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.

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

Q1	Model Solution – 25 Marks	Marking Notes
(a)	$(2x + 1)(x^2 + px + 4)$ $2x^3 + 2px^2 + 8x + x^2 + px + 4$ $8 + p = 2(2p + 1)$ $8 + p = 4p + 2$ $3p = 6$ $p = 2$ Or Coefficient of x is $8 + p$ Coefficient of x^2 is $2p + 1$ $8 + p = 2(2p + 1)$ $8 + p = 4p + 2$ $3p = 6$ $p = 2$	**Scale10D (0, 4, 5, 8, 10)** *Low Partial Credit:* - Any relevant multiplication *Mid Partial credit:* - Multiplication completed without error(**s**) - Multiplication completed with errors and correctly identifies (in terms of p) the coefficient of **either** x^2 or x - Correctly identifies the coefficient of **either** x or x^2 *High Partial credit:* - Multiplication completed with error(s) but finishes correctly without further errors - Relevant coefficients equated (equation in p) - Multiplication completed and coefficients of x^2 and x identified but solves incorrect equation in p

(b)

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

$$\text{CD: } 5(2x+1)(3x-1)$$

$$15(3x-1) + (4x+2)(3x-1)$$

$$= 10(2x+1)$$

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

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

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

$$x = -3 \text{ or } x = \frac{3}{4}$$

Or

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

$$\frac{15 + 2(2x+1)}{5(2x+1)} = \frac{2}{3x-1}$$

$$\frac{4x+17}{10x+5} = \frac{2}{3x-1}$$

$$(4x+17)(3x-1) = 2(10x+5)$$

$$12x^2 + 47x - 17 = 20x + 10$$

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

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

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

$$x = -3 \text{ or } x = \frac{3}{4}$$

Scale 15D (0, 4, 7, 11,15)

Low Partial Credit:
- CD or partial CD identified
- Cross multiply on LHS
- Multiplies one term correctly by one of the denominators
- $x = -3$ **or** $x = \frac{3}{4}$ substituted and justified as a solution

Mid Partial Credit:
- Equation without fractions

High Partial Credit:
- Relevant quadratic in the form: $ax^2 + bx + c = 0$

<u>*Note*</u>: No quadratic $\Rightarrow$ low partial credit at most, except in the case where the candidate has reached the mid partial stage