

# Numerical Methods

## Question Paper

Level	Pre U
Subject	Maths
Exam Board	Cambridge International Examinations
Topic	Numerical Methods
Booklet	Question Paper

**Time Allowed:** 35 minutes

**Score:** /29

**Percentage:** /100

**Grade Boundaries:**

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- 1 Given that the equation  $x^3 + 2x - 7 = 0$  has a root between  $x = 1$  and  $x = 2$ , use the Newton-Raphson formula with  $x_0 = 1$  to find this root correct to 3 decimal places. [4]
- 2 Taking  $x = 2$  as a first approximation, use the Newton-Raphson process to find a root of the equation  $\frac{1}{x^2} - 0.119 - 0.018x = 0$ . Give your answer correct to 3 significant figures. [4]
- 3 (i) Let  $f(x) = x^3 - x - 1$ . Use a sign change method to show that the equation  $x^3 - x - 1 = 0$  has a root between  $x = 1$  and  $x = 2$ . [2]
- (ii) By taking  $x = 1$  as a first approximation to this root, use the Newton-Raphson formula to find this root correct to 3 decimal places. [4]
- 4 (i) Show that the equation  $x^3 - 6x + 2 = 0$  has a root between  $x = 0$  and  $x = 1$ . [2]
- (ii) Use the iterative formula  $x_{n+1} = \frac{2 + x_n^3}{6}$  with  $x_0 = 0.5$  to find this root correct to 4 decimal places, showing the result of each iteration. [3]
- 5 (i) Sketch, on a single diagram, the graphs of  $y = e^{\frac{1}{5}x}$  and  $y = x$  and state the number of roots of the equation  $e^{\frac{1}{5}x} = x$ . [3]
- (ii) Use the Newton-Raphson method with  $x_0 = 0$  to determine the value of a root of the equation  $e^{\frac{1}{5}x} = x$  correct to 3 decimal places. [4]
- 6 The equation  $x^3 - 5x + 3 = 0$  has a root between  $x = 0$  and  $x = 1$ .
- (i) The equation can be rearranged into the form  $x = g(x)$  where  $g(x) = px^3 + q$ . State the values of  $p$  and  $q$ . [1]
- (ii) By considering  $|g'(x)|$ , show that the iterative form  $x_{n+1} = g(x_n)$  with a suitable starting value converges to the root between  $x = 0$  and  $x = 1$ . [You are not required to find this root.] [2]