Parent Functions

Feb 27/2019

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	$f(x)=\dfrac{1}{x}$	$k(x)=\dfrac{4}{x+2}-6$
absolute value	$f(x)=\lvert x\rvert$	$m(x)=-\lvert x+1\rvert+7$

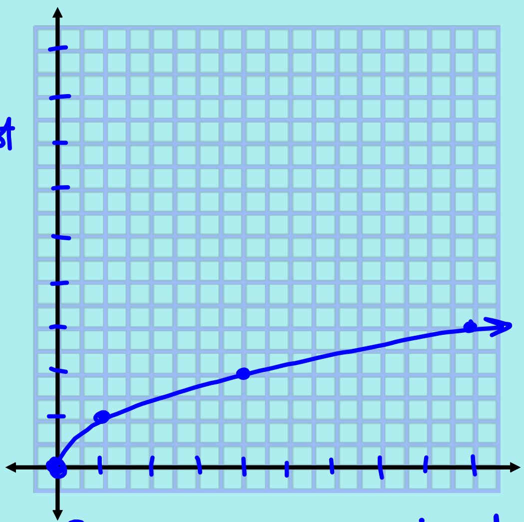
Feb 24-10:27 AM

1. The Radical Function

see handout

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

x	y
-4	$\sqrt{-4}$ does not exist
-1	$\sqrt{-1}$ DNE
0	$\sqrt{0}=0$
1	$\sqrt{1}=1$
4	$\sqrt{4}=2$
9	$\sqrt{9}=3$



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

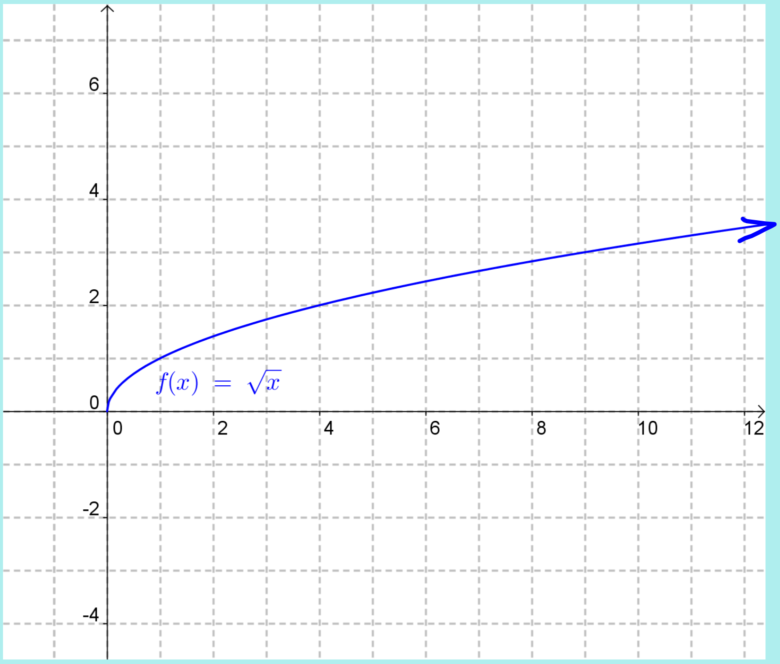
Range: $\{y\in\mathbb{R} \mid y\geq 0\}$

max/min? min at $y=0$

Feb 22-9:25 PM

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

see handout



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

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

Feb 22-9:49 PM

2. The Reciprocal Function

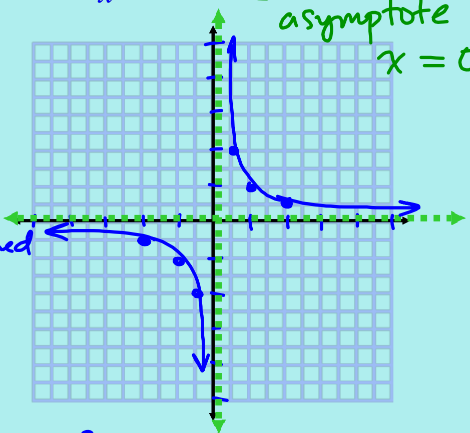
see handout

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	$\frac{1}{2}=\frac{1}{2}$

Vertical asymptote (VA)

$x=0$



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

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

max/min? no

asymptotes?

VA : $x=0$

HA : $y=0$

(horizontal)

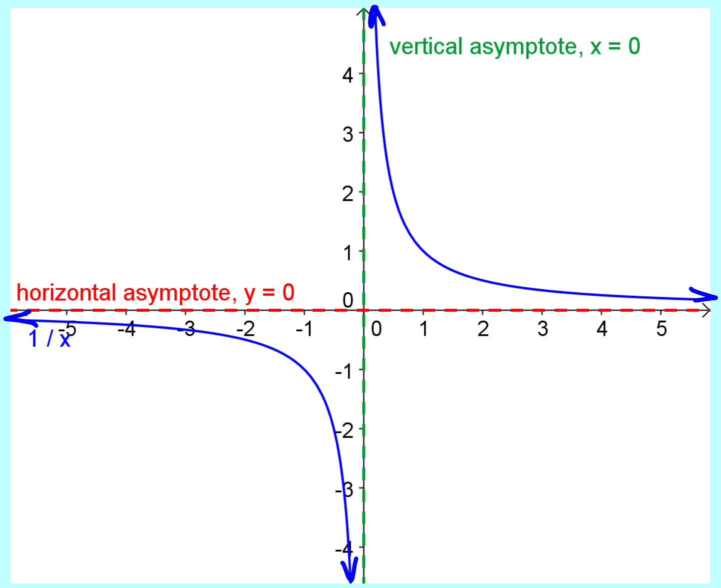
$y=\frac{1}{x}$

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

Feb 22-9:25 PM

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

see handout



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

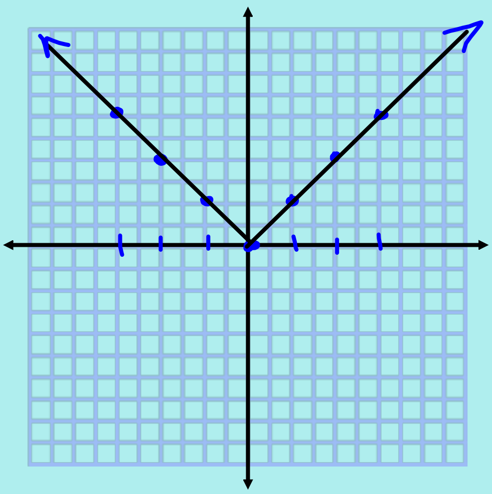
Feb 23-9:20 PM

3. The Absolute Value Function

see handout

Consider $f(x)=|x|$

x	$y=\lvert x\rvert$
-3	$\lvert -3\rvert=3$
-2	$\lvert -2\rvert=2$
-1	$\lvert -1\rvert=1$
0	$\lvert 0\rvert=0$
1	$\lvert 1\rvert=1$
2	$\lvert 2\rvert=2$
3	$\lvert 3\rvert=3$



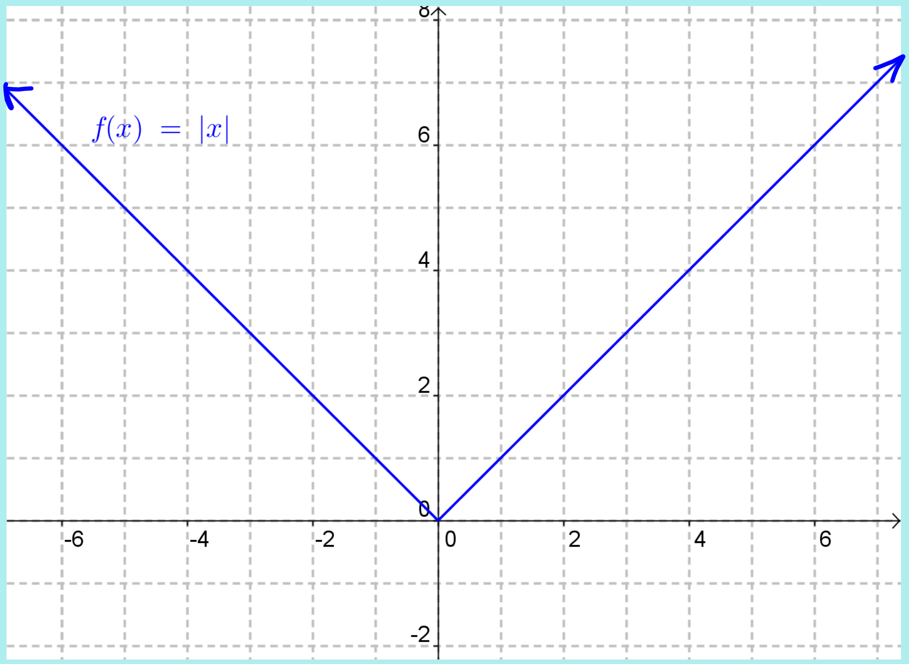
Domain: $\{x\in\mathbb{R}\}$ max/min? min at $y=0$

Range: $\{y\in\mathbb{R}\mid y\geq 0\}$ asymptotes? no

Feb 22-9:25 PM

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

see handout



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

Feb 22-9:49 PM

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.

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

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

Feb 27-10:16 PM

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.

Mar 2-12:23 PM

Assigned Work:

Worksheet: Function Notation

$f(-2a)$ $\quad f(x) = x^2$

$= (-2a)^2$

$= (-2a)(-2a)$

$= 4a^2$

$f\left(\frac{a}{2}\right)$ $\quad \frac{a}{2}$

$\left(\frac{a}{2}\right)^2 = \left(\frac{a}{2}\right)\left(\frac{a}{2}\right) = \frac{a^2}{4}$

$\sqrt{\frac{a}{2}} = \frac{\sqrt{a}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2a}}{2}$

$\frac{1}{\frac{a}{2}} = \frac{\frac{1}{1}}{\frac{a}{2}} = \frac{1}{1} \times \frac{2}{a} = \frac{2}{a}$

Feb 10-10:23 PM

$5f[\underbrace{4(a-1)}_{x}]-3 = 5\left(4(a-1)\right)-3$

$= 20(a-1)-3$

$= 20a-20-3$

$f(x) = x \quad = 20a-23$

$5\,f[4(a-1)] = 5(4(a-1))$

$-3 \qquad -3$

$f(x) = x^2$

$5f[4(a-1)]-3 = 5\left(4(a-1)\right)^2-3$

$= 5\left[4^2(a-1)^2\right]-3$

$= 5\left[16(a^2-2a+1)\right]-3$

$= 80(a^2-2a+1)-3$

$= 80a^2-160a+77$

$5f[4(a-1)]-3 \longrightarrow f(x)=\frac{1}{x}$

x

$= 5\left[\frac{1}{4(a-1)}\right]-3$

$= \frac{5}{4(a-1)}-3$

Feb 28-2:01 PM

$f(x) \qquad x \qquad x^2 \qquad \sqrt{x} \qquad \frac{1}{x}$

$-3f(a-5)+2 \qquad \frac{-3}{a-5}+2$

$f(3a-6) \quad 3a-6$

OR

$3f(a-2)$

OR

$f[3(a-2)]$

Feb 28-2:07 PM

$f\left(\frac{a}{2}\right)$

$\frac{1}{x}$

$\frac{1}{\frac{a}{2}}$

$= \frac{2}{a}$

$2f(a)$

Feb 28-2:13 PM