

Are you ready?



# Chapter 4 Families of Quadratic Functions

aka Lots of Graphing!

What do you remember about quadratics?

Give the three equations for a quadratic

Standard Form:

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



Intercept Form:

$$y = a(x - x_1)(x - x_2)$$

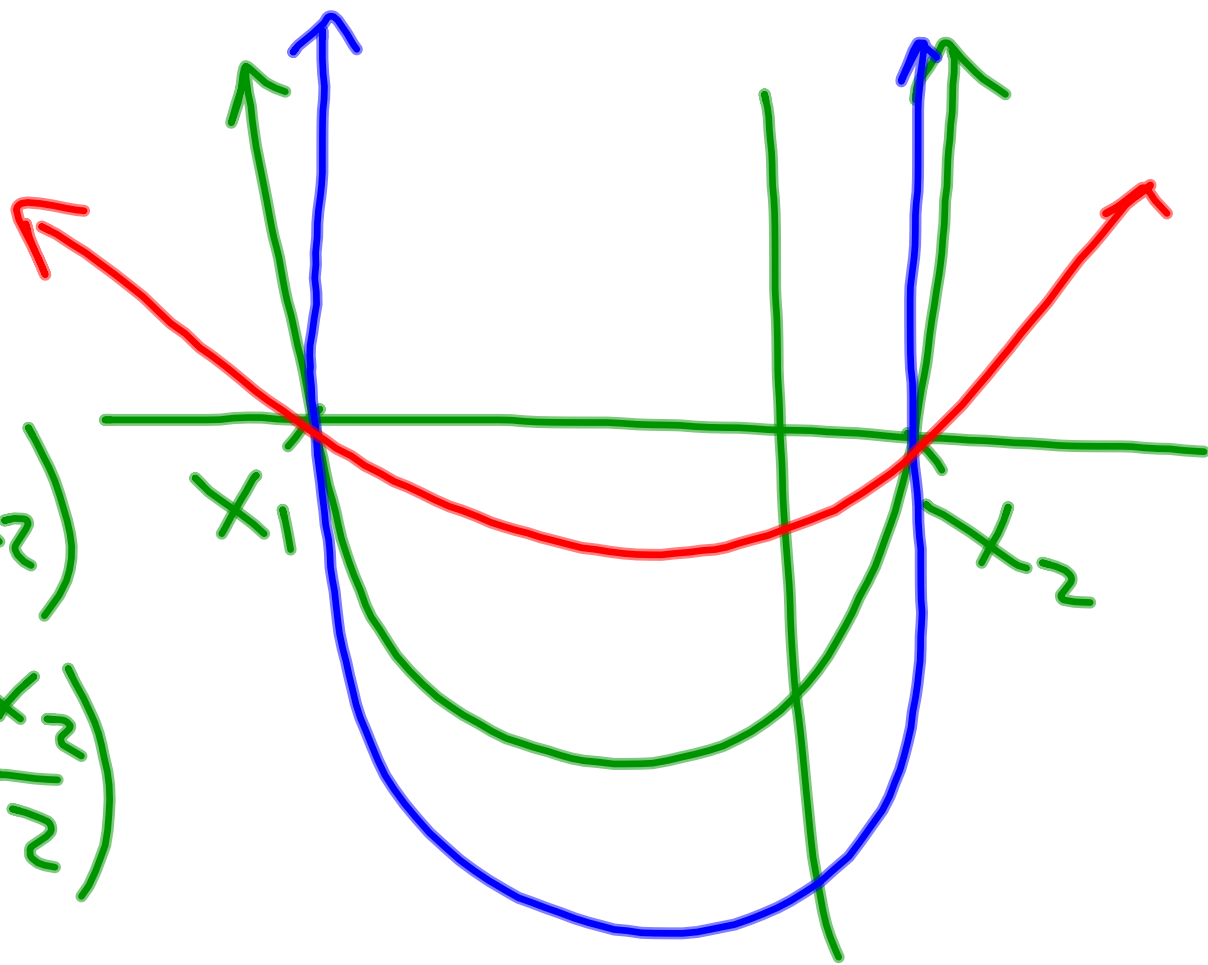
are roots  
x-intercepts

Vertex Form:

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

$(h, k)$  are the coordinates of the vertex.

$$\begin{aligned} y &= (x-x_1)(x-x_2) \\ &= 2\left(\frac{x}{2}-\frac{x_1}{2}\right)\left(\frac{x}{2}-\frac{x_2}{2}\right) \\ &\neq 2(x-x_1)(x-x_2) \end{aligned}$$





Give the Quadratic Formula:

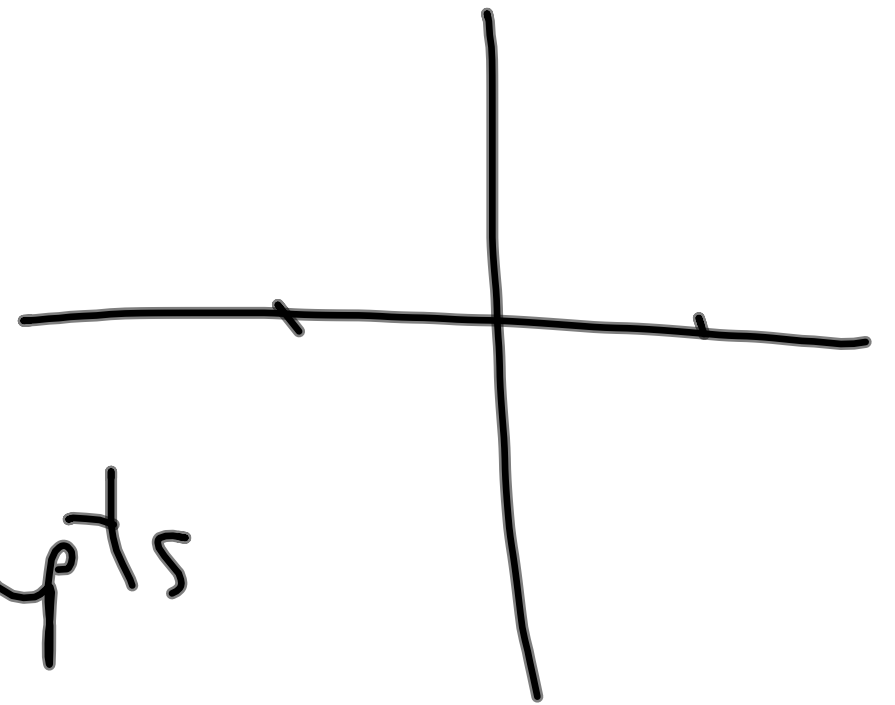
$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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

What does it find?

$x_1, x_2$  x-intercepts

Roots



What is the Discriminant?

$$(b)^2 - 4ac$$

$$\sqrt{b^2 - 4ac}$$

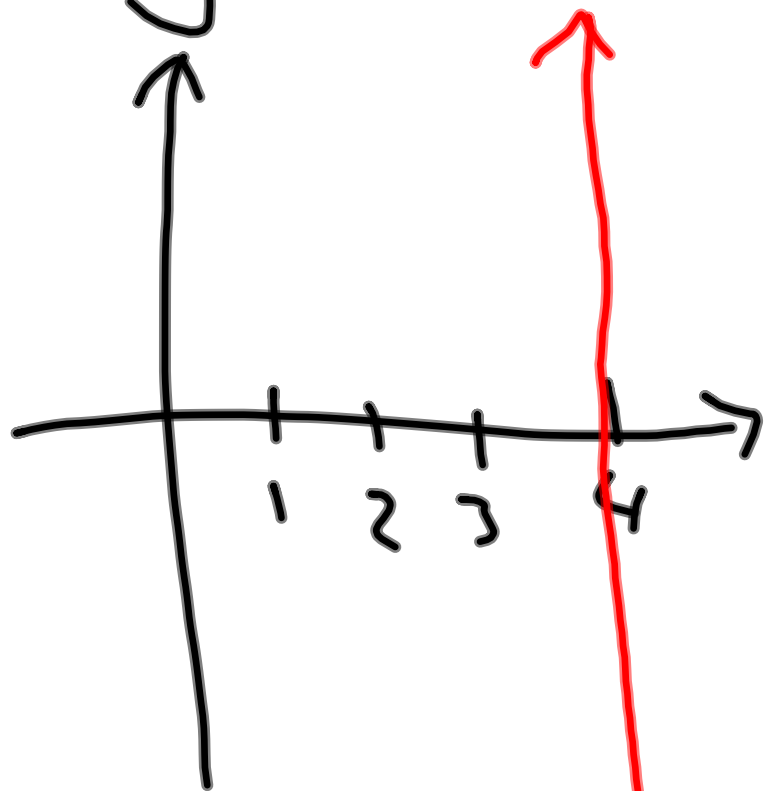
What does it tell you?

Disc.  $< 0$  no real roots

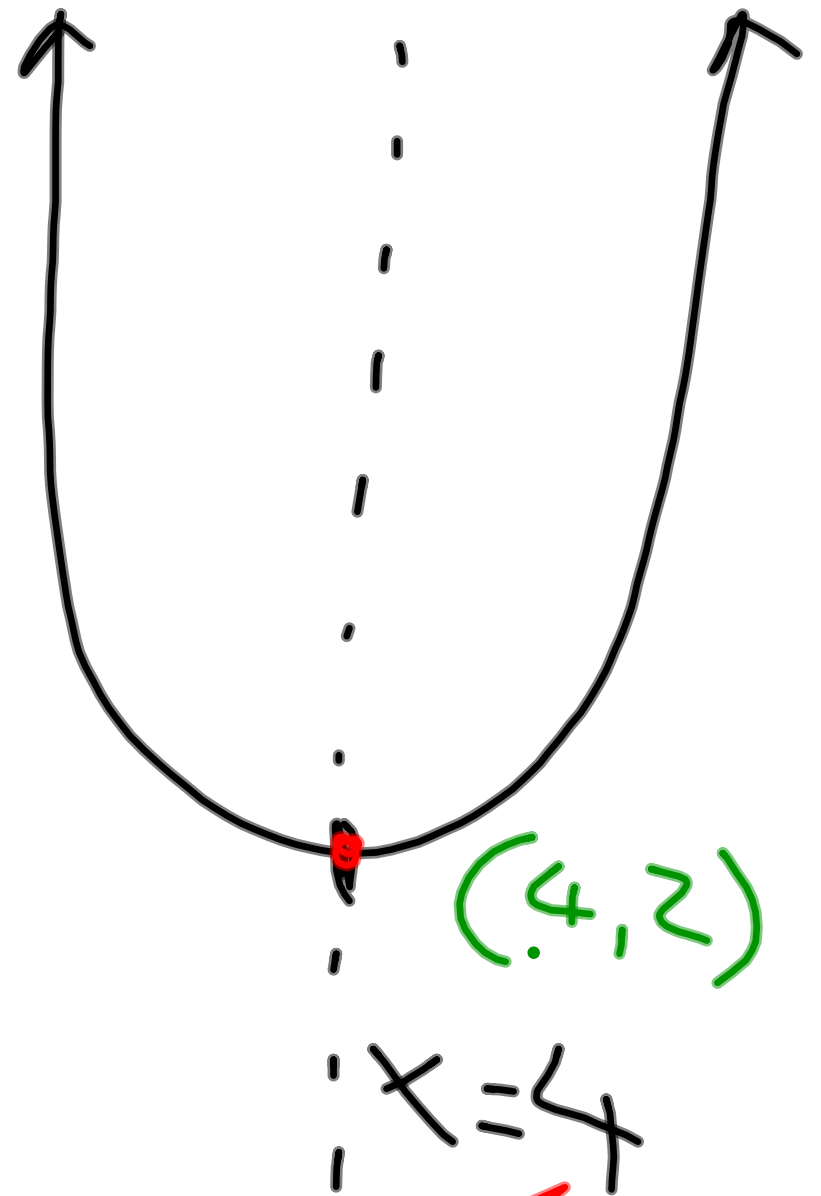
Disc.  $= 0$  one root

Disc.  $> 0$  two roots

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



$x = 4$



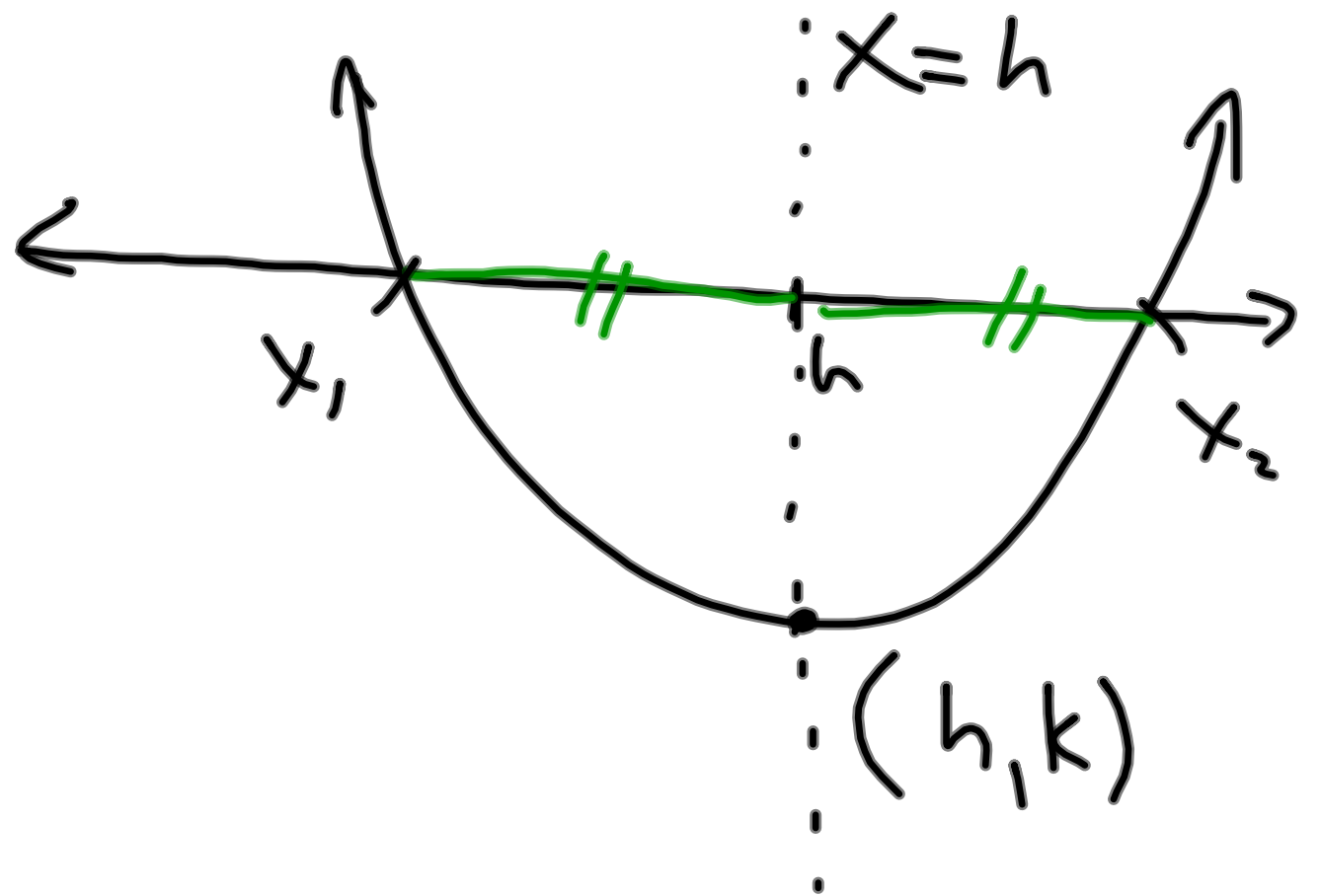
Give the formula for the line of symmetry:

v:  $x = h$

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

~~What does it find?~~

ī:  $x = \frac{x_1 + x_2}{2}$



Give the formula for finding the coordinates of the vertex:

Know  $h$ , find  $k$

Plug into equation!

$$y = x^2 - 4x - 12$$

$$h = \frac{-b}{2a} = \frac{4}{2}$$

$$\underline{h = 2}$$

$$(2, -16)$$

$$k = 2^2 - 4(2) - 12$$

$$= 4 - 8 - 12$$

$$= -16$$

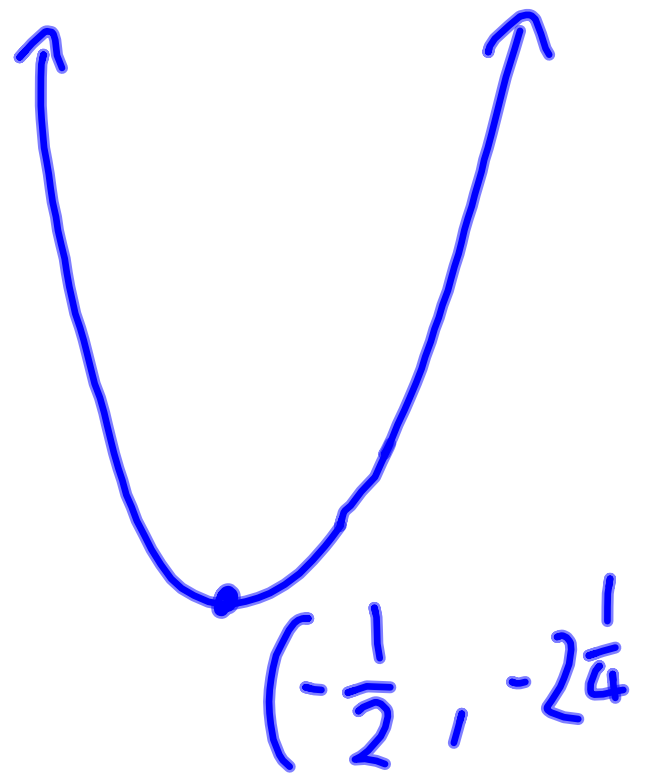
$$y = x^2 + x - 2$$

Give vertex form  $y = \left(x + \frac{1}{2}\right)^2 - 2\frac{1}{4}$

$$h = \frac{-b}{2a} = -\frac{1}{2}$$

$$k = \left(-\frac{1}{2}\right)^2 + \left(-\frac{1}{2}\right) - 2$$

$$= \frac{1}{4} - \frac{1}{2} - 2 = -2.25$$



What are the important points of a parabola?

1. Opens up/down

2. X-intercepts (roots)

3. vertex

4. Y-intercept

$$y = 3x^2 - 4x + 2$$

1. opens up.

2.

3.

4.



Next you are going to investigate the parts of the intercept form of the quadratic equation.

Don't try to use the formulae from above, but do refer back to see how they can help you.

It is important that you spend time graphing these parabolas. You need to develop a feel for how they work.

4-13. PARABOLA LAB, Part One

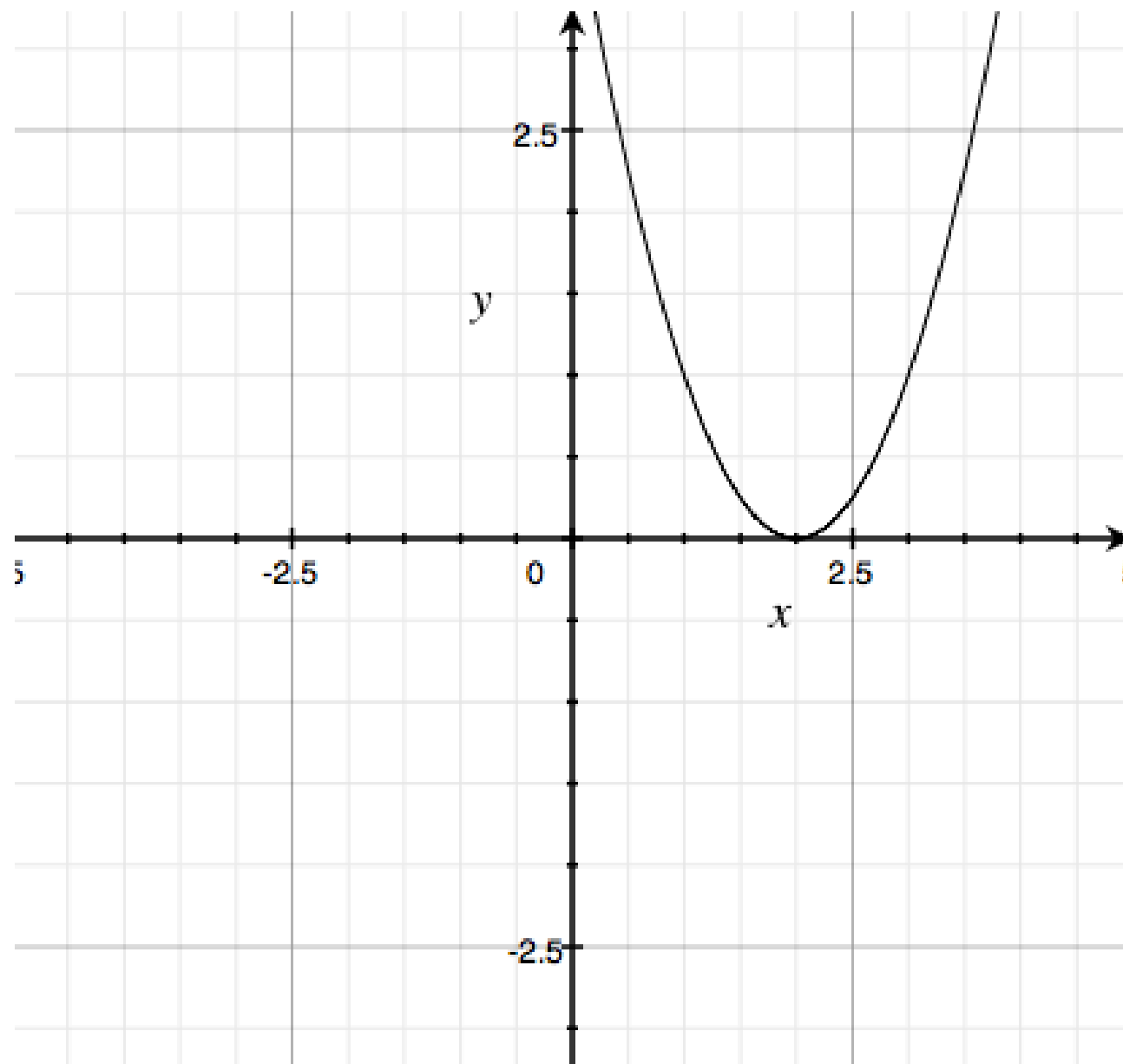
What happens to a parabola's graph when you change the numbers in the equation? To get a better sense of the different ways to transform the graph of a parabola, complete the lab outlined below as a team. As you work, be sure to sketch the graphs you see in your graphing calculator carefully and record the equations you enter.



- On graph paper, graph the equation  $y = (x - 2)(x - 2)$ . Be sure to label any important points on your graph, including the lowest point on the graph, called the **vertex**. (If the graph were to open downward, the vertex would be the highest point on the graph.) Also, sketch and write the equation of the line of symmetry of your graph.
- Use your graphing calculator to find the equations of two parabolas with *different* graphs that also open upward and still have a vertex at  $(2, 0)$ . Add sketches of these two new graphs to your graph from part (a), along with their equations. As you work, keep track of any ideas you try along with their results, even if they do not answer this question, as they may help you later.
- Use your graphing calculator to find the equations of two different parabolas that open *downward*, each with its vertex on the  $x$ -axis at  $x = 2$ . How did you change the equation so that the parabola would open downward? Add sketches of these graphs and their equations to your axes. What are their lines of symmetry?
- Use your graphing calculator to find the equation of a parabola that opens downward with a vertex at  $(-4, 0)$ . What is the equation of your parabola's line of symmetry?
- Choose a new point on the  $x$ -axis and find at least three equations of parabolas that touch the  $x$ -axis only at that one point.

a) On graph paper graph  $y = (x - 2)(x - 2)$   
Label the important points.  
Draw the line of symmetry and give its equation.

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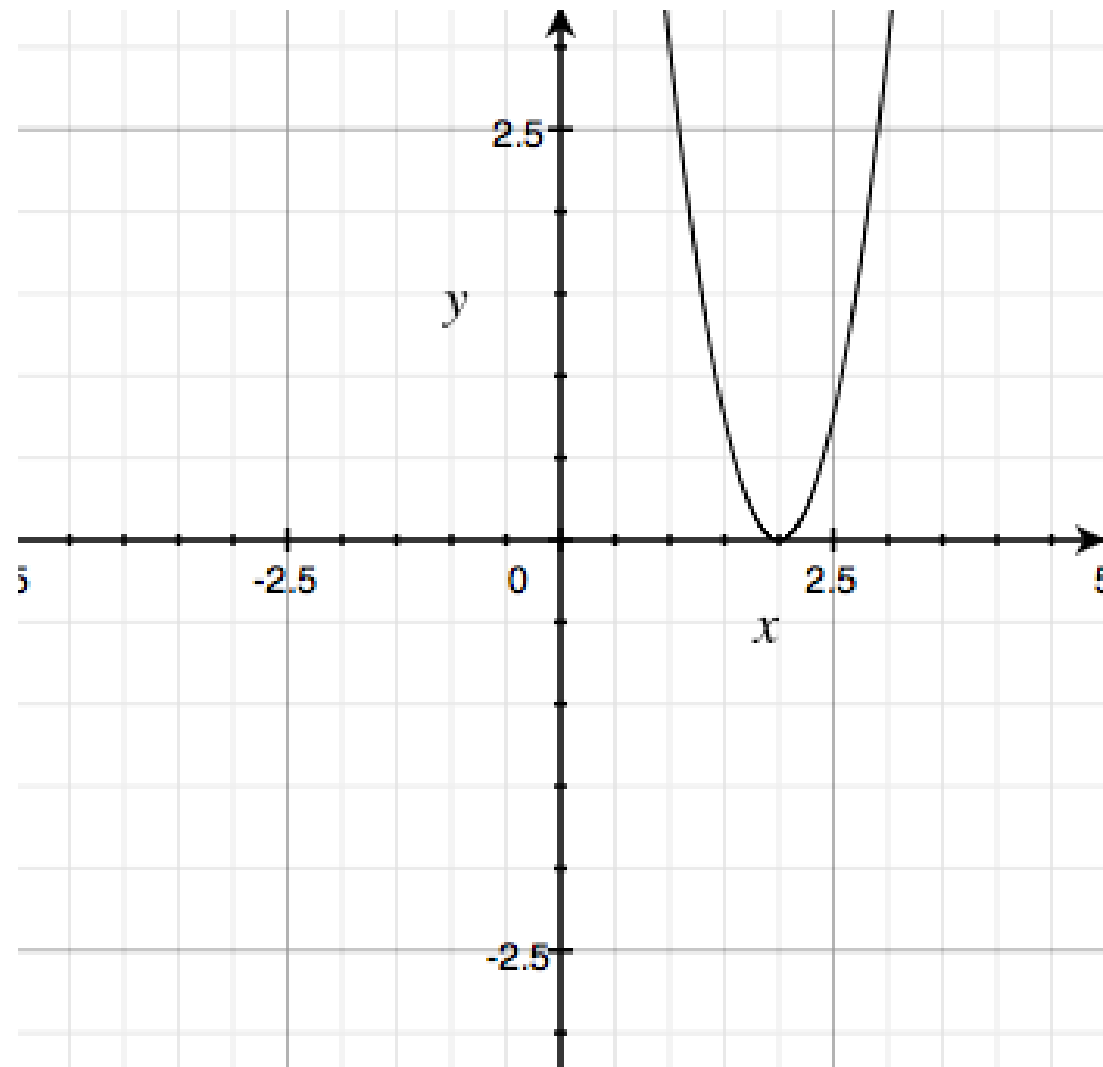


On your calculator find the equations of two different parabolas that have the same vertex of  $(2,0)$ .

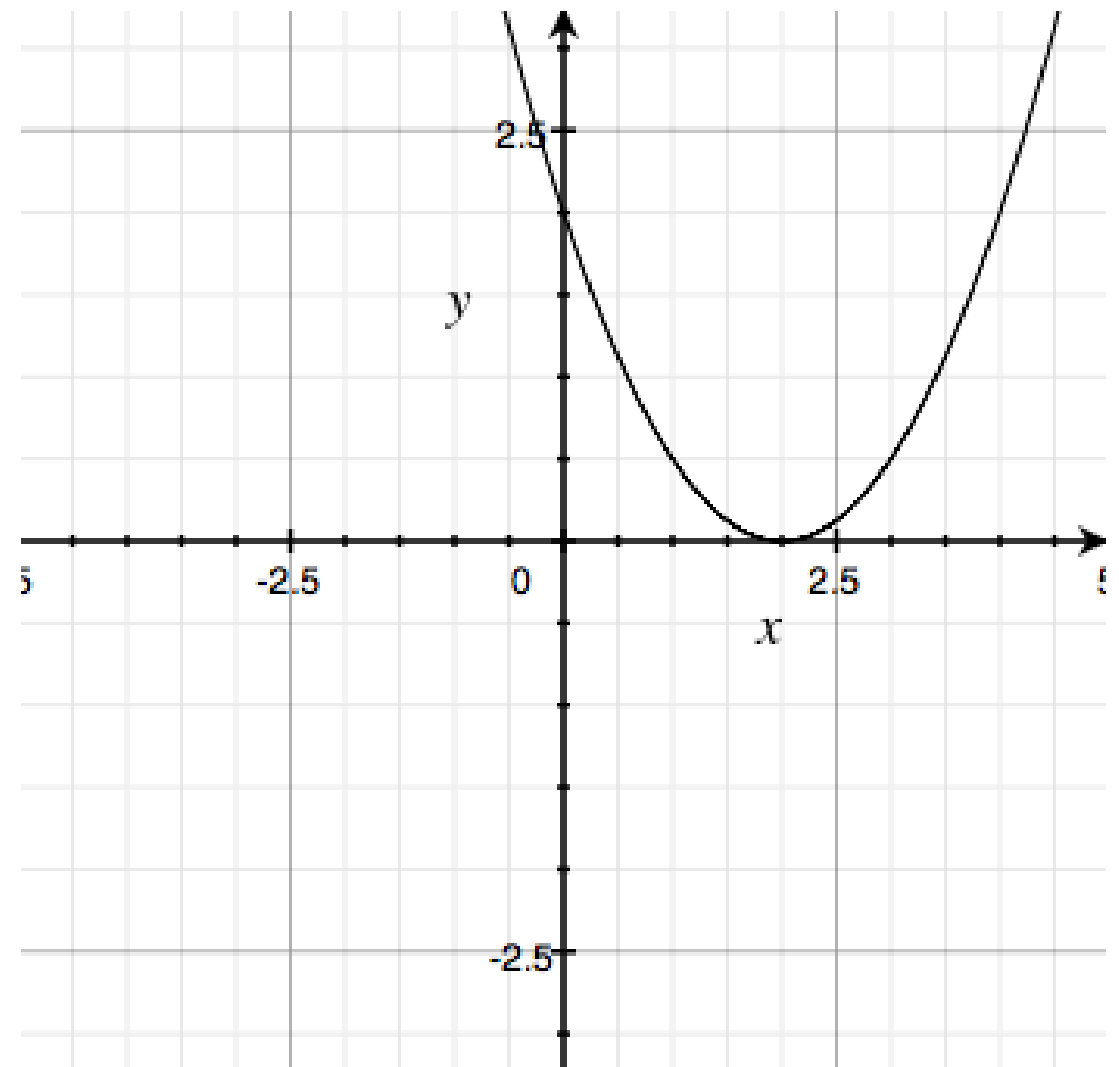
When you have them add them to your graph along with their equations.

Make a note on what you did and how it effects the parabola.

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



$$y=0.5(x-2)(x-2)$$



How do you change the equation to make the graph open downward?

Add these to you graph paper.

Note what you did and how it changes the graph.

Let's see if you get it:

Write an equation of a parabola that opens downward with a vertex at  $(-4,0)$ .

What is the equation of its line of symmetry?

HW 4-5 to 4-12

Test: ~~Mon.~~  
Tues { Alg  
Exponents

