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Cambridge Assessment International Education

# Cambridge IGCSE™

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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.


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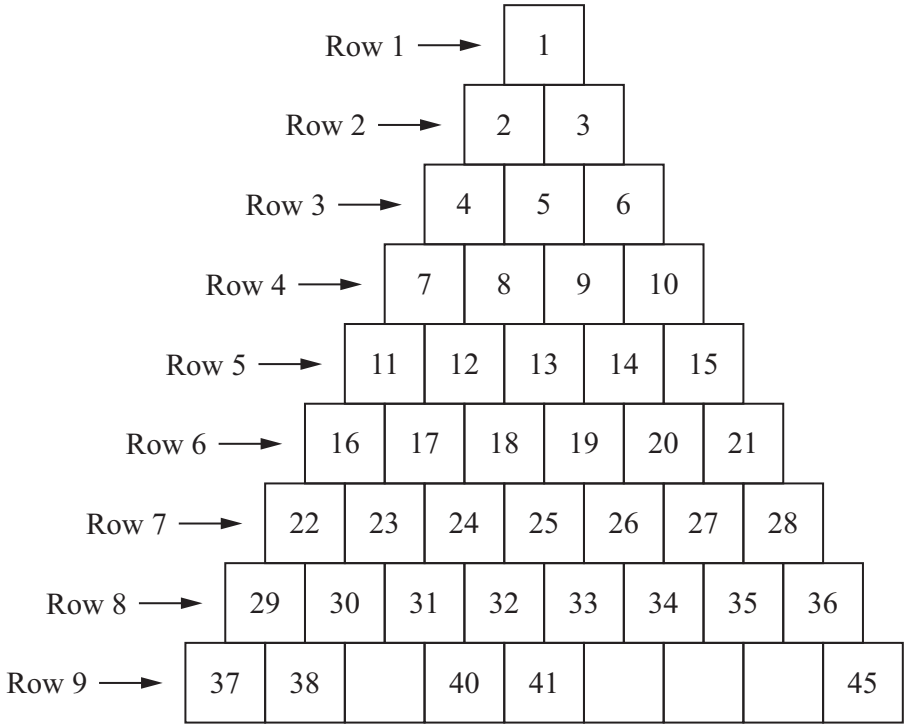
**[Turn over**

## 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, .....) = 12 [1]

**(ii)** N(....., 4) = 25 [1]

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**(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 × 2 = | 1 |
| 2 | 2 × 3 = | 3 |
| 3 | 3 × = | 6 |
| 4 | × = | |
| 5 | × = | |
| 6 | 6 × 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(..... , .....) = ..... + ..... = 50 [1]

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

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

[1]



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**(c)** $\mathrm{N}(R, 11) = 362$

Find the value of $R$.

..... [4]

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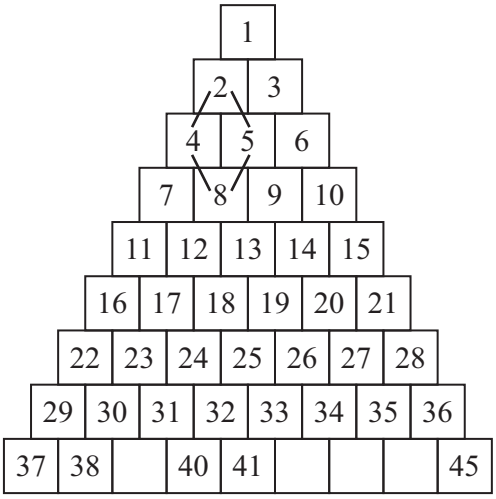
**3** Numbers in the pyramid can be joined to make a diamond as shown.
All diamonds in this investigation are similar.

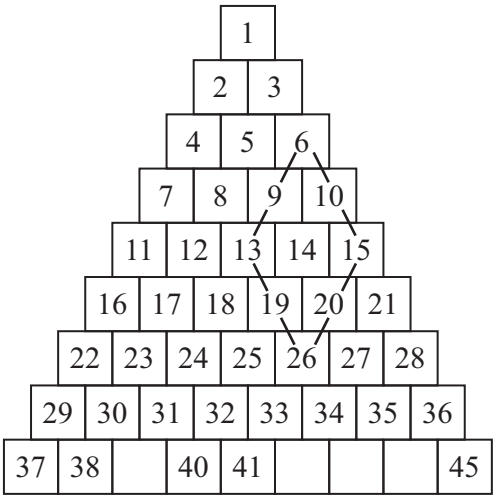



2, 4, 5 and 8 make a diamond.

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

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

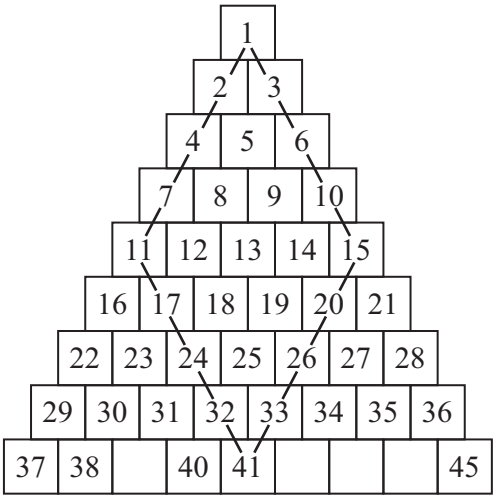
We write D(2, 4, 5, 8) has width 1.




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 $15 - 11 = 4$.

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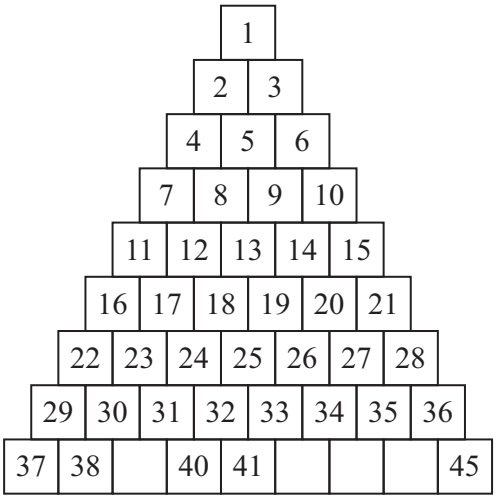
**(a)**




Complete the statements.

D(..... , ..... , 18 , 31 ) has width .....

D(..... , ..... , 19 , .....) 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(....., .....)

$d$ = N(....., .....)

[2]

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**(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]

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## Section B

## MODELLING FISH GROWTH

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

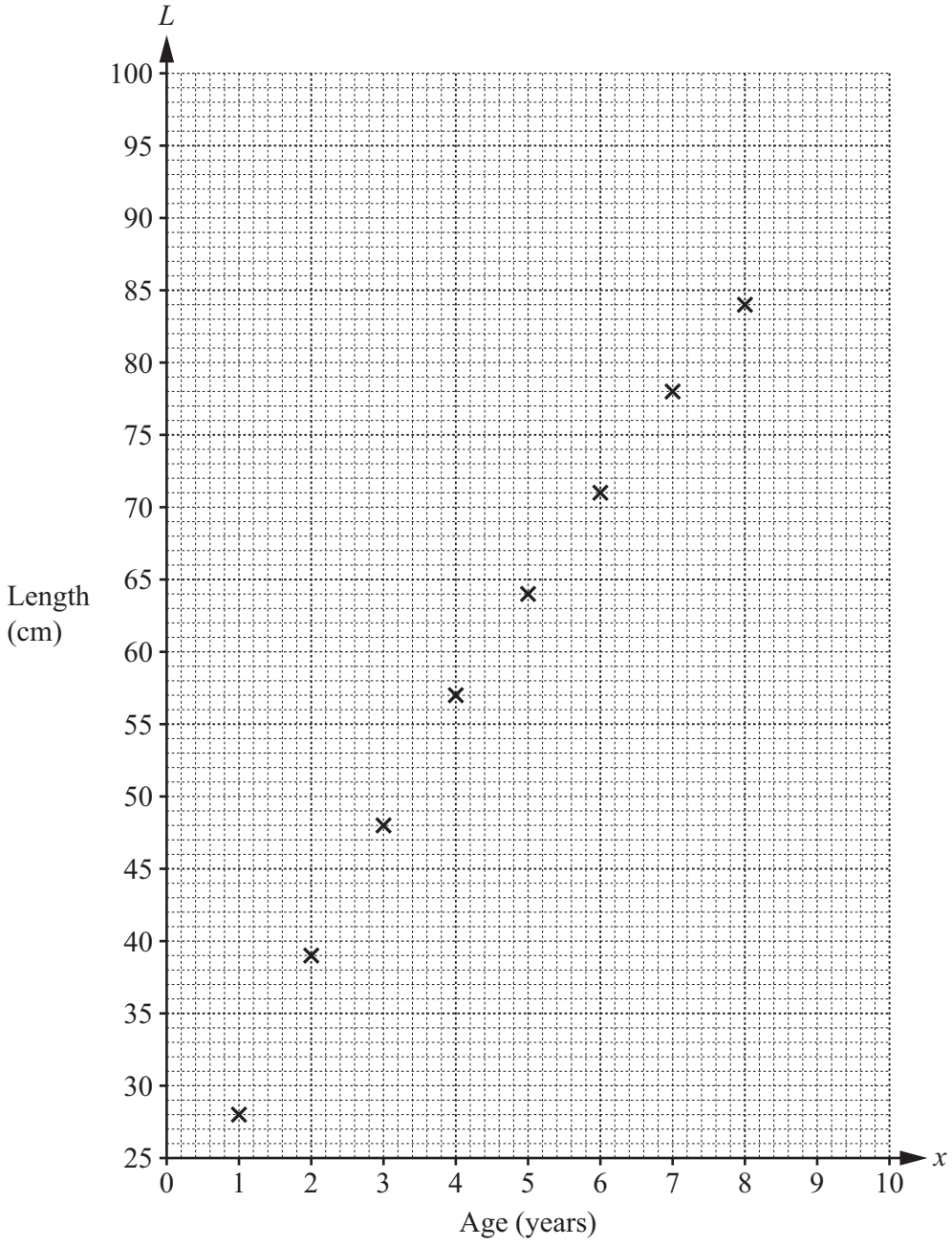
In this task you will be modelling the age and length of fish.

**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.

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**(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]

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**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]

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**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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