Sec 5-1: Quadratic Function

A function is a quadratic if the largest exponent is 2.

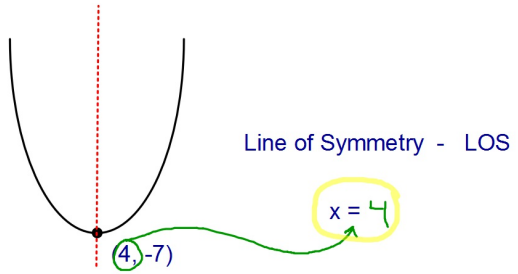
Standard Form of a Quadratic Function

$y = ax^2 + bx + c$

Quadratic Term — Linear Term — Constant

If the the vertex of a parabola is (4, -7) what is the equation of the Line of Symmetry?

The Line of Symmetry is a Vertical line passing through the Vertex



Use this equation of a quadratic.

$y = x^2 - 4x + 7$

The Line of Symmetry is $x = 2$

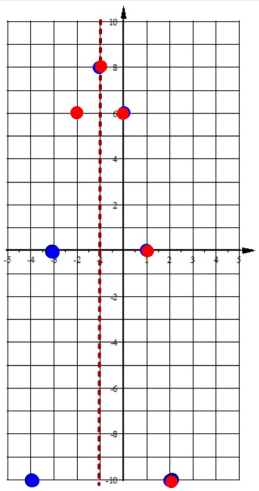
What are the coordinates of the vertex?

(2 , 3)

To find the y-coordinate just replace x in the equation with 2 and find the value of y. $y = (2)^2 - 4(2) + 7 = 3$

Below is a table of values for the graph of a parabola. Plot these points and find 2 other points to complete the picture of this parabola.

x	y
−2	6
−1	8
0	6
1	0
2	−10



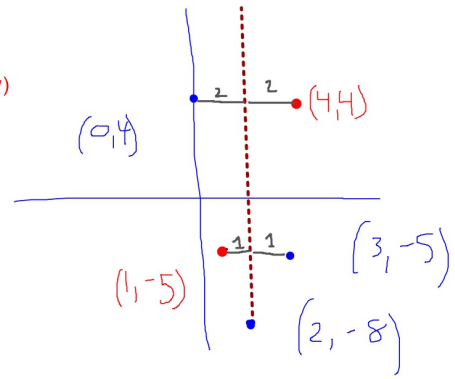
Since (-1,8) is going to be the highest point on the graph it is the vertex. The Line of Symmetry is x = -1.

Reflecting (1,0) and (2, -10)over the line of symmetry will give you two more points.

The vertex of a parabola is (2, -8)

If the points (3, -5) and (0,4) are on the parabola find two other points on the parabola.

When you reflect over a vertical line (Line of Symmetry) the y-coordinate remains the same and the x-coordinate is the same distance away from the line of symmetry but on the other side.



Does each parabola open up or down?

1. $y = -87x^2 + 23x + 115$ — a is neg

Down

2. $y = 0.01x^2 + x - 70$ — a is pos

UP

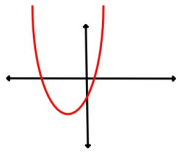
3. $y = -57x + 12x^2$ — a is pos

UP

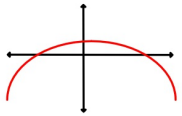
4. $y = -x^2 + 106x - 2$ — a is neg

Down

Does each parabola have a maximum or a minimum?

1. 

Minimum

2. 

Maximum

Is the vertex of each parabola a Maximum or a Minimum?

1. $y = -87x^2 + 23x + 115$ — a is neg

Opens Down

Vertex is a Max

2. $y = 0.01x^2 + x - 70$ — a is pos

Opens UP

Vertex is a Min

3. $y = -57x + 12x^2$ — a is pos

Opens UP

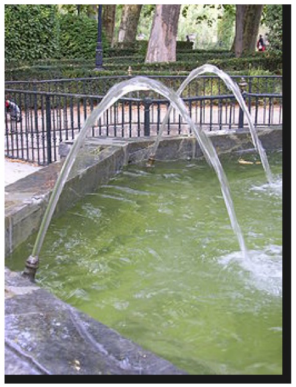
Vertex is a Min

4. $y = -x^2 + 106x - 2$ — a is neg

Opens Down

Vertex is a Max

Real-world parabolas

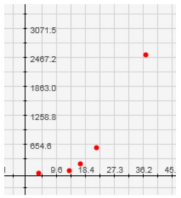


An object thrown into the air has a path that takes the shape of a parabola (exlcuding air resistance or any other outside forces).

Make a scatter plot on the graphing calculator of this data:

x	y
4.2	55.8
13.5	102.1
16.9	251.6
21.8	585.3
36.9	2517.6

Does this scatter plot appear to be a linear function? No, it appears to be more of a curve.



Find the equation of the linear regression line

y = 79.09x - 773.39

Does this equation appear to be a good fit? The correlation coefficient is r = 0.92 Since this seems close to 1 it appears to be a good fit, but the data points still seem to look like a curve is a better fit.

Press STAT

Arrow to CALC

Is there another option other than LineReg(ax+b) that you would think find an equation that would fit this data better ?

5:QuadReg

Graph this quadratic along with the linear regression line and the scatter plot. Which equations appears to be a better fit?

$y = 2.995x^2 - 47.810x + 203.315$

When you graph the line and the quadratic together with the data points the quadratic is a much better fit since it touches all five data points and the line doesn't touch any of them. I would select the quadratic equation as a better fit for the data.

If you have the vertex of a parabola you only need one other point to find the equation.

What if you don't have the vertex?

Without the vertex you need 3 noncollinear points to write the equation of a parabola.

Find the equation of the parabola that passes through these three points:

(4, -1) (-7,9) (0,6)

(4, -1) (-7,9) (0,6)

x	y
4	-1
-7	9
0	6

Perform a Quadratic Regression

rounded to the nearest thousandth:

$y = -0.120x^2 - 1.27x + 6$