GSE Algebra 1 **7.1 – Notes** Name: ____________________

The goal here to see what happens to parabolas as we move them around a graph, what happens in the equation and how that can affect the tables.

Let's look at quadratics again. What shape do they make? Parabola

Multiply area by 5

Match the correct statement to the description below.

Matching Equation (A, B, C, or D)	Statement		Function Equation
B	The length of each side of a square is increased by 5 units.	A	$A(x) = 5x^2$
C	The length of each side of a square is multiplied by 5 units.	B	$A(x) = (x+5)^2$ → Add on
D	The area of a square is increased by 5 square units.	C	$A(x) = (5x)^2$
A	The area of a square is multiplied by 5.	D	$A(x) = x^2 + 5$

What is the **domain** of $y = x^2$? $(-\infty, \infty)$

PARENT FUNCTION: $\boldsymbol{y = x^2}$

Let's look at how each part above changes the graph, equation and table.

$\boldsymbol{y = x^2 + 5}$

How has this changed from the parent function $y = x^2$?

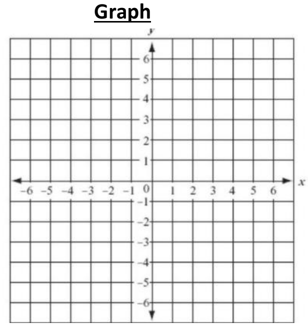
Equation

$y = x^2$	$\boldsymbol{y = x^2 + 5}$
Parent	UP 5

Table

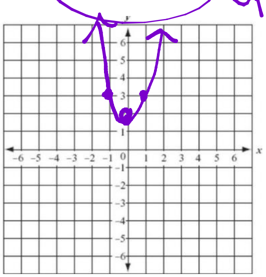
$\boldsymbol{y = x^2}$		$\boldsymbol{y = x^2 + 5}$	
x	y	x	y
-2	4	-2	9
-1	1	-1	6
0	0	0	5
1	1	1	6
2	4	2	9
3	9	3	14

Graph

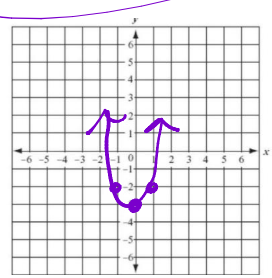


Let's look at a few more. Try these two based off the work from above.

a) $y = x^2 + 2$ UP 2



b) $y = x^2 - 3$ Down 3



So the number OUTSIDE of the parentheses

(in the back of the equation) makes the

parabola move UP ***or*** Down

Now let's try this one:

$y = (x+5)^2$

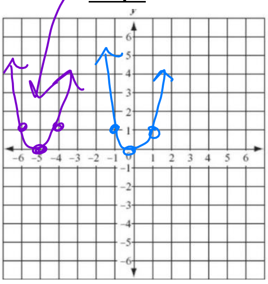
Equation

$y = x^2$	$y = (x+5)^2$
parent	left 5

Table

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

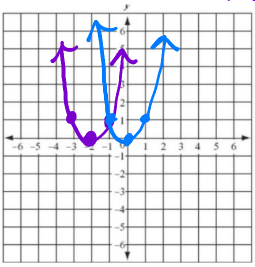
Graph



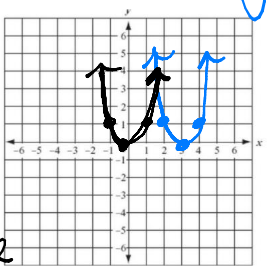
$x+5=0$
$-5 \quad -5$
$x=-5$

Let's look at a few more. Try these two based off the work from above.

a) $y = (x+2)^2$ left 2



b) $y = (x-3)^2$ Right 3



*So the number **INSIDE** of the parentheses (in the middle of the equation) makes the parabola move* left *or* Right

* Opposite of # inside

Now this one:

$y = 5x^2$

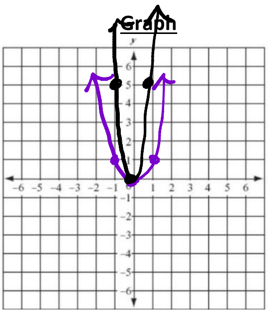
Equation

$y = x^2$	$y = 5x^2$
parent	skinny *Vertical stretch *horizontal compression

Table

$y = x^2$		$y = 5x^2$	
x	y	x	y
-2	4	-2	20
-1	1	-1	5
0	0	0	0
1	1	1	5
2	4	2	20
3	9	3	45

Graph

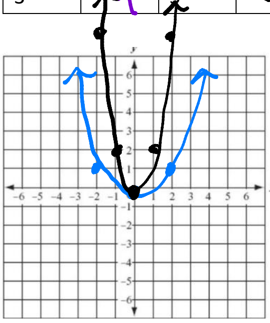


Now try these two:

a) $y = \frac{1}{4}x^2$

x	-2	-1	0	1	2	3
y	1	1/4	0	1/4	1	9/4

Fat
* horizontal stretch
* Vertical compression



b) $y = 2x^2$ skinny

x	-2	-1	0	1	2	3
y	8	2	0	2	8	18

*Vertical stretch
*Horizontal compression

*# in front greater than 1
*Vertical stretch

* in front less than 1 (Fraction)
* Horiz. stretch

Let's look at what happens when the parabola is flipped upside down.

$$y = -x^2$$

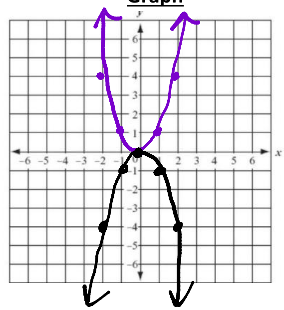
Equation

$y = x^2$	$y = -x^2$
Parent	Flipped over x-axis

Table

$y = x^2$		$y = -x^2$	
x	y	x	y
-2	4	-2	-4
-1	1	-1	-1
0	0	0	0
1	1	1	-1
2	4	2	-4
3	9	3	-9

Graph



So what happens when the number in **front** of the x^2 is **negative**?

This is called a Reflection over the x-axis.

Bringing it ALL together!

The vertex form of a quadratic is all of what you just did put together.

Vertex form

$$y = a(x - h)^2 + k$$ ← **Vertex: (h, k)**

What does each part mean?

a	If **a** is **positive** up	If **a** is **negative** Reflection over x-axis	If **a > 1** $4x^2$ Vert. stretch Horiz compress	If **0 < a < 1** $\frac{1}{3}x^2$ Horiz stretch vert. compress
h	If **h** is **positive** in the equation $(x+7)^2$ left # * opposite of what #		If **h** is **negative** in the equation $(x-11)^2$ Right # * opposite of what #	
k	If **k** is **positive** in the equation x^2+45 up #		If **k** is **negative** in the equation x^2-96 Down #	

Tell what has happened just based on the equation.

1) $y = 4(x-1)^2 + 3$

2) $y = -(x+3)^2 - 2$

3) $y = \frac{1}{3}x^2 - 3$

H. stretch Down 3

4) $y = -10(x+2)^2$