

QUESTION 7 (40 MARKS)**Question 7 (a) (i)**

$$a = 2n + 1, b = 2n^2 + 2n, c = 2n^2 + 2n + 1$$

$$n = 2:$$

$$a = 2(2) + 1 = 5$$

$$b = 2(2)^2 + 2(2) = 12$$

$$c = 2(2)^2 + 2(2) + 1 = 13$$

$$a^2 + b^2 = 5^2 + 12^2 = 25 + 144 = 169$$

$$c^2 = 13^2 = 169$$

$$\therefore a^2 + b^2 = c^2$$

Question 7 (a) (ii)

$$a = 2n + 1, b = 2n^2 + 2n, c = 2n^2 + 2n + 1$$

$$a^2 + b^2$$

$$= (2n + 1)^2 + (2n^2 + 2n)^2$$

$$= 4n^2 + 4n + 1 + 4n^4 + 8n^3 + 4n^2$$

$$= 4n^4 + 8n^3 + 8n^2 + 4n + 1$$

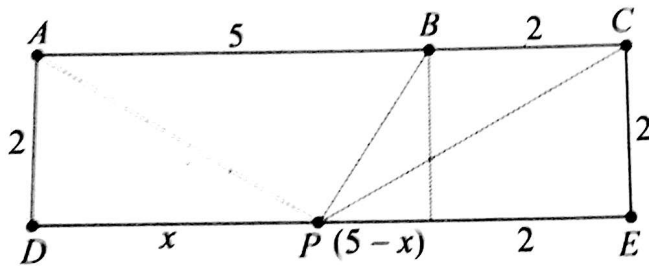
$$c^2 = (2n^2 + 2n + 1)^2$$

$$= (2n^2 + 2n + 1)(2n^2 + 2n + 1)$$

$$= 4n^4 + 4n^3 + 2n^2 + 4n^3 + 4n^2 + 2n + 2n^2 + 2n + 1$$

$$= 4n^4 + 8n^3 + 8n^2 + 4n + 1$$

$$\therefore a^2 + b^2 = c^2$$

Question 7 (b) (i)

$$|PA|^2 = x^2 + 2^2 = x^2 + 4$$

$$\begin{aligned} |PB|^2 &= (5-x)^2 + 2^2 \\ &= 25 - 10x + x^2 + 4 \\ &= x^2 - 10x + 29 \end{aligned}$$

$$\begin{aligned} |PC|^2 &= (7-x)^2 + 2^2 \\ &= 49 - 14x + x^2 + 4 \\ &= x^2 - 14x + 53 \end{aligned}$$

$$\begin{aligned} f(x) &= |PA|^2 + |PB|^2 + |PC|^2 \\ &= x^2 + 4 + x^2 - 10x + 29 + x^2 - 14x + 53 \\ &= 3x^2 - 24x + 86 \end{aligned}$$

Question 7 (b) (ii)

$$f(x) = 3x^2 - 24x + 86$$

$$f'(x) = 6x - 24 = 0$$

$$\therefore x = 4 = k$$

$$f(4) = 3(4)^2 - 24(4) + 86 = 38$$