UNIT 24 *Solving Quadratic Equations* Introduction to SIM

Learning objectives

This unit is focused on methods of solving quadratic equations. After completing this unit of STUDENT INSTRUCTIONAL MATERIAL (SIM) you should

- be able to solve quadratic equations that factorise into two linear terms
- be able to use the formula for solving quadratic equations
- understand how to complete the square for a quadratic and hence solve the equation.

Key points and principles

- There are three methods of solving quadratic equations:

  (i) ***quadratic factorisation***, where we can write

  $ax^2 + bx + c = a(x - p)(x - q)$ when p and q are rational numbers

  which has solution $x = p$ or $x = q$

  (ii) ***formula*** $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

  (iii) ***completing the square***, where we write

  $$ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c$$

- Note that if $(x - a)(x - b) = 0$, then either $x - a = 0$ or $x - b = 0$, giving $x = a$ or $x = b$.

- Quadratic equations have 2, 1 or 0 real roots according to the value of "$b^2 - 4ac$":

  (i) If $b^2 > 4ac$, there are 2 real distinct roots

  (ii) If $b^2 = 4ac$, there is 1 (repeated) real root

  (iii) If $b^2 < 4ac$, there are no real roots.

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Facts to remember

- If $(x - a)(x - b) = 0$ then $x = a$ or $x = b$

- The formula for solving the quadratic equation
$$ax^2 + bx + c = 0$$
is
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- The number of real roots of a quadratic is
$$2 \text{ if } b^2 > 4ac$$
$$1 \text{ if } b^2 = 4ac$$
$$0 \text{ if } b^2 < 4ac$$

Glossary of Terms

Quadratic factorisation This is when you can write a quadratic formula in the form
$$ax^2 + bx + c = a(x - p)(x - q)$$

Formula for solving quadratic equation The formula for solving the quadratic equation
$$ax^2 + bx + c = 0$$
is
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Completing the square This is when we write the quadratic in the form
$$ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c$$