

SAMPLE PAPER 3: PAPER 1

QUESTION 1 (25 MARKS)

Question 1 (a)

$$\left(1 - \frac{1}{x}\right)^2 = 2$$

$$1 - \frac{1}{x} = \pm\sqrt{2}$$

$$1 \pm \sqrt{2} = \frac{1}{x}$$

$$x = \frac{1}{1 + \sqrt{2}}, \frac{1}{1 - \sqrt{2}}$$

Rationalise the denominators by multiplying above and below by the conjugate of the denominator.

$$\frac{1}{(1 + \sqrt{2})} \times \frac{(1 - \sqrt{2})}{(1 - \sqrt{2})} = \frac{1 - \sqrt{2}}{1 - 2} = \sqrt{2} - 1$$

$$\frac{1}{(1 - \sqrt{2})} \times \frac{(1 + \sqrt{2})}{(1 + \sqrt{2})} = \frac{1 + \sqrt{2}}{1 - 2} = -\sqrt{2} - 1$$

Question 1 (b)

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

$$x = -2: (-2)^3 + 3(-2)^2 - 2 - 2 = 0$$

$\therefore (x + 2)$ is a factor

$$\therefore x^3 + 3x^2 + x - 2 = (x + 2)(x^2 + kx - 1)$$

$$= x^3 + (k + 2)x^2 + (2k - 1)x - 2 \quad [\text{Line up the coefficients.}]$$

$$\therefore 3 = k + 2 \Rightarrow k = 1$$

$$\therefore x^3 + 3x^2 + x - 2 = (x + 2)(x^2 + x - 1) = 0$$

$$x^2 + x - 1 = 0 \quad [\text{Solve the quadratic equation.}]$$

$$x = \frac{-1 \pm \sqrt{1^2 - 4(1)(-1)}}{2(1)}$$

$$= \frac{-1 \pm \sqrt{1 + 4}}{2} = \frac{-1 \pm \sqrt{5}}{2}$$

$$\therefore x = -2, \frac{-1 \pm \sqrt{5}}{2}$$