

# Quadratic Equations | Definition, Formulas and Examples

Author: MTN Maths Editorial Team

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## What is a Quadratic Equation?

*“A **quadratic equation** is a second-degree polynomial equation in one variable. In simple terms, it’s any equation that can be written in the form:*

$$\mathbf{ax^2 + bx + c = 0.}”$$

Here:

- **a, b, c** are constants with **a ≠ 0**
- **x** is the unknown variable
- The highest power of **x** is 2, which makes it “quadratic.”

**Example:**

- $2x^2 + 3x - 5 = 0$
- $x^2 - 9 = 0$  The standard form is written as:

$$\textcolor{blue}{a}x^2 + \textcolor{red}{b}x + \textcolor{orange}{c} = 0$$

*Figure 1 Quadratic Equation in Standard form, coefficients are color coded*

## Standard Form of a Quadratic Equation

The standard form is written as:

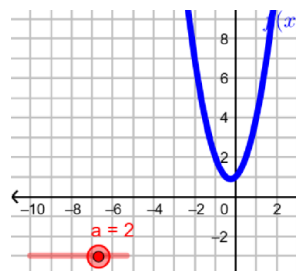
$$ax^2 + bx + c = 0$$

Where:

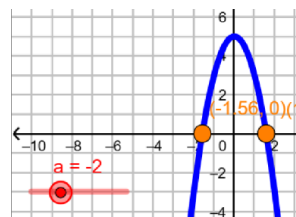
- **a** = coefficient of  $x^2$
- **b** = coefficient of  $x$
- **c** = constant term

**Standard form:**

When  $a$  is **positive**



When  $a$  is **negative**



## Properties of Quadratic Equations

1. The graph of a quadratic equation is always a **parabola**.
2. If  $a > 0$ , the parabola opens **upwards**; if  $a < 0$ , it opens **downwards**.
3. A quadratic equation can have:
  - **Two real roots**
  - **One real root** (when discriminant = 0)
  - **No real root** (when discriminant  $< 0$ )

## Methods to Solve Quadratic Equations

There are four common ways to solve:

1. **Factorization Method**
2. **Completing the Square**
3. **Quadratic Formula**
4. **Graphical Method**

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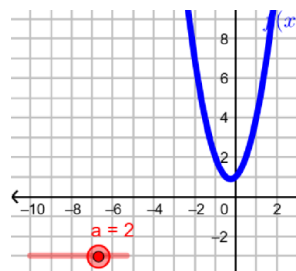
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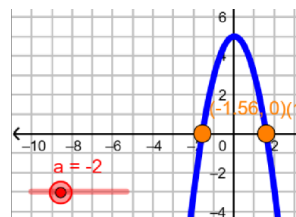
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## FAQs

### Q1. What is the definition of a quadratic equation?

A quadratic equation is a polynomial equation of degree 2, written as

$$ax^2 + bx + c = 0.$$

### Q2. Can a quadratic have no real solution?

Yes. If the discriminant ( $b^2 - 4ac$ )  $< 0$ , the roots are complex, not real.

### Q3. What is the easiest way to solve quadratic equations?

If the equation is easily factorable, factorization is the fastest. Otherwise, use the quadratic formula.

### Q4. What does the graph of a quadratic equation look like?

It's a parabola—opening upwards if  $a > 0$ , downwards if  $a < 0$ .

### Q5. Where are quadratic equations used in real life?

Quadratics are used in physics (projectile motion), economics (profit maximization), engineering (design curves), and computer graphics.

## Final Note

Quadratic equations are a foundation of algebra. Mastering them makes advanced math topics much easier.

👉 Need help with solving quadratic problems step by step? **Book your online session with MTN Maths tutors at [www.mytutornetwork.com](http://www.mytutornetwork.com)**

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