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Quadratic Functions

Unit 9 Lesson 2

QUADRATIC FUNCTIONS

Students will be able to:

Identify the axis of symmetry and vertex of a quadratic function and use them to graph the quadratic function

Key Vocabulary:

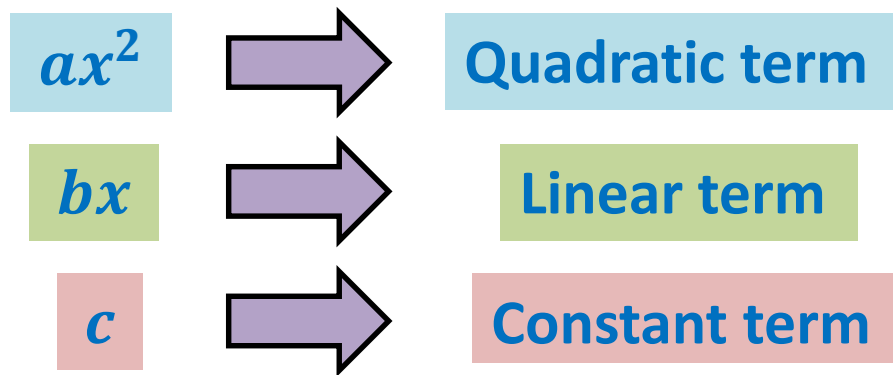
- Quadratic Function
- Vertex
- Axis of Symmetry
- Graphing Quadratic Function

QUADRATIC FUNCTIONS

A **quadratic function** is of the form:

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

Where, $a \neq 0$.



QUADRATIC FUNCTIONS

Consider the quadratic function $f(x) = ax^2 + bx + c$, $a \neq 0$.

- **Axis of Symmetry** is the line that divides the graph of the quadratic function into two parts that are mirror images of each other. Mathematically, it is given as:

$$x = -\frac{b}{2a}$$

- **Vertex of the parabola** is the point which intersects the axis of symmetry of the graph of the quadratic function. Mathematically, its coordinates are given as:

$$\left(-\frac{b}{2a}, f\left(-\frac{b}{2a} \right) \right)$$

QUADRATIC FUNCTIONS

Problem 1: Identify the axis of symmetry and the vertex of the graph of the quadratic equation $y = 2x^2 + 8x - 4$.

QUADRATIC FUNCTIONS

Problem 1: Identify the axis of symmetry and the vertex of the graph of the quadratic equation $f(x) = 2x^2 + 8x - 4$.

First find the axis of symmetry, here $a = 2, b = 8$:

$$x = -\frac{b}{2a} \Rightarrow x = -\frac{8}{2(2)} \Rightarrow x = -2$$

Now put this value of x in the equation of the quadratic function:

$$f(-2) = 2(-2)^2 + 8(-2) - 4 \Rightarrow f(-2) = 8 - 16 - 4$$

$$\Rightarrow f(-2) = -12$$

$$\Rightarrow \text{Vertex} = (-2, -12)$$

QUADRATIC FUNCTIONS

Graphing quadratic Functions

If we can find the vertex and axis of symmetry, we can use them to graph the quadratic functions. Graphing can be done by following these steps:

- Find the equation of axis of symmetry.
- Find the vertex of the quadratic function.
- Graph the vertex and axis of symmetry.
- Find 2 or 3 points on the graph and plot them.
- Use the axis of symmetry to complete the graph.

QUADRATIC FUNCTIONS

Problem 2: Graph the quadratic function $f(x) = 2x^2 - 4x + 2$.

QUADRATIC FUNCTIONS

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- First find the axis of symmetry, here $a = 2$, $b = -4$:

$$x = -\frac{b}{2a} \quad \Rightarrow \quad x = -\frac{-4}{2(2)} \quad \Rightarrow \quad x = 1$$

- Now put this value of x in the equation of the quadratic function:

$$f(1) = 2(1)^2 - 4(1) + 2 \quad \Rightarrow \quad f(1) = 2 - 4 + 2 = 0$$

$$\Rightarrow \quad f(1) = 0$$

$$\Rightarrow \quad \text{Vertex} = (1, 0)$$

QUADRATIC FUNCTIONS

Problem 2: Graph the quadratic function $f(x) = 2x^2 - 4x + 2$.

- Find two more points on the function:

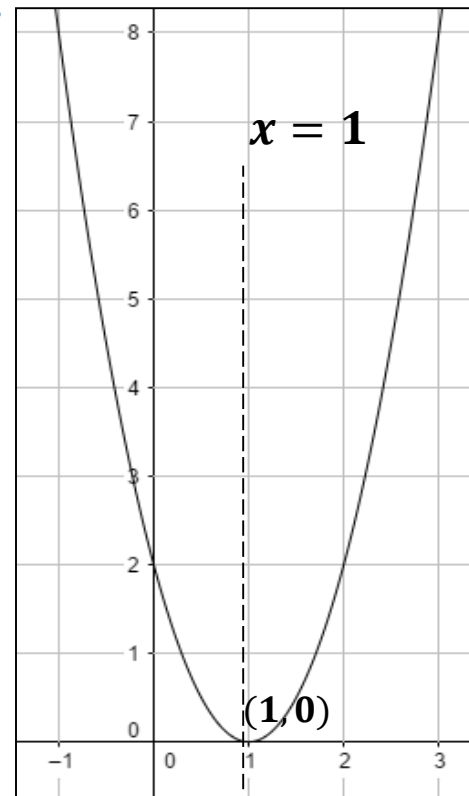
$$f(0) = 2(0)^2 - 4(0) + 2 \quad \Rightarrow \quad f(0) = 2$$

$$\Rightarrow (0, 2)$$

$$f(-1) = 2(-1)^2 - 4(-1) + 2 \quad \Rightarrow \quad f(-1) = 8$$

$$\Rightarrow (-1, 8)$$

- Now plot all these points and use the axis of symmetry to complete the graph.



$$f(x) = 2x^2 - 4x + 2$$