Parabolas

Preliminaries and Objectives

Preliminaries

- Polynomials
- Graph of $y = x^2$
- Graph Transformations

Objectives

- Find the axis of symmetry of a Parabola
- Find the vertex of a Parabola
- Graph a Parabola

Definitions

A **quadratic function** is a polynomial of degree 2. It has the general form

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

General Parabola

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

General Parabola

$$y = ax^2 + bx$$

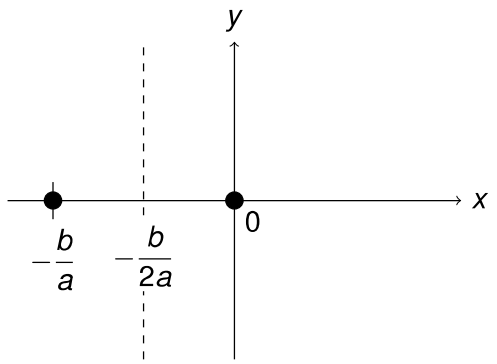
$$y = \left(x^2 + \frac{b}{a}x\right)$$

$$y = x\left(x + \frac{b}{a}\right)$$

- Shift vertically by c
- Stretch by a factor of a
- Find the axis of symmetry

Axis of Symmetry and Vertex

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



Vertex : $\left(-\frac{b}{2a}, ?\right)$

Axis of Symmetry and Vertex

For the parabola defined by the equation $y = ax^2 + bx + c$

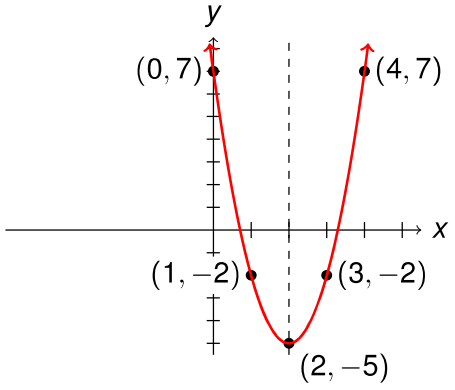
- The axis of symmetry is $x = -\frac{b}{2a}$,
- The vertex has an x-coordinate of $-\frac{b}{2a}$,
- The y-coordinate of the vertex can be found by plugging the x-value $-\frac{b}{2a}$ into the original equation.

Example

Graph the parabola $y = 3x^2 - 12x + 7$

Axis of symmetry : $x = -\frac{(-12)}{2(3)} = 2$

Vertex : $\left(2, -5\right)$



Recap

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

- Axis of symmetry : $x = -\dfrac{b}{2a}$
- Vertex : $\left(-\dfrac{b}{2a}\ ,\ f\left(-\dfrac{b}{2a}\right)\right)$
- Stretch factor $= a$