# Algebra 1B Name_____
# 10.1-10.3 Graphing Quadratic Functions Introduction

**Recall:** $y = mx + b$ is a linear function and its graph is a line.

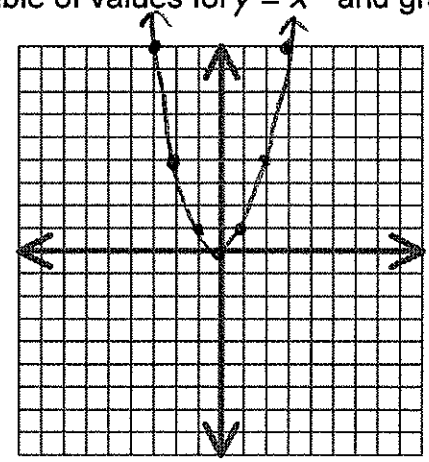
All functions of the form $y = ax^2 + bx + c$ are quadratic functions, because it has $x^2$.

***Graphing Activity (Part 1)***

- Complete the table of values for $y = x^2$ and graph the function.

$y = x^2$

| x | y |
|---|---|
| -3 | 9 |
| -2 | 4 |
| -1 | 1 |
| 0 | 0 |
| 1 | 1 |
| 2 | 4 |
| 3 | 9 |
| 4 | 16 |



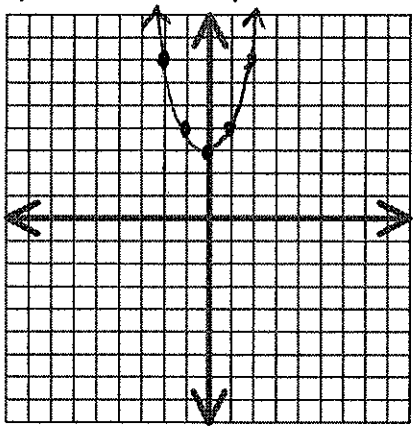
- This graph of a quadratic function is called a Parabola.
- The minimum point is called the vertex.

The vertex for $y = x^2$ is (0,0).

- Now let's graph $y = x^2 + 3$ and $y = x^2 - 4$.

$y = x^2 + 3$

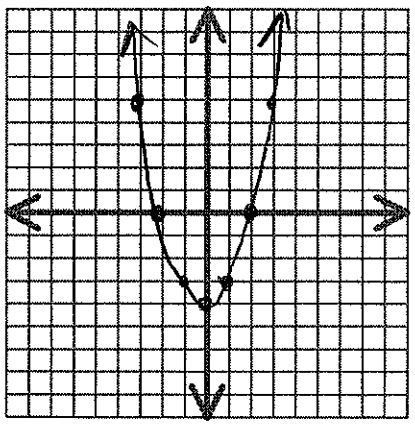
| x | y |
|---|---|
| -3 | 12 |
| -2 | 7 |
| -1 | 4 |
| 0 | 3 |
| 1 | 4 |
| 2 | 7 |
| 3 | 12 |
| 4 | 19 |



Vertex: (0,3)

$y = x^2 - 4$

| x | y |
|---|---|
| -3 | 5 |
| -2 | 0 |
| -1 | -3 |
| 0 | -4 |
| 1 | -3 |
| 2 | 0 |
| 3 | 5 |
| 4 | 12 |



Vertex: (0,-4)

***What effect does "c" in the equation $y = ax^2 + bx + c$ have on the graph?***

Shifts the graph up or down

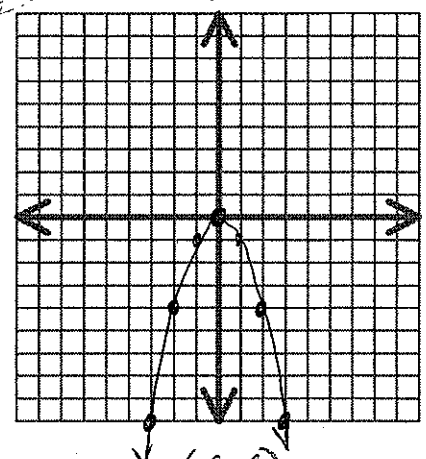
- Now graph $y = x^2 + 3x + 2$ and $y = x^2 - x - 6$ on new graph paper. Make a table for each equation to graph each. Then note the vertex, y-intercept, and x-intercept(s). Remember, plug in 0 for y and solve for x, if you don't see the x-intercepts in your table.

***Graphing Activity (Part 2)***

- Now let's graph $y = -x^2$ and $y = -x^2 + 3$.

$y = -x^2$ $-(-3)^2$ $= -9$

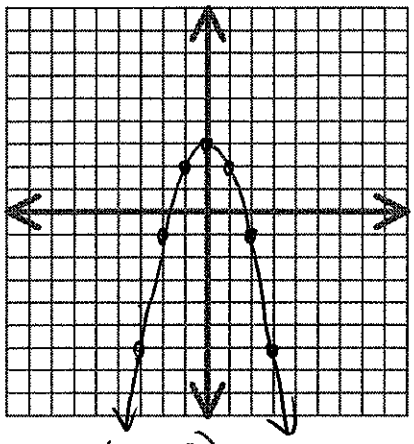
| x | y |
|---|---|
| -3 | -9 |
| -2 | -4 |
| -1 | -1 |
| 0 | 0 |
| 1 | -1 |
| 2 | -4 |
| 3 | -9 |
| 4 | -16 |



Vertex: (0,0) ; y-int: (0,0)

$y = -x^2 + 3$

| x | y |
|---|---|
| -3 | -6 |
| -2 | -1 |
| -1 | 2 |
| 0 | 3 |
| 1 | 2 |
| 2 | -1 |
| 3 | -6 |
| 4 | -13 |



Vertex: (0,3) ; y-int: (0,3)

*Notice the vertex is now a* Maximum *rather than a minimum!*

***What effect does "a" in the equation $y = ax^2 + bx + c$ have on the graph?***

If a is negative, the graph flips over the x-axis (Opens Down)

- Now let's graph $y = -x^2 + 4x - 3$

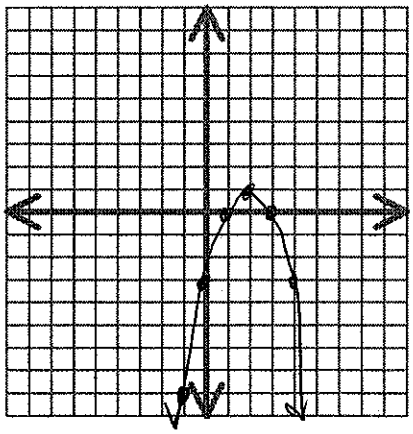
*Before graphing the function, answer these questions:*

1) Will the parabola open up or down? Down
2) What will the y-intercept be? (0,-3)

*After graphing the function, identify more characteristics:*

3) What is the vertex? (2,1)
4) What are the x-intercepts? (1,0)(3,6)

| x | y |
|---|---|
| -3 | -24 |
| -2 | -15 |
| -1 | -8 |
| 0 | -3 |
| 1 | 0 |
| 2 | 1 |
| 3 | 0 |
| 4 | -3 |



- Now graph $y = 2x^2 - 4x - 5$ ; $y = -2x^2 + x + 1$; and $y = x^2 + 2x - 8$ on new graph paper. Identify the **y-intercept** and **direction of opening** of each BEFORE graphing. Make a table for each equation to graph each. Lastly, note the **vertex** and **x-intercept(s)**.

***Graphing Activity (Part 3)***

Parabolas demonstrate **symmetry** on either side of its vertex. Therefore, to efficiently graph a parabola, it is helpful to identify its vertex first!

To graph a parabola efficiently:

| | |
|---|---|
| STEP 1: | Identify the **direction of opening** and **y-intercept** |
| STEP 2: | Find the **vertex**<br>1.) Calculate $-\frac{b}{2a}$. This is the x-value of the vertex.<br>2.) Find the y-value of the vertex (plug the x-value into the function). |
| STEP 3: | Construct a table using 2 x-values *above* and 2 x-values *below* the vertex. |
| STEP 4: | Graph the parabola. |
| STEP 5: | Identify the **x-intercepts**, if possible. |

Try graphing these quadratic functions:

1.) $y = x^2 + 6x + 8$

Direction: Up

y-intercept: (0,8)

$x = \frac{-6}{2(1)}$

$x = -3$

$y = (-3)^2 + 6(-3) + 8$

$y = 9 - 18 + 8$

$y = -1$

vertex

| x | y |
|---|---|
| -5 | 3 |
| -4 | 0 |
| -3 | -1 |
| -2 | 0 |
| -1 | 3 |

x-int (-4, 0) + (-2, 0)

2.) $y = 2x^2 - 4x - 5$

Direction: Up

y-intercept: (0, -5)

| x | y |
|---|---|
| -1 | 1 |
| 0 | -5 |
| 1 | -7 |
| 2 | -5 |
| 3 | 1 |

Can't see x-int?

3.) $y = -x^2 - 4x + 12$

Direction: down

y-intercept: (0, 12)

$x = \frac{4}{2(-1)}$

$x = -2$

$y = 16$

| x | y |
|---|---|
| -4 | 12 |
| -3 | 15 |
| -2 | 16 |
| -1 | 15 |
| 0 | 12 |

Vertex

x-int (2, 0) (-6, 0)

4.) $y = -2x^2 + 8x - 7$

Direction: down

y-intercept: (0, -7)

| x | y |
|---|---|
| 0 | -7 |
| 1 | -1 |
| 2 | 1 |
| 3 | -1 |
| 4 | -7 |

Vertex

Can't see x-int