2.3A Base Functions

Base functions are used as building blocks for more complicated functions. The list of base functions that you are responsible for are:

$$f(x)=x \qquad g(x)=x^2 \qquad k(x)=\sqrt{x} \qquad h(x)=\frac{1}{x} \qquad r(x)=|x| \qquad q(x)=x^3$$

Key Properties of the Base Functions

Domain: Possible *x* values. **Range:** Possible *y* values.

Increasing: Intervals in the domain, where *y* increases as *x* increases.

Decreasing: Intervals in the domain, where *y* decreases as *x* increases.

Asymptotes: A line that the function approaches but never reaches.

y-intercept: The point where the relation crosses the *y*-axis ($x = 0$).

x-intercept: The point(s) where the relation crosses the *x*-axis ($y = 0$).

Finite Differences: The difference in *y*-values for consecutive *x*-values.

1) Linear Function

$y = x$

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

Range: $\{y \in \mathbb{R}\}$

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

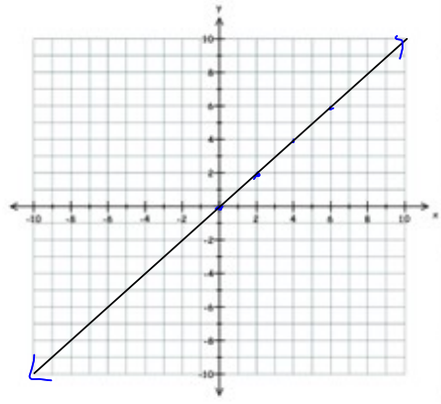
Decreasing: NONE

Asymptotes: 0

y-intercept: 0

x-intercept: 0

x	y
-2	-2
-1	-1
0	0
1	1
2	2



Finite Differences:

x	y	
-2	-2	
-1	-1	1
0	0	1
1	1	1
2	2	1

Common 1ST Diff.

2) Quadratic Function

$y = x^2$

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

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

Increasing: $\{x \in \mathbb{R} \mid x > 0\}$

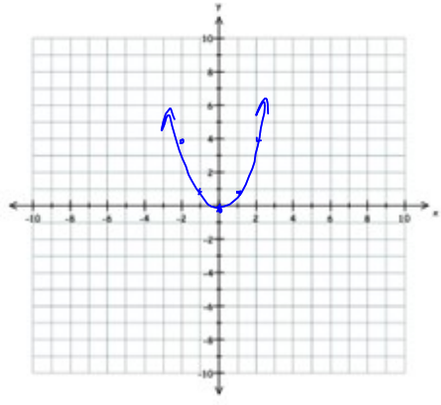
Decreasing: $\{x \in \mathbb{R} \mid x < 0\}$

Asymptotes: None

y-intercept: 0

x-intercept: 0

x	y
-2	4
-1	1
0	0
1	1
2	4

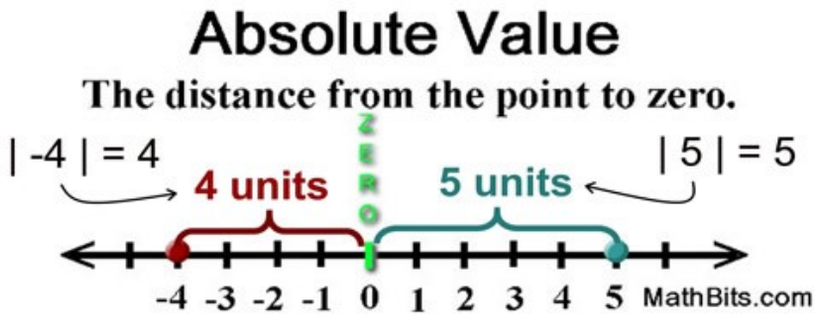


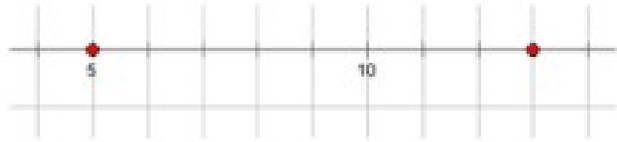
Finite Differences:

x	y		
-2	4		
-1	1	-3	
0	0	-1	+2
1	1	+1	+2
2	4	+3	+2

Common 2ND Diff

What does "absolute value" mean?



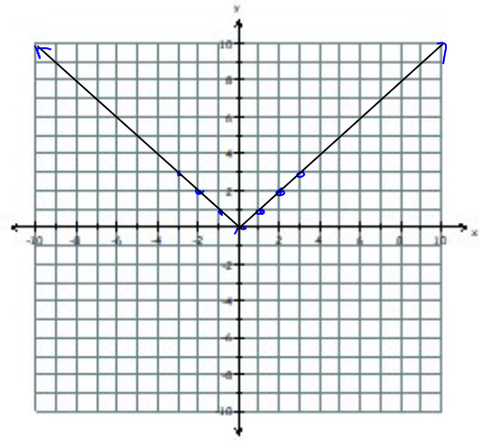


$|5 - 13| = 8$

$|13 - 5| = 8$

3) Absolute Value Function	$y = \|x\|$	
Domain: $\{x \in \mathbb{R}\}$		
Range: $\{y \in \mathbb{R} \mid y \geq 0\}$		
Increasing: $\{x \in \mathbb{R} \mid x > 0\}$		
Decreasing: $\{x \in \mathbb{R} \mid x < 0\}$		
Asymptotes: None		
y-intercept: 0		
x-intercept: 0		

x	y
-2	2
-1	1
0	0
1	1
2	2



4) Root/Radical Function

$y = \sqrt{x}$

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

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

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

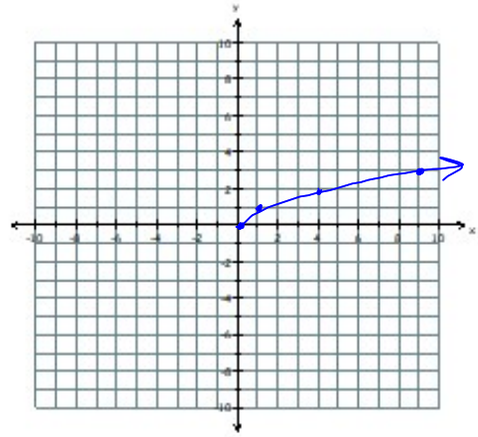
Decreasing: NONE

Asymptotes: NONE

y-intercept: 0

x-intercept: 0

x	y
-2	und.
-1	und.
0	0
1	1
4	2
9	3



5) Cubic Function

$y = x^3$

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

Range: $\{y \in \mathbb{R}\}$

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

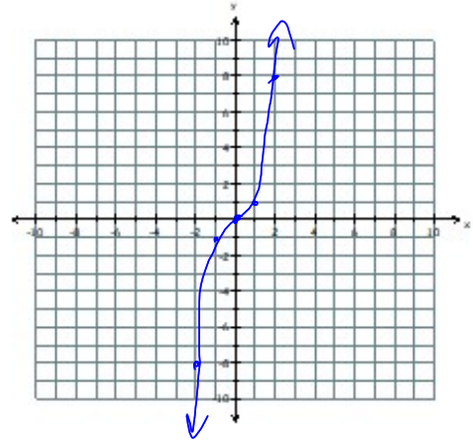
Decreasing: NONE

Asymptotes: NONE

y-intercept: 0

x-intercept: 0

x	y
-2	-8
-1	-1
0	0
1	1
2	8



Finite Differences: Common 3RD Diff.

x	y			
-2	-8			
		+7		
-1	-1		-6	
		+1		+6
0	0		0	
		+1		+6
1	1		+6	
		+7		
2	8			

6) Rational Function (Reciprocal Function)

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

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

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

Increasing: NONE

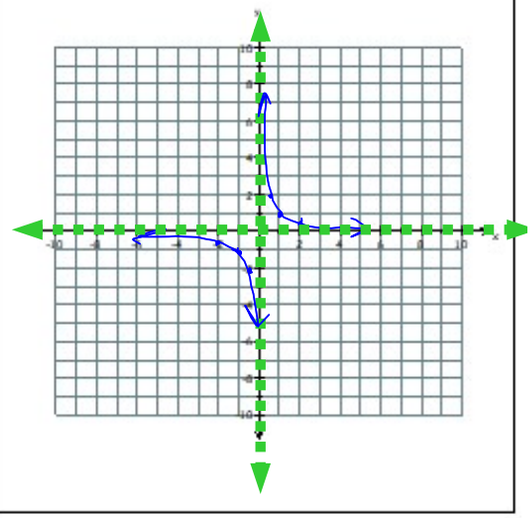
Decreasing: $\{x \in \mathbb{R} \mid x \neq 0\}$

Asymptotes: Horz. $y = 0$
Vert. $x = 0$

y-intercept: NONE

x-intercept: NONE

x	y
-2	$-\frac{1}{2}$
-1	-1
-1/2	-2
-1/4	-4
0	UND.
1/4	4
1/2	2
1	1
2	$\frac{1}{2}$



$f(x) = \frac{1}{x}$

$f\left(\frac{1}{2}\right) = \frac{1}{\frac{1}{2}}$

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

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

$= 2$

Practice!

For each base function (parent function)

- Practice key points

- Key take-away pieces to memorize

- Graph

$f(x) = x$ $g(x) = x^2$ $k(x) = \sqrt{x}$ $h(x) = \frac{1}{x}$ $r(x) = |x|$ $q(x) = x^3$