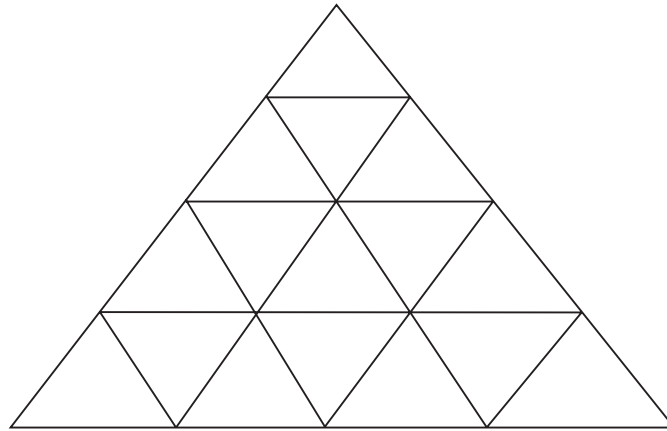


## LC 2013 (SET D): PAPER 1

**QUESTION 9 (50 MARKS)**

**Question 9 (a) (i)**



**Question 9 (a) (ii)**

Pattern	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
Number of small triangles	1	4	9	16
Number of matchsticks	3	9	18	30

**MARKING SCHEME NOTES**

**Question 9 (a) (i) [Scale 5B (0, 2, 5)]**

2: • Incomplete 4th line

**Question 9 (a) (ii) [Scale 5C (0, 2, 4, 5)]**

2: • One or two correct entries in empty boxes

4: • Three correct entries in empty boxes

**Question 9 (b)**

Number of triangles in the 1<sup>st</sup> pattern ( $n = 1$ ):  $T_1 = 1 = 1^2$

Number of triangles in the 2<sup>nd</sup> pattern ( $n = 2$ ):  $T_2 = 4 = 2^2$

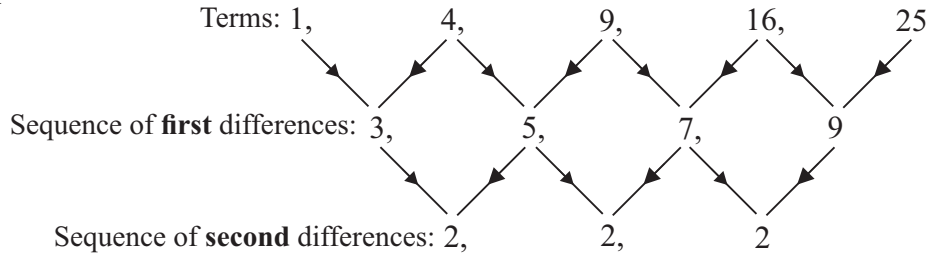
Number of triangles in the 3<sup>rd</sup> pattern ( $n = 3$ ):  $T_3 = 9 = 3^2$

Number of triangles in the 4<sup>th</sup> pattern ( $n = 4$ ):  $T_4 = 16 = 4^2$

⋮

Number of triangles in the  $n^{\text{th}}$  pattern ( $n = n$ ):  $T_n = n^2$

OR



A constant term of 2 in the sequence of second differences implies the number of triangles in each pattern forms a quadratic sequence.

**MARKING SCHEME NOTES**

**Question 9 (b) [Scale 10B (0, 5, 10)]**

5: •  $1^2, 2^2, 3^2$  etc – recognising the natural numbers squared

or

**Question 9 (b) [Scale 10B (0, 5, 10)]**

5: • Second differences calculated

**Question 9 (c)**

Number of matchsticks to turn 1<sup>st</sup> pattern into 2<sup>nd</sup> pattern ( $n = 2$ ):  $6 = 3(2)$

Number of matchsticks to turn 2<sup>nd</sup> pattern into 3<sup>rd</sup> pattern ( $n = 3$ ):  $9 = 3(3)$

Number of matchsticks to turn 3<sup>rd</sup> pattern into 4<sup>th</sup> pattern ( $n = 4$ ):  $12 = 3(4)$

⋮

Number of matchsticks to turn  $(n - 1)$ <sup>th</sup> pattern into  $n$ <sup>th</sup> pattern ( $n = n$ ):  $3n$

**MARKING SCHEME NOTES**

**Question 9 (c) [Scale 10B (0, 5, 10)]**

5: • Recognition of series 6, 9, 12,.... or similar

or

**Question 9 (c) [Scale 10B (0, 5, 10)]**

5: • Second differences calculated

**Question 9 (d)**

$$u_n = an^2 + bn$$

$$u_1 = a(1)^2 + b(1) = 3 \Rightarrow a + b = 3 \dots (1)$$

$$u_2 = a(2)^2 + b(2) = 9 \Rightarrow 4a + 2b = 9 \dots (2)$$

$$a + b = 3 \dots (1) (\times -2)$$

$$4a + 2b = 9 \dots (2)$$

$$-2a - 2b = -6$$

$$4a + 2b = 9$$

$$\hline 2a = 3 \Rightarrow a = \frac{3}{2}$$

$$a = \frac{3}{2} : a + b = 3 \Rightarrow b = 3 - \frac{3}{2} = \frac{3}{2}$$

$$\text{ANSWER: } a = \frac{3}{2}, b = \frac{3}{2}$$

**MARKING SCHEME NOTES****Question 9 (d) [Scale 10C (0, 3, 7, 10)]**

3: • One linear equation in  $a$  and  $b$ , e.g.  $u_1: a + b = 3$

7: • Two correct linear equations

or

**Question 9 (d) [Scale 10C (0, 3, 7, 10)]**

3: • Recognition of A.P.

7: •  $a = d = 3$  and some use of  $S_n$  formula

**Question 9 (e)**

$$u_n = an^2 + bn = 4134$$

$$\frac{3}{2}n^2 + \frac{3}{2}n = 4134$$

$$3n^2 + 3n - 8268 = 0$$

$$n^2 + n - 2756 = 0$$

$$(n - 52)(n + 53) = 0$$

$$\therefore n = 52$$

$$\text{Number of triangles} = n^2 = 52^2 = 2704$$

**MARKING SCHEME NOTES****Question 9 (e) [Scale 10C (0, 3, 7, 10)]**

3: • Expression of  $u_n$  in one variable only

• Quadratic equation

7: • Values of  $n$