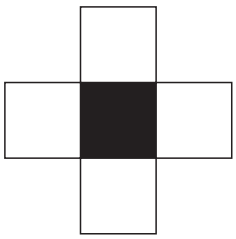
Sample Paper 5: Paper 1

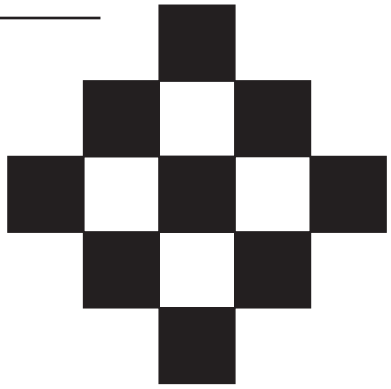
Question 7 (50 marks)

Question 7 (a)

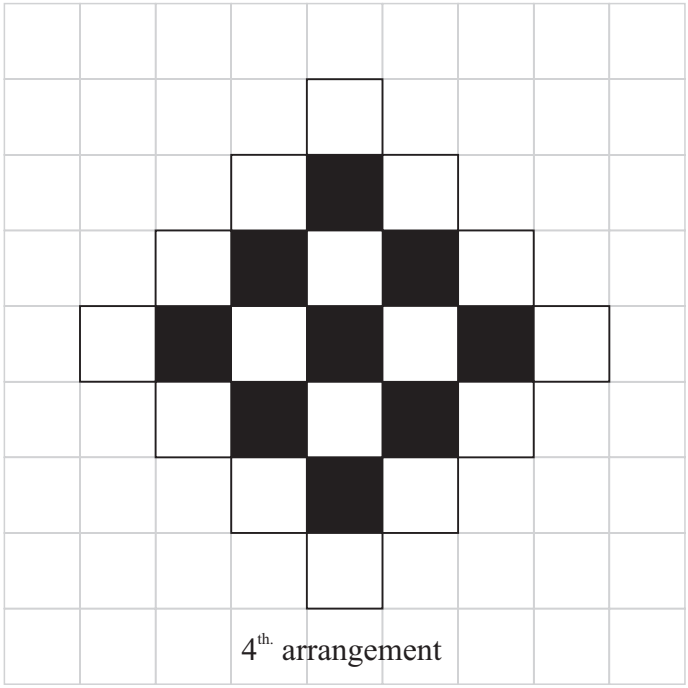
1st. arrangement



2nd. arrangement



3rd. arrangement



4th. arrangement

Question 7 (b)

	1st. arrangement	2nd. arrangement	3rd. arrangement	4th. arrangement
Row 1	1	1	1	1
Row 2		3	3	3
Row 3		1	5	5
Row 4			3	7
Row 5			1	5
Row 6				3
Row 7				1
Total	1	5	13	25

Question 7 (c) (i)

Fifth arrangement: 1 + 3 + 5 + 7 + 9 + 7 + 5 + 3 + 1 = 41

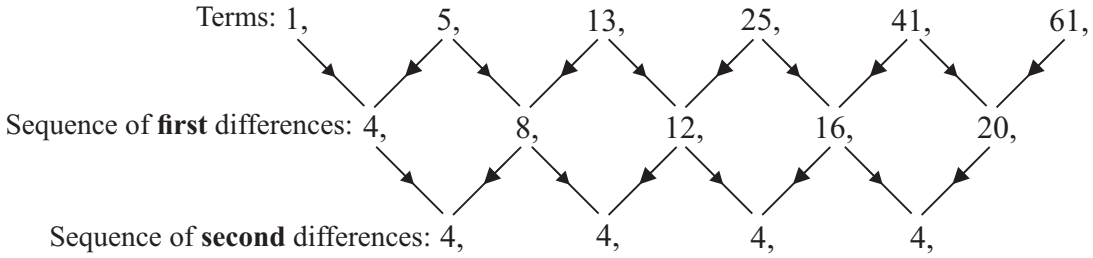
Sixth arrangement: 1 + 3 + 5 + 7 + 9 + 11 + 9 + 7 + 5 + 3 + 1 = 61

Question 7 (c) (ii)

Total number of tiles in each arrangement: 1, 5, 13, 25, 41, 61

Question 7 (c) (iii)

How do you show that the numbers: 1, 5, 13, 25, 41, 61,... forms a quadratic sequence? Subtract the terms to find the sum of first sequences: 4, 8, 12, 16, 20,... Now subtract these terms again to find the sequence of second differences. This sequence 4, 4, 4,..., where all the terms have the same value, shows that the original sequence was quadratic.



Question 7 (d)

$T = 2n^2 + an + b$

$1^{st.}$ arrangement $(n = 1) : T = 1$

$\therefore 1 = 2(1)^2 + a(1) + b$

$1 = 2 + a + b$

$a + b = -1$.....**(1)**

$T = 2n^2 + an + b$

$2^{nd.}$ arrangement $(n = 2) : T = 5$

$\therefore 5 = 2(2)^2 + a(2) + b$

$5 = 8 + 2a + b$

$2a + b = -3$.....**(2)**

Solve equations (**1**) and (**2**) simultaneously to find a and b.

$a + b = -1$.....**(1)**

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

$$\begin{array}{r} a + b = -1 \\ -2a - b = 3 \\ \hline -a \quad\quad = 2 \end{array} \Rightarrow a = -2$$

Substitute into equation (**1**): $-2 + b = -1 \Rightarrow b = 1$

Answer: $a = -2$, $b = 1$

Question 7 (e)

$T = 2n^2 - 2n + 1$

$10^{th.}$ arrangement $(n = 10) : T = ?$

$T = 2(10)^2 - 2(10) + 1$

$= 2(100) - 20 + 1$

$= 200 - 20 + 1$

$= 181$

Question 7 (f)

$T = 2n^2 - 2n + 1$

$T = 265,\ n = ?$

$265 = 2n^2 - 2n + 1$

$0 = 2n^2 - 2n - 264$

$0 = n^2 - n - 132$

$0 = (n - 12)(n + 11)$

$\therefore n = 12$