9.1-9.2 GRAPHING QUADRATIC FUNCTIONS

A quadratic function is a function that can be written in the standard form of $y = ax^2 + bx + c$ where $a \neq 0$.

Every quadratic function has a U-shaped graph called a parabola.

- Opens up if the value of a is positive
- Opens down if the value of a is negative

EXAMPLES: Decide whether the parabola opens up or down.

1. $y = -x^2$

   $a = -1 \longrightarrow$ open down

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

   $a = 2 \longrightarrow$ open up

3. $y = -3x^2 + 5x - 1$

   $a = -3 \longrightarrow$ open down

To Graph...

1. Find the axis of symmetry: $x = \frac{-b}{2a}$
2. Use the value of x from above to find the vertex. To do this, plug that x-value into the original equation and solve for y. This point will be the vertex (also known as the maximum or minimum of the graph).
3. Make a table of values. Suggestion: Pick two x-values on either side of the vertex for your table.
4. Plot the points and connect them with a smooth curve.

4. Find the equation of the axis of symmetry and the coordinates of the vertex of the graph of $y = -2x^2 - 8x - 3$. $a=-2 \quad b=-8 \quad c=-3$

$$x = \frac{-b}{2a} = \frac{8}{2(-2)} = \frac{8}{-4} = -2$$

a.o.s. $x = -2$

$$y = -2x^2 - 8x - 3$$
$$y = -2(-2)^2 - 8(-2) - 3$$
$$y = 5$$

vertex $(-2, 5)$

5. Sketch the graph of $y = x^2 - 2x - 3$.

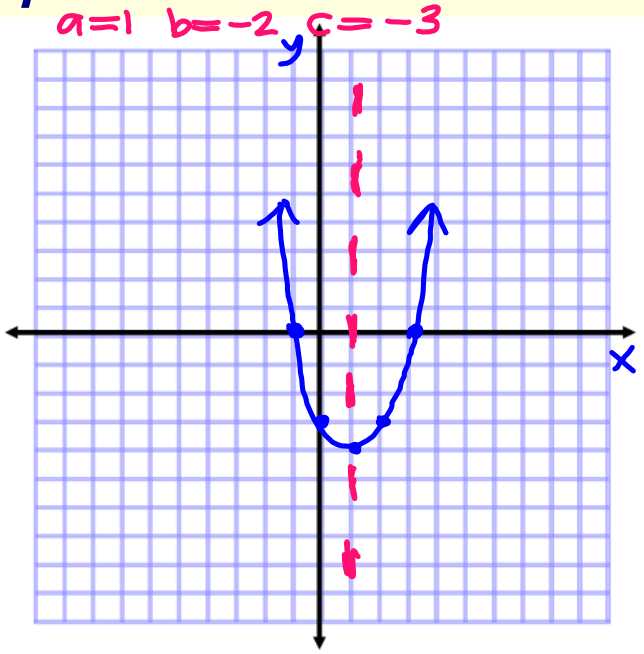
STEP 1: Find the axis of symmetry.
STEP 2: Find the vertex.
STEP 3: Make a table of values.
STEP 4: Graph.

$a=1 \quad b=-2 \quad c=-3$

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

a.o.s. $x = 1$

x		y
-1	$(-1)^2 - 2(-1) - 3$	0
0	$(0)^2 - 2(0) - 3$	-3
1	$(1)^2 - 2(1) - 3$	-4
2	$(2)^2 - 2(2) - 3$	-3
3	$(3)^2 - 2(3) - 3$	0



6. Sketch the graph of $y = -x^2 + 1$.

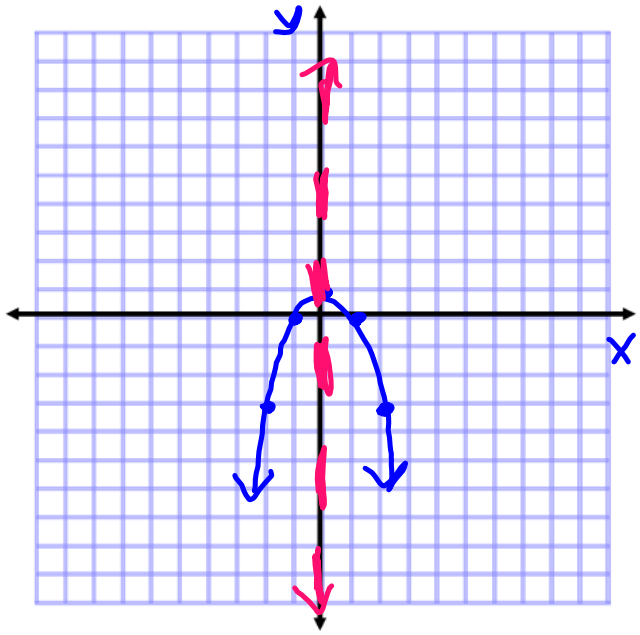
$a=-1 \quad b=0 \quad c=1$

STEP 1: Find the axis of symmetry.
STEP 2: Find the vertex.
STEP 3: Make a table of values.
STEP 4: Graph.

$x = \frac{-b}{2a} = \frac{0}{2(-1)} = \frac{0}{-2} = 0$

a.o.s. $x = 0$

x		y
-2	$-(-2)^2 + 1$	-3
-1	$-(-1)^2 + 1$	0
0	$-(0)^2 + 1$	1
1	$-(1)^2 + 1$	0
2	$-(2)^2 + 1$	-3



7. Sketch the graph of $y = x^2 + 3x - 1$.

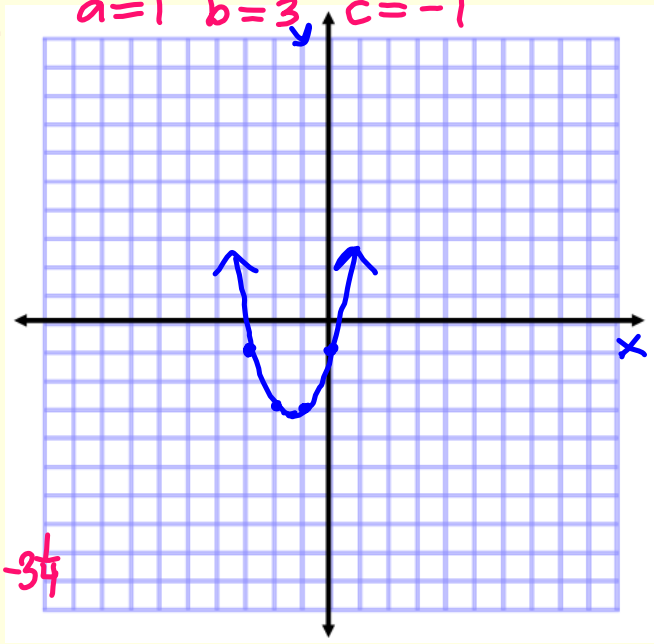
$a=1 \quad b=3 \quad c=-1$

STEP 1: Find the axis of symmetry.
STEP 2: Find the vertex.
STEP 3: Make a table of values.
STEP 4: Graph.

$x = \frac{-b}{2a} = \frac{-3}{2(1)} = \frac{-3}{2}$

a.o.s. $x = -\frac{3}{2}$

x		y
0	$(0)^2 + 3(0) - 1$	-1
-1	$(-1)^2 + 3(-1) - 1$	-3
$-1\frac{1}{2}$	$(-\frac{3}{2})^2 + 3(-\frac{3}{2}) - 1$	$-\frac{13}{4}$ $-3\frac{1}{4}$
-2	$(-2)^2 + 3(-2) - 1$	-3
-3	$(-3)^2 + 3(-3) - 1$	-1



8. Sketch the graph of $y = -x^2 + 2x$.

$a=-1 \quad b=2 \quad c=0$

STEP 1: Find the axis of symmetry.
STEP 2: Find the vertex.
STEP 3: Make a table of values.
STEP 4: Graph.

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

a.o.s. $x = 1$

x		y
-1	$-(-1)^2 + 2(-1)$	-3
0	$-(0)^2 + 2(0)$	0
1	$-(1)^2 + 2(1)$	1
2	$-(2)^2 + 2(2)$	0
3	$-(3)^2 + 2(3)$	-3