

LC 2014: PAPER 1**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)

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

$$a^2 + b^2$$

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

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

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

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

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

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

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

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

MARKING SCHEME NOTES**Question 7 (a) (i) [Scale 10B (0, 5, 10)]**

- 5:**
- Correct substitution of chosen value
 - Not squaring values

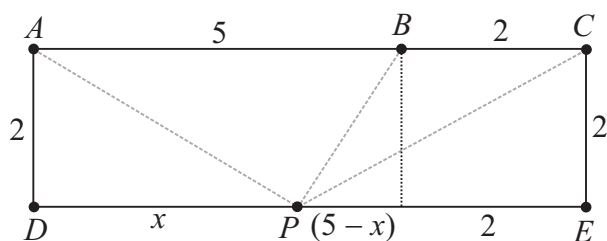
NOTE: Allow 10 marks for $n = 0$ and correct work in (a)(i)

Question 7 (a) (ii) [Scale 10D (0, 3, 7, 8, 10)]

- 3:**
- a^2 or b^2 or c^2 expressed in terms of n
- 7:**
- Any two terms
- 8:**
- Three terms fully squared
 - $(a^2 + b^2)$ fully worked out in terms of n

Notes for (a)(i) and (a)(ii):

- Mark particular case with scheme for (a)(i) wherever it occurs
- Mark general case with scheme for (a)(ii) wherever it occurs

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)

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

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

$$\therefore x = 4 = k$$

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

MARKING SCHEME NOTES
Question 7 (b) (i) [Scale 5D (0, 2, 3, 4, 5)]

- 2: • Expression for either $|PA|^2$ or $|PB|^2$ or $|PC|^2$ in terms of x
 • Any appropriate construction line, e.g. the line PM
- 3: • Correct expression of two sides in terms of x
- 4: • Correct expression of three sides in terms of x
 • Correct expression of function in x not simplified

Question 7 (b) (ii) [Scale 15C (0, 7, 10, 15)]

- 7: • Stating $f'(x) = 0$ with no work
 • Any correct differentiation

- 10: • Finding value of x

OR

- 7: • 3 as factor

- 10: • Finding value of x