Guided notes Lesson 17.1 Graphing Quadratic Equations

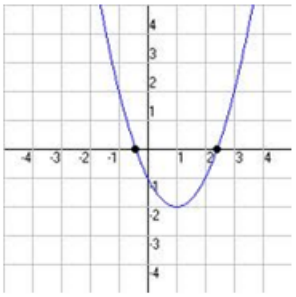
Quadratic Equations

The name **Quadratic** comes from "quad" meaning square, because the variable gets squared (like x^2).

this makes it Quadratic

$$5x^2 - 3x + 3 = 0$$

The graph of a Quadratic function is a **Parabola**.



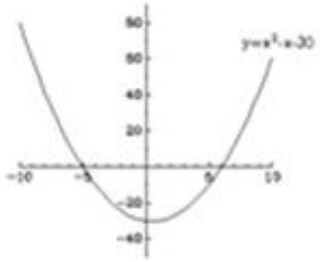
A parabola is a U-shaped graph

The graph could open up or down.

The **Standard Form** of a Quadratic Equation looks like this:

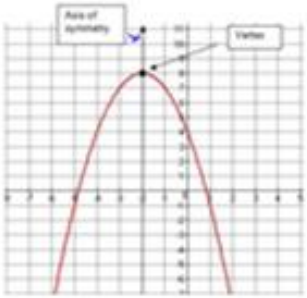
$$ax^2 + bx + c = 0$$

also written as: $y = ax^2 + bx + c$



If a is POSITIVE
Opens Upward.

Or this...

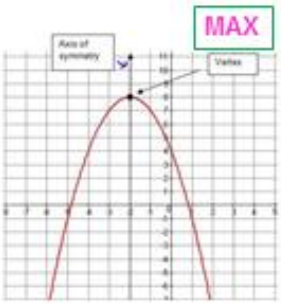


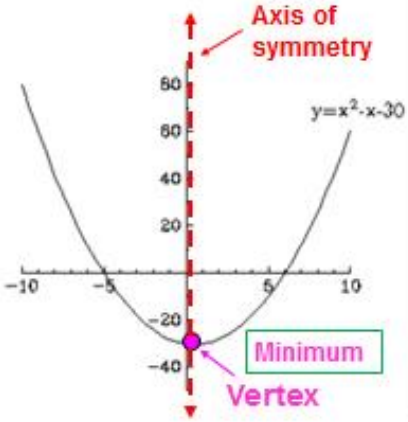
Quadratic Equation → $y = ax^2 + bx + c$

If a is NEGATIVE
Opens Downward

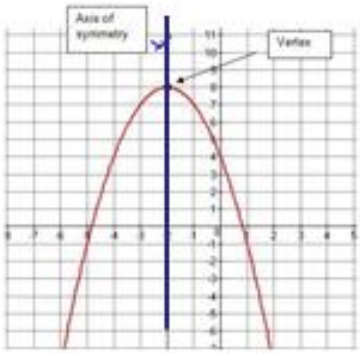
Vertex – the maximum or minimum point of the parabola…

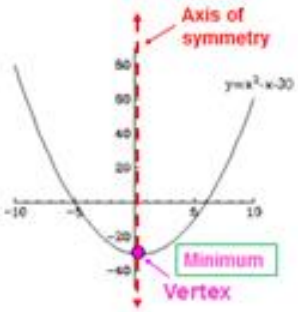
the point of change.





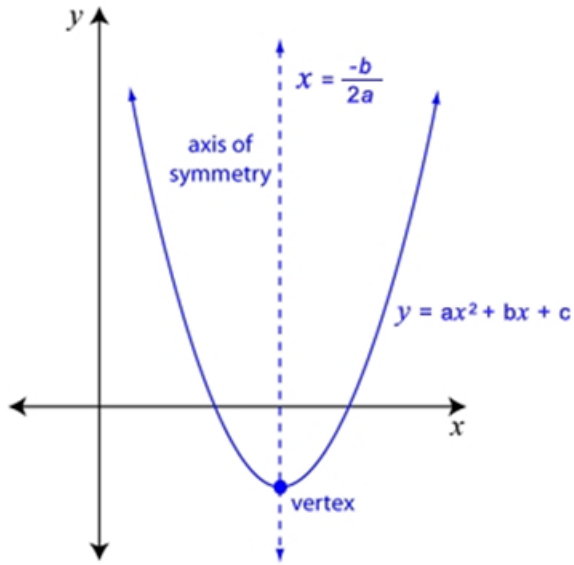
Parabolas have **symmetry**, which means that when they are folded in half on a line that passes through the vertex, each half matches the other exactly. This line is called the **axis of symmetry**.





Putting it all together:

Parabola – Vertex and Axis of Symmetry



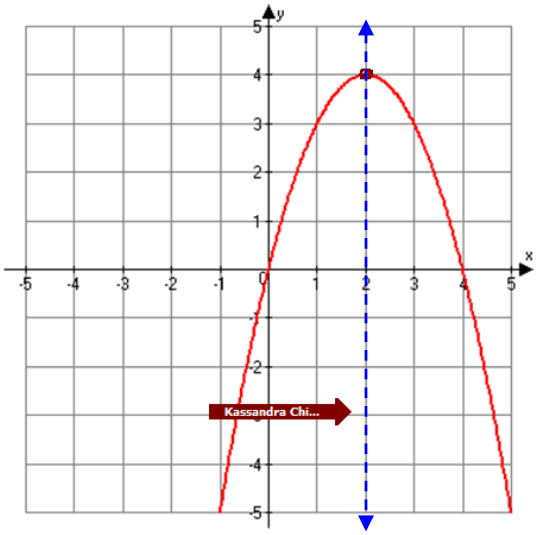
Vertex
- Turning point
- Minimum: if opens up
- Maximum: if opens down

Axis of Symmetry
- Imaginary Line where parabola is symmetric

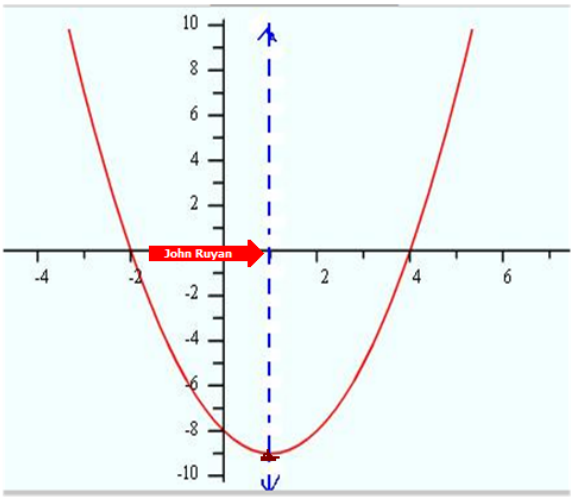
EXAMPLES:

Name Vertex and Axis of Symmetry

Vertex: (2,4)
Axis of Symmetry: x = 2



Vertex: (1,-9)
Axis of Symmetry: x=1



Find the Vertex:

To find the x coordinate of the vertex, we use the formula:

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

Just plug the values from your standard equation into the formula to solve for x.

(Axis of Symmetry)

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

To find the y coordinate, just substitute the x value into the equation.

EXAMPLE:

Vertex and Axis of Symmetry

Given the Quadratic Equation

The **Standard Form** of a Quadratic Equation looks like this:

$$ax^2 + bx + c = 0$$

***NOTE: Remember if there is no coefficient (number in front of the variable), then the coefficient is 1.

Steps to find the vertex:

1. Calculate the axis of symmetry using the formula: $x = -\frac{b}{2a}$
2. Plug the x-value (from step 1) into the original equation and solve for y.
3. Vertex = (x, y)

Example:

$$y = x^2 + 6x + 5$$

1. $x = \frac{-6}{2(1)} \rightarrow -3$
2. $y = (-3)^2 + 6(-3) + 5$

   $y = 9 + (-18) + 5$

   $y = -4$
3. Vertex = (-3, -4)

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

Here are some things that will be helpful when graphing quadratic functions.

Quadratic Functions

- Standard form is $y = ax^2 + bx + c$.
- The graph is called a parabola.
- If the coefficient of x^2 (a) is positive, the parabola will point upward.
  If the coefficient of x^2 (a) is negative, the parabola will point downward.
- Find the axis of symmetry by calculating $x = -\frac{b}{2a}$.
- Use the x-value from the axis of symmetry as the x-value of the vertex.
- Substitute the x-value from the axis to find the y-value for the vertex.

Now you have learned how to graph a quadratic equation!

Visit this site to create a graph! On line graphing calculator: www.desmos.com

17.2 Quadratic Formula

- ☐ What is a Quadratic Equation? The quadratic equation forms a parabola.
- ☐ A quadratic formula is an equation that has a SQUARED TERM involved…
- ☐ EXAMPLES of a Quadratic Equation: $x^2 + 4x + 10 = 0$ $3x^2 - 2x + 8 = 5$ $4x^2 + 16 = 96$
  AND… $(x + 5)(x – 2) = 0$ Because when you multiply your first two terms (x * x) it equals x^2
- ☐ The **Quadratic Formula** can be used to solve any quadratic equation.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

The quadratic formula allows you to find the roots of a **quadratic equation** (if they exist) even if the quadratic equation does not factor.

ROOTS or ZEROS…
remember when we found the x intercept, (x, 0),
y was always equal to zero…
that's what we're finding…
the x intercepts of a parabola!!!

You will never HAVE to remember the Quadratic Formula… but if you WANT to… here's a fun way!

If $ax^2 + bx + c = 0$

then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Quadratic Formula

- There once was a negative boy (-b) who was all mixed up (+/-) so he went to this radical (√) party.
- But because the boy was square ($\boxed{b^2}$), he lost (-) out on 4 awesome chicks (4ac) so he cried his way home when it was all over (/) at 2 AM (2a).

$$x = \frac{\boxed{-b}\ \boxed{\pm}\ \sqrt{b^2 - 4ac}}{2a}$$

To see Examples worked out…

Solve Using the Quadratic Formula

1. **Make sure equation is set = to ZERO**
2. **Identify values for a, b, and c**
3. **Plug values into formula and solve!**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\overset{a}{x^2} + \overset{b}{5}x + \overset{c}{6} = 0$$

a = 1, b = 5, c = 6

SIMPLY plug your values into the FORMULA!!!!

$$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(6)}}{2(1)} = \frac{-5 \pm \sqrt{25 - 24}}{2} = \frac{-5 \pm \sqrt{1}}{2}$$

Separate the plus/minus to get 2 solutions☺

$$x = \frac{-5 + 1}{2} = -2 \qquad x = \frac{-5 - 1}{2} = -3$$

If $ax^2 + bx + c = 0$

then $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Solve $x^2 + 3x - 4 = 0$

a=1, b=3, c=-4

Using the quadratic formula,

$$x = \frac{-(3) \pm \sqrt{(3)^2 - 4(1)(-4)}}{2(1)}$$

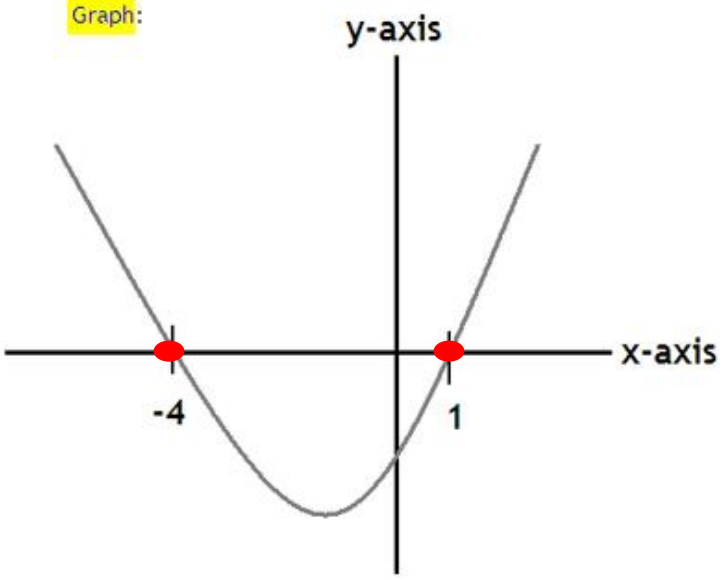
$$x = \frac{-(3) \pm \sqrt{9 + 16}}{2}$$

$$x = \frac{-(3) \pm \sqrt{25}}{2}$$

$$x = \frac{-(3) \pm 5}{2}$$

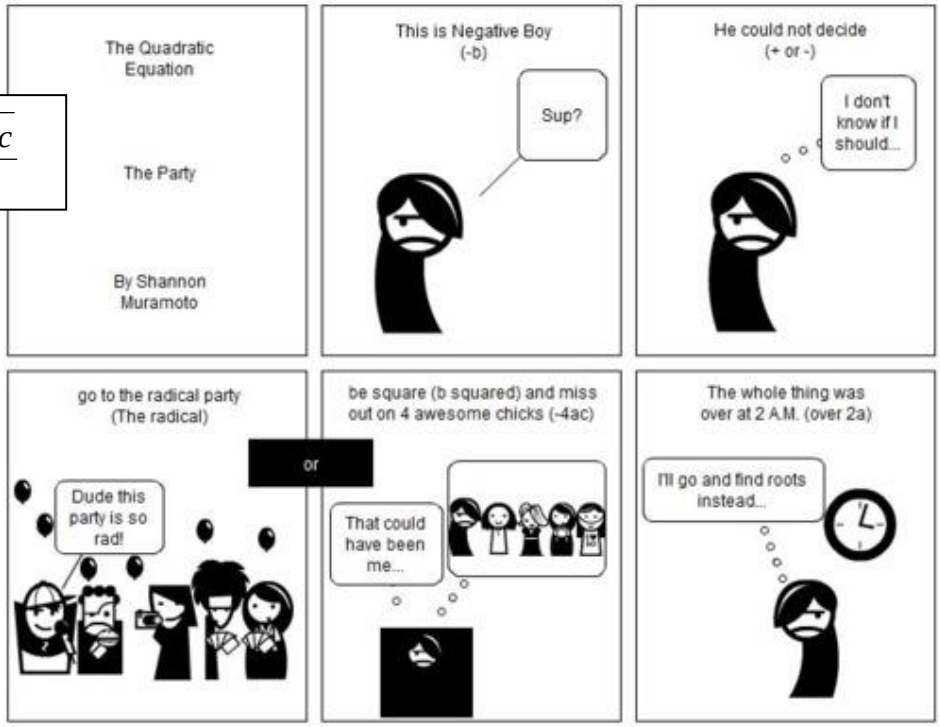
$$\boxed{x = 1, -4}$$

Graph:



As you can see, the points where the parabola cross the x-axis are the same as the roots, or x-values, found using the quadratic equation. Therefore, $\boxed{x=1, -4.}$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$



SOME INTERACTIVE AND EXCITING WEB SITES …

http://www.coolmath.com/crunchers/algebra-problems-solving-quadratics-formula.htm
Graphing a parabola with the vertex formula…
http://www.onlinemathlearning.com/parabola-graph.html

Graphing Quadratic Functions

This Jeopardy type game has you practice working with the 3 forms of quadratic equations - standard, vertex & intercepts. You are able to find the vertex, intercepts, describe what graphs look like and solve applications.
http://www.quia.com/cb/24731.html

Quadratic Equation Graph: create your own parabola or check your work!!
http://www.softschools.com/math/algebra_1/quadratic_equation_graph/

Graphing Quadratic Functions Game: http://www.quia.com/cb/24731.html

Graphing Quadratics Lessons (Parabolas): http://www.coolmath.com/algebra/11-graphing-quadratics parabolas/index.html

Interactive Parabola: graph and equation:
http://www.mathwarehouse.com/quadratic/parabola/interactive-parabola.php

Quadratic Equations – printables, quizzes & games:
http://www.algebra4children.com/topics_quadratic_equation.html

To **LISTEN** to the lesson, go to the Math 3 Classroom and click on Help Video.

Be patient… it may take a few minutes to load. ☺

ARE YOU READY FOR YOUR Lesson 17 TEST and Unit 3 EXAM??

- **Did you Refer to your RESOURCES…** Live Sessions/ Classroom Content/ Help Videos / Practice Test/ Test Power Points/ Guided Notes/ Teachers ????
- **Open the PRINT TEST first… Work the Problems… Record your answers! it's good to have your answers ready before you go to the actual test.** ☺
- Remember that the order of the answers on your print test may be different than the order of your answers on the actual test.

Help with the test:
https://ecot.webex.com/ecot/ldr.php?RCID=712f208a534f2d164c377f0f9dd3feeb

PHONE A TEACHER
if you have questions..!!