Cambridge Assessment
International Education

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CANDIDATE NAME

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/53**

Paper 5 Investigation (Core) **May/June 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.
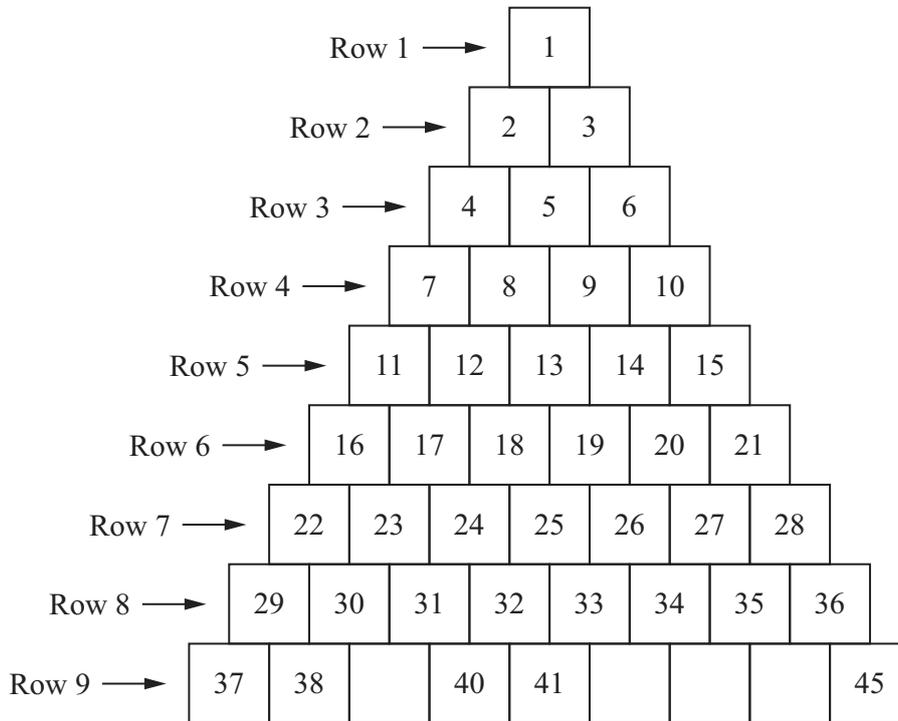
INFORMATION
- The total mark for this paper is 40.
- The number of marks for each question or part question is shown in brackets [ ].

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

[Turn over

INVESTIGATION   NUMBER PYRAMIDS

In this investigation you will look at the numbers in a pyramid of numbers.
The numbers are placed in order in rows.
Each row has one more number than the row above.

Row									
Row 1 →	1								
Row 2 →	2	3							
Row 3 →	4	5	6						
Row 4 →	7	8	9	10					
Row 5 →	11	12	13	14	15				
Row 6 →	16	17	18	19	20	21			
Row 7 →	22	23	24	25	26	27	28		
Row 8 →	29	30	31	32	33	34	35	36	
Row 9 →	37	38		40	41				45

1 **(a)** Complete row 9 in the pyramid.

[1]

(b) In row 4 the 2nd number is 8.   We write $N(4, 2) = 8$.

In row 4 the 3rd number is 9.   We write $N(4, 3) = 9$.

In row 4 the last number is 10.   We write $N(4, 4) = 10$.

(i) Complete the statement.

In row 3 the 1st number is 4.   We write $N(\text{..............} , \text{...............}) = 4$.   [1]

(ii) Complete the statements.

$N(6, 3) = \text{...............}$

$N(5, \text{...............}) = 12$

$N(\text{...............}, 4) = 25$

[2]

(c) Complete the statement.

In row 8 the last number is written $N(\text{..............} , \text{...............})$.   [1]

2 The numbers at the end of the rows make this sequence.

$$1, \quad 3, \quad 6, \quad 10, \quad 15, \quad ...$$

(a) Complete the statement.

This is the sequence of .... numbers. [1]

(b) (i) Complete the table.
Use the pyramid of numbers and patterns to help you.

Row number	Calculation					Last number in the row
1	1	×	2	=	2	1
2	2	×	3	=		3
3	3	×		=		6
4		×		=		
5		×		=		
6	6	×	7	=	42	21
⋮						
10		×		=		

[3]

(ii) Show that the last number in row 50 is 1275.

[2]

(iii) Find an expression for the last number in row R.

.... [1]

3 To find a number in the pyramid add its position in the row to the last number in the row above.
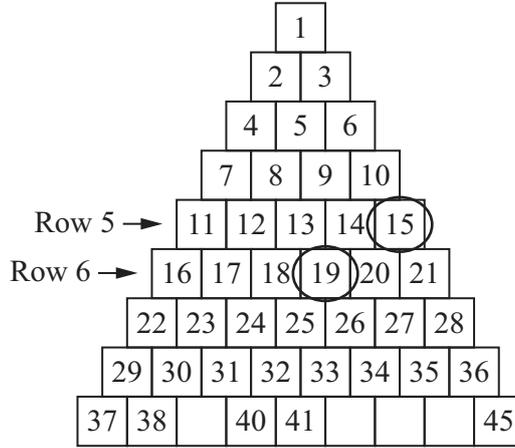
<u>Example</u>
N(6, 4) is in row 6.
The last number in row 5 is 15.
N(6, 4) is in position 4.
So N(6, 4) = 15 + 4 = 19.

(a) Complete the statements.

(i) N(7, 4) = ... + 4 = 25 [1]

(ii) N(............... , ...) = 45 + ... = 50 [1]

(b) This is a formula to find any number in row *R*.

$$N(R, k) = \frac{R(R-1)}{2} + k$$

k is the position of the number in row *R*.

(i) Show that the formula is correct for N(6, 4).

[1]

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    (ii) Find the 10th number in row 55.

.... [2]

(c) **(i)** Calculate N(26, 26).

.... [2]

    (ii) $N(R, k) = 362$

        Find the value of R and the value of k.

$R = $ ....

$k = $ ....
[3]

4 Numbers in the pyramid can be joined to make a diamond as shown.
All diamonds in this investigation are similar.
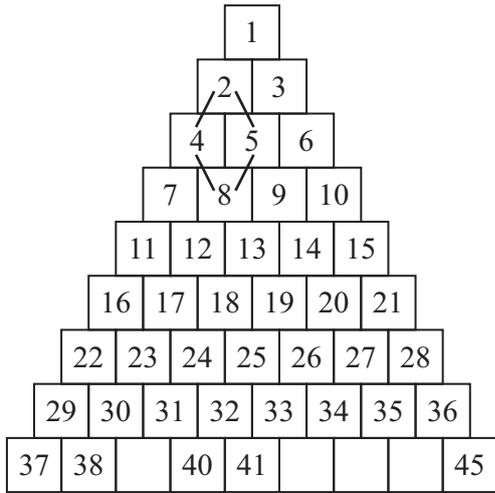
2, 4, 5 and 8 make a diamond.

The four numbers are always written in order from smallest to largest.

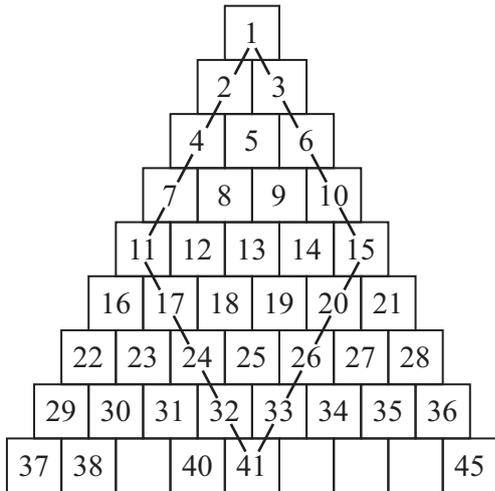This diamond has width 1 because $5 - 4 = 1$.

We write D(2, 4, 5, 8) has width 1.
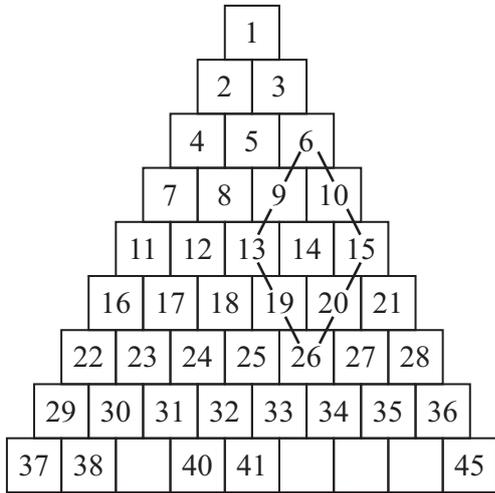
6, 13, 15 and 26 make a diamond.

This diamond has width 2 because $15 - 13 = 2$.
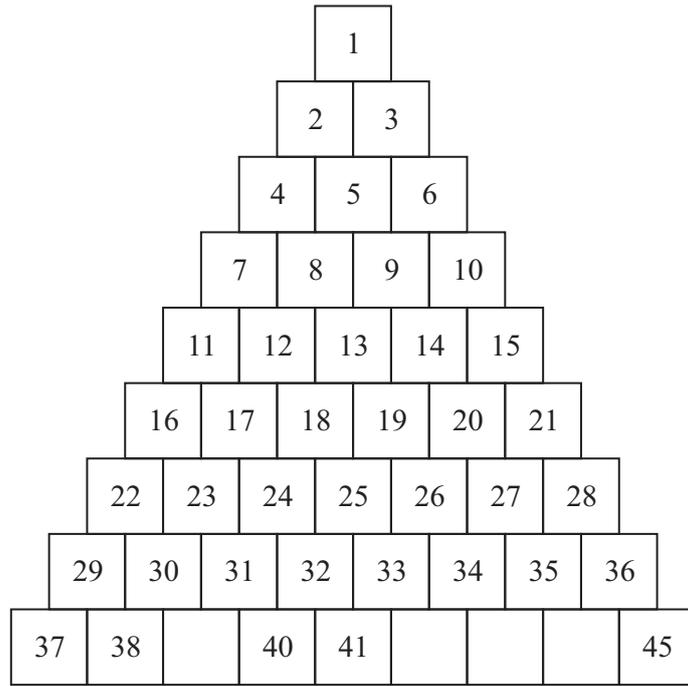
We write D(6, 13, 15, 26) has width 2.

1, 11, 15 and 41 make a diamond.

D(1, 11, 15, 41) has width 4 because $15 - 11 = 4$.

(a)

				1				
			2	3				
		4	5	6				
	7	8	9	10				
11	12	13	14	15				

(i) Complete the statements.

D(5 , 8 , ... , 13) has width ....

D(............... , 18 , 20 , ...) has width ....

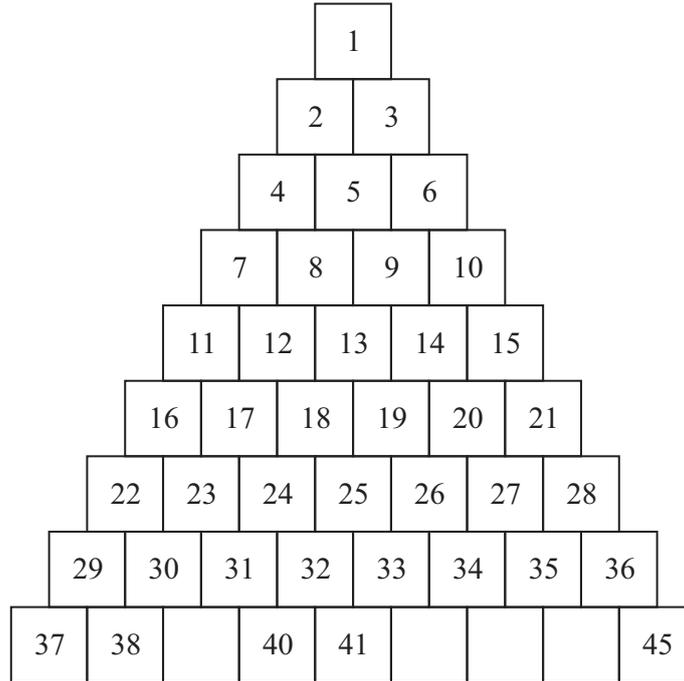D(2 , ... , ... , ...) has width 4.

[6]

(ii) Violetta draws diamond D(a, b, c, 33).
Her diamond has the largest possible width.

Find the width and the values of a, b and c.

				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		40	41				45

width = ...

a = ...

b = ...

c = ...
[3]

(iii) For D(a, b, c, d) write an expression for the width, w, in terms of b and c.

.... [1]

(b) (i) Complete the table.

D(a, b, c, d)	$(a+d)-(b+c)$					Width w
D(5, 8, 9, 13)	(5 + 13)	–	(8 + 9)	=	1	1
D(4, 11, 13, 24)	(4 + 24)	–	(11 + 13)	=	4	2
D(6, 18, 21, 42)	(6 + 42)	–	(18 + 21)	=	9	3
D(3, 17, 21, 51)	(3 + 51)	–	(17 + 21)	=	16	4

[3]

(ii) Complete this statement using an expression in terms of w.

$$(a+d)-(b+c) = \text{...} \quad [1]$$

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(c) D(a, b, 147, 182) has $w = 2$.

Find the value of a and the value of b.

$a =$ ....

$b =$ ....

[4]

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