

## Lesson 8 – Translations of Parent Functions

Objective:

I will translate parent functions to create a family of functions.

The Parent  
Functions

The most common **parent functions** are:

$$f(x) = |x|$$

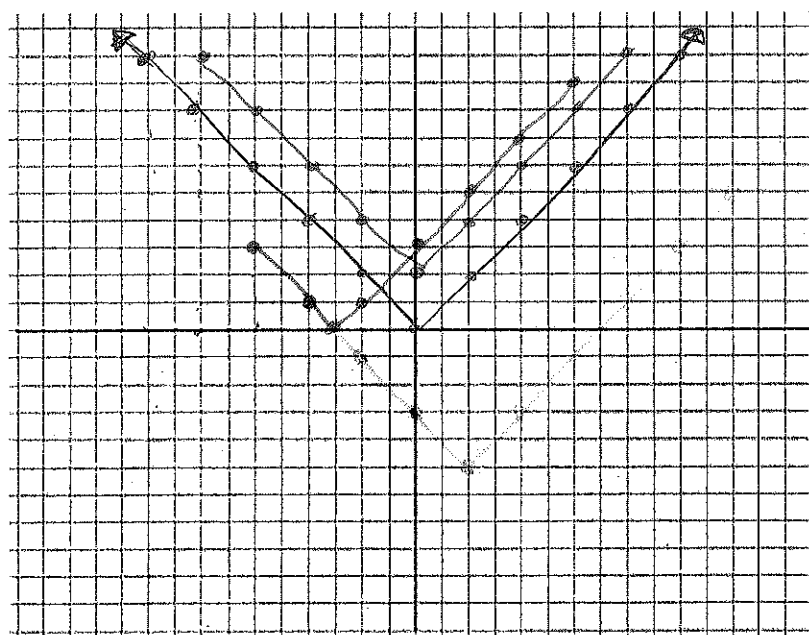
$$f(x) = x^2$$

$$f(x) = \sqrt{x}$$

Translating  
the Absolute  
Value  
Function

Graph the **absolute value function**  $f(x) = |x|$  by making a table of values

$x$	$f(x)$
-10	$ -10  = 10$
-8	8
-6	6
-4	4
-2	2
0	0
2	2
4	4
6	6
8	8
10	10



Now make a table of values for the function  $f(x) = |x| + 2$ , then graph it on the same graph as the parent function in a different color. What happened?

x	f(x)
-8	$ -8  + 2 = 8 + 2 = 10$
-6	$ -6  + 2 = 6 + 2 = 8$
-4	6
-2	4
0	2
2	4
4	6
6	8

$$f(x) = |x| + 2$$

Graph shifted  
up 2 units.

Make a new table of values for the function  $f(x) = |x + 3|$ . Graph is on the same graph as the parent function in a different color. What happened?

x	f(x)
-6	$ -6 + 3  =  -3  = 3$
-4	$ -4 + 3  =  -1  = 1$
-2	$ -2 + 3  =  1  = 1$
0	$ 0 + 3  = 3$
2	$ 2 + 3  = 5$
4	$ 4 + 3  = 7$
6	$ 6 + 3  = 9$

$$f(x) = |x + 3|$$

Shifted left  
3 units

Lastly, make a table of values for the function  $f(x) = |x - 2| - 5$ . Graph this function on the graph with the parent function in a different color. What do you notice?

$$f(x) = |x - 2| - 5$$

Shifted right 2  
down 5

x	f(x)
-6	$ -6 - 2  - 5 =  -8  - 5 = 8 - 5 = 3$
-4	$ -4 - 2  - 5 =  -6  - 5 = 6 - 5 = 1$
-2	-1
0	-3
2	-5
4	-3
6	-1

How do we move a graph up or down?

We add or subtract  
to the function.

$$f(x) = |x| + 5 \quad f(x) = |x| - 5$$

How do we move a graph left or right?

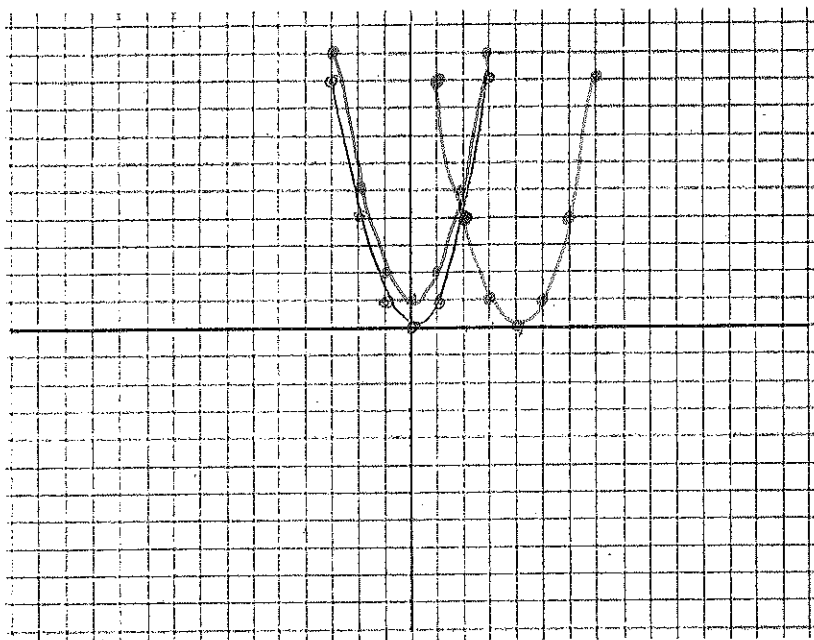
We add or subtract  
to the value of x inside  
the grouping symbol

$$f(x) = |x + 5| \text{ left}$$

$$f(x) = |x - 5| \text{ right}$$

What do you think the graph of  $g(x) = x^2 + 1$  would look like? Make a quick sketch.

Below graph the parent function for the quadratic family, then make a table of values for the translation  $g(x) = x^2 + 1$ . Graph your results below in a different color. Was your prediction correct?



$x$	$f(x) = x^2$	$f(x) = x^2 + 1$
-3	9	$9 + 1 = 10$
-2	4	$4 + 1 = 5$
-1	1	$1 + 1 = 2$
0	0	$0 + 1 = 1$
1	1	$1 + 1 = 2$
2	4	$4 + 1 = 5$
3	9	$9 + 1 = 10$

Shifted up 1 unit.

What do you think you can say about moving the quadratic function up or down?

Add or subtracting to the function

$$f(x) = x^2 + 1$$

$$f(x) = x^2 - 1$$

Graph the function  $g(x) = (x - 4)^2$  on the graph above in a different color.

$x$	$g(x)$
-1	$(-1 - 4)^2 = (-5)^2 = 25$
0	$(0 - 4)^2 = (-4)^2 = 16$
1	$(1 - 4)^2 = (-3)^2 = 9$
2	$(2 - 4)^2 = (-2)^2 = 4$
3	$(3 - 4)^2 = (-1)^2 = 1$
4	$(4 - 4)^2 = 0^2 = 0$

$x$	$g(x)$
5	$(5 - 4)^2 = 1^2 = 1$
6	4
7	9

Shifted right  
4 units

How can we move the quadratic function left or right?

Add or subtract to  $x$  inside the  $( )$

$$f(x) = (x + 2)^2 = \text{left } 2$$

$$f(x) = (x - 2)^2 = \text{right } 2$$

Describe in words how the following graphs would be transformed from their parent functions.

1).  $h(x) = \sqrt{x + 2} - 9$

left 2  
down 9

2).  $k(x) = (x - 2)^2 + 3$

right 2  
up 3