

## 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:

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



### 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.

Note: Constant first differences means Linear  
 Constant second differences means Quadratic  
 Constant third differences means Cubic

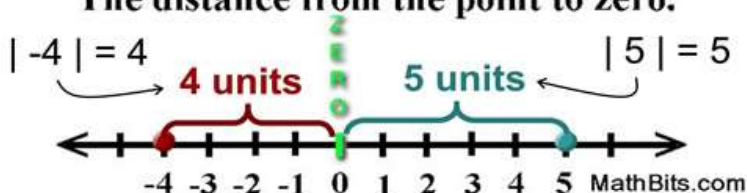
1) Linear Function	$y = x$													
Domain: $\{x \in \mathbb{R}\}$	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>-2</td> </tr> <tr> <td>-1</td> <td>-1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>2</td> </tr> </tbody> </table>	x	y	-2	-2	-1	-1	0	0	1	1	2	2	
x		y												
-2		-2												
-1		-1												
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x	y													
-2	-2													
-1	-1													
0	0													
1	1													
2	2													

2) Quadratic Function	$y = x^2$	$\bullet$ - key points												
Domain: $\{x \in \mathbb{R}\}$	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>4</td> </tr> <tr> <td>-1</td> <td>1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>4</td> </tr> </tbody> </table>	x	y	-2	4	-1	1	0	0	1	1	2	4	
x		y												
-2		4												
-1		1												
0		0												
1		1												
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x	y													
-2	4													
-1	1													
0	0													
1	1													
2	4													

What does "absolute value" mean?

### Absolute Value

The distance from the point to zero.



Distance is always positive, or zero.



$$|5 - 13| = 8$$

$$|13 - 5| = 8$$

3) Absolute Value Function	$y =  x $	<i>- key points</i>												
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y-intercept: 0														
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4) Root/Radical Function	$y = \sqrt{x}$	• - key points														
Domain: $\{x \in \mathbb{R}, x \geq 0\}$	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>/</td> </tr> <tr> <td>-1</td> <td>/</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>4</td> <td>2</td> </tr> <tr> <td>9</td> <td>3</td> </tr> </tbody> </table>	x	y	-2	/	-1	/	0	0	1	1	4	2	9	3	
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$(-2)^3$

5) Cubic Function	$y = x^3$	• - key pts																							
Domain: $\{x \in \mathbb{R}\}$	<table border="1"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>-8</td> </tr> <tr> <td>-1</td> <td>-1</td> </tr> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td>8</td> </tr> </tbody> </table>	x	y	-2	-8	-1	-1	0	0	1	1	2	8												
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$\therefore$  Constant 3rd difference  
 $\therefore$  cubic  $x^3$

<b>6) Rational Function (Reciprocal Function)</b>	$y = \frac{1}{x}$	• - key pts AND asymptotes.																				
Domain: $\{x \in \mathbb{R}, x \neq 0\}$	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>y</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td><math>-\frac{1}{2}</math></td> </tr> <tr> <td>-1</td> <td>-1</td> </tr> <tr> <td><math>-\frac{1}{2}</math></td> <td>-2</td> </tr> <tr> <td><math>-\frac{1}{4}</math></td> <td>-4</td> </tr> <tr> <td>0</td> <td>undefined</td> </tr> <tr> <td><math>\frac{1}{4}</math></td> <td>4</td> </tr> <tr> <td><math>\frac{1}{2}</math></td> <td>2</td> </tr> <tr> <td>1</td> <td>1</td> </tr> <tr> <td>2</td> <td><math>\frac{1}{2}</math></td> </tr> </tbody> </table>	x	y	-2	$-\frac{1}{2}$	-1	-1	$-\frac{1}{2}$	-2	$-\frac{1}{4}$	-4	0	undefined	$\frac{1}{4}$	4	$\frac{1}{2}$	2	1	1	2	$\frac{1}{2}$	
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Range: $\{y \in \mathbb{R}, y \neq 0\}$																						
Increasing: Never																						
Decreasing: Always.																						
Asymptotes: $x = 0$ (y-axis) $y = 0$ (x-axis)																						
y-intercept: None																						
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