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.

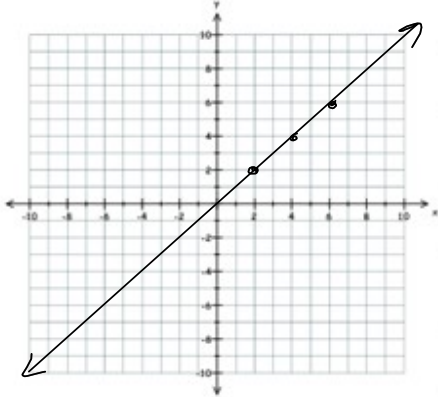Increasing: Intervals in the domain, where *y* increases as *x* increases.

Decreasing: Intervals in the domain, where *y* decreases as *x* increases.
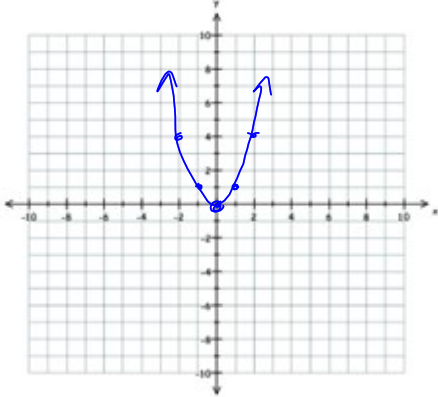
Asymptotes: A line that the function approaches but never reaches.

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: NONE

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	+1
0	0	+1
1	1	+1
2	2	

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	-3	+2
-1	1	-1	+2
0	0	1	+2
1	1	3	
2	4		

Common 2ND Diff

What does "absolute value" mean?

Absolute Value
The distance from the point to zero.

$|-4| = 4$ 4 units   5 units $|5| = 5$

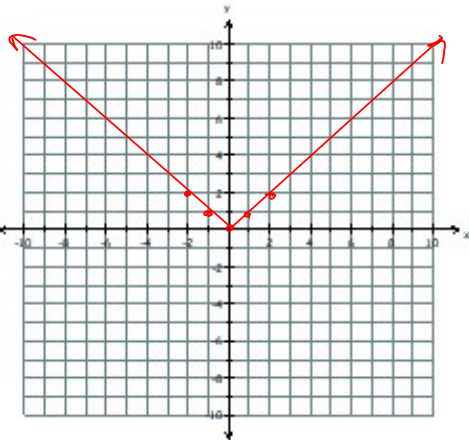-4 -3 -2 -1 0 1 2 3 4 5   MathBits.com
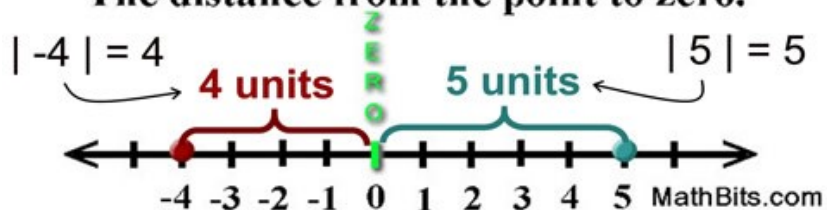
Distance is always positive, or zero.
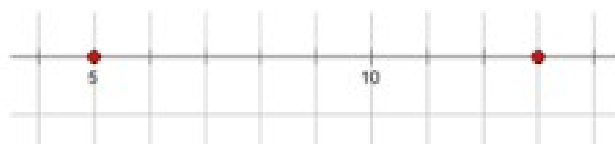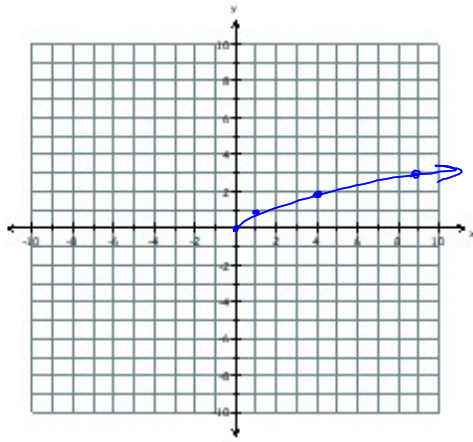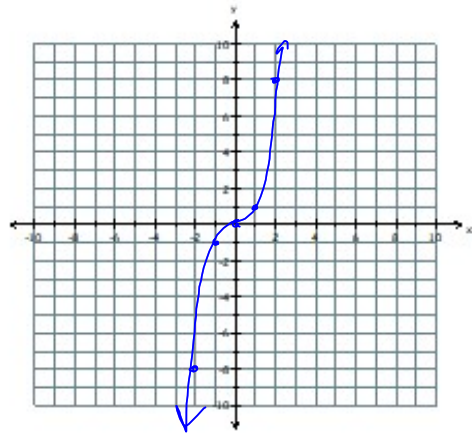
$$|5 - 13| = 8$$
$$|13 - 5| = 8$$

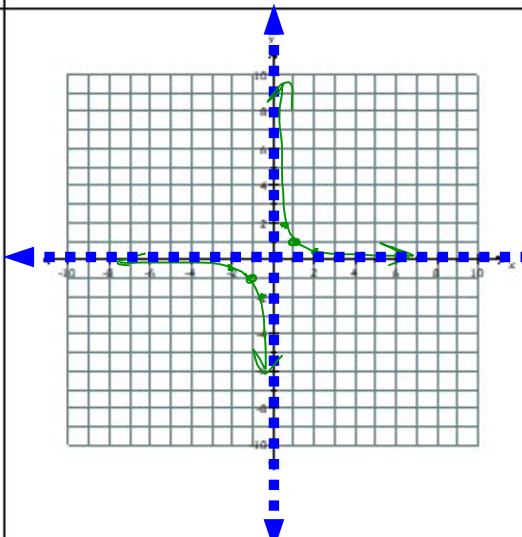| 3) Absolute Value Function		$y = |x|$	
Domain: $\{x \in \mathbb{R}\}$			
Range: $\{y \in \mathbb{R} \mid y \geq 0\}$			
Increasing: $\{x \in \mathbb{R} \mid x > 0\}$			
Decreasing: $\{x \in \mathbb{R} \mid x < 0\}$			
Asymptotes: None			
y-intercept: 0			
x-intercept: 0			

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

Decreasing: Never

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: NEVER

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

6) Rational Function (Reciprocal Function)	$y = \dfrac{1}{x}$	
Domain: $\{x \in \mathbb{R} \mid x \neq 0\}$		
Range: $\{y \in \mathbb{R} \mid y \neq 0\}$		
Increasing: NEVER		
Decreasing: $\{x \in \mathbb{R} \mid x \neq 0\}$		
Asymptotes: Horiz. $y = 0$ 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	$\frac{1}{2}$

Practice

Graphing each
of the base functions.