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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/52**

Paper 5 Investigation (Core) **February/March 2022**

1 hour 10 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a graphic display calculator where appropriate.
- You may use tracing paper.
- You must show all necessary working clearly, including sketches, to gain full marks for correct methods.
- In this paper you will be awarded marks for providing full reasons, examples and steps in your working to communicate your mathematics clearly and precisely.

INFORMATION

- The total mark for this paper is 36.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Any blank pages are indicated.

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Answer **all** the questions.

INVESTIGATION **DOT PATTERNS**

This investigation looks at patterns in sequences of dots, and of dots and crosses.

1 This is a sequence of dot patterns.

Pattern 1 Pattern 2 Pattern 3

(a) Draw Pattern 4.

[1]

(b) Complete the table.

Pattern number, n	1	2	3	4	5	6
Number of dots	2	3	4			

[1]

(c) How many dots are in Pattern 9?

..... [1]

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

..... [1]

(e) Find the number of the pattern that has 26 dots.

..... [2]

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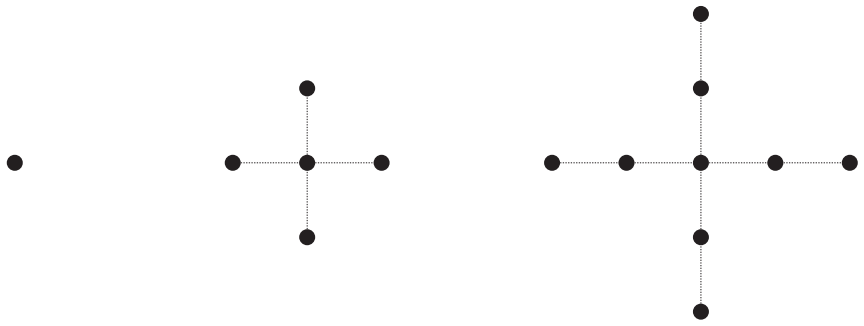
2 This is another sequence of dot patterns.

Pattern 1 Pattern 2 Pattern 3



(a) Complete the table.
You may use the grid below to help you.

Pattern number, n	1	2	3	4	5	6
Number of dots						21

[3]

(b) Find an expression, in terms of n, for the number of dots in Pattern n.

..... [2]

(c) Work out the number of dots in Pattern 40.

..... [2]

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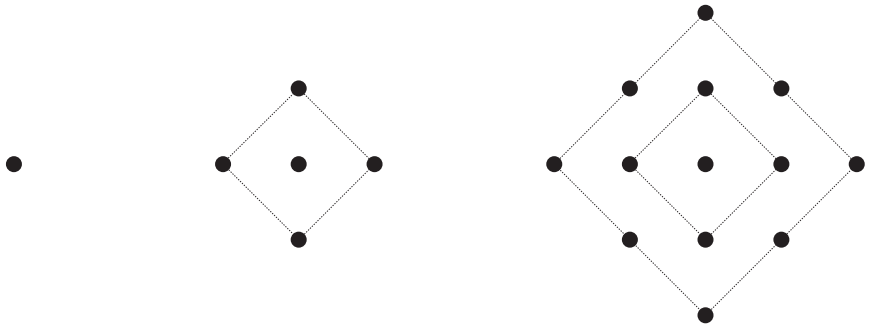
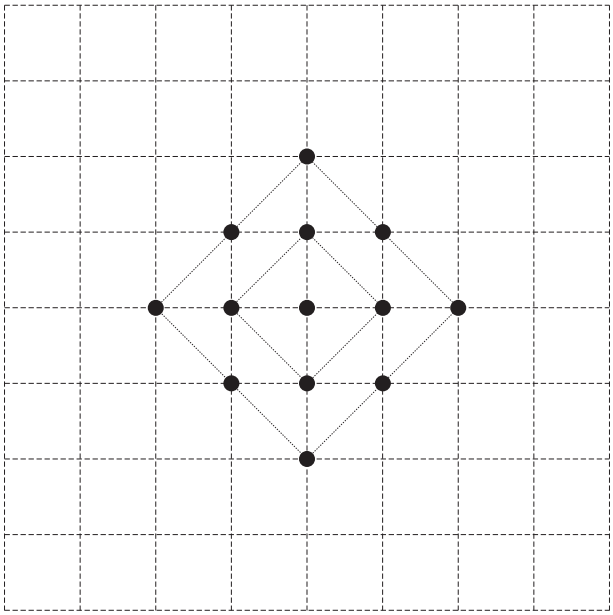
3 **(a)** Oliver draws this sequence of patterns called *centred squares*.

Pattern 1 Pattern 2 Pattern 3



(i) Pattern 3 is drawn on the grid.

Complete the diagram to show Pattern 4.



[1]

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(ii) Complete the table.

Pattern number, n	1	2	3	4	5
Number of dots	1	5	13		

[2]

(iii) Work out the number of dots in Pattern 6.

..... [2]

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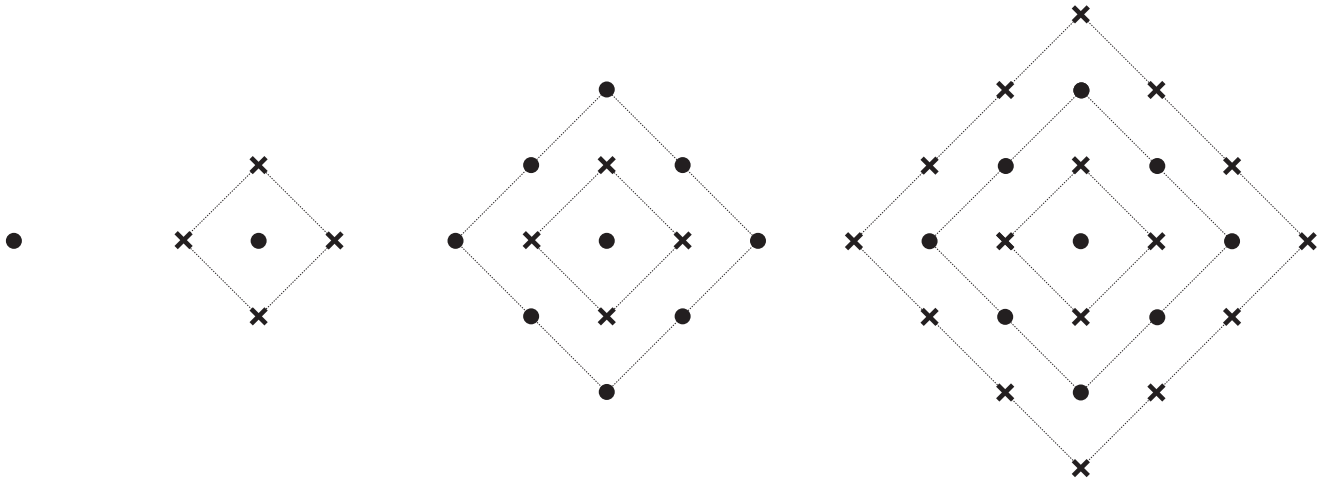
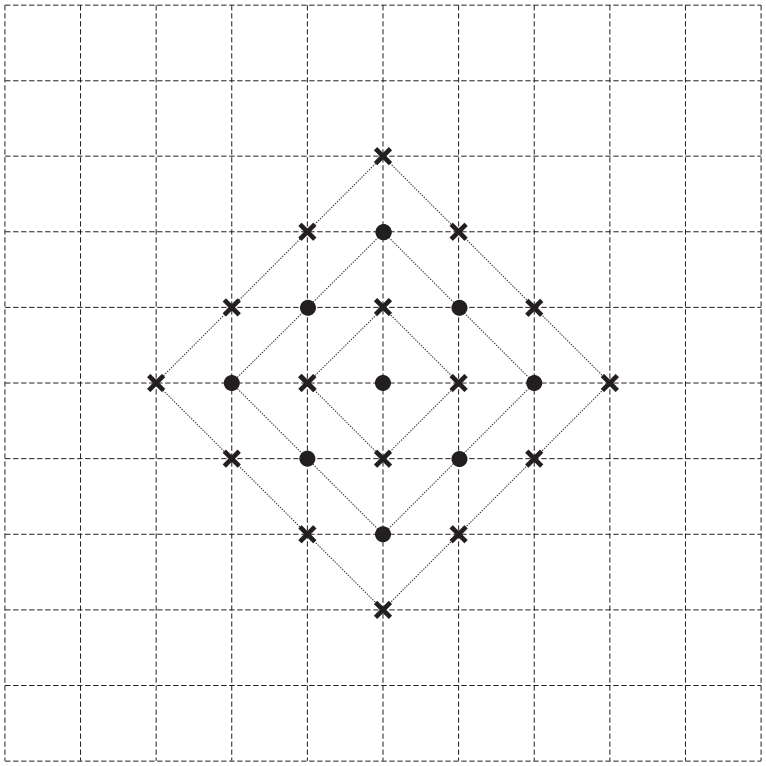
(b) Oliver draws the patterns of centred squares using dots and crosses.

Pattern 1 Pattern 2 Pattern 3 Pattern 4



(i) Pattern 4 is drawn on the grid.

Complete the diagram to show Pattern 5.



[1]

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(ii) Complete the table.

Pattern number, n	Number of dots	Number of crosses	Total number of dots and crosses
1	1	0	1
2	1	4	5
3	9	4	13
4		16	
5			
6			

[3]

(iii) Complete the table.

Pattern number, n	Number of dots	Number of crosses	Total number of dots and crosses
1	$1 = 1^2$	$0 = 0^2$	$1^2 + 0^2 = 1$
2	$1 = 1^2$	$4 = 2^2$	$2^2 + 1^2 = 5$
3	$9 = 3^2$	$4 = 2^2$	$3^2 + 2^2 = 13$
4		$16 =$	
5			
6			

[2]

(iv) Complete the formula for the total number of dots and crosses, T, in Pattern n.

$T =$ ..... [2]

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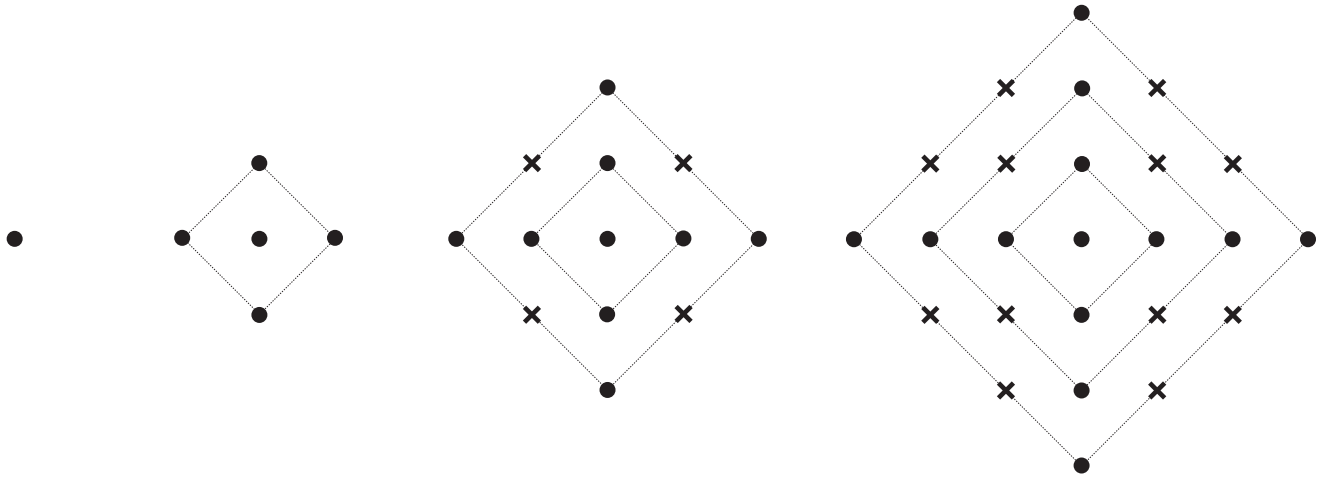
4 Sophia draws the patterns of centred squares using dots and crosses in a different way.

Pattern 1 Pattern 2 Pattern 3 Pattern 4



(a) Complete the table.

Pattern number, n	Number of dots	Number of crosses	Total number of dots and crosses
1	1	0	1
2	5	0	5
3	9	4	13
4	13		25
5			

[2]

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(b) Complete the table.

Pattern number, n	Number of dots	Number of crosses	Total number of dots and crosses
1	1	$0 = 4 \times 0$	$1 + 4 \times 0 = 1$
2	5	$0 = 4 \times 0$	$5 + 4 \times 0 = 5$
3	9	$4 = 4 \times 1$	$9 + 4 \times 1 = 13$
4	13	$12 = 4 \times (1 + 2)$	$13 + 4 \times (1 + 2) = 25$
5		$= 4 \times (1 + 2 +$ $)$	$+$ $=$
6			

[3]

(c) **(i)** In Sophia's patterns, Pattern k has 112 **crosses**.

Find the value of k.

$k =$ ..... [3]

(ii) Work out the total number of dots and crosses in Pattern k.

..... [2]

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