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The Quadratic Formula

IGCSE Mathematics

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Quality Mathematics Education for Students

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1 Introduction to Quadratic Equations

Note

The quadratic formula is one of the most powerful and important tools in algebra. It allows us to solve *any* quadratic equation, even those that cannot be factorised easily. Mastering the quadratic formula is essential for IGCSE success and forms the foundation for more advanced mathematics.

In this chapter, we will explore:

- The standard form of a quadratic equation
- Deriving the quadratic formula by completing the square
- Using the quadratic formula to solve equations
- The discriminant and the nature of roots
- Interpreting solutions graphically
- Real-world applications

2 Standard Form of a Quadratic Equation

Definition

A **quadratic equation** is a polynomial equation of degree 2. Its **standard form** is:

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

where:

- a , b , and c are real number constants (called **coefficients**)
- $a \neq 0$ (if $a = 0$, the equation becomes linear)
- x is the unknown variable

Method**Identifying a , b , and c**

Before using the quadratic formula, always rearrange the equation into standard form $ax^2 + bx + c = 0$, then read off the values of a , b , and c .

Step 1: Move all terms to one side so the equation equals zero

Step 2: Write terms in descending powers of x

Step 3: Identify the coefficient of x^2 as a , the coefficient of x as b , and the constant term as c

Example

Write each equation in standard form and state the values of a , b , and c .

(a) $5x^2 - 3x + 7 = 0$

Already in standard form: $a = 5$, $b = -3$, $c = 7$

(b) $x^2 - 9x = 0$

Already in standard form (with $c = 0$): $a = 1$, $b = -9$, $c = 0$

(c) $4x^2 = 7x - 2$

Rearrange: $4x^2 - 7x + 2 = 0$

$a = 4$, $b = -7$, $c = 2$

(d) $8x - 3x^2 = 5$

Rearrange: $-3x^2 + 8x - 5 = 0$, or equivalently $3x^2 - 8x + 5 = 0$

$a = 3$, $b = -8$, $c = 5$

Warning

Common Mistake: Forgetting to include the negative sign!

If the equation is $3x^2 - 7x + 1 = 0$, then $b = -7$, NOT $b = 7$.

Carrying the wrong sign into the formula causes errors in every calculation that follows.

Preview ends here

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