Identifying Points on Parabola

by Sophia

WHAT'S COVERED

This tutorial covers how to identify points on a parabola, through the definition and discussion of:

1. Parabolas

A parabola is the shape of the graph of a quadratic equation. Parabolas have a general U shape to them, either opening up or opening down. In the general quadratic equation below, the coefficient a determines the upward or downward shape of the parabola.

$y = ax^2 + bx + c$

- When the coefficient *a* is positive, the parabola will open upward.
- When the coefficient *a* is negative, the parabola will open downward.

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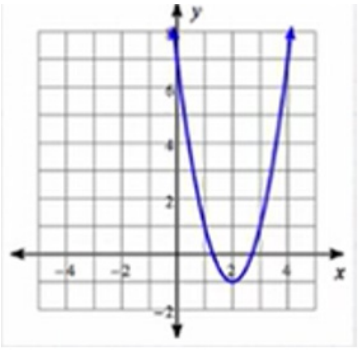
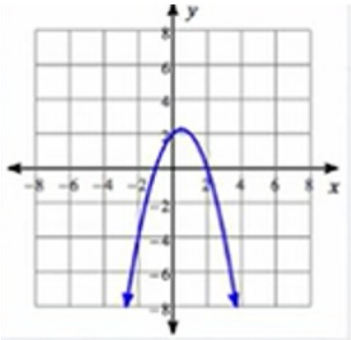


"a" positive, parabola opens upward

$y = ax^2 + bx + c$



"a" negative, parabola opens downward

Even though we don't know the equation to the graphs above, you can see if the value of a is positive or negative. Graphing parabolas can be used to model the path of objects in motion, solve problems involving area, and solve optimization problems.

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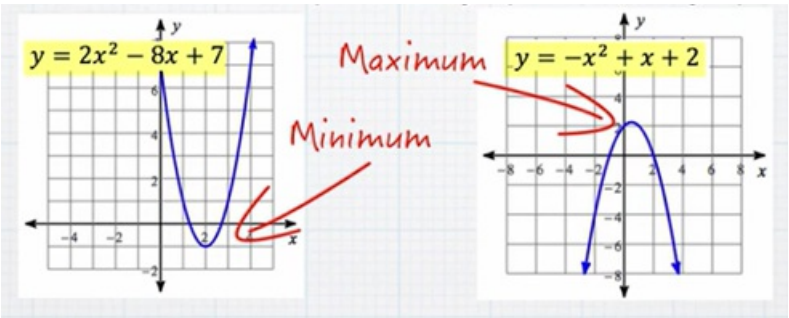
2. Vertex of a Parabola

Every parabola has either a low point or a high point on the graph called the **vertex**. In the graph below, the parabola has a low, or minimum, point. The minimum point has the lowest y-value on the parabola. The second parabola below has a high, or maximum, point, which has the highest y-value on the parabola.



HINT

Remember, when looking at the equation of a quadratic graph, if the *a* coefficient of a quadratic equation is positive, the parabola opens upward and the vertex is a minimum point. If the *a* coefficient is negative,

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the parabola opens downward and the vertex is a maximum point.

TERM TO KNOW

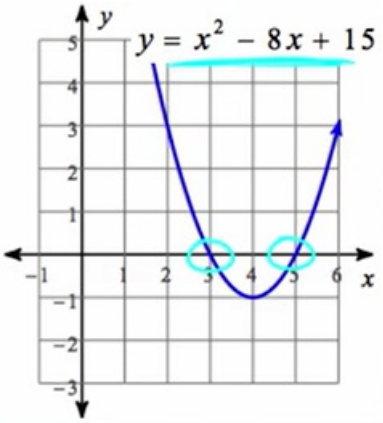
Vertex (of a Parabola)

The maximum or minimum point of a parabola

3. x-Intercepts of a Parabola

The x-intercept of a graph is a point where that graph intersects the x-axis and when y equals 0. The y-intercept of a graph is a point where the graph intersects the y-axis and when x equals 0. On a parabola, the x-intercepts are the x-values that make y equal to 0, and they also correspond to the solutions of the quadratic equation.

↱ EXAMPLE In the graph below, how can you solve the quadratic equation: $x^2 - 8x + 15 = 0$?



You solve the equation by graphing the equation below and identifying the x-intercepts of the graph.

$y = x^2 - 8x + 15$

You can see in the graph above that your x-intercepts are (3, 0) and (5, 0). Therefore, the solutions to the quadratic equation are:

$x = 3$
$x = 5$

4. Solutions to a Quadratic Equation on a Graph

You can determine the solutions to a quadratic equation by looking at a graph.

↱ EXAMPLE Suppose you have another example of a parabola, with the equation:

$y = -\frac{1}{2}x^2 - 2x$

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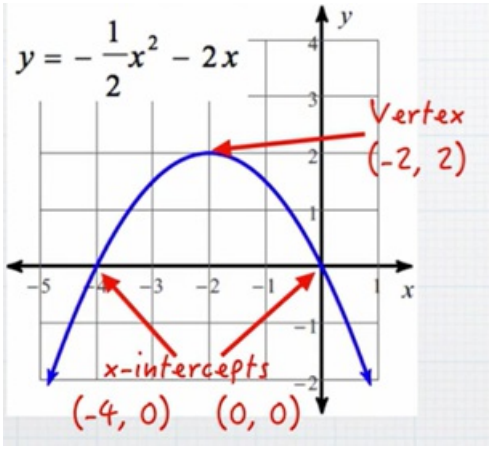
The vertex of this graph is a maximum point and is at the point (-2, 2) on the graph. The x-intercepts of the graph are at the points (- 4, 0) and (0, 0).



Again, the x-intercepts are the solution to this quadratic equation.

$$-\frac{1}{2}x^2 - 2x = 0$$

Therefore, the solutions to this equation are:

$x = -4$
$x = 0$

SUMMARY

Today you learned that a **parabola** is the shape of the graph of a quadratic equation, and that it has a general U shape, either opening up or opening down. You learned that in the general quadratic equation, the coefficient a determines the upward or downward shape of the graph. You also learned that every parabola has either a low point or a high point on the graph called the **vertex,** and that if the coefficient of a quadratic equation is positive, the vertex is a minimum point, whereas if the a coefficient is negative, the vertex is a maximum point. Lastly, you learned that the **x-intercepts of a parabola** are the x-values that make y equal 0 and also correspond to the**solutions of the quadratic equation on a graph**.

Source: This work is adapted from Sophia author Colleen Atakpu.

TERMS TO KNOW

Vertex (of a Parabola)
The maximum or minimum point of a parabola.

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