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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 [].

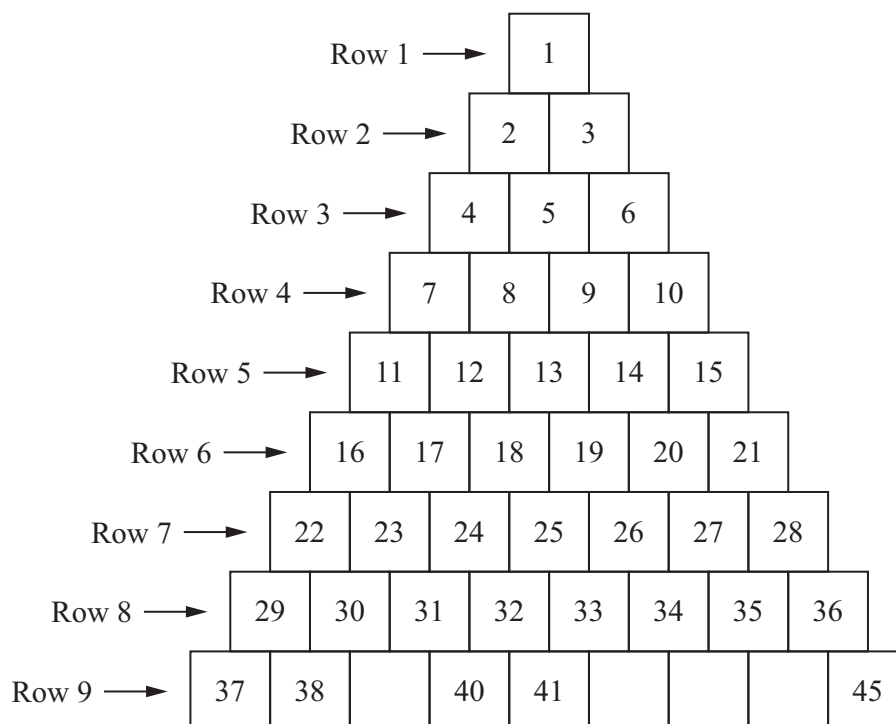
This document has **12** pages. Any blank pages are indicated.



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.



- 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 $N(\dots\dots\dots, \dots\dots\dots) = 4$.

[1]

- (ii) Complete the statements.

$N(6, 3) = \dots\dots\dots$

$N(5, \dots\dots\dots) = 12$

$N(\dots\dots\dots, 4) = 25$

[2]

- (c) Complete the statement.

In row 8 the last number is written $N(\dots\dots\dots, \dots\dots\dots)$.

[1]





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

1, 3, 6, 10, 15, ...

(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.

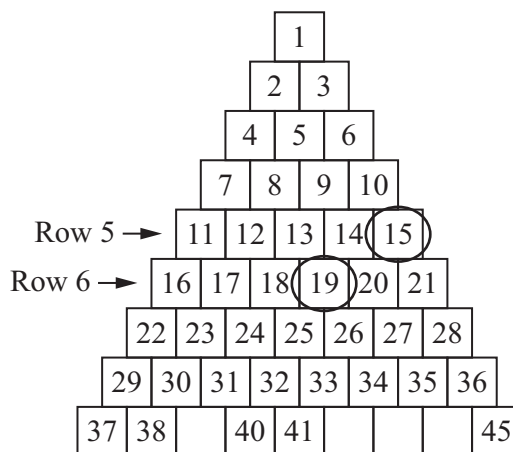
Example

$N(6, 4)$ 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) $N(7, 4) = \dots + 4 = 25$

[1]

(ii) $N(\dots, \dots) = 45 + \dots = 50$

[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]





(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 .

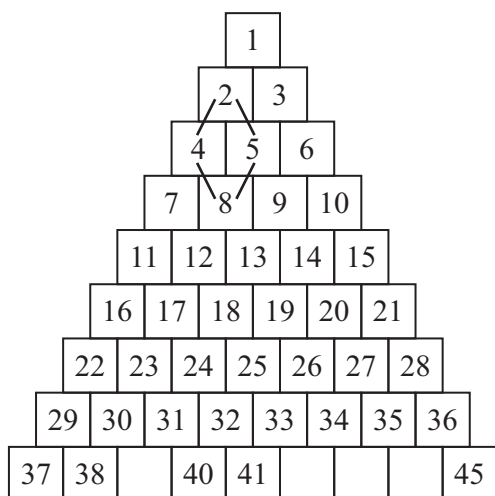
$R =$

$k =$

[3]



- 4 Numbers in the pyramid can be joined to make a diamond as shown.
All diamonds in this investigation are similar.

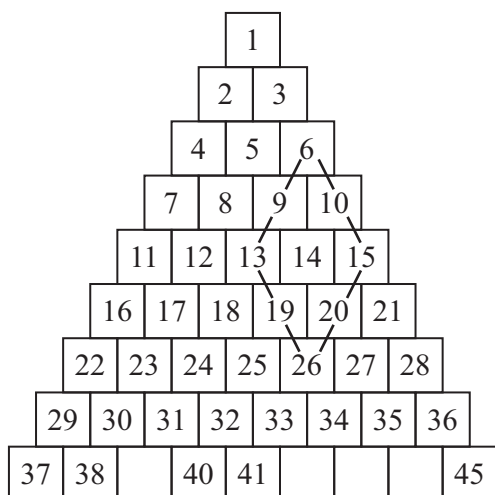


2, 4, 5 and 8 make a diamond.

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

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

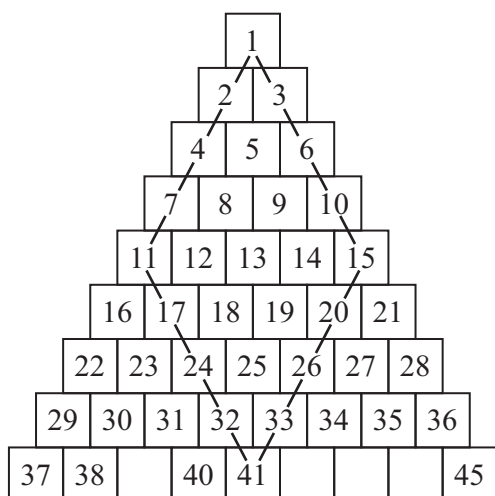
We write $D(2, 4, 5, 8)$ has width 1.



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.



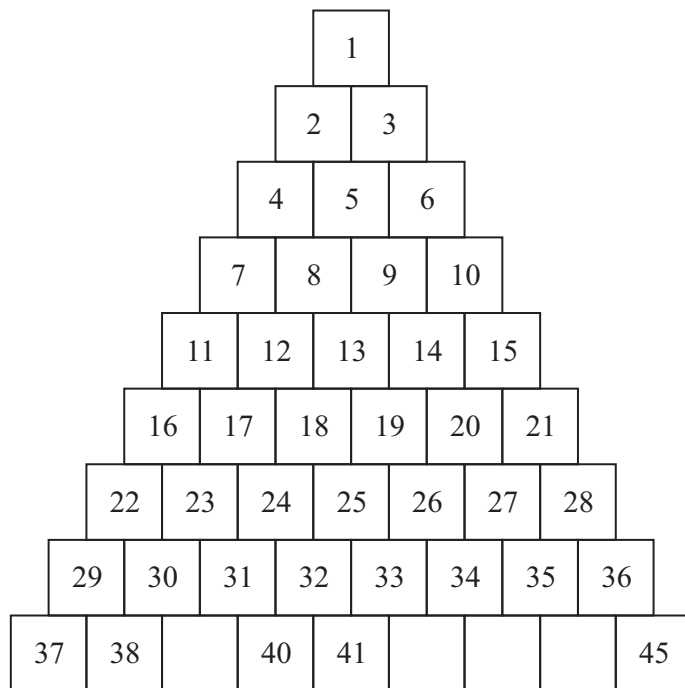
1, 11, 15 and 41 make a diamond.

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





(a)



(i) Complete the statements.

D(5 , 8 , , 13) has width

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

D(2 , , ,) has width 4.

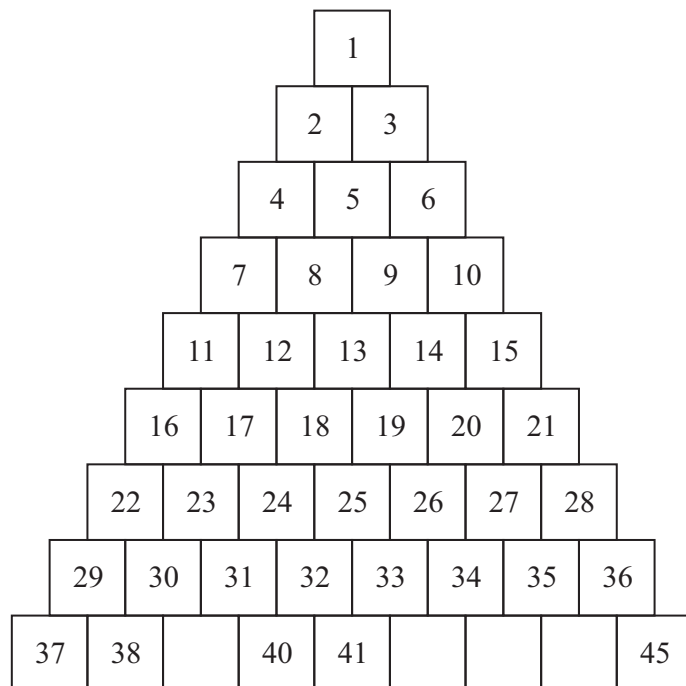
[6]





- (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 .



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
$D(6, 18, 21, 42)$	$(\quad) - (\quad) = 9$	3
$D(3, 17, 21, 51)$	$(\quad) - (\quad) =$	

[3]

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

$$(a + d) - (b + c) = \dots\dots\dots [1]$$





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

Find the value of a and the value of b .

$a = \dots\dots\dots$

$b = \dots\dots\dots$

[4]







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