Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

4366897499

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 (Extended) **May/June 2018**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Graphics calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.
You may use an HB pencil for any diagrams or graphs.
DO **NOT** WRITE IN ANY BARCODES.

Answer both parts **A** (Questions 1 to 3) and **B** (Questions 4 to 6).
You must show all relevant working to gain full marks for correct methods, including sketches.
In this paper you will also be assessed on your ability to provide full reasons and communicate your mathematics clearly and precisely.
At the end of the examination, fasten all your work securely together.
The total number of marks for this paper is 40.

This document consists of **14** printed pages and **2** blank pages.

DC (NF/CT) 153612/2

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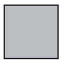
Answer both parts **A** and **B**.

A INVESTIGATION (QUESTIONS 1 to 3)

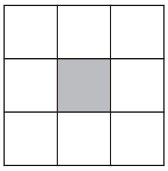
TILE PATTERNS (20 marks)

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

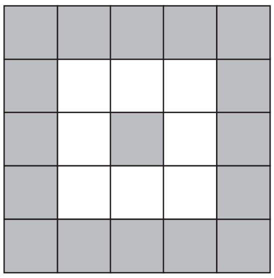
This investigation looks at the number of grey tiles and the number of white tiles in a sequence of square patterns.
All the tiles are the same size and each is a square.
The grey tiles and white tiles make borders around a single grey tile.
The single grey tile is the first grey border.



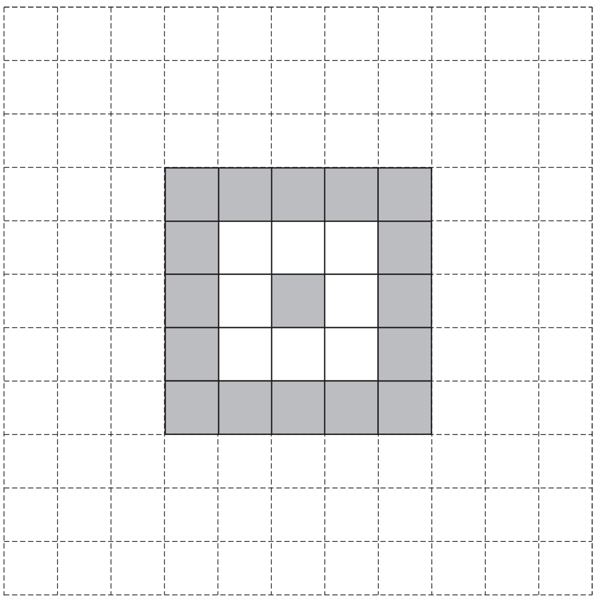
The first white border is 8 white tiles surrounding the grey tile.



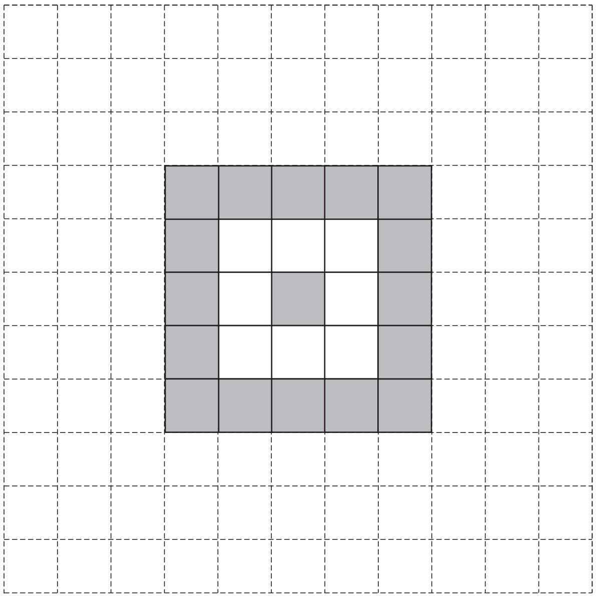
The second grey border is 16 grey tiles surrounding the 8 white tiles.



1 (a) On this grid, complete the diagram to show the second white border.



(b) On this grid, complete the diagram to show the third grey border.



2 This question looks at the patterns that finish with a **white** border.

Pattern finishes with	Number of white tiles in border	Total number of white tiles in pattern
1st white border	8	8
2nd white border		32
3rd white border	40	
4th white border		128
5th white border	72	200

(a) Complete the table.

(b) The values in the last column, for the total number of white tiles in these patterns, form a sequence.

Find an expression, in terms of n, for the total number of **white** tiles in the pattern that finishes with the nth white border.

....

(c) There are 3 white tiles along one side of the pattern that finishes with the first white border.

(i) Complete the table.

Pattern finishes with	Number of white tiles along one side
1st white border	3
2nd white border	
3rd white border	
nth white border	

(ii) Use your answer to **part (c)(i)** to write down an expression, in terms of n, for the **total** number of **all** tiles in the pattern that finishes with the nth white border.

....

(d) Use your answers in **part (b)** and **part (c)** to show that an expression for the total number of **grey** tiles in the pattern that finishes with the *n*th white border is

$$8n^2 - 8n + 1.$$

3 **(a)** Michel uses the tiling method of **question 2** to cover a square floor.
The first tile is grey and the final border is white.
The square floor measures 5.7 m by 5.7 m. Each tile measures 30 cm by 30 cm.

Work out the number of white tiles and the number of grey tiles Michel needs to cover the floor completely.

number of white tiles = ...

number of grey tiles = ...

(b) Jasmine has 500 white tiles and 500 grey tiles.
Each tile measures 30 cm by 30 cm.
She uses the same method of tiling, but she can finish with a grey border or a white border.

Find the side length of the biggest square floor that she can cover completely.
Find how many tiles of each colour will **not** be used in this case.

side length of biggest square floor = ...

number of white tiles **not** used = ...

number of grey tiles **not** used = ...

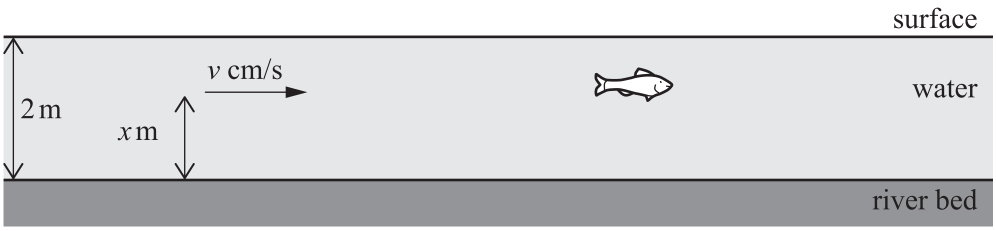
B MODELLING (QUESTIONS 4 to 6)

GOING WITH THE FLOW (20 marks)

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

In this task you will look at models for how the speed of water in a river changes with its height above the river bed.

The river is 2 metres deep.
An engineer measures the speed of water at different heights above the river bed.
The water flows parallel to the river bed.
The speed of the water at height x metres above the river bed is v cm/s.

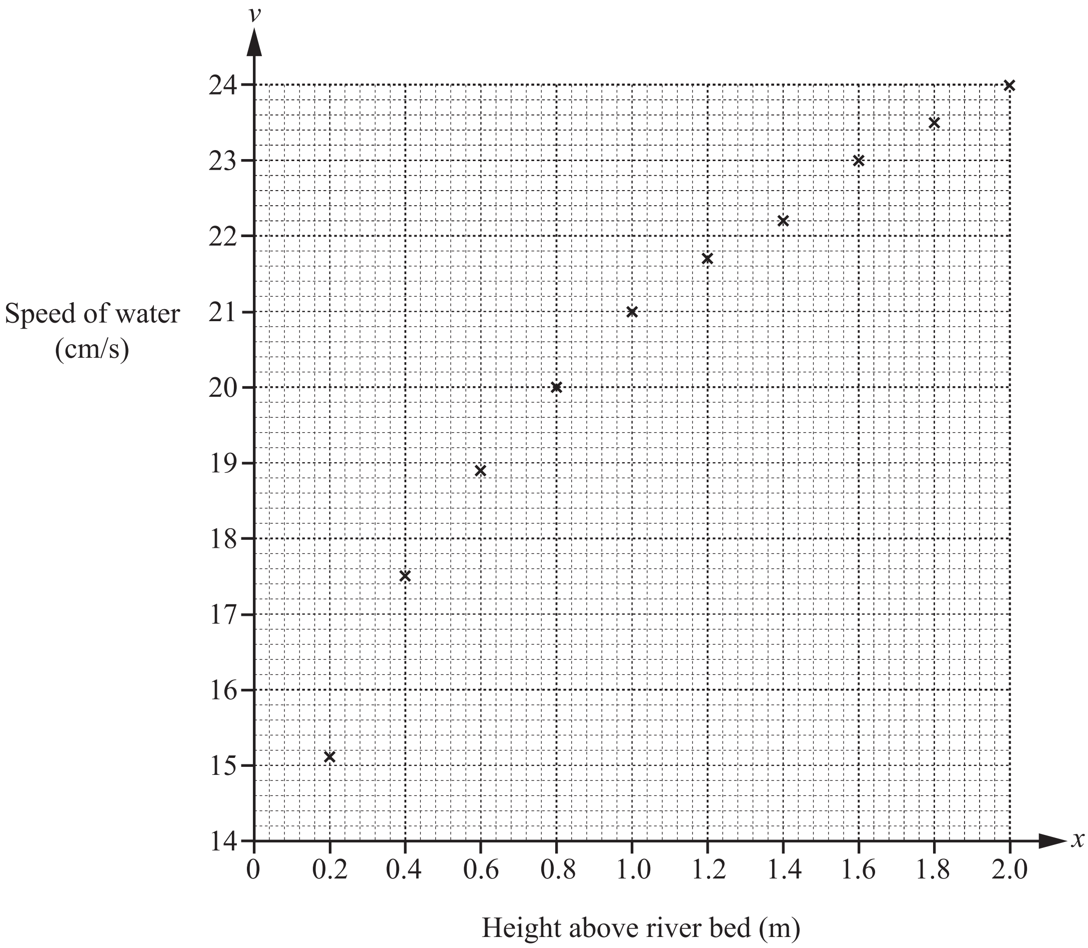


NOT TO SCALE

The table shows the data that the engineer collects.

Height above river bed (x metres)	Speed of water (v cm/s)
0.2	15.1
0.4	17.5
0.6	18.9
0.8	20.0
1.0	21.0
1.2	21.7
1.4	22.2
1.6	23.0
1.8	23.5
2.0	24.0

The data is plotted on the grid on the next page.


v
24
23
22
21
20
19
18
17
16
15
14
Speed of water
(cm/s)
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
x
Height above river bed (m)

4 **(a)** The engineer models the data using

$$v = ax^2 + bx + 12 \qquad \text{where } a \text{ and } b \text{ are constants.}$$

(i) Use the values of v when $x = 1$ and when $x = 2$ to write down two equations, each in terms of a and b.

....

....

(ii) Solve your equations to find the value of a and the value of b.
Write your values in the model below.

$v =$ .... $x^2 +$ .... $x + 12$

(b) The table shows the values that this model gives.

x	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
v	14.3	16.3	18.1	19.7	21.0	22.1	22.9	23.5	23.9	24.0

(i) Plot these values and draw the graph of the model on the grid on page 8.

(ii) Give the range of values of x for which this model overestimates the speed of the water.

....

5 In this question, all logarithms are base 10.

The engineer decides to test another model for how v changes with x.
This model is

$$v = k\left(\frac{x}{2}\right)^m \quad \text{where } k \text{ and } m \text{ are constants.}$$

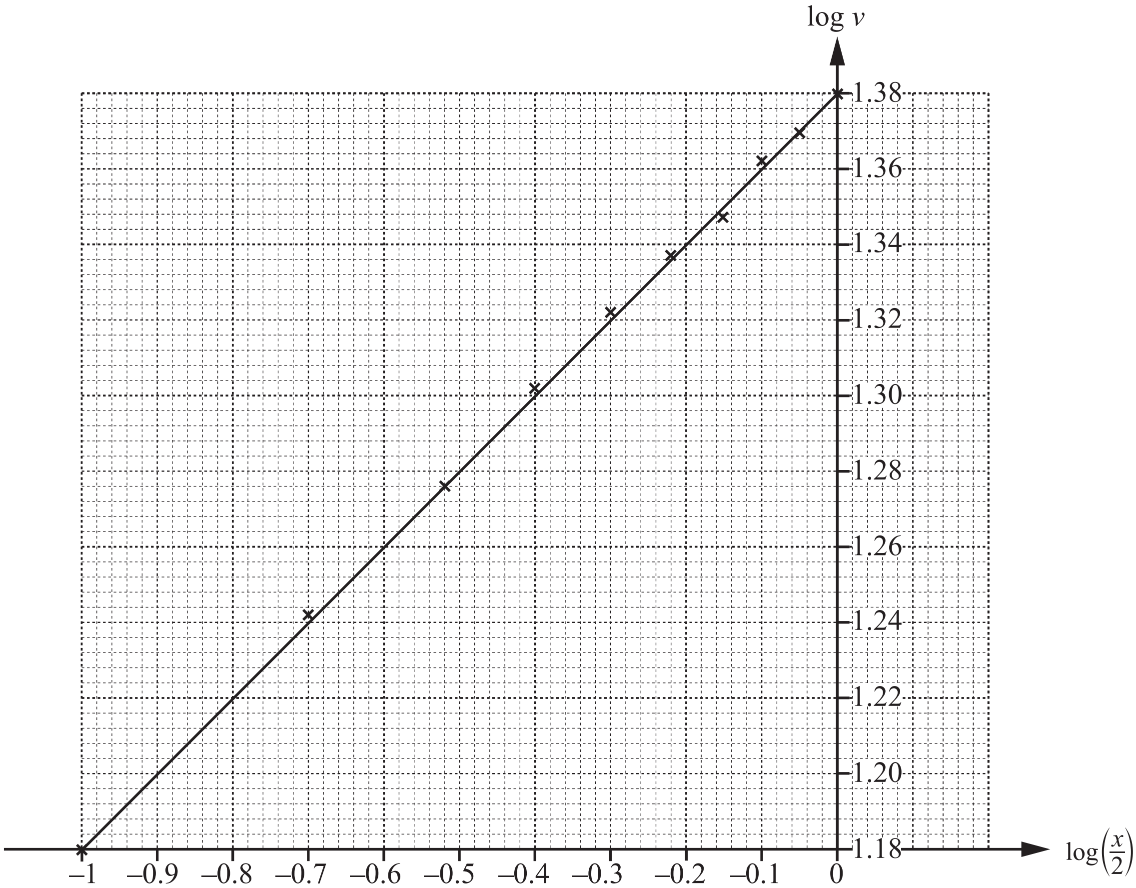
(a) Using $x = 2.0$ and $v = 24.0$ find the value of k for this model.

$k =$ ....

(b) **(i)** Take logarithms of both sides of this model to complete the equation below.

$\log v =$ .... $\log\left(\frac{x}{2}\right) +$ ....

(ii) The graph shows the data values of $\log v$ plotted against $\log\left(\frac{x}{2}\right)$ and a line of best fit.



Use the graph to calculate the value of m for the model, and write down the model.

m = ...

v = ...$\left(\frac{x}{2}\right)$....................

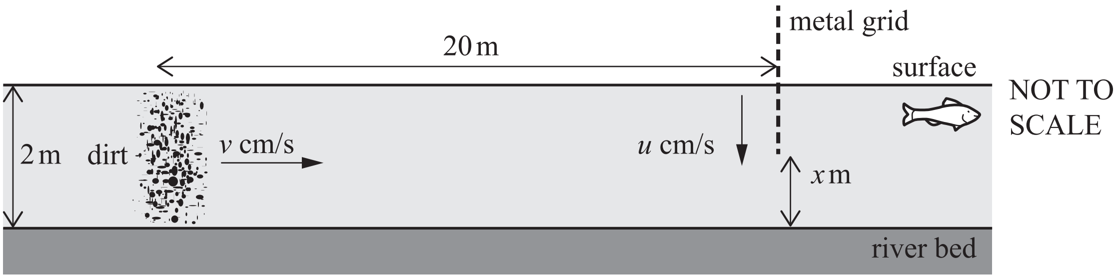
(c) Use this model to find the height above the river bed where the water is moving at 12 cm/s.

....

6 A factory releases some dirt into the river.
The dirt moves parallel to the river bed at the same speed as the water.

At the same instant that the factory releases the dirt, the engineer lowers a metal grid into the river. The metal grid is 20 m from the factory.

The metal grid does not affect the speed of the water but will stop the dirt.



(a) The metal grid moves vertically downwards at speed u **centimetres** per second.

Show that the number of seconds it takes the bottom of the metal grid to move from the surface to a height x **metres** above the river bed is

$$\frac{100(2-x)}{u}.$$

(b) The dirt moves along the river towards the grid at the speed given by the model in **question 5(b)(ii)**.

Find an expression, in terms of x, for the time it takes the dirt to move 20 m along the river.

....

(c) Use **part (a)** and your answer to **part (b)** to show that the metal grid stops the dirt at height x if

$$u \geqslant 1.2(2-x)\left(\frac{x}{2}\right)^{0.2}.$$

Question 6(d) is printed on the next page.

(d) **(i)** On the axes below, sketch the graph of $u = 1.2(2-x)\left(\frac{x}{2}\right)^{0.2}$ for $0 \leqslant x \leqslant 2$.

(ii) Find the smallest value of u that stops **all** the dirt.

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