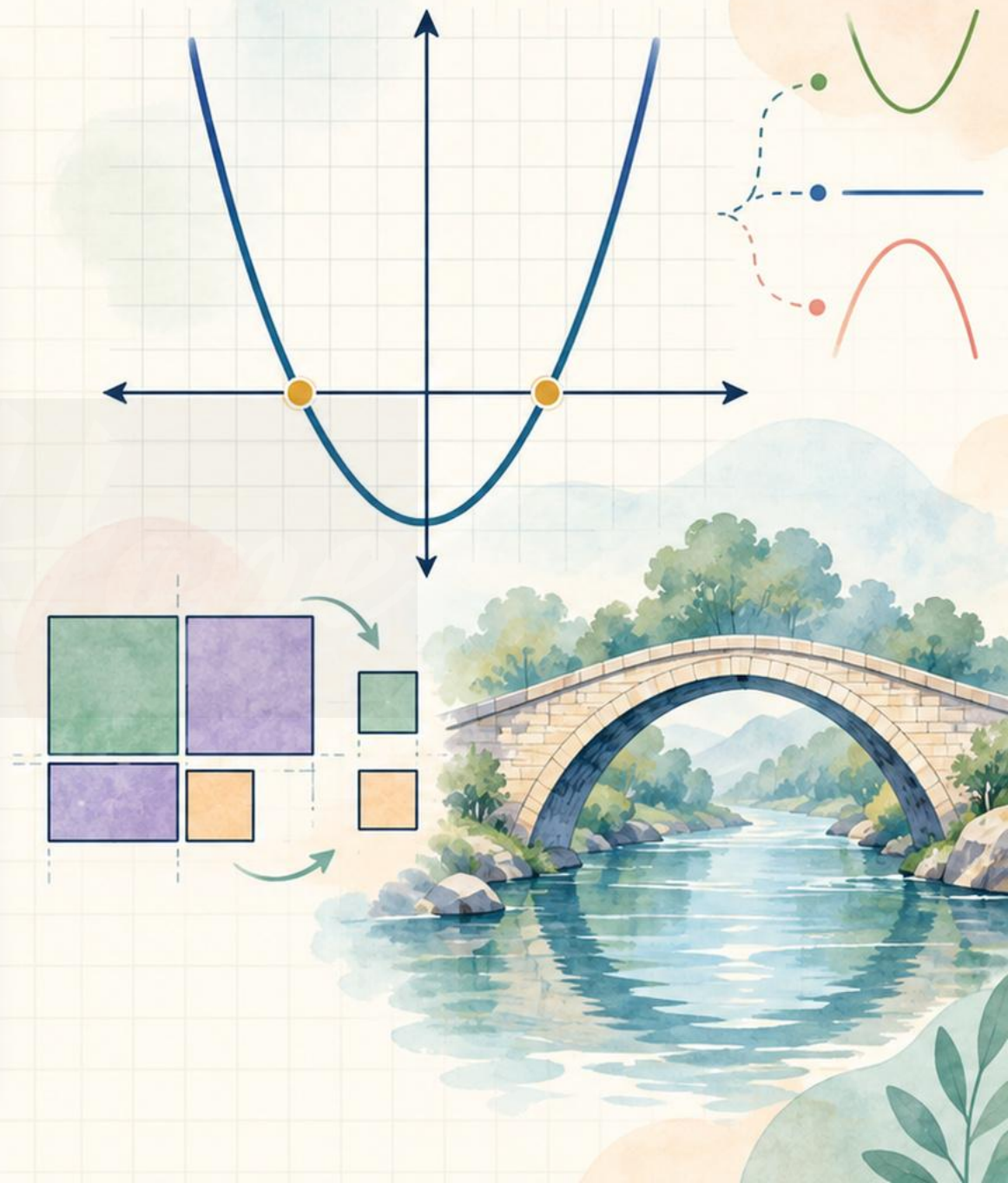


MATHEMATICS • CLASS 10

CHAPTER 4

Quadratic Equations

CHAPTER NOTES



QUADRATIC EQUATIONS: BASICS

1. DEFINITION

- A quadratic equation in x can be written as

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

where a, b, c are real numbers and $a \neq 0$.

2. DEGREE

- Degree is 2 because the highest power of x is 2.

EXAMPLE - Converting to Standard Form

Convert the equation $2x(x-1) = x^2 + 3$ into standard form.

$$2x(x-1) = x^2 + 3$$

(Given)

$$2x^2 - 2x = x^2 + 3$$

(Expand brackets)

$$2x^2 - 2x - x^2 = 3$$

(Bring all terms to one side)

$$x^2 - 2x - 3 = 0$$

(Combine like terms)

Thus, $x^2 - 2x - 3 = 0$ is in the form $ax^2 + bx + c = 0$.

Here, $a = 1$, $b = -2$, $c = -3$.

3. COEFFICIENTS

- a = coefficient of x^2
- b = coefficient of x
- c = constant term
- Note: $a \neq 0$.

4. STANDARD FORM CHECKLIST

- 1 Expand brackets wherever present.
↓
- 2 Bring every term to one side of the equation.
↓
- 3 Combine like terms.
↓
- 4 Check that the coefficient of x^2 is non-zero.

6. RECOGNISE CORRECTLY

- $x^2 - 5x + 6 = 0 \longrightarrow$ Quadratic equation (degree 2)
- $x^3 + x = 0 \longrightarrow$ Not a quadratic equation (degree 3)
- $5x - 2 = 0 \longrightarrow$ Linear equation (degree 1)

ROOTS OF A QUADRATIC EQUATION

CONNECTION:

The roots of a quadratic equation $ax^2 + bx + c = 0$ are exactly the zeros of the quadratic polynomial $p(x) = ax^2 + bx + c$.

DEFINITION 1:

- A real number α is a root of $ax^2 + bx + c = 0$ if substituting $x = \alpha$ makes the equation true.

DEFINITION 2:

- For $p(x) = ax^2 + bx + c$, roots of $p(x) = 0$ are exactly the zeros of $p(x)$.

EXAMPLE - Finding and Checking Roots

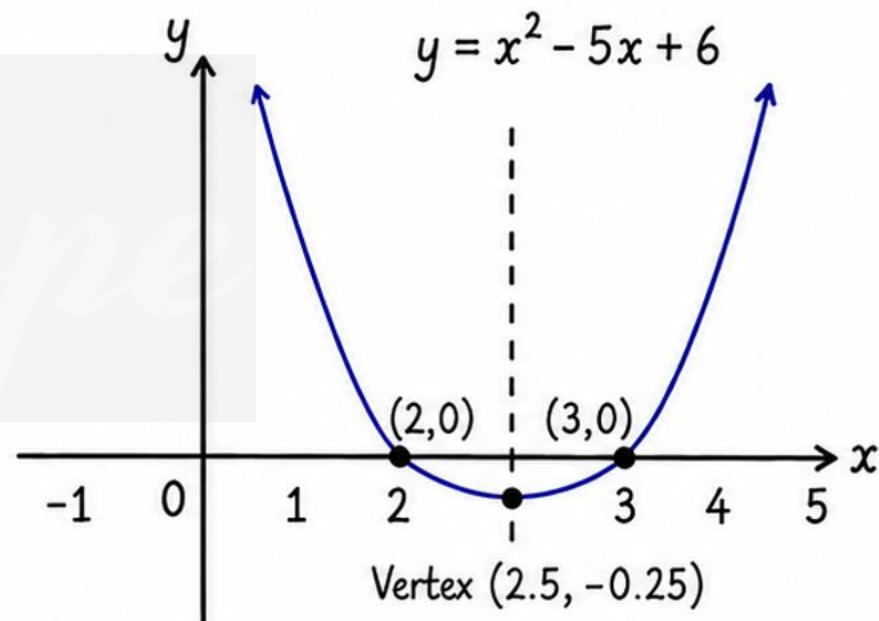
$$p(x) = x^2 - 5x + 6 = (x - 2)(x - 3).$$

So $p(x) = 0$ gives $x = 2$ or $x = 3$.

Check:

$$p(2) = 4 - 10 + 6 = 0$$

$$p(3) = 9 - 15 + 6 = 0.$$



x -intercepts = real zeros

Solving a quadratic equation means finding the values of x (the roots) that make the equation true—or equivalently, the zeros of its polynomial.

SOLVING BY FACTORISATION

- ① Write the equation in standard form $ax^2+bx+c=0$.
- ② Factorise the quadratic polynomial completely.
- ③ Use the zero-product property:
if $AB=0$, then $A=0$ or $B=0$.
- ④ Solve each resulting linear equation.
- ⑤ Substitute the roots back to check.

$$\begin{aligned}(px+q)(rx+s) &= 0 \\ px+q &= 0 \quad \text{OR} \quad rx+s=0 \\ x &= -\frac{q}{p} \quad \text{OR} \quad x = -\frac{s}{r}.\end{aligned}$$

SPLITTING THE MIDDLE TERM

- ① For ax^2+bx+c , find two numbers m and n such that $m+n=b$ and $mn=ac$.
- ② Split bx as $mx+nx$.
- ③ Rewrite and group terms:
$$\begin{aligned}ax^2+bx+c &= ax^2+mx+nx+c \\ &= x(ax+m)+(nx+c)\end{aligned}$$
- ④ Factorise completely and solve.

QUICK ILLUSTRATION (NOT SOLVED)

$$6x^2+11x+3 \longrightarrow m+n=11, mn=18$$

$$m=9, n=2 \longrightarrow 6x^2+9x+2x+3$$

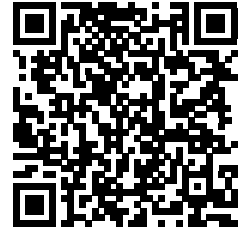


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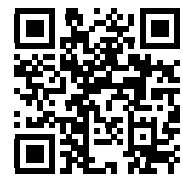


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