Parent Functions

A parent function is the simplest, unmodified version of a particular type of function.

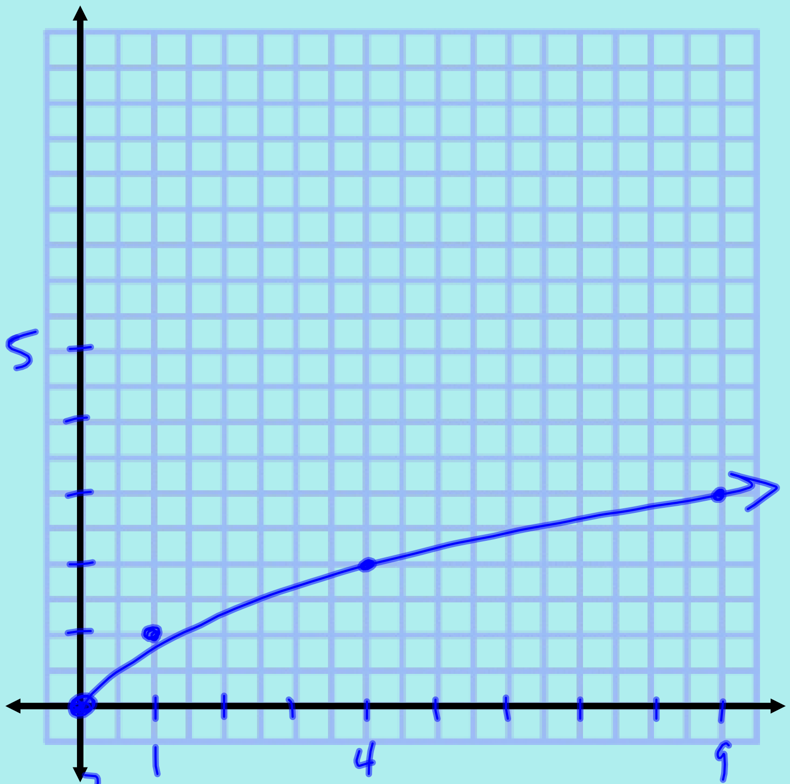
function	parent	sample child
✓ quadratic	$f(x) = x^2$	$g(x) = 3(x-2)^2 - 5$
? radical	$f(x) = \sqrt{x}$	$h(x) = -2\sqrt{x+3} - 1$
? reciprocal	$f(x) = \frac{1}{x}$	$k(x) = \frac{4}{x+2} - 6$
? absolute value	$f(x) = \lvert x \rvert$	$m(x) = -\lvert x+1 \rvert + 7$

1. The Radical Function

see handout

Consider the relation $y = \sqrt{x}$

	x	y
✗	-4	$\sqrt{-4}$ DNE
✗	-1	$\sqrt{-1}$ DNE
✓	0	$\sqrt{0} = 0$
✓	1	$\sqrt{1} = 1$
✓	4	$\sqrt{4} = 2$
✓	9	$\sqrt{9} = 3$



Domain: $\{x \in \mathbb{R} \mid x \geq 0\}$

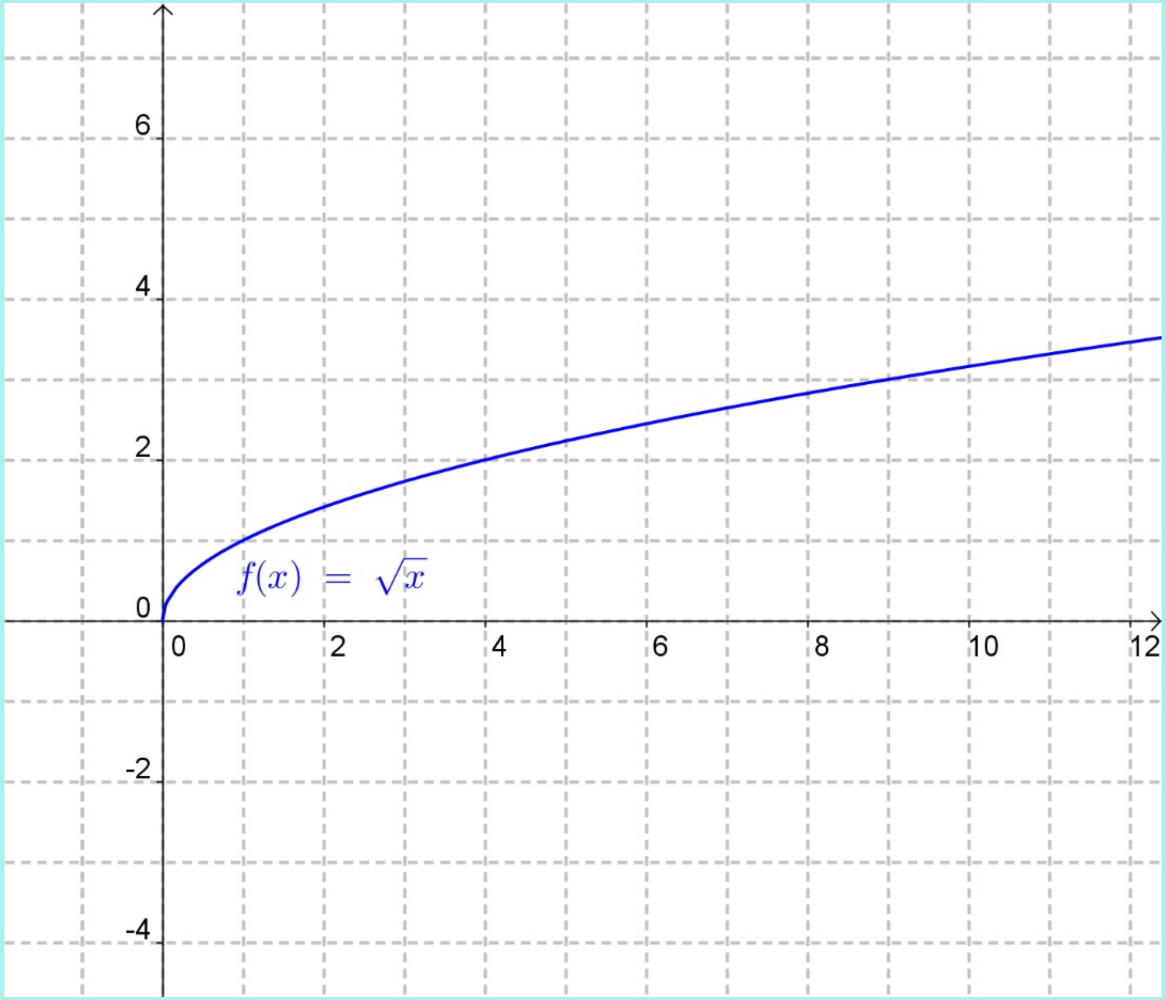
Range: $\{y \in \mathbb{R} \mid y \geq 0\}$

max/min? min, $y = 0$

y-values

The radical function, $f(x)=\sqrt{x}$

see handout



$$D=\{x\in\mathbb{R}\mid x\geq 0\}$$

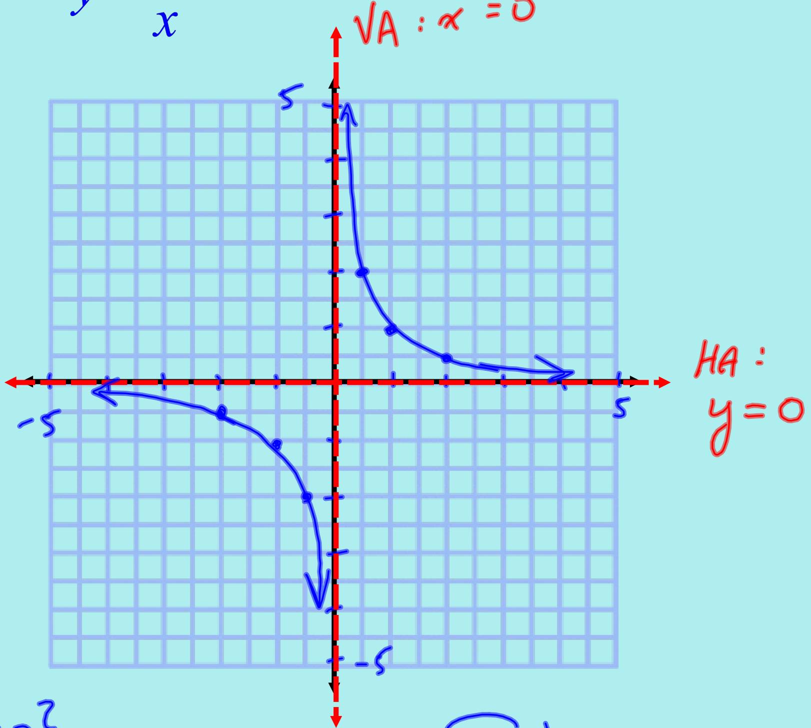
$$R=\{y\in\mathbb{R}\mid y\geq 0\}$$

2. The Reciprocal Function

see handout

Consider the relation $y = \frac{1}{x}$

x	y
-2	$\frac{1}{-2} = -\frac{1}{2}$
-1	$\frac{1}{-1} = -1$
-0.5	$\frac{1}{-0.5} = -2$
0	$\frac{1}{0}$ undefined
0.5	$\frac{1}{0.5} = 2$
1	$\frac{1}{1} = 1$
2	$\frac{1}{2}$



Domain: $\{x \in \mathbb{R} \mid x \neq 0\}$

Range: $\{y \in \mathbb{R} \mid y \neq 0\}$

$y = \frac{1}{x} \rightarrow x \neq 0$

$\Rightarrow x = \frac{1}{y} \rightarrow y \neq 0$

max/min? no

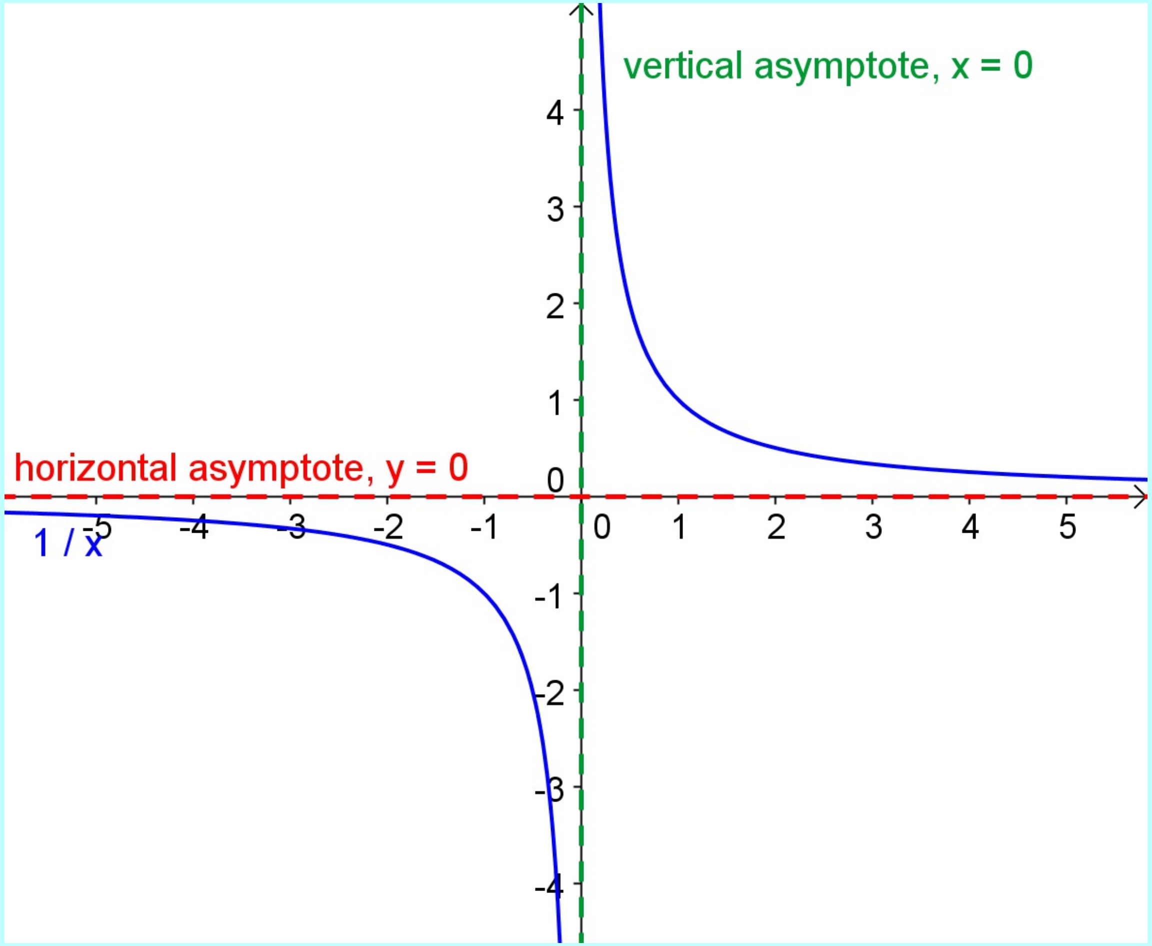
asymptotes?

VA : $x = 0$

HA : $y = 0$

The reciprocal function, $f(x)=\frac{1}{x}$

see handout



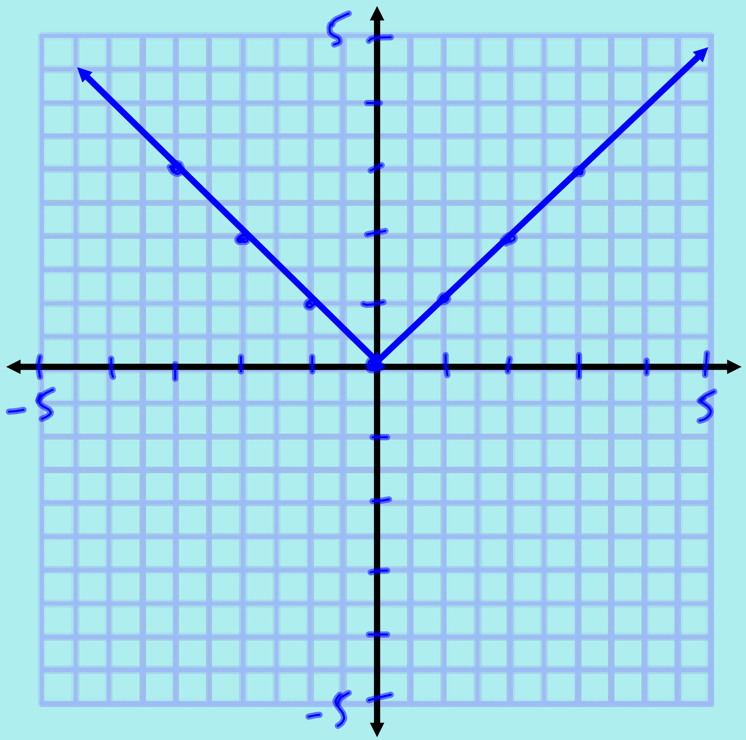
$$D=\{x\in\mathbb{R}\mid x\neq 0\}\qquad R=\{y\in\mathbb{R}\mid y\neq 0\}$$

3. The Absolute Value Function

see handout

Consider $f(x) = |x|$

x	$y = \|x\|$
✓ -3	$\|-3\| = 3$
✓ -2	$\|-2\| = 2$
✓ -1	$\|-1\| = 1$
✓ 0	$\|0\| = 0$
✓ 1	$\|1\| = 1$
✓ 2	$\|2\| = 2$
✓ 3	$\|3\| = 3$



Domain: $\{x \in \mathbb{R}\}$

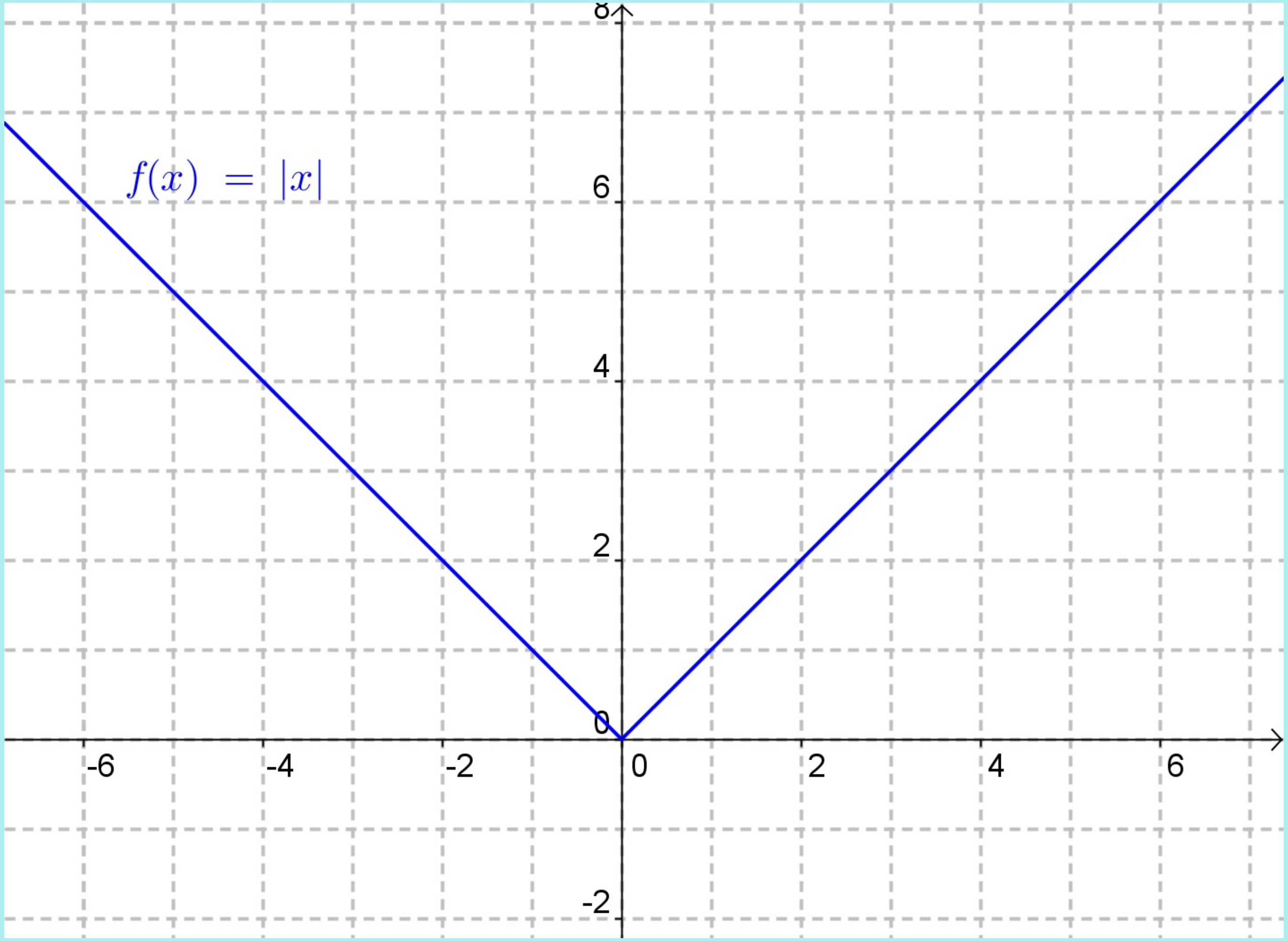
Range: $\{y \in \mathbb{R} \mid y \geq 0\}$

max/min? min at $y = 0$

asymptotes? none

The absolute value function, $f\left(x\right) = \left|x\right|$

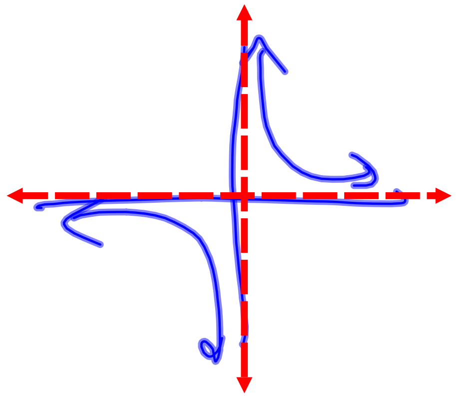
see handout



$D = \{x \in \mathbb{R}\}$ $R = \{y \in \mathbb{R} \mid y \geq 0\}$

Asymptotes

A line that a curve approaches, but never touches, is called an asymptote. The reciprocal function has two asymptotes:



Vertical Asymptote (VA): x = 0

Horizontal Asymptote (HA): y = 0

Note how these asymptotes correspond to the restrictions on the domain and range of the function.

$$D = \{x \in \mathbb{R} \mid x \neq 0\}$$

$$R = \{y \in \mathbb{R} \mid y \neq 0\}$$

Absolute Value Function

Sometimes, we are only concerned with the size of a value, rather than the sign (positive or negative).

This is called the magnitude of the value.

To represent this concept algebraically, we make use of the absolute value notation:

$$y = |x| \quad \text{or} \quad f(x) = |x|$$

The result will always be positive. *

Assigned Work:

Worksheet: Function Notation