a}{b}$$


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

$$\frac{1}{x}$$

Exploring Rational Functions Using Transformations

Focus on...

- graphing, analysing, and comparing rational functions using transformations and using technology
- examining the behaviour of the graphs of rational functions near non-permissible values

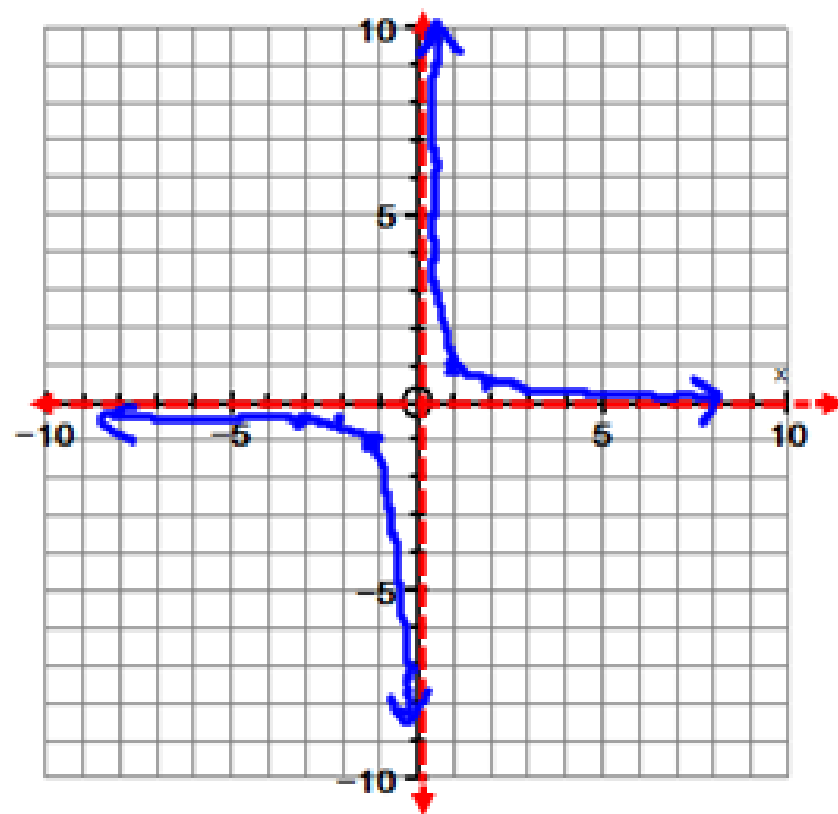
Chapter 9.1 Rational Functions and Transformations

Recall from Precal 11: $f(x) = \frac{1}{x}$

Table of Values:

x	y
-3	$-\frac{1}{3}$
-2	$-\frac{1}{2}$
-1	-1
0	undefined
1	1
2	$\frac{1}{2}$
3	$\frac{1}{3}$

x	y
10	$\frac{1}{10}$
2	$\frac{1}{2}$
10	10



Horizontal Asymptote: $y=0$ Vertical Asymptote: $x=0$

Domain: everything
but VA
 $\{x \mid x \neq 0\}$

Range: everything but
HA.
 $\{y \mid y \neq 0\}$

Ch 1

Transformations of this rational function: $y = af(x-h) + k$

$R_x \rightarrow$

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

Mapping Rule: $(x, y) \rightarrow (x+h, ay+k)$

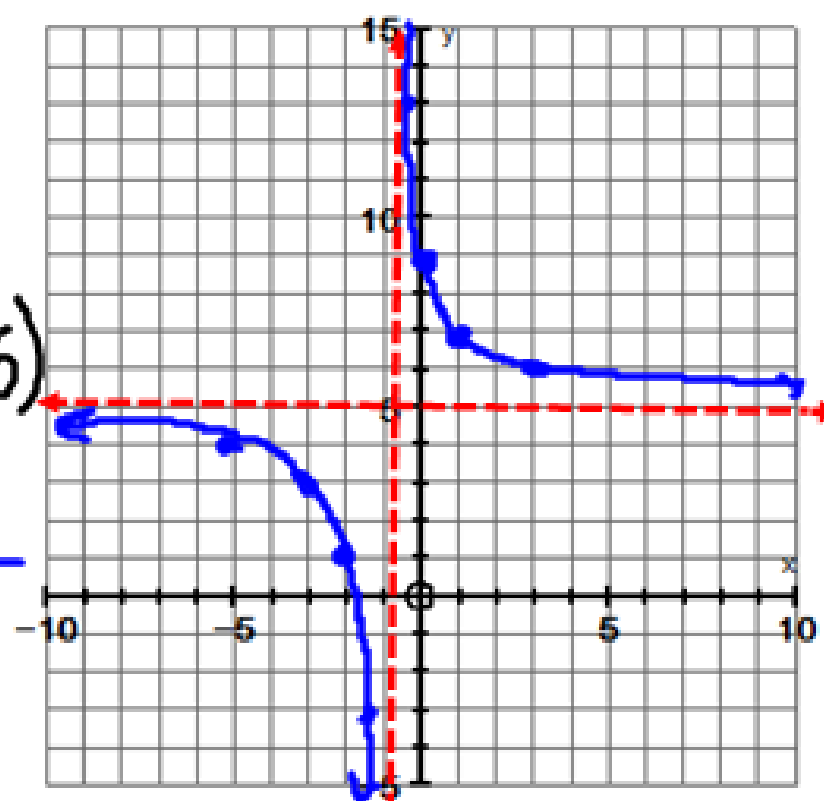
Example: Graph $y = \frac{4}{x+1} + 5$

VS 4
VT + 5
HT - 1

$(x, y) \rightarrow (x-1, 4y+5)$

x	y
2	1/2
1	1
0	2
-1	und
-2	1/2
-3	0
-4	-1/2

x-1	4y+5
-3	3
-2	1
-1.5	-3
-1	und
-0.5	13
0	9
1	7



VA: $x = -1$ (HT)
 HA: $y = 5$ (VT)

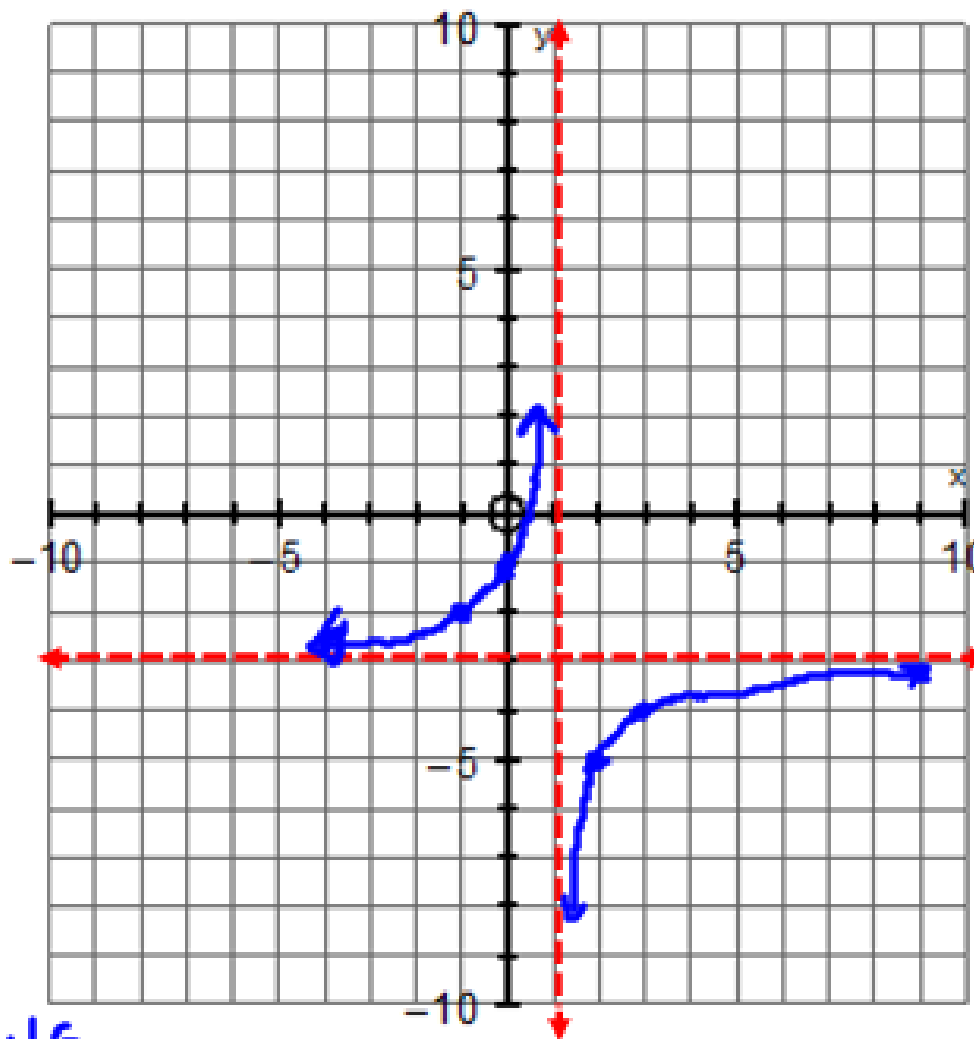
Example: Graph $y = \frac{-2}{x-1} - 3$

VS 2 HT+1 HA: $y = -3$
 VT-3 VA: $x = 1$
 Rx Yes

$(x, y) \rightarrow (x+1, -2y-3)$

pattern: over 1 up 1
 2 $\frac{1}{2}$
 3 $\frac{1}{3}$

New pattern over 1 down 1 x 2 Rx VS
 2 $\frac{1}{2}$ x 2
 3 $\frac{1}{3}$ x 2



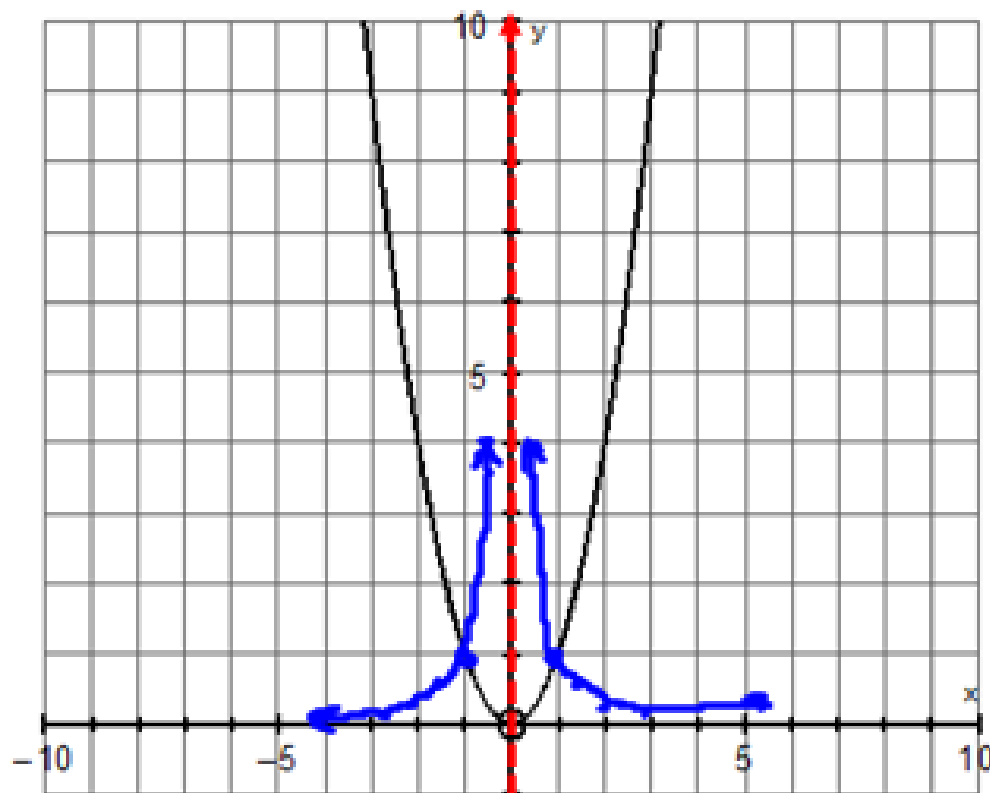
} from the intersection
 pt of the
 asymptotes

Graphs of Quadratic functions and Their Reciprocals

$$y = \frac{1}{x^2} \quad y = x^2$$

x	y
-2	$\frac{1}{4}$
-1	$\frac{1}{1}$
0	und
1	$\frac{1}{1}$
2	$\frac{1}{4}$

x	y
10	100
$\frac{1}{2}$	4



Horizontal Asymptote: $y=0$

Vertical Asymptote: $x=0$

Interval of decrease: $x > 0$

Interval of increase: $x < 0$

Domain: everything but $x=0$

$$\{x | x \neq 0\}$$

Range: everything greater than 0

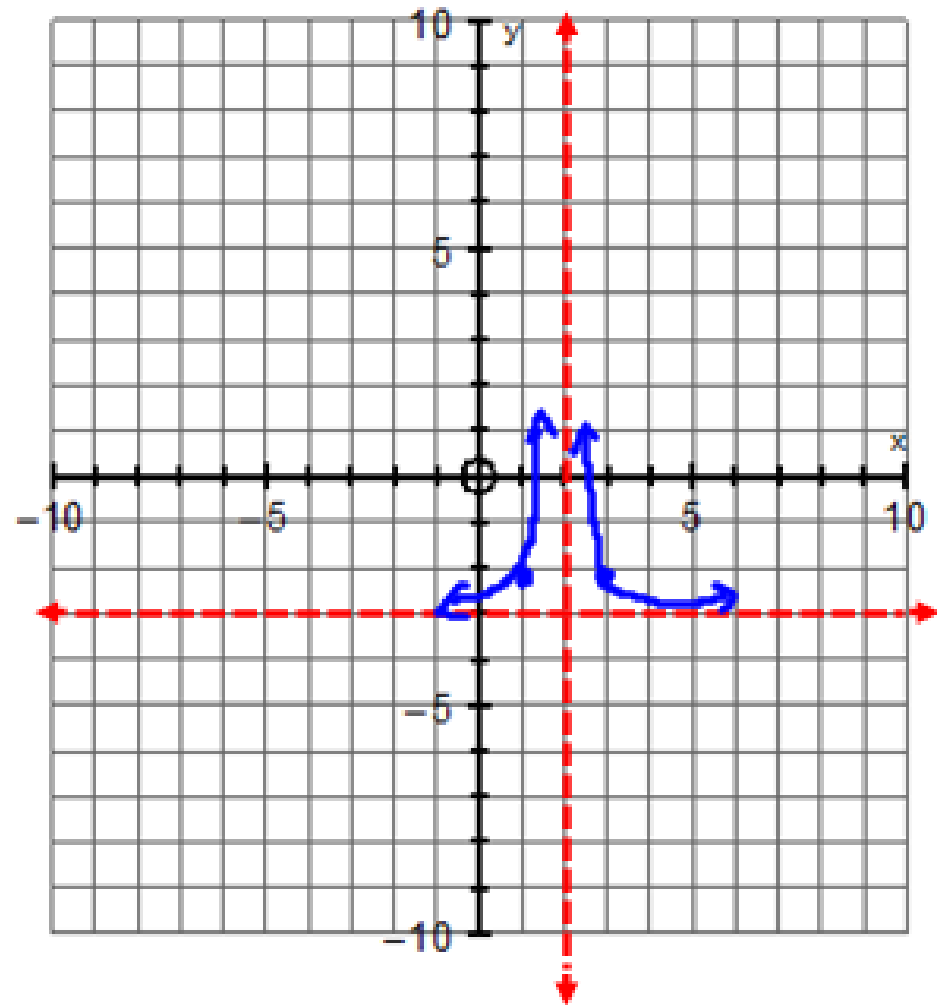
$$\{y | y > 0\}$$

$$y = \frac{a}{(x-h)^2} + k \quad \text{Mapping Rule: } (x, y) \rightarrow (x+h, ay+k)$$

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

$$\text{VA: } x=2$$
$$\text{HA: } y=-3$$

VT-3 R_x -None
VS 1 HT+2



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

$$y = \frac{2}{(x+3)} + 2$$

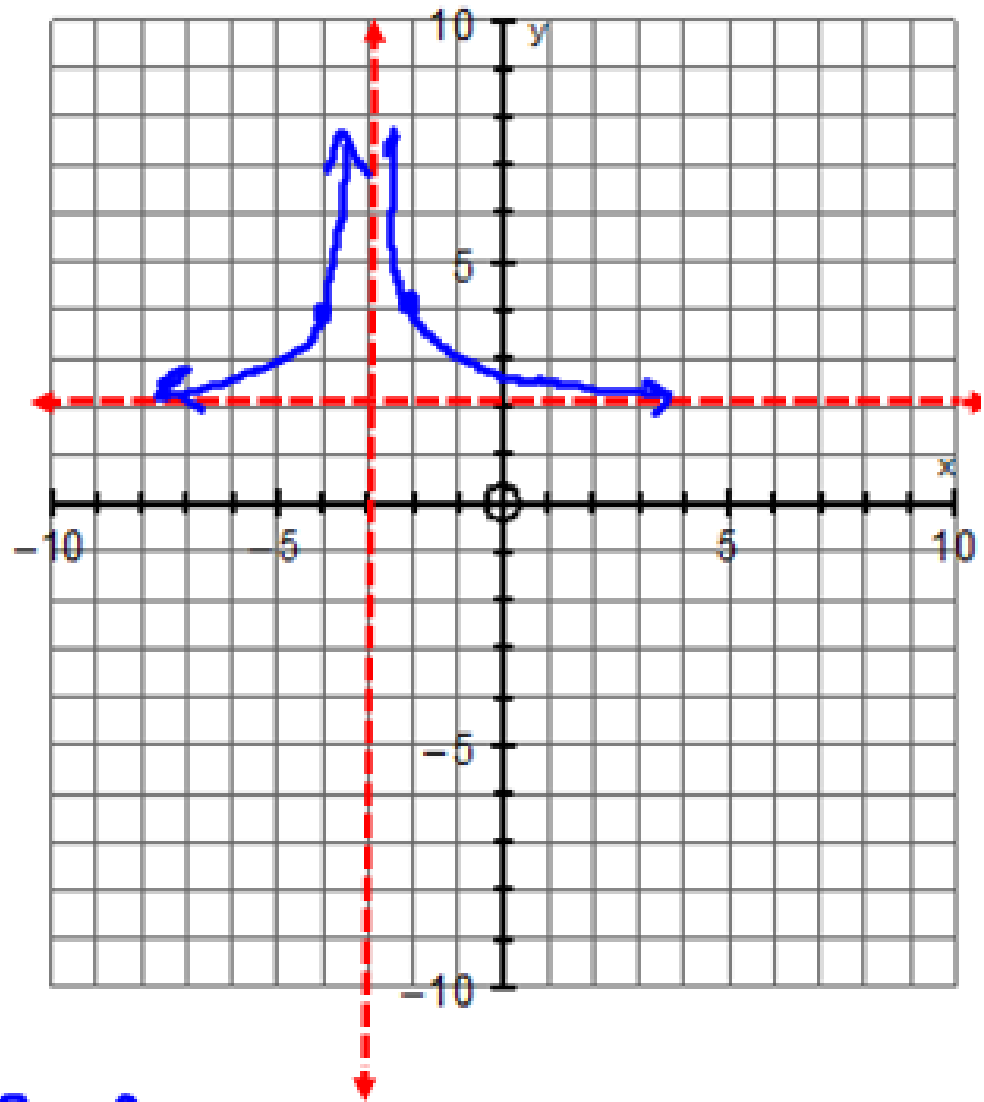
VSZ HT-3
VT2

$$VA: x = -3$$

$$HA: y = 2$$

old pattern over 1 up 1
2 up $\frac{1}{4}$
3 up $\frac{1}{9}$

new pattern over 1 up $1 \times 2 = 2$
2 $\frac{1}{4} \times 2 = \frac{1}{2}$
3 $\frac{1}{9} \times 2 = \frac{2}{9}$



$$y = \frac{-3}{(x-1)^2} + 9$$

VS 3

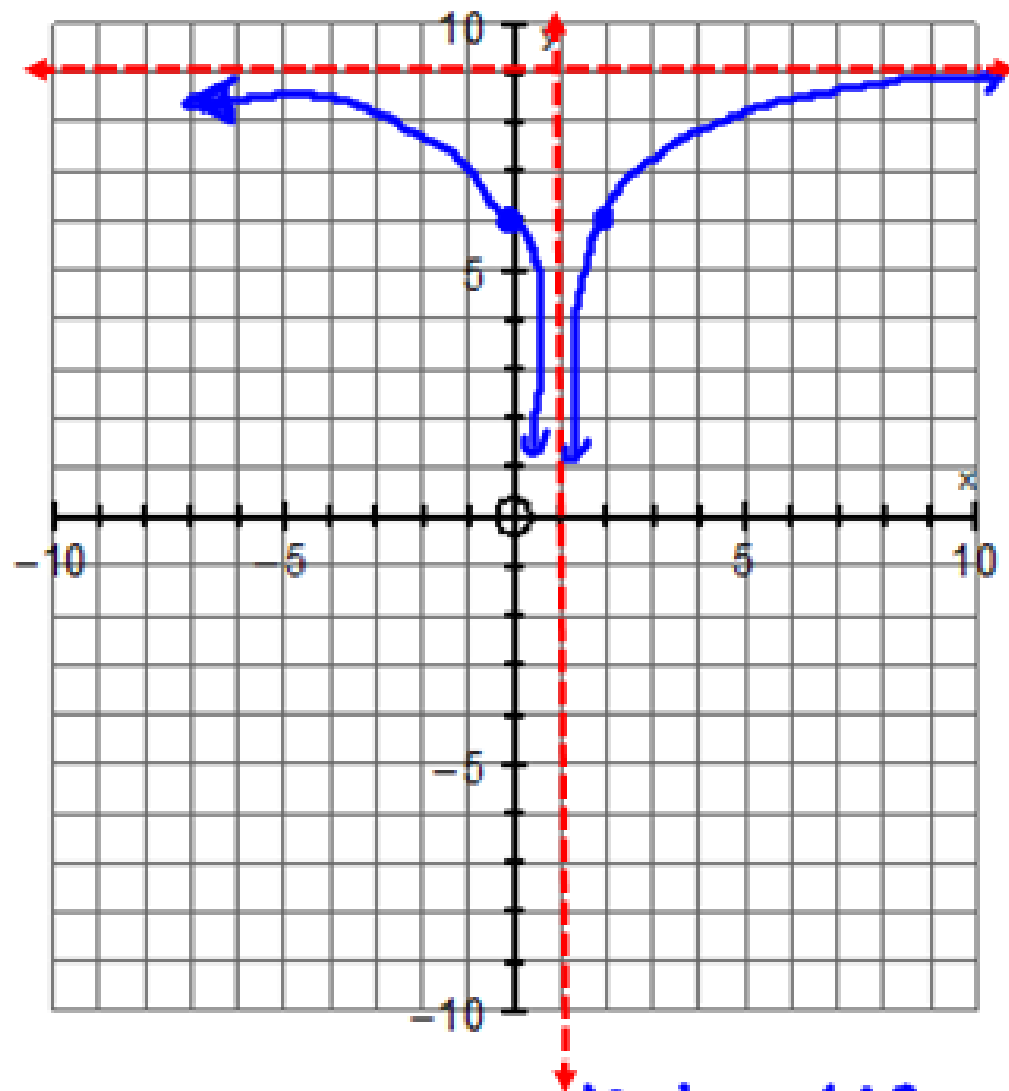
HT +1

VA: $x=1$

VT 9

HA: $y=9$

Rx Yes



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1-4, 6-8
Sheet