Quadratic & Exponential Functions

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Graphing: The Shape of Quadratic functions

When graphed, quadratic functions take the shape of a parabola. Note that unlike the quadratic equation (which $= 0$), we equate the function to y.

$ax^2 + bx + c = 0$ for $a \neq 0$ is the general form of the quadratic equation.

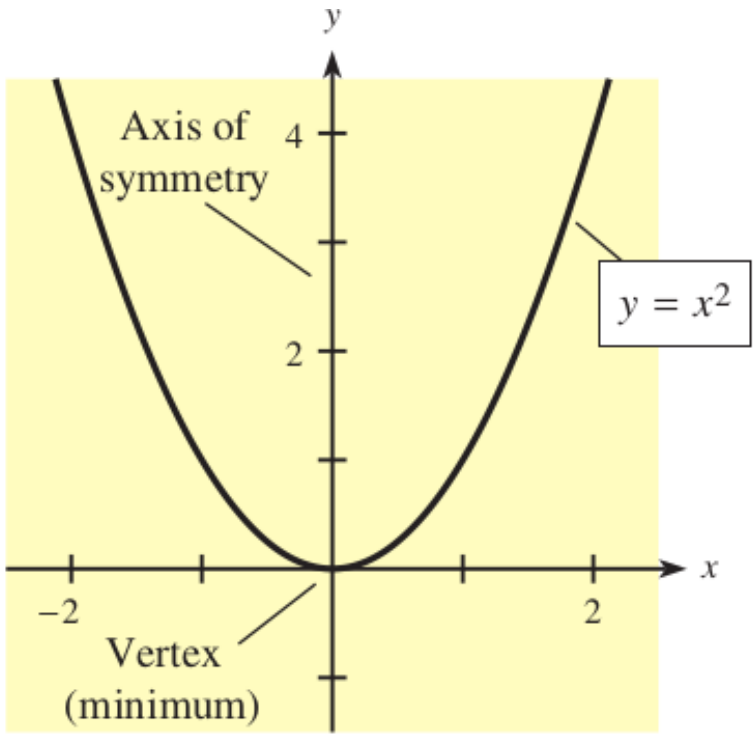
$ax^2 + bx + c = y$ for $a \neq 0$ is the general form of the quadratic function. The more common form is $y = ax^2 + bx + c$

Graphing: The Shape of Quadratic functions

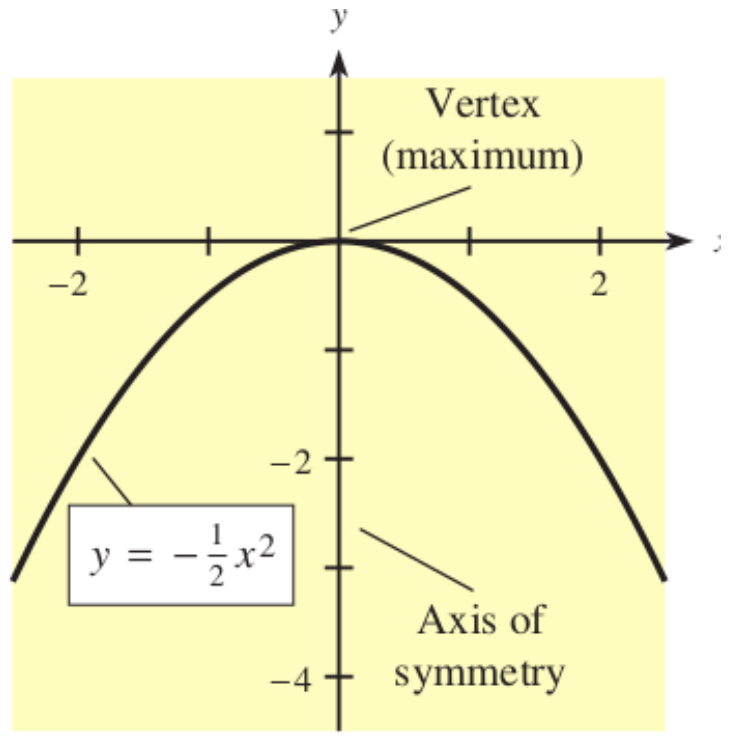
- Quadratic functions take a U or n shape with symmetry along the x = a.
- The maximum or minimum (depending on the shape is the vertex).
- U-shaped quadratic functions have a minimum, while the n-shaped ones have a maximum.
- The value of a in $y = ax^2 + bx + c$, determines the shape of the graph of the quadratic function.

Graphing: The Shape of Quadratic functions

- If a > 0, then we have a U-shaped graph, otherwise, we have an n-shaped graph.
- The shape of the graph of a quadratic function is parabolic. See below.
- In the examples below, the symmetry is along x $= 0$, the y-axis.



(a)



(b)

Graphing: The Shape of Quadratic functions

- In other cases, the line of symmetry can be different, but always a vertical line x = a for some constant a. See below.

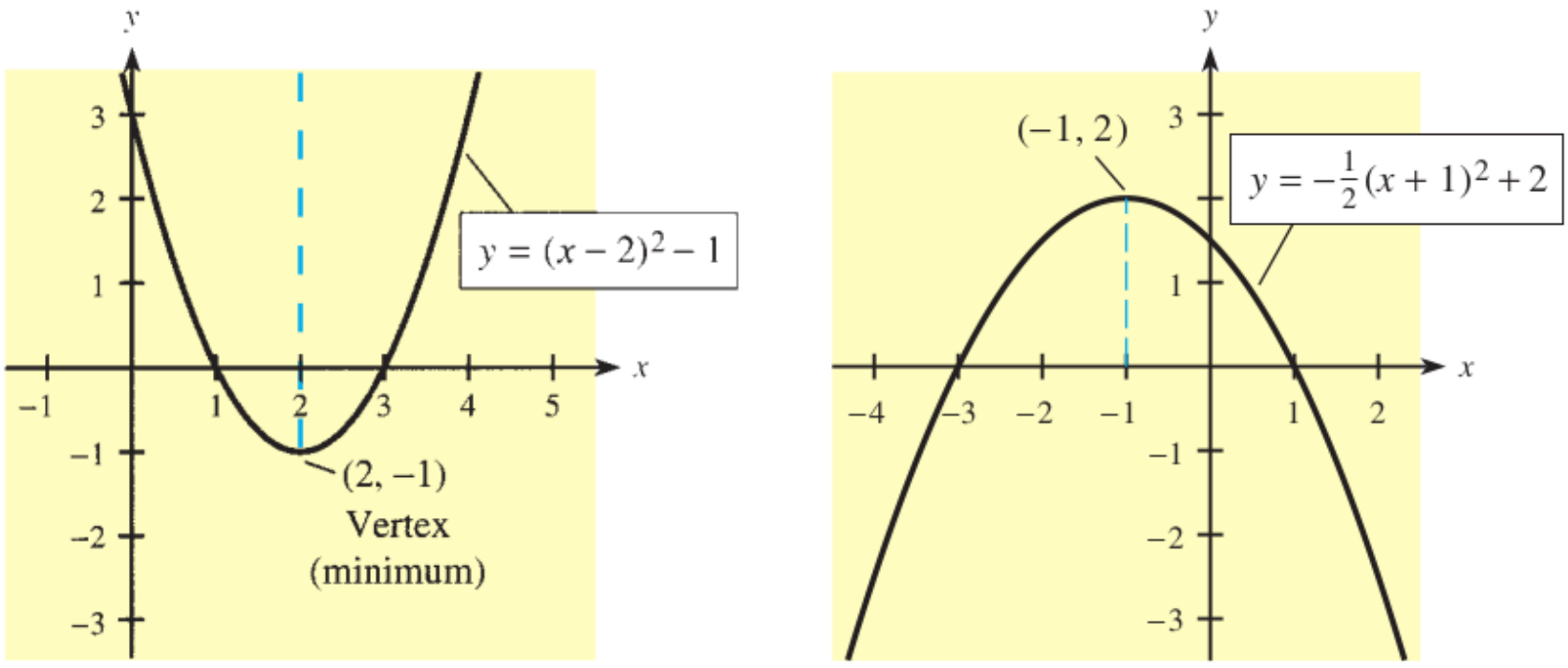


Figure 2: Shape of Quadratic Functions

The Shape of Quadratic functions: Maxima or Minima

- We can find the x-coordinate of the vertex of the graph of y 5 ax 2 1 bx 1 c by using the fact that the axis of symmetry of a parabola passes through the vertex.
- Regardless of the location of the vertex of $y = ax^2 + bx + c$ or the direction it opens, the y-intercept of the graph of $y = ax^2 + bx + c$ is (0, c) and there is another point on the graph with y-coordinate c.
- In other words, the y-intercept of any quadratic function is the c in $y = ax^2 + bx + c$
- Hence, to get the vertex, we can substitute y with c and solve the equation.

The Shape of Quadratic functions: Maxima or Minima

- $y = ax^2 + bx + c$
- Substituting y = c
- $c = ax^2 + bx + c$
- $0 = ax^2 + bx$
- $0 = x(ax + b)$
- $x = 0$ or $x = \frac{-b}{a}$
- Remember the vertex represents the maximum or minimum.