

Answer all six questions from this section.

Question 1

(25 marks)

- (a) In the expansion of $(2x + 1)(x^2 + px + 4)$, where $p \in \mathbb{N}$, the coefficient of x is twice the coefficient of x^2 . Find the value of p .

$$2x^3 + 2px^2 + 8x + x^2 + px + 4$$

$$\text{coeff. of } x = 8 + p$$

$$\text{coeff. of } x^2 = 2p + 1$$

$$\therefore 8 + p = 2(2p + 1)$$

$$\therefore 8 + p = 4p + 2$$

$$6 = 3p$$

$$\boxed{2 = p}$$

- (b) Solve the equation $\frac{3}{2x+1} + \frac{2}{5} = \frac{2}{3x-1}$ where $x \neq -\frac{1}{2}, \frac{1}{3}$, and $x \in \mathbb{R}$.

$$\frac{3}{2x+1} (2x+1)(5)(3x-1) + \frac{2}{5} (2x+1)(5)(3x-1)$$

$$= \frac{2}{3x-1} (2x+1)(5)(3x-1)$$

$$\therefore 45x - 15 + 2(6x^2 + 3x - 2x - 1) = 20x + 10$$

$$\therefore 45x - 15 + 12x^2 + 2x - 2 = 20x + 10$$

$$\therefore 12x^2 + 27x - 27 = 0$$

$$\therefore 4x^2 + 9x - 9 = 0$$

$$(4x - 3)(x + 3) = 0$$

$$\boxed{x = \frac{3}{4}} \quad \vee \quad \boxed{x = -3}$$