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CAMBRIDGE INTERNATIONAL MATHEMATICS**0607/63**

Paper 6 Investigation and Modelling (Extended)

May/June 2025**1 hour 30 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 50.
- The number of marks for each question or part question is shown in brackets [].

This document has **12** pages.



Section A

INVESTIGATION

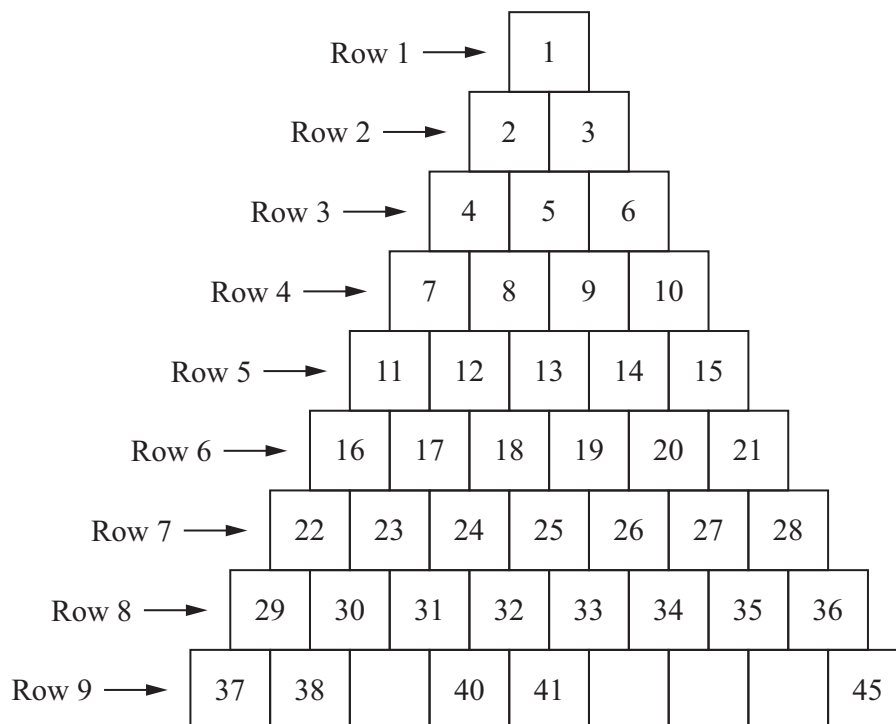
NUMBER DIAMONDS

You are advised to spend no more than 45 minutes on this section.

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 $N(4, 4) = 10$.

Complete these statements.

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

[1]

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

[1]





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

Row number (R)	Calculation	Last number in the row
1	1 $\times$ 2 =	1
2	2 $\times$ 3 =	3
3	3 $\times$ =	6
4	$\times$ =	
5	$\times$ =	
6	6 $\times$ 7 = 42	21

[2]

- (ii) Find an expression in terms of R , for the last number in row R .

..... [1]

- 2 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 statement.

$$N(\text{.....}, \text{.....}) = \text{.....} + \text{.....} = 50 \quad [1]$$

- (b) Use your expression from **Question 1(c)(ii)** to show that

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

[1]





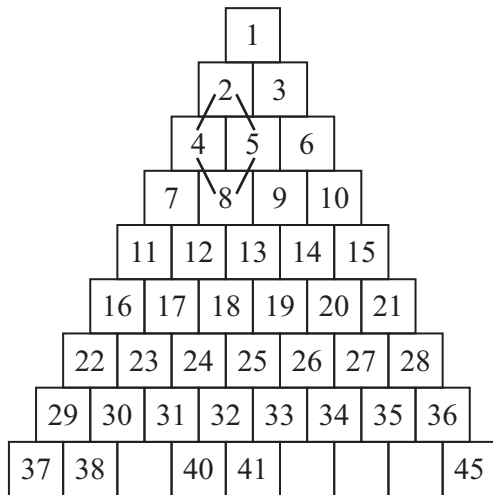
(c) $N(R, 11) = 362$

Find the value of R .

..... [4]



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

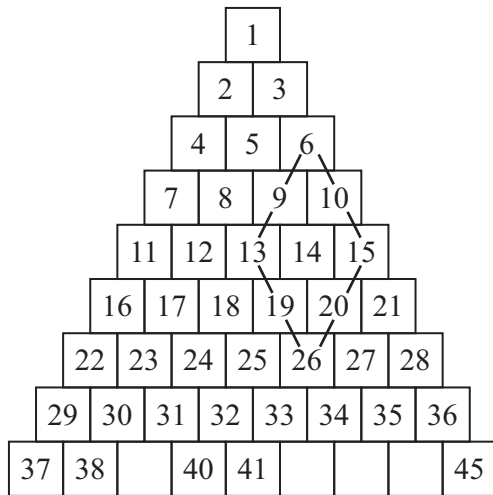


2, 4, 5 and 8 make a diamond.

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

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

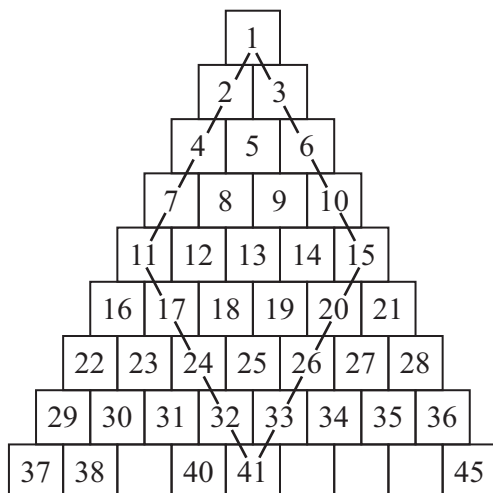
We write $D(2, 4, 5, 8)$ has width 1.



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.



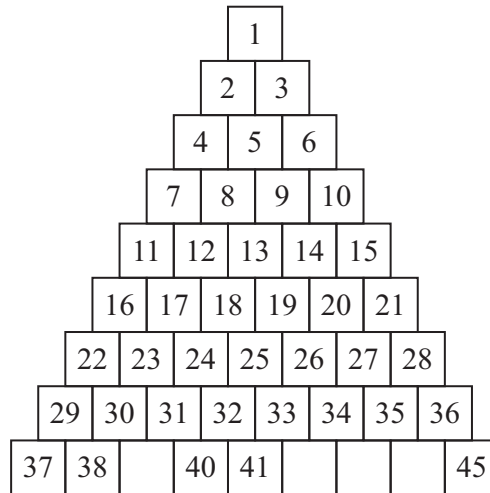
1, 11, 15 and 41 make a diamond.

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





(a)



Complete the statements.

$D(\dots\dots\dots, \dots\dots\dots, 18, 31)$ has width $\dots\dots\dots$

$D(\dots\dots\dots, \dots\dots\dots, 19, \dots\dots\dots)$ has width 3.

[3]

- (b) A diamond is $D(a, b, c, d)$.
 $a = N(p, p)$ and $b = N(p+1, p)$.

(i) Find c and d in terms of p .

$$c = N(\dots\dots\dots, \dots\dots\dots)$$

$$d = N(\dots\dots\dots, \dots\dots\dots)$$

[2]





(ii) Use the formula from **Question 2(b)** and your answers to **Question 3(b)(i)** to show that

$$b + c = p^2 + 3p + 1.$$

[3]

(iii) $b + c = 701$

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

$a =$

$b =$

$c =$

$d =$

[5]





Section B

MODELLING

FISH GROWTH

You are advised to spend no more than 45 minutes on this section.

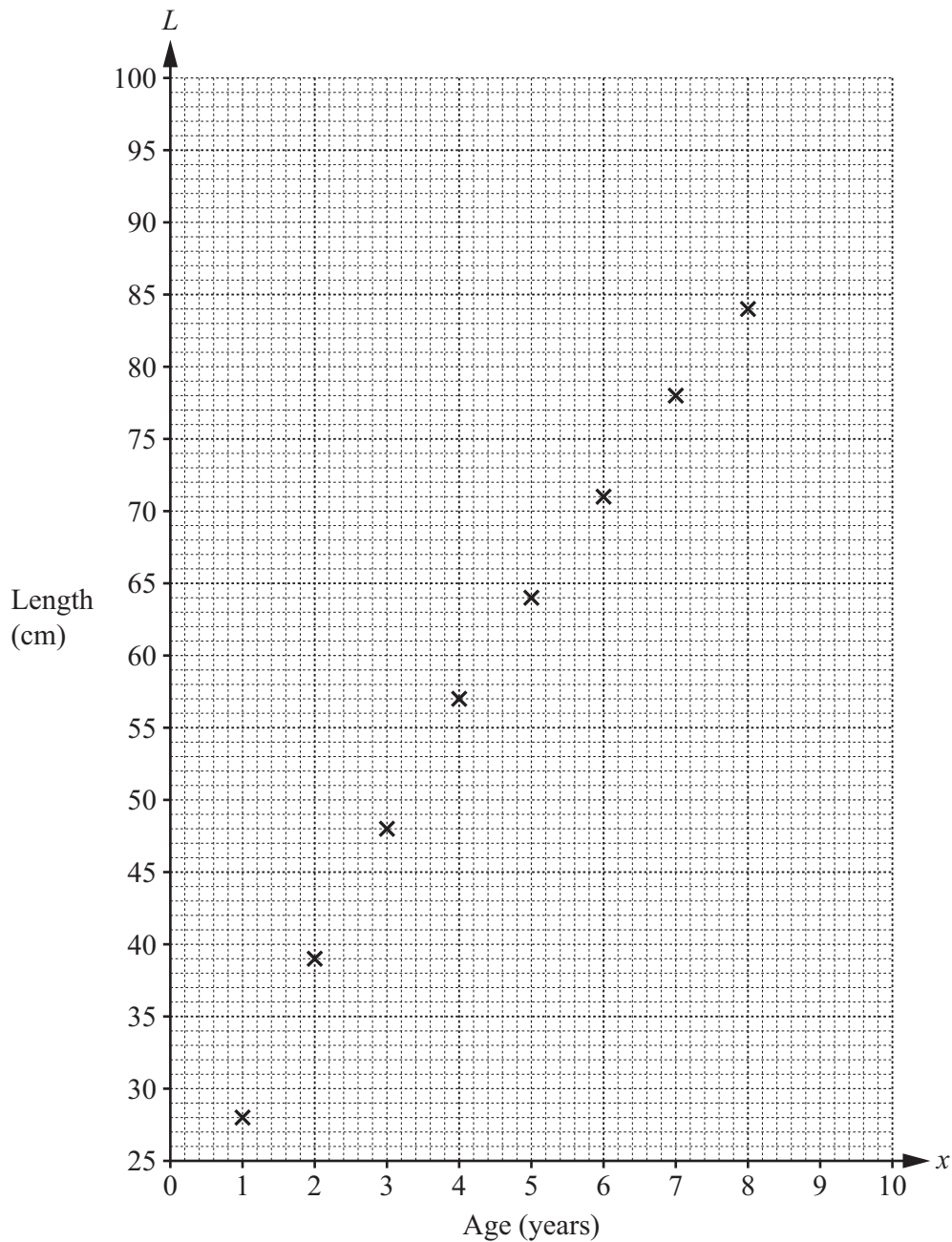
In this task you will be modelling the age and length of fish.

- 4 Matteo finds some data about the average length of kingfish at different ages. The table shows this.

Age (x years)	1	2	3	4	5	6	7	8	9	10
Length (L cm)	28	39	48	57	64	71	78	84	89	94

- (a) The first eight points are plotted on the grid.

Plot the last two points.





(b) Matteo decides to model the data using the regression line in the form $L = mx + c$.

(i) Find the equation of this model.

..... [2]

(ii) Explain what the value of the gradient m represents in this context.

..... [1]

(iii) Explain what the value of c represents in this context.

..... [1]

5 Irene finds this data about older kingfish.

Age (x years)	11	12	13	14	15	16	17	18	19	20
Length (L cm)	98	102	105	109	112	114	117	119	121	122

Is the model used in **Question 4(b)** valid for older kingfish?

Give a reason for your answer.

.....

..... [1]





6 Irene uses this model for the length of a kingfish.

$$L = ax^2 + bx + 2$$

(a) Use the lengths at age 10 years and at age 20 years to write two equations in terms of a and b .

.....

.....

[2]

(b) Solve your simultaneous equations from **part (a)** and write down Irene's model.

..... [3]

(c) Use Irene's model in **part (b)** to estimate the length of a kingfish at age 14.5 years.

..... [2]



- 7 Mayuko uses a different model for the length of a kingfish.

$$L = \frac{123}{1 + 3.2 \times 10^{-kx}} \text{ where } k \text{ is a positive constant}$$

- (a) Use this model to find the length of the kingfish when $x = 0$.

..... [2]

- (b) (i) Write down what happens to the value of 10^{-kx} as the age of the kingfish increases.

..... [1]

- (ii) Use **part (i)** to explain why the value of L gets closer to 123 as the age of the kingfish increases.

..... [1]

- (c) The length of a kingfish is 89 cm at age 9 years.

Find the value of k .

..... [3]

Question 8 is printed on the next page.





8



- (a) Sketch Irene's model from **Question 6(b)** for values of x between 0 and 30. [2]
- (b) Sketch Mayuko's model from **Question 7** for values of x between 0 and 30. [2]
- (c) Identify the better model giving a reason for your choice.

..... [1]

.....

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