Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7284796208

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 Investigation and Modelling (Extended) **May/June 2023**

1 hour 40 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer both part **A** (Questions 1 to 4) and part **B** (Questions 5 to 6).
- 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 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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The Investigation starts on the next page.

Answer **both** parts **A** and **B**.

A INVESTIGATION (QUESTIONS 1 to 4)

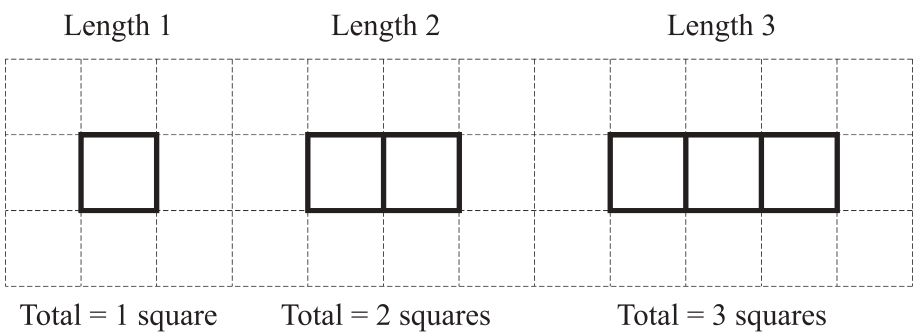
SQUARES IN RECTANGLES (30 marks)

You are advised to spend no more than 50 minutes on this part.

This investigation looks at finding the total number of squares inside a rectangle drawn on a grid.

In this investigation:
- the sides of the rectangles are on the grid lines
- the length of a rectangle is never less than its width.

1 Rectangles of width 1



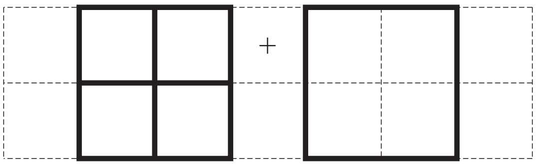
Complete the statements.

The number of squares in a rectangle of width 1 and length 4 is ....

The number of squares in a rectangle of width 1 and length L is .... [1]

2 Rectangles of width 2

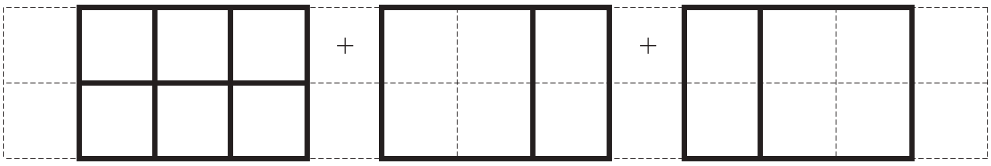
Length 2



4 squares of side 1 + 1 square of side 2

Total = 5 squares

Length 3

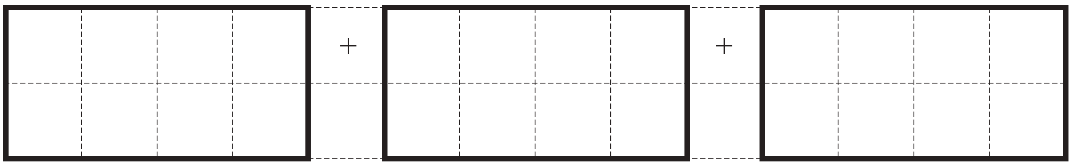


6 squares of side 1 + 1 square of side 2 + 1 square of side 2

Total = 8 squares

(a) Draw lines on these rectangles and write the number of squares under each one to show there is a total of 11 squares.

Length 4

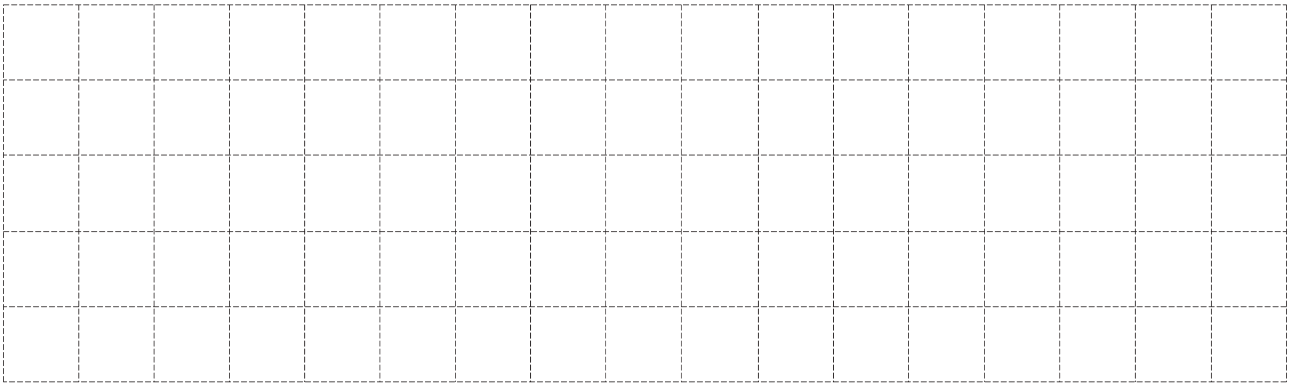


.... squares of side 1 + ... squares of side 2 + ... square of side 2

Total = 11 squares [3]

(b) **(i)** Complete the table.
You may use the grid below the table to help you.

Rectangles of width 2	
Length of rectangle	Total number of squares
2	5
3	8
4	11
5	



[2]

(ii) Find an expression, in terms of L, for the total number of squares in a rectangle of width 2 and length L.

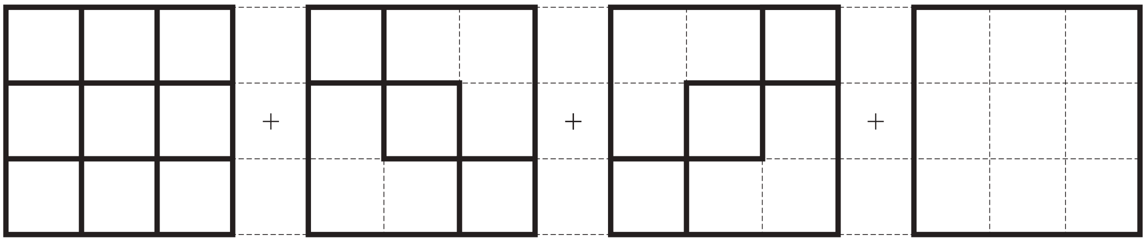
.... [2]

(iii) Calculate the total number of squares in a rectangle of width 2 and length 170.

.... [2]

3 Rectangles of width 3

Length 3



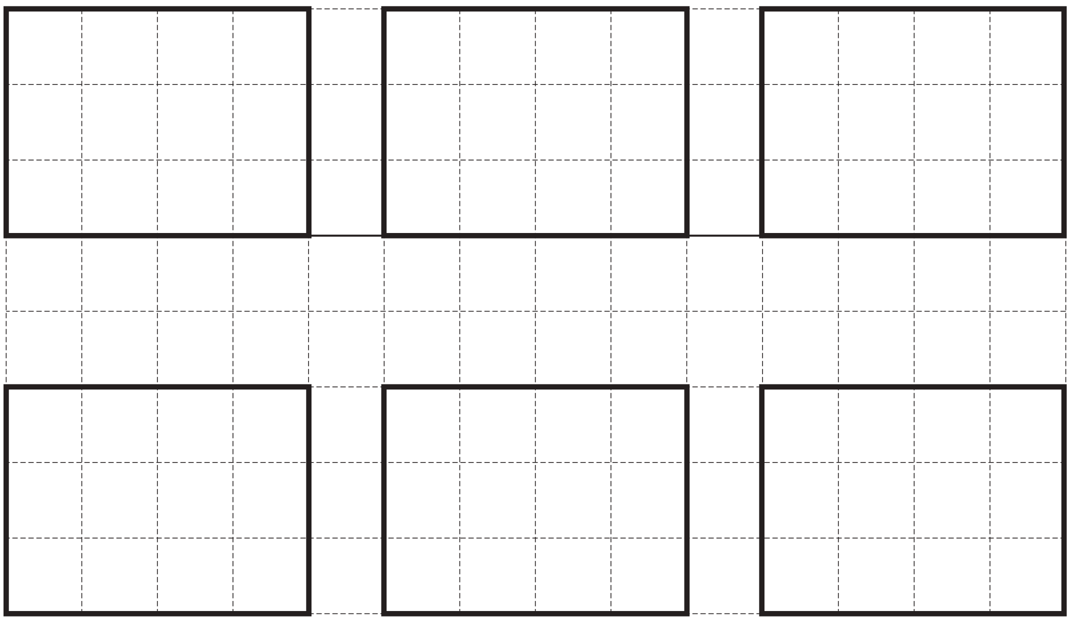
9 squares of side 1 + 2 squares of side 2 + 2 squares of side 2 + 1 square of side 3

Total = 14 squares

(a) Draw lines on these rectangles and write the number of squares under each one to find the total number of squares in a rectangle of width 3 and length 4.

You may not need to use all the rectangles.

Length 4



.... [4]

(b) **(i)** Complete the table.
You may use the grid to help you.

Rectangles of width 3	
Length of rectangle	Total number of squares
3	14
4	
5	26
6	32
7	

[2]

(ii) Find an expression, in terms of L, for the number of squares in a rectangle of width 3 and length L.

.... [2]

4 **(a)** Complete the table.

Use your answers to **Question 1**, **Question 2(b)(ii)** and **Question 3(b)(ii)** to help you.

Width of rectangle, w	Expression for total number of squares in terms of L
1	
2	
3	
4	$10L - 10$
5	
6	$21L - 35$

[3]

(b) The expressions in the table have two terms.

(i) The first term is kL, where k is an integer.

Find an expression for k in terms of w.

.... [3]

(ii) The second term in the expression is a constant.
The constant is in the form $aw^3 + bw$, where a and b are both fractions.

Find the value of a and the value of b.
Write down the expression for the constant in terms of w.

a = ...

b = ...

.... [4]

(iii) Use your expressions in **part (i)** and **part (ii)** to find the total number of squares in a rectangle of width 10 and length 11.

.... [2]

B MODELLING (QUESTIONS 5 to 6)

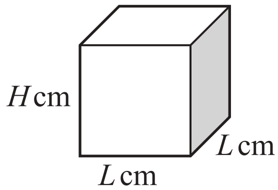
CARDBOARD BOXES (30 marks)

You are advised to spend no more than 50 minutes on this part.

This task looks at the dimensions of storage boxes.

A company stores metal bolts in closed boxes which are square-based cuboids.
The boxes are made of 5 mm thick cardboard.
The external side of the base is L cm and the external height is H cm.

> The **volume** of a box is all the space that the box takes up.
> The **capacity** of a box is all the space inside it.



5 (a) Show that the internal dimensions of the box are $(L - 1)$ cm and $(H - 1)$ cm.

[2]

(b) Write down a formula for C, the capacity of the box, in terms of L and H.

.... [2]

(c) The bolts are so heavy that an extra piece of cardboard of thickness 5 mm is placed in the bottom of the box to increase its strength.

Change your model for C in **part (b)** to include this extra piece of cardboard.

.... [1]

(d) The external area of the base of the box is 900 cm^2.
The height of the box is 5 cm longer than the length of the base.

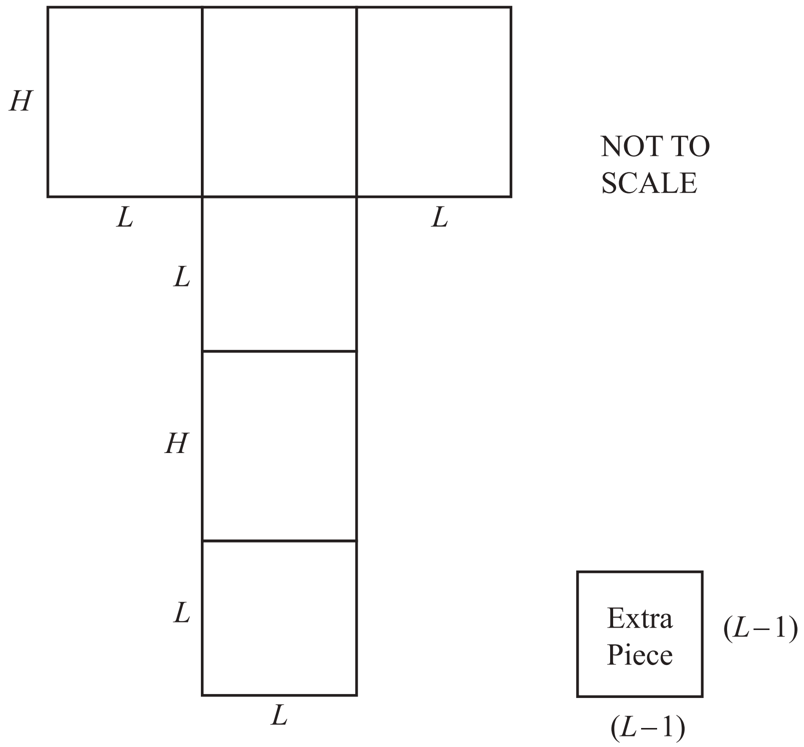
(i) Use your model in **part (c)** to calculate the capacity of the box.
Write down all the figures on your calculator.

.... [4]

(ii) Calculate the difference between the capacity and the volume of the box.

.... [3]

6 The net of a 3D shape is what it looks like when it is opened out flat.
This is a net for a box with the extra piece of cardboard.



(a) Show that the formula for A, the area of cardboard including the extra piece, is

$$A = 3L^2 + 4LH - 2L + 1.$$

You may use the diagram to help you.

[3]

(b) The box with external dimensions L cm, L cm and H cm has a volume of 12 500 cm^3.

(i) Write an expression for H in terms of L.

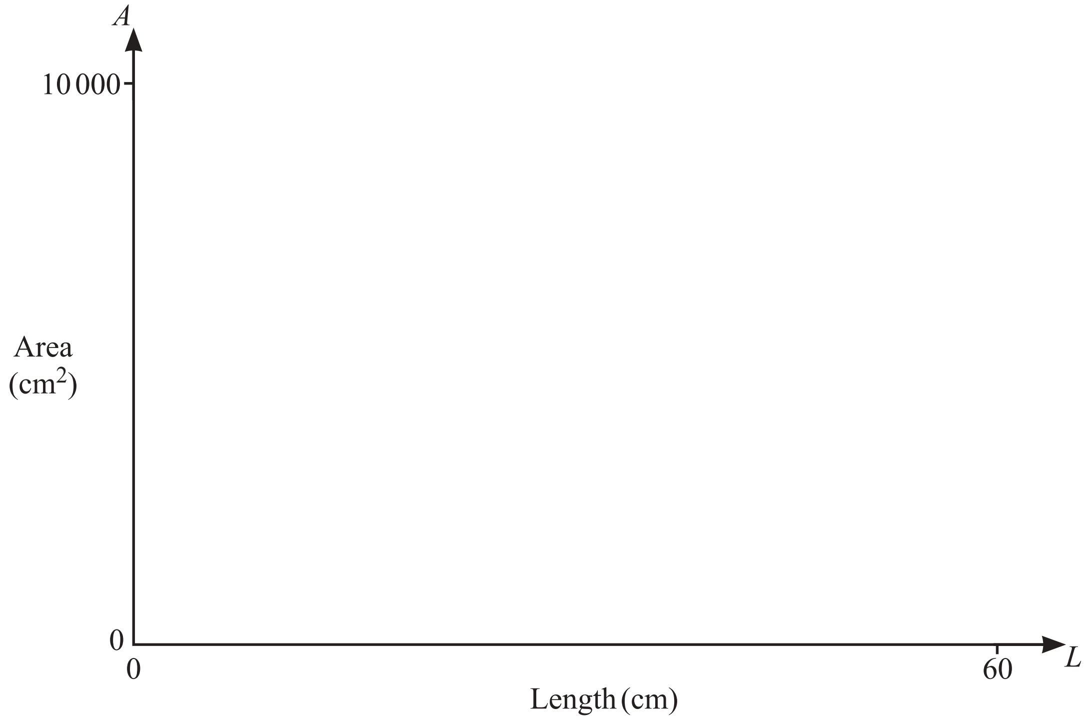
.... [1]

(ii) Show that the model for A in **part (a)** in terms of L is

$$A = 3L^2 + \frac{50\,000}{L} - 2L + 1.$$

[1]

(iii) Sketch the model in **part (ii)** on the axes, for $0 < L \leqslant 60$.



[2]

(iv) Box A has the minimum area of cardboard.

Write down the length of the base of the box and the area of the cardboard.

Length = ...

Area = ... [2]

(v) Box B is a cube with volume 12 500 cm^3.

Find the area of the cardboard when the box is a cube.

.... [3]

(vi) Find which box, A or B, has the greater height.
Calculate the difference in height.

.... [3]

(vii) Find which box, A or B, has the greater capacity.
Calculate the difference in capacity.

.... [3]

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