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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/51**

Paper 5 Investigation (Core) **October/November 2025**

1 hour 15 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 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages.

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INVESTIGATION SQUARE RINGS

In this investigation, you will work with the numbers along the inside edges of two squares drawn on a number grid of width 10.

The diagram shows a 10 by 10 grid with the numbers 1 to 100.
On the grid, a 4 by 4 square surrounds a 2 by 2 square.
The shaded area forms a 4 by 4 *square ring*.
A square ring is always one square thick.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

The *ring value* is worked out in this way.

step 1 Add the numbers along the inside edges of the large square to get L.
step 2 Add the numbers along the inside edges of the small square to get S.
step 3 Calculate $L - S$. This is the ring value.

Example
step 1 $L = 3 + 4 + 5 + 6 + 16 + 26 + 36 + 35 + 34 + 33 + 23 + 13$
step 2 $S = 14 + 15 + 25 + 24$
step 3 Ring value $= L - S$

1 4 by 4 square rings

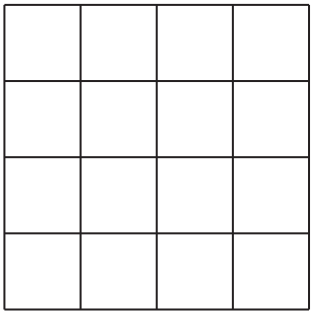
The example shows square ring 3.
This is because 3 is the top left number in the ring.

(a) Work out the ring value for the square ring in the example.

..... [2]

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(b) Work out the ring value for square ring 1, which has 1 in the top left corner.
You may use this grid to help you.



..... [3]

(c) Complete this table using **part (a)**, **part (b)** and any patterns you notice.

	Square ring (n)	L	S	Ring value $L-S$
part (b)	1			
	2	222	74	148
part (a)	3			
	4	246		164
	5		86	

[3]

(d) An expression for the ring value is $gn+132$.

Find the value of g and write down the expression.

..... [2]

(e) Mina draws a 4 by 4 square ring on the 10 by 10 grid.
Mina's square ring has the largest possible ring value.

Find the ring value.

..... [3]

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2 6 by 6 square rings

The grid continues downwards beyond the number 100.
A 6 by 6 square surrounds a 4 by 4 square.
The square ring has width 6.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90

(a) Complete the working to find the ring value for square ring 1.

$L = 1 + 2 + 3 + 4 + 5 + 6 + 16 + 26 + 36 + 46 + 56 + 55 + 54 + 53 + 52 + 51 + 41 + 31 + 21 + 11$

$= 570$

$S = 12 + 13 + 14 + 15 + 25 + 35 + 45 + 44 + 43 + 42 + 32 + 22$

= .....

Ring value = ...

[2]

(b) Complete the table.

Square ring (n)	L	S	Ring value $L - S$
1	570		
2	590		236
3	610	366	
4	630		
5	650		260

[3]

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(c) Find an expression, in terms of n, for the ring value.

..... [3]

(d) Explain why moving the square ring one square to the right increases the values in column L by 20.

.....

..... [1]

(e) Find the ring value for square ring 45.

..... [2]

(f) A square ring has a ring value of 1028.

Find the number in the bottom right square of this square ring.

..... [4]

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3 *w* by *w* square rings

The width of a square ring is w.
For the square ring in **Question 1**, $w = 4$.
For the square ring in **Question 2**, $w = 6$.

For a w by w square ring, an expression for the ring value is $8n + kw - k$.
For an 8 by 8 square ring, an expression for the ring value is $8n + 308$.

Find the value of k.
Write down an expression, in terms of n and w, for the ring value of a w by w square ring.

$k =$ .....

expression for the ring value .....

[3]

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4 **(a)** Square ring 71 has a ring value of 832.

Find the width of this square ring.

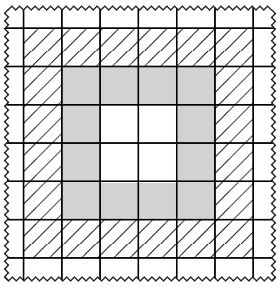
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Question 4(b) is printed on the next page.

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(b) In the diagram, a 6 by 6 square ring surrounds a 4 by 4 square ring.



The 4 by 4 square ring has a ring value of 1300.

Find the difference between the ring values for these two square rings.

..... [5]

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