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MATHEMATICS -CORE

TOPIC- Patterns & Sequences

11-J-13

1 Here are the first four terms of a sequence.

4 11 18 25

Write down an expression for the nth term.

Answer ..... [2]

02

12-N-15

−1, 3, 7, 11, ...

Write down the nth term for this sequence.

Answer ..... [2]

13-N-15

03 These are the first four terms in a sequence.

21 17 13 9

(a) Write down the next number in this sequence.

Answer(a) ..... [1]

(b) Write down the rule for continuing the sequence.

Answer(b) ..... [1]

04 (a) Write down the next two terms in the following sequence. 12-J-15

73, 66, 59, 52, ..., ...

[2]

(b) Write down an expression for the nth term of the sequence in **part (a)**.

Answer(b) ..... [2]

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05 (a) Write down the next term in each of these sequences. 11-N-15

(i) 5 9 13 17 . . .

Answer(a)(i) ..... [1]

(ii) 3 6 12 24 . . .

Answer(a)(ii) ..... [1]

(b) Here are the first four terms in a different sequence.

2 7 12 17

Find an expression for the nth term of this sequence.

Answer(b) ..... [2]

06 Find the nth term of each sequence.

11-N-16

(a) 7, 13, 19, 25, 31, ...

..... [2]

(b) 9, 16, 25, 36, 49, ...

..... [2]

07 (a) 2, 3, 6, 11, 18, ... 11-J-15

(i) Write down the next two terms in this sequence.

Answer(a)(i) ....., ... [2]

(ii) Describe, in words, the rule for continuing this sequence.

Answer(a)(ii) ..... [1]

(b) The nth term of a different sequence is $4n - 3$.

Work out the first three terms in this sequence.

Answer(b) ....., ..., ... [1]

For Examiner's Use

0 8 **(a)** Write down the next term and the rule for finding the next term for the following sequences.

(i) 3, 9, 27, 81, ...

Answer(a)(i) Next term ..... rule ..... [2]

(ii) 2, 3, 6, 11, 18, ...

Answer(a)(ii) Next term ..... rule ..... [2]

(iii) 4, 2, 1, $\frac{1}{2}$, ...

Answer(a)(iii) Next term ..... rule ..... [2]

(iv) 5, –10, 20, –40, ...

Answer(a)(iv) Next term ..... rule ..... [2]

(b) **(i)** Write down the next two terms of this sequence.

5, 13, 21, 29, ..., ... [2]

(ii) Write down the *n*th term of this sequence.

Answer(b)(ii) ..... [2]

(iii) Find the 100th term.

Answer(b)(iii) ..... [1]

9 **(a)** Here are the first four terms of a sequence.

5 8 11 14

(i) Write down the next term in this sequence.

Answer(a)(i) ..... [1]

(ii) Write down the rule for finding the next term of this sequence.

Answer(a)(ii) ..... [1]

(iii) Find an expression for the nth term of this sequence.

Answer(a)(iii) ..... [2]

(iv) Explain why the number 300 is not in this sequence.

Answer(a)(iv) ..... [1]

(b) Here are the first four terms of another sequence.

4 7 11 16

(i) Write down the next two terms in this sequence.

Answer(b)(i) ..... , ... [2]

(ii) Write down the rule for continuing this sequence.

Answer(b)(ii) ..... [1]

10 For each of these sequences, write down the next term and the rule for continuing the sequence.

(i) 8, 11, 14, 17, ...

Next term is .....

The rule is ..... [2]

(ii) 25, 17, 9, 1, ...

Next term is .....

The rule is ..... [2]

(iii) 2, 4, 7, 11, ...

Next term is .....

The rule is ..... [2]

(iv) 1, 8, 27, 64, ...

Next term is .....

The rule is ..... [2]

11 **(a)** Write down the next two terms in each of these sequences.

J-32-17

(i) 8, 14, 20, 26, ...

..... , ... [2]

(ii) 12, 10, 7, 3, ...

..... , ... [2]

(b) Find the nth term of this sequence.

14, 25, 36, 47, ...

..... [2]

(c) Work out the second term of the sequence whose nth term is $5(3-2n)$.

..... [1]

(d) 1, 4, 9, 16, ...

The nth term of this sequence is n^2.

Use this information to write down the nth term of each of these sequences.

(i) 2, 5, 10, 17, ...

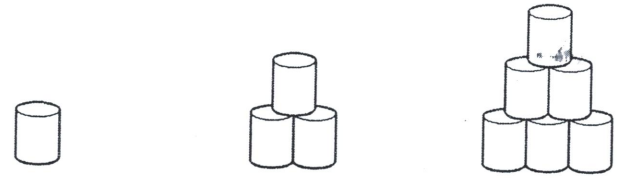
..... [1]

(ii) 3, 12, 27, 48, ...

..... [1]

12-J-13

For Examiner's Use



1 row 2 rows 3 rows

Complete the table for 4 rows and 5 rows.

Number of rows	1	2	3	4	5
Number of cans	1	3	6		

[2]

1

(a) A solid has 6 faces, 8 vertices and 12 edges.
All the edges have the same length.

Write down the mathematical name of this solid.

..... [1]

(b) Here is a sequence of diagrams made from identical square tiles.

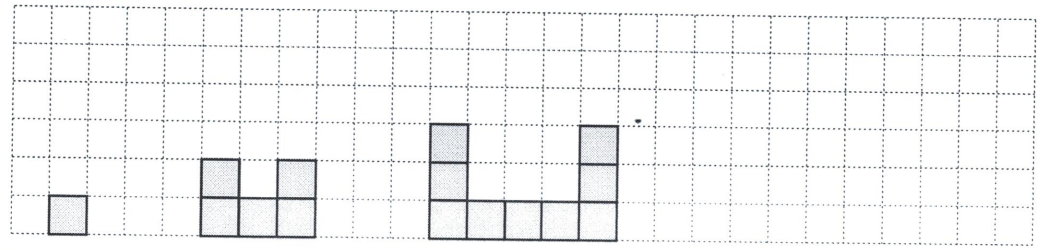


Diagram 1 Diagram 2 Diagram 3 Diagram 4

(i) On the grid, draw Diagram 4. [1]

(ii) Complete the table.

Diagram	1	2	3	4	5
Number of tiles	1	5	9		

[2]

(iii) Find an expression, in terms of n, for the number of tiles in Diagram n.

..... [2]

(iv) Find the number of tiles in Diagram 19.

..... [1]

(v) A box contains 98 of these tiles.

(a) Diagram x is made from as many tiles as possible from this box.

Find the value of x.

$x =$ ..... [2]

(b) When Diagram x is made, how many tiles are left in the box?

..... [1]

14 The first three diagrams in a sequence are shown below.

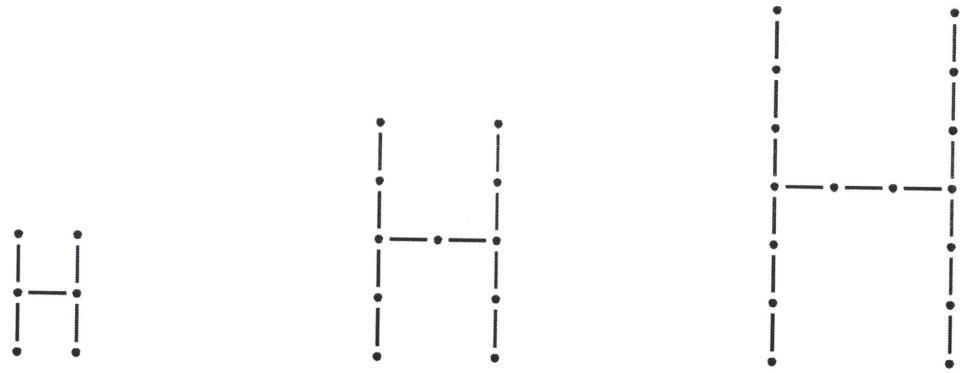


Diagram 1 Diagram 2 Diagram 3

(a) Complete the table for the number of lines and the number of dots in Diagram 3 and Diagram 4.

Diagram	1	2	3	4
Lines	5	10		
Dots	6	11		

[2]

(b) For Diagram n, write down an expression, in terms of n, for the number of

(i) lines,

Answer(b)(i) ..... [1]

(ii) dots.

Answer(b)(ii) ..... [1]

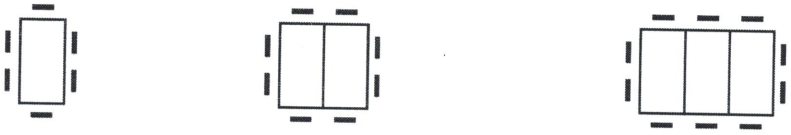
(c) Work out the number of lines and the number of dots in Diagram 20.

Answer(c) Number of lines = ...

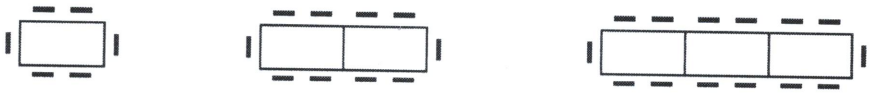
Number of dots = ... [2]

15 Tables and chairs can be arranged in two different patterns.

Pattern *A*



Pattern *B*



1 table 2 tables 3 tables

(a) Complete the following table.

Number of tables	1	2	3	4		8
Number of chairs in Pattern A	6	8				
Number of chairs in Pattern B	6	10				

[5]

(b) How many chairs are needed with n tables

(i) in Pattern *A*,

Answer(b)(i) ..... [2]

(ii) in Pattern *B*?

Answer(b)(ii) ..... [2]

(c) Sofia needs to arrange tables to seat 66 people.

Which pattern uses the least number of tables and by how many?

Answer(c) Pattern ..... by ..... tables [3]

16 **(a)** Here are three different sequences.
Write the missing terms in the spaces provided.

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(i) 2, 8, 14, 20, ... [1]

(ii) 1, 4, 9, ..., 25 [1]

(iii) ....., 12, 7, 2, ... [2]

(b) Here is the rule for finding the next term in another sequence.

Double the previous term and subtract 1.

The first two terms in this sequence are 3 and 5.

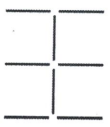
(i) Work out the **next two** terms in the sequence.

Answer(b)(i) ....., ... [2]

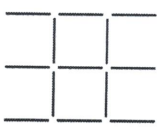
(ii) Complete the following statement.

All the terms in this sequence are ..... numbers. [1]

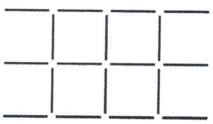
(c) Here is the start of a sequence of stick patterns.



Pattern 1
8 sticks



Pattern 2
13 sticks



Pattern 3
18 sticks

(i) Find the number of sticks in Pattern 4.

Answer(c)(i) ..... [1]

(ii) Write down an expression for the number of sticks in Pattern n.

Answer(c)(ii) ..... [2]

(iii) One pattern in the sequence has 98 sticks.

Which pattern number is this?

Answer(c)(iii) ..... [2]

17 Here are the first four diagrams in a sequence.

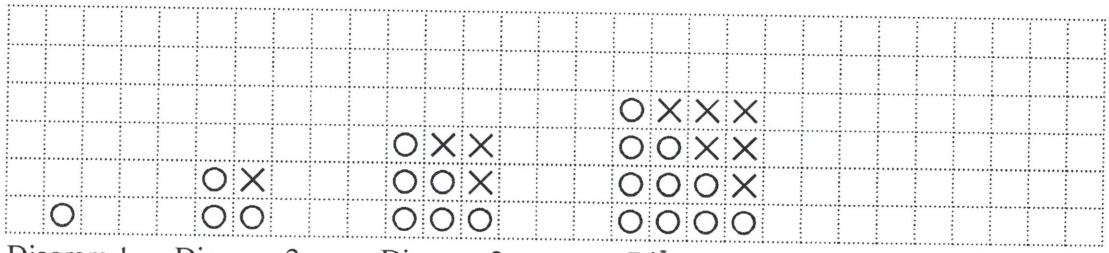


Diagram 1 Diagram 2 Diagram 3 Diagram 4 Diagram 5

(a) On the grid, draw Diagram 5. [1]

(b) Complete the table below for Diagram 4 and Diagram 5.

Diagram number	Number of Os	Number of Xs	Total number of Os and Xs
1	1	0	1
2	3	1	4
3	6	3	9
4			
5			

[2]

(c) Find an expression, in terms of n, for the total number of Os and Xs in Diagram n.

Answer(c)..... [1]

(d) Find the total number of Os and Xs in Diagram 23.

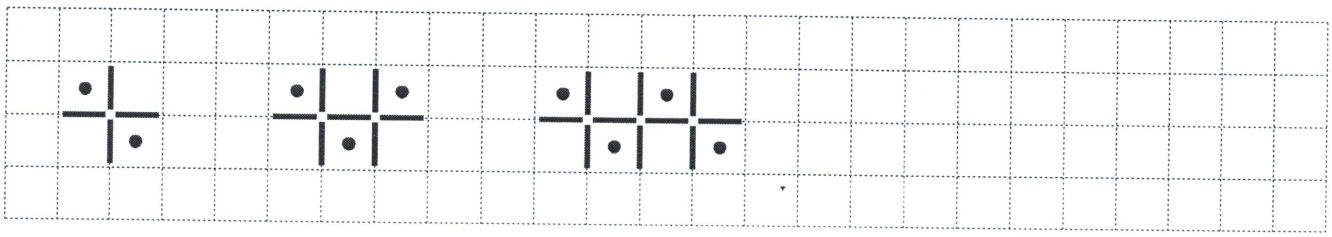
Answer(d)..... [1]

(e) Describe in words the rule for continuing the sequence for the number of Os.

1, 3, 6, ...

Answer(e)..... [1]

18 A sequence of patterns is made from lines and dots.
The first three patterns in the sequence are shown.



Pattern 1 Pattern 2 Pattern 3 Pattern 4

(a) Draw Pattern 4 on the grid. [1]

(b) Complete the table.

Pattern	1	2	3	4		10
Number of dots	2	3				
Number of lines	4	7				

[4]

(c) Find an expression, in terms of n, for

(i) the number of dots in Pattern n,

..... [1]

(ii) the number of lines in Pattern n.

..... [2]

(d) One of these patterns has 76 lines.

Work out how many **dots** are in this pattern.

..... [2]

19

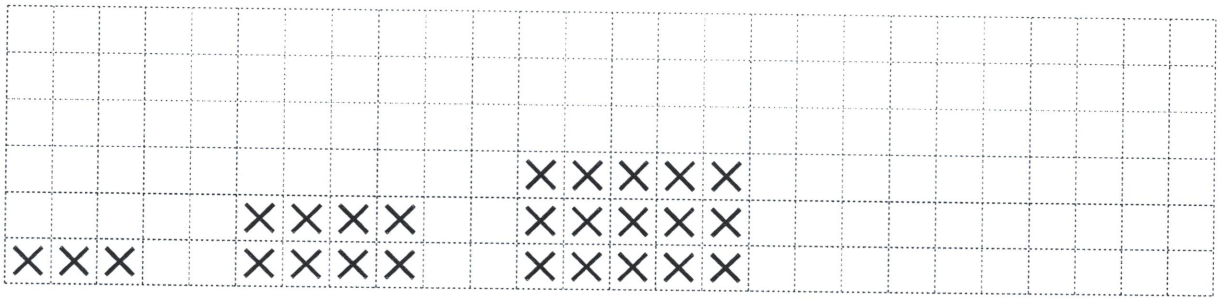


Diagram 1 Diagram 2 Diagram 3 Diagram 4

The number of crosses in each Diagram forms a sequence.

(a) On the grid draw Diagram 4. [1]

(b) Write down the number of crosses needed to draw Diagram 5.

Answer(b) ..... [1]

(c) Diagram 1 has 1 row of 3 crosses.
Diagram 2 has 2 rows of 4 crosses.

(i) Complete this statement for Diagram *n*.

Diagram *n* has *n* rows of ..... crosses. [1]

(ii) Write down, in terms of *n*, how many crosses are needed to draw Diagram *n*.

Answer(c)(ii) ..... [1]

(iii) Find the number of crosses needed to draw Diagram 20.

Answer(c)(iii) ..... [1]

20

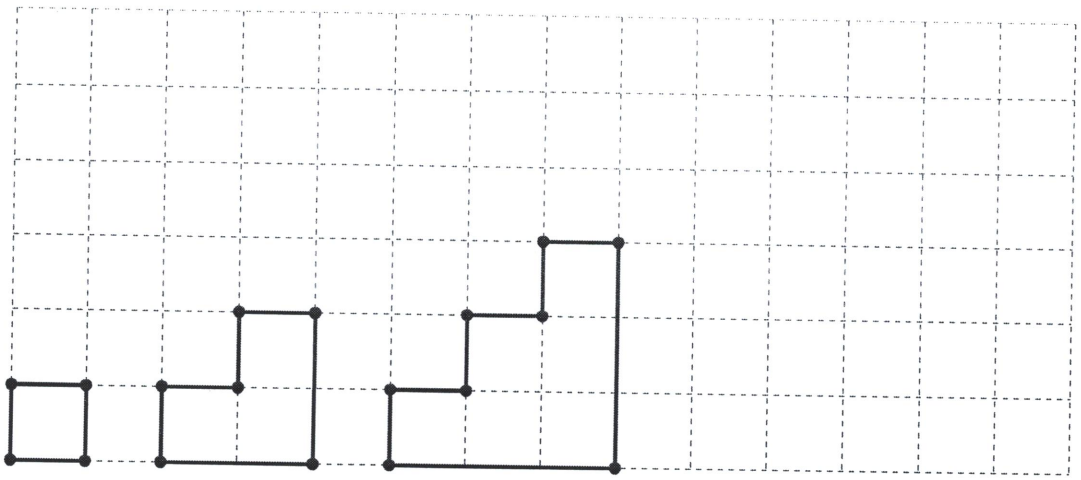


Diagram 1 Diagram 2 Diagram 3 Diagram 4

For Examiner's Use

(a) The pattern of diagrams above forms a sequence.

(i) On the grid, draw Diagram 4. [1]

(ii) Complete the table.

Diagram	1	2	3	4	5
Number of dots	4	6			

[2]

(b) Find the number of dots in Diagram n.

Answer(b) ..... [2]

(c) Find the number of dots in Diagram 48.

Answer(c) ..... [1]

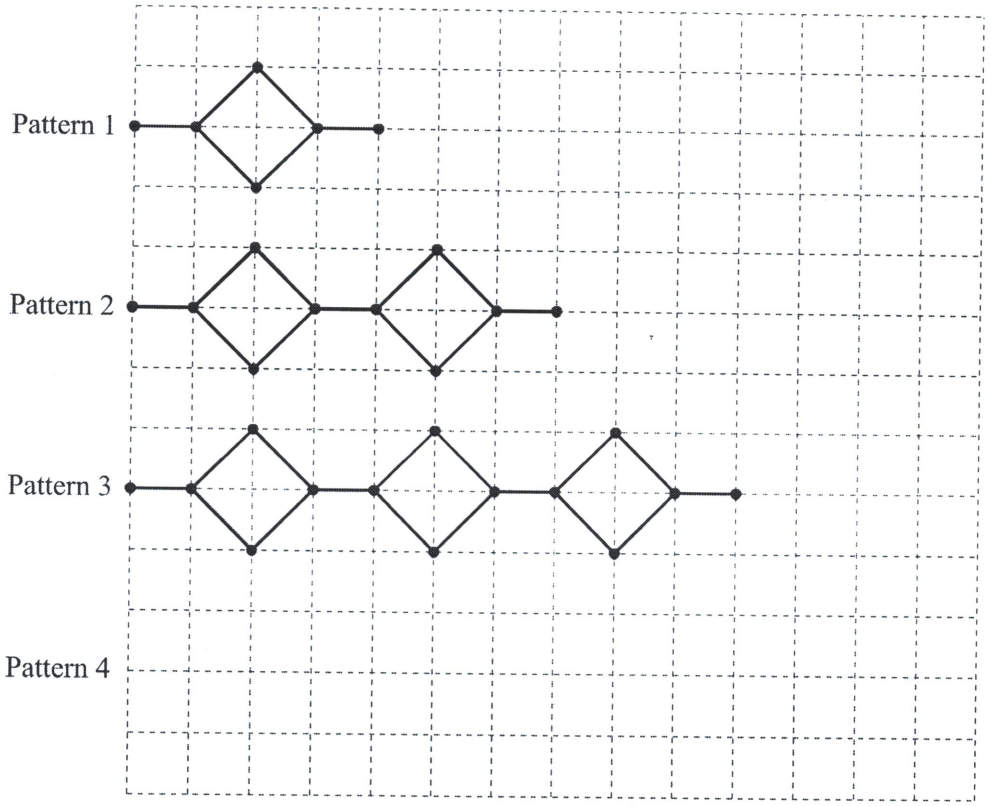
(d) There are 3 one centimetre squares in Diagram 2.

Find the number of one centimetre squares in Diagram 5.

Answer(d) ..... [2]

21 The Patterns shown below form a sequence.

Pattern 1 has 6 dots and 6 lines.
Pattern 2 has 10 dots and 11 lines.



For Examiner's Use

(a) On the grid, draw Pattern 4. [1]

(b) **(i)** Find the number of dots in Pattern 5.

Answer(b)(i) ..... [1]

(ii) Explain how you worked out your answer in **part (b)(i)**.

Answer(b)(ii) ..... [1]

(c) Write down an expression, in terms of n, for the number of dots in Pattern n.

Answer(c) ..... [2]

(d) The number of dots in Pattern n is 62.

Find n.

Answer(d) n = ... [2]

22

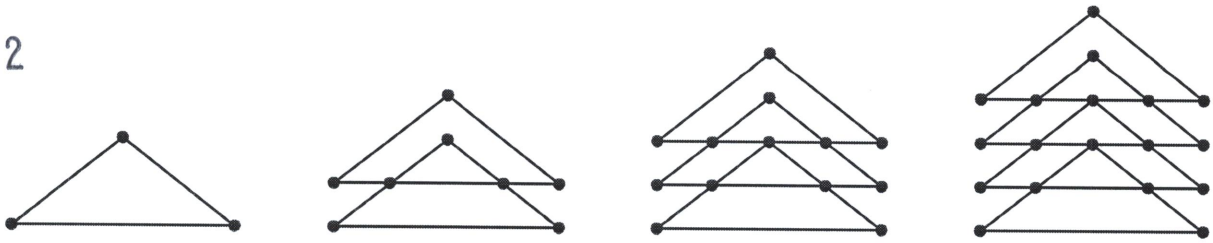


Diagram 1 Diagram 2 Diagram 3 Diagram 4

Diagrams 1 to 4 show a sequence of shapes made up of lines and dots at the intersections of lines.

(a) (i) Complete the table showing the number of dots in each diagram.

Diagram	1	2	3	4	5	6
Dots	3	8	13			

[3]

(ii) Write down the rule for continuing the sequence of dots.

Answer(a)(ii) ..... [1]

(iii) Write down an expression, in terms of n, for the number of dots in Diagram n.

Answer(a)(iii) ..... [2]

(iv) Find the number of dots in Diagram 15.

Answer(a)(iv) ..... [1]

(b) The dots are joined by sloping lines and horizontal lines.

(i) Diagram 1 has 2 sloping lines and Diagram 2 has 6 sloping lines.

Find the number of sloping lines in Diagrams 3 and 4.

Answer(b)(i) Diagram 3 .....

Diagram 4 ..... [2]

(ii) Write down an expression, in terms of n, for the number of sloping lines in Diagram n.

Answer(b)(ii) ..... [2]

23 Here is a sequence of diagrams made using identical rectangles.
A dot is shown at the junction of three lines.
A cross is shown at the junction of two lines.

J-31-17

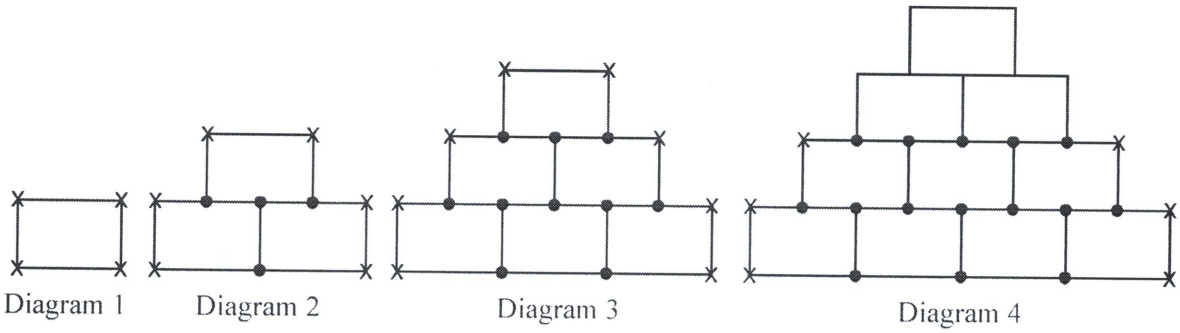


Diagram 1 Diagram 2 Diagram 3 Diagram 4

(a) Write down the order of rotational symmetry of Diagram 1.

..... [1]

(b) Complete Diagram 4 using dots and crosses. [1]

(c) Complete the table for Diagram 4 and Diagram 5.

Diagram	1	2	3	4	5
Number of dots	0	4	10		
Number of crosses	4	6	8		

[3]

(d) **(i)** Describe, in words, the rule for continuing the sequence for the number of dots.

..... [1]

(ii) The expression for the number of dots in Diagram n is n^2+n-2.

Find the number of dots in Diagram 12.

..... [2]

(e) **(i)** Write down an expression for the number of crosses in Diagram n.

..... [2]

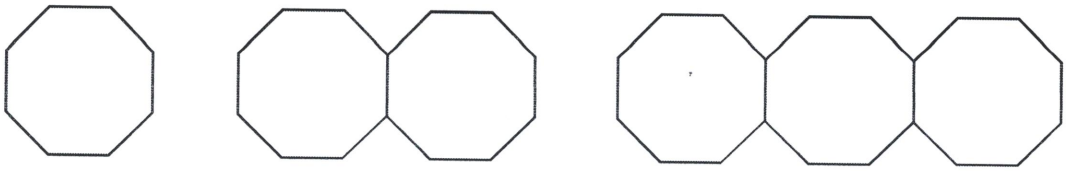
(ii) Diagram n has 100 crosses.

Find the value of n.

$n =$ ..... [2]

24 Here is a sequence of patterns made using identical polygons.

For Examiner's Use



Pattern 1 Pattern 2 Pattern 3

(a) Write down the mathematical name of the polygon in Pattern 1.

Answer(a) ..... [1]

(b) Complete the table for the number of vertices (corners) and the number of lines in Pattern 3, Pattern 4 and Pattern 7.

Pattern	1	2	3	4		7
Number of vertices	8	14				
Number of lines	8	15				

[5]

(c) **(i)** Find an expression for the number of **vertices** in Pattern n.

Answer(c)(i) ..... [2]

(ii) Work out the number of vertices in Pattern 23.

Answer(c)(ii) ..... [1]

(d) Find an expression for the number of **lines** in Pattern n.

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Answer(d) ..... [2]

(e) Work out an expression, in its simplest form, for

(number of lines in Pattern n) − (number of vertices in Pattern n).

Answer(e) ..... [2]

Question 9 is printed on the next page.

25 **(a)** Write down the mathematical name of a polygon with 8 sides.

Answer(a) ..... [1]

(b) Calculate the interior angle of a regular 8-sided polygon.

Answer(b) ..... [3]

(c)

Diagram 1

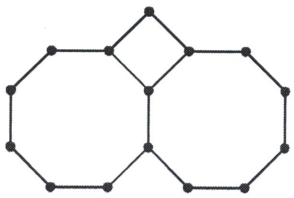

Diagram 2

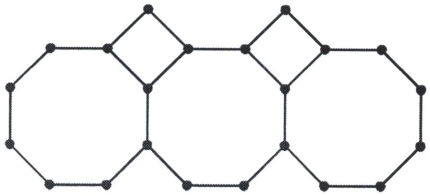

Diagram 3

The pattern of diagrams above forms a sequence.

(i) Complete the table.

Diagram	1	2	3	4	5
Number of dots	8	15			

[2]

(ii) Find an expression, in terms of n, for the number of dots in Diagram n.

Answer(c)(ii) ..... [2]

(iii) Find the number of dots in Diagram 10.

Answer(c)(iii) ..... [1]

(iv) Find the value of n for a diagram with 92 dots.

Answer(c)(iv) ..... [2]