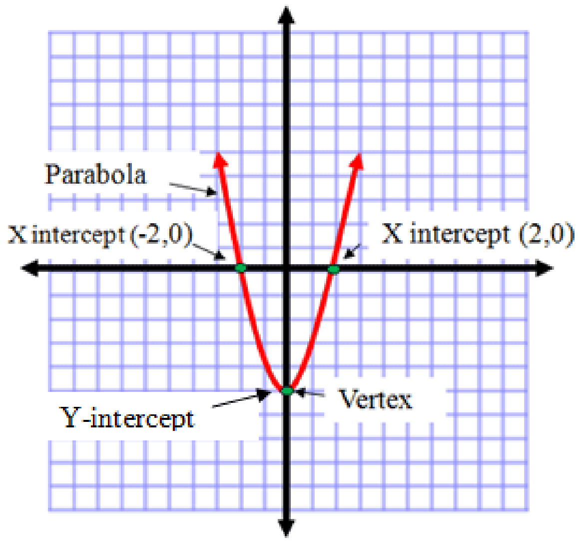
Unit 9- Graphing Quadratics

Standard Form: $y = ax^2 + bx + c$

When the "a" term is **positive** we are **"smiling"**

$a > 1$



This parabola opens up and can be classified as **concave up.**

All parabolas that **open up** will have a **positive "a"** value.

The vertex is the lowest point or the **minimum point.**

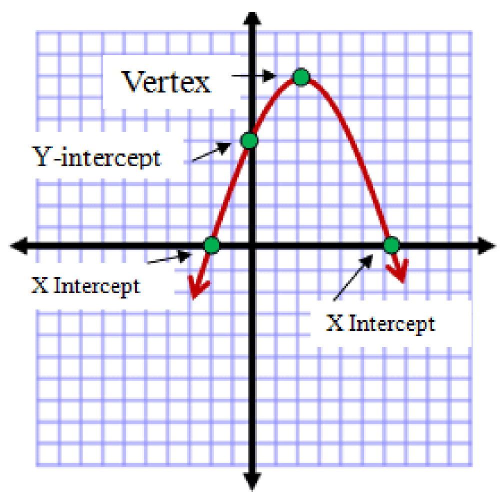
When the "a" term is **negative** we are **"frowning"**

$a < 1$

This parabola opens down and can be classified as **concave down.**

All parabolas that **open down** will have a **negative "a"** value.

The vertex is the highest point or the **maximum point**.



- **Roots** -where the parabola crosses the x – axis
- **Vertex/ Turning Point**- where the parabola begins to change direction
- **Maximum/Minimum**-represents the vertex
- **Axis of Symmetry**- where the parabola could be "folded" in half
  Equation is x= (x-value of T.P)

  Formula for axis of symmetry $x = \frac{-b}{2a}$

Graphically find the roots

- Where the graph crosses the x-axis
- Where the y-value is 0.
- Can be written as $\{-6, 3\}$

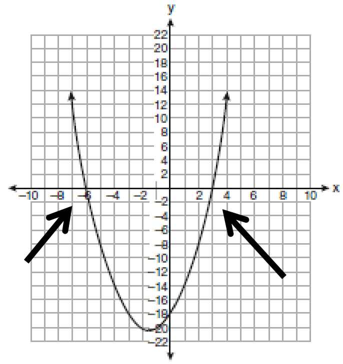


TABLE: Look for y-value = 0

x	y
-1	0
0	-5
1	-8
2	-9
3	-8
4	-5
5	0

Steps to Using the Calculator When Looking for the Roots

When Looking For The **LEFT ROOT**:	When Looking For The **Right ROOT**:
Y = Type in the given equation	Y = type in the given equation
2^{nd} Trace – select #2 (zero)	2^{nd} Trace – select #2 (zero)
Go Above the x-axis, press ENTER	Go BELOW the x-axis, press ENTER
Go BELOW the x-axis, press ENTER	Go ABOVE the x-axis, press ENTER
Press ENTER	Press Enter
Root values will appear	Root values will appear

Standard Form of a Quadratic Equation

$$y = ax^2 + bx + c$$

1. Identify the roots {0,-4}
2. Do Backwards T-Bar

$x = 0 \quad x = -4$

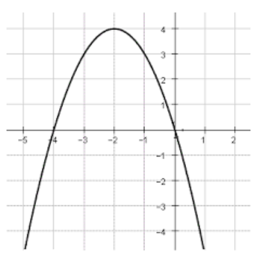
$(x+0)(x+4) = y$

$x(x+4) = y$

$x^2 + 4x = y$

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

$y = -x^2 - 4x$



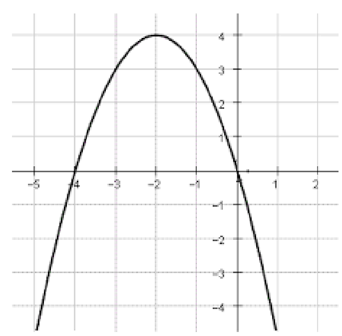
Vertex Form of a Quadratic Equation

$$y = (x - h)^2 + k$$

1. Identify the Vertex (-2, 4)
2. Plug vertex into the equation $y = -(x+2)^2 + 4$

Remember the following:

- The h-value represents the negation of the x-value of the T.P.
- The k represents the y-value of the T.P.



Axis of Symmetry

Algebraically Determining the Axis of Symmetry

$$y = x^2 - 4x + 1$$

Identify the a, b, and c value from the equation

a = 1, b = -4 , c = 1

Use the axis of symmetry formula to solve for x:

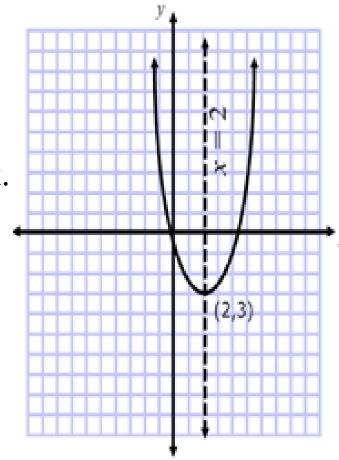
$$x = \frac{-b}{2a}$$

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

$$x = 2$$

Graphically Identifying the Axis of Symmetry:

- A vertical line that divides the parabola into two symmetric halves.
- Where the parabola could be "folded" to produce symmetry.
- Always an $x = \#$.
- The x-value of the T.P./Vertex.



TURNING POINT / VERTEX / MINIMUM POINT / MAXIMUM POINT

Algebraically Solving for the Vertex of a Quadratic Function

Given: $y = x^2 - 4x - 5$

Identify the a-value, b-value & c-value.

a = 1, b = -4, c = -5

Step 1: Use the axis of symmetry formula:

$$x = \frac{-b}{2a}$$

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

$$x = 2$$

Step 2: Plug the x-value into the given equation to find the y-value.

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

$$y = (2)^2 - 4(2) - 5$$

$$y = -9$$

Step 3: Write your answer as coordinates. $(2, -9)$

Step 4: Check your answer with the table/graph on the calculator

Graphically Solving for the Vertex a Quadratic Function

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

Step 1: Type equation into "y =" into calculator

Step 2: Press 2nd trace

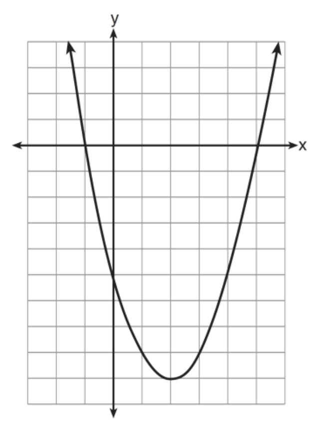
Step 3: Choose #3 (minimum) or #4 (Maximum)

Step 4: Place blinky man to the left of the TP/vertex, press enter

Step 5: Place blinky man to the right of the TP/vertex, press enter

Step 6: Press enter to get the turning point

x	Y
-1	0
0	-5
1	-8
2	-9
3	-8
4	-5
5	0



COMPLETETEING THE SQUARE TO FIND QUADRATIC EQUATION IN *VERTEX FORM*

Given: $y = x^2 - 8x + 11$

Step 1: Move the constant ("c" value) to the right side.

$$y = x^2 - 8x + 11$$
$$-11 \qquad\qquad -11$$
$$y - 11 = x^2 - 8x$$

Step 2: Take half of the "b" value and square it and add it to BOTH sides.

$$b = \frac{-8}{2} = (-4)^2 = 16$$
$$y - 11 + 16 = x^2 - 8x + 16$$

Step 3: Make the left side a perfect square trinomial.

$$y + 5 = x^2 - 8x + 16$$

Step 4: Factor the perfect square trinomial and simplify the right side.

$$y + 5 = (x-4)(x-4)$$
$$y + 5 = (x-4)^2$$

Remember, you don't need to show this step, you can skip down to the line right below

Step 5: Solve for y

$$y + 5 = (x-4)^2$$
$$-5 \qquad\qquad -5$$
$$y = (x-4)^2 - 5$$

Step 6: Write in vertex form $y = (x - h)^2 + k$

Step 7: Identify the turning point (h, k): $(\mathbf{4}, \mathbf{-5})$