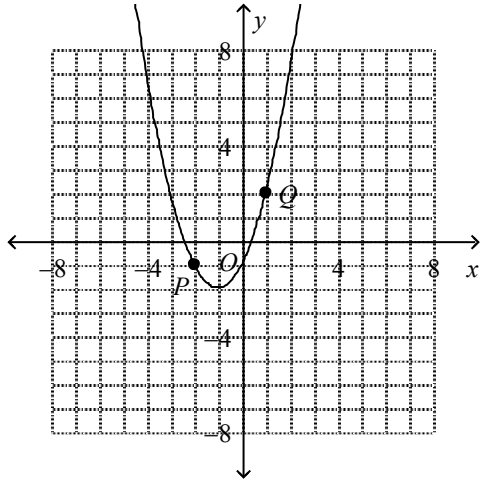
Algebra 2
Lesson 5-1: Modeling Data with Quadratic Functions
Mrs. Snow, Instructor



Is the graph to the left a function? How so?

What is the name of the function graphed?

This graphed shape is called a **parabola** and the function modeled is known as a **quadratic function.** What is the domain of a quadratic function?

Range????

The function in standard form is:

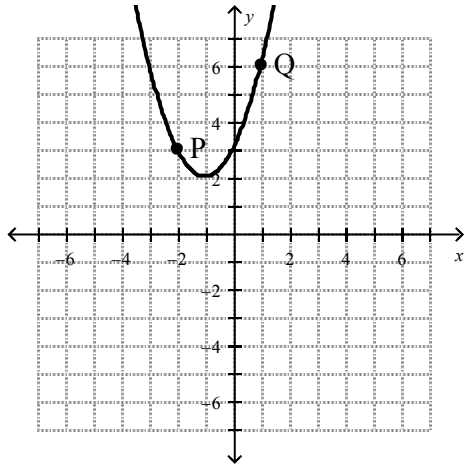
$$f(x) = ax^2 + bx + c$$

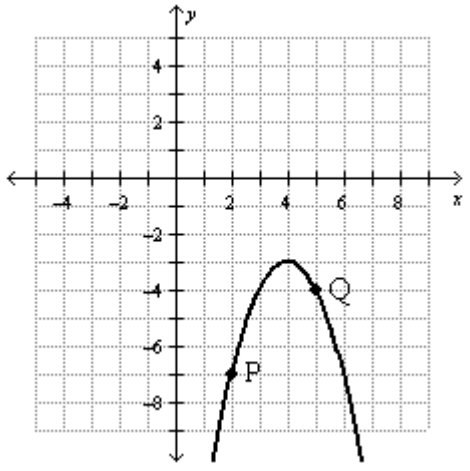
quadratic term | linear term | constant term

A quadratic function will have this form. Yes, "b" can equal 0 and "c" can equal 0. <u>If "a" equals 0 then it is no longer a quadratic, but linear.</u>

Axis of symmetry – a line that divides a parabola into two parts that are mirror images of each other. The axis of symmetry will be a vertical line with an equation in the form of **x=real number** and will be equal to the **x** value.
Vertex – is where the minimum or maximum value of the function and will occur at the value of the **y point**. This is the point where the direction of the parabola changes from decreasing to increasing or increasing to decreasing.
Minimum or Maximum – the value of y at the vertex
Corresponding point – points on a parabola that are the reflection of other points on the parabola.
e.g. on the above graph $P\ (-2,-1)\ corresponds\ to\ P'\ ((0,-1)$, plot P', What is Q'?

Identify the vertex, minimum or maximum, axis of symmetry and the domain and range for the graphs.
Identify the corresponding points **for P and Q**





If a calculator is allowed, you may find the minimum/maximum point of the parabola:

1. Using the **Y=** button enter the equation.
2. Hit **GRAPH** ***Note: the stat plots must be off for the graphing function to work.***
3. Adjust the window of the view screen under **ZOOM** or **WINDOW** in order to view the vertex.
4. Hit **2nd TRACE 3** minimum or **4** maximum. The view screen will ask for the left bound, arrow over so that the blinking star (asterisk) is on the left side of the vertex. **ENTER** You will be asked for the right bound, and again arrow over so that the asterisk is now on the right side of the vertex. **ENTER ENTER** and the view screen will identify the x and y coordinates for the vertex.

Given 3 ordered pairs, a quadratic equation may be found:

1. Substitute the values of x and y into the quadratic equation: $y = ax^2 + bx + c$
2. With the 3 resultant equations you have a **system of 3 linear equations** and may be solved by methods learned in Chapter 3 and 4 or in the "Final Word on Chapter 4" lesson.
3. Using the augmented matrix form, key in the coefficients and constant into a 3x4 matrix on the calculator and find the reduced row-echelon form of the matrix, thus finding the solutions to the variables which are in fact the coefficients of the quadratic equation!

Example: Use the calculator to write a quadratic equation with the following points:

x	2	3	4
y	3	13	29

$(1, -2), (2, -2), (3, -4)$

Here we use different methods to solve:

Method 1:

1. A system of 3 equations and 3 unknowns may be solved with elimination or substitution.

Method 2:

1. Write as a matrix equation and solve.

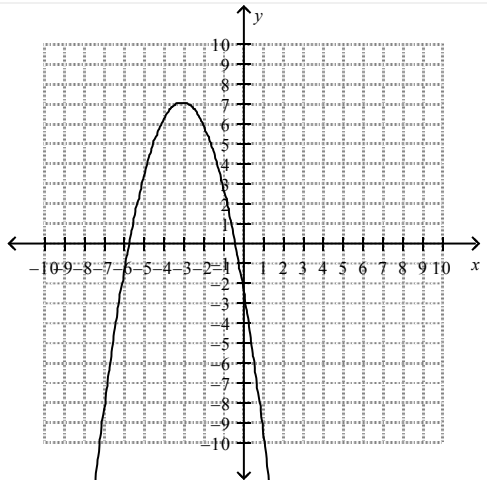
Method 3:

1. Use the stat plot function on the calculator to plot the original given points
2. A quadratic regression (calculator) will yield the equation of best fit.

Method 3:

LINEAR/QUADRATIC REGRESSION	
Using STAT PLOT and finding a best fit line or curve:	
1. Given a set of data: 2. Enter the Data into the calculator:	[**STAT] [ENTER]** type in independent variable **(x)** data into **L1**, dependent data **(y)** data into **L2,** followed by **2nd [MODE]** (quit)
3. Turn on STAT PLOT1	**2nd [Y=] [Enter] [Enter] 2nd [MODE]** **OR** **[Y=] ↑ Plot1 [Enter]**
4. Plot the data points	**[ZOOM] – 9**
5. Find the best fit and send the equation over to the y-plot select **4** for linear or **5** for quadratic regression.	**[STAT] [CALC] 5 [VARS] ► Y-VARS [ENTER] [ENTER] [ENTER] [GRAPH]**
6. When **Y=** is opened you will see the equation has been placed for graphing, and a line will be drawn of best fit	***** IF YOU ONLY NEED AN EQUATION:** **STAT ► CALC 4 ENTER** FOR A LINEAR **STAT ► CALC 5 ENTER** FOR A QUADRATIC

Even with the limited knowledge we have from just completing one section, we can still come up with some information that describes a graph of a quadratic and choose an equation that represents the function modeled.



What is the vertex?

What is the y-intercept?

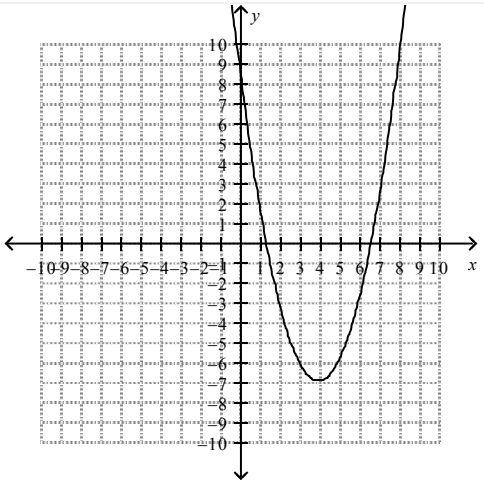
Leading coefficient, + / - ?

a. $f(x) = -x^2 + 6x + 2$

b. $f(x) = -x^2 - 6x - 2$

c. $f(x) = -x^2 - 6x + 2$

d. $f(x) = -x^2 + 6x - 2$



What is the vertex?

What is the y-intercept?

Leading coefficient, + / - ?

a. $f(x) = x^2 - 8x - 9$

b. $f(x) = x^2 + 8x + 9$

c. $f(x) = x^2 + 8x - 9$

d. $f(x) = x^2 - 8x + 9$