Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/63**

Paper 6 (Extended) **October/November 2015**

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** and **B**.
You must show all the 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 **12** printed pages.

CAMBRIDGE International Examinations

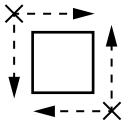
Answer **both** parts **A** and **B**.

A INVESTIGATION POSITION OF SECURITY CAMERAS (20 marks)

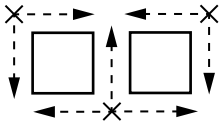
You are advised to spend no more than 45 minutes on this part.

Houses are built around squares.
Security cameras give a clear view for a distance of **one** side of a square in **any** direction.

On the diagrams a cross represents a security camera.



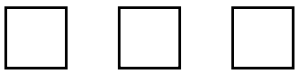
One square needs a minimum of 2 cameras to view all four sides.



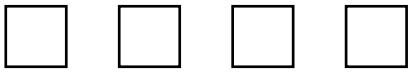
Two squares, in a row, need a minimum of 3 cameras as shown.

This investigation looks at the minimum number of security cameras for squares in different arrangements.

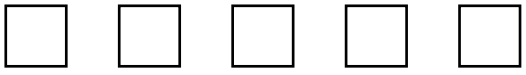
1 (a) (i) Three squares in one row need a minimum of 4 cameras.
Draw 4 crosses on the diagram to show the positions of the cameras.



(ii) Four squares in one row need a minimum of 5 cameras.
Draw 5 crosses on the diagram to show the positions of the cameras.



(iii) Draw crosses on the diagram to show the positions of the minimum number of cameras for five squares in one row.

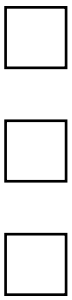


(b) Find an expression, in terms of n, for the minimum number of cameras for n squares in one row.

.....

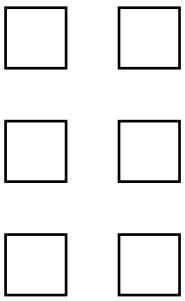
2 There are now three rows of squares.

(a) (i) What is the minimum number of cameras needed when there is 1 square in each of three rows? Draw crosses on the diagram to show the positions of these cameras.



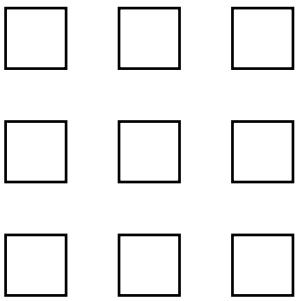
Minimum = ...

(ii) Two squares in each of three rows need a minimum of 6 cameras.
Draw crosses on the diagram to show the positions of these cameras.



Minimum = 6

(iii) Draw crosses on the diagram to show the positions of the minimum number of cameras for 3 squares in each of three rows.



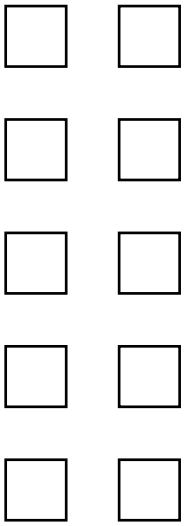
Minimum = ...

(b) Find an expression, in terms of n, for the minimum number of cameras for n squares in each of three rows.

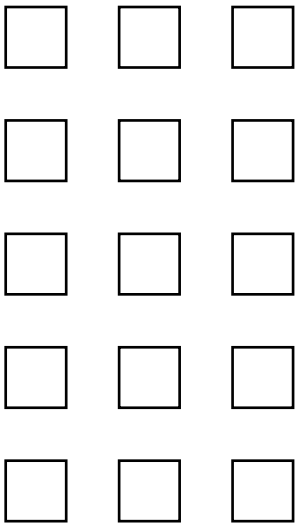
.....

3 There are now five rows of squares.

Find the minimum number of cameras for 2 and 3 squares in each of five rows.



Minimum = ...



Minimum = ...

4 **(a)** Complete the table to show the minimum number of cameras for an odd number of rows.

	Number of squares in each row						
	1 square	2 squares	3 squares	4 squares	5 squares		*n* squares
One row	2	3	4	5			
Three rows		6					
Five rows	6						
Seven rows	8						

(b) Find an expression for the minimum number of cameras for n squares in each of r rows, when r is an odd number.

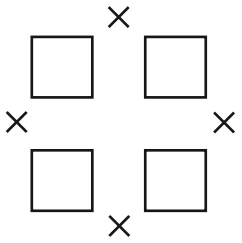
.....

(c) For an odd number of rows, the minimum number of cameras is 16.
Find all the possible numbers of squares in each row.

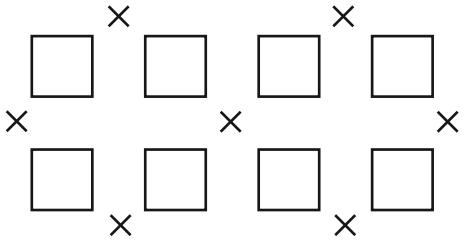
.....

[Turn over

5 Now consider **even** numbers of rows with an **even** number of squares in each row.

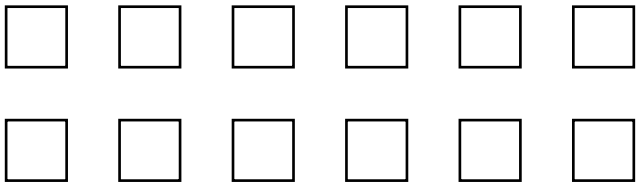


Two rows, each with two squares, need a minimum of 4 cameras.

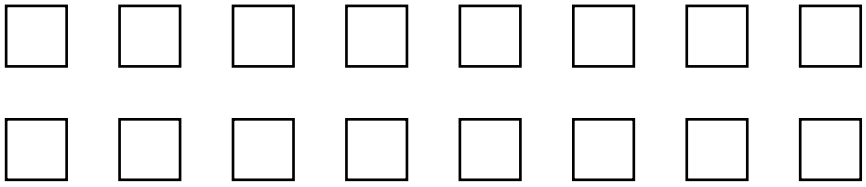


Two rows, each with four squares, need a minimum of 7 cameras.

(a) Find the minimum number of cameras for 6 and 8 squares in each of two rows.



Minimum = ...



Minimum = ...

(b) Find an expression for the minimum number of cameras for two rows each with n squares, when n is even.

.....

6 **(a)** Complete the table to show the minimum number of cameras for even numbers of rows each with an even number of squares.

	Number of squares in each row					
	2 squares	4 squares	6 squares	8 squares		*n* squares
Two rows	4	7				
Four rows	7	12				
Six rows	10		24			
Eight rows	13			40		

(b) Find an expression for the minimum number of cameras when the number of rows, *r,* and the number of squares in each row, *n*, are both even numbers.

.....

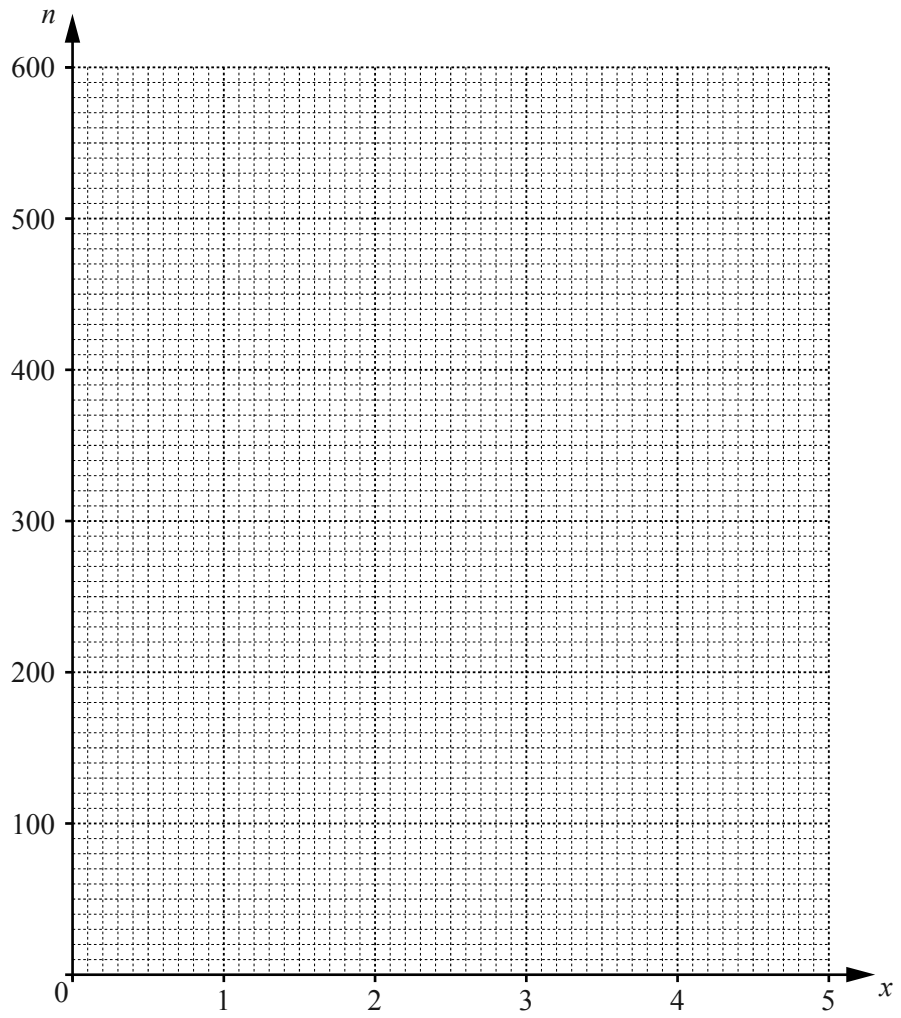
B MODELLING BACTERIA (20 marks)

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

In an experiment a biologist recorded the number of bacteria in a dish at the end of each day for 5 days. The table shows the results.

Time in days (x)	1	2	3	4	5
Number of bacteria (n)	120	170	250	370	530

1 **(a)** On the grid below, plot the five points and join them to form a smooth curve.



(b) Write down an estimate for the number of bacteria at the start of the experiment.

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2 **(a)** Which of the following models best fits the relationship between x and n?

$n = pq^x$ $\quad$ $n = px^2 + q$ $\quad$ $n = px + q$

.....

(b) Use the number of bacteria for day 3 and day 4 with your model to find a value for q.

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(c) Find the value of p that corresponds to the value for q in **part (b)**.

.....

(d) **(i)** Rewrite your model substituting your values for p and q.

Use your model to estimate the number of bacteria at the end of the seventh day.

.....

(ii) Use your model to estimate the number of bacteria at the start of the experiment.

.....

(iii) Compare your answer in **part (ii)** with your estimate in **question 1(b)**.

.....

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3 **In this question log n represents $\log_{10} n$.**

(a) Complete the table of values, giving log n correct to 3 significant figures.

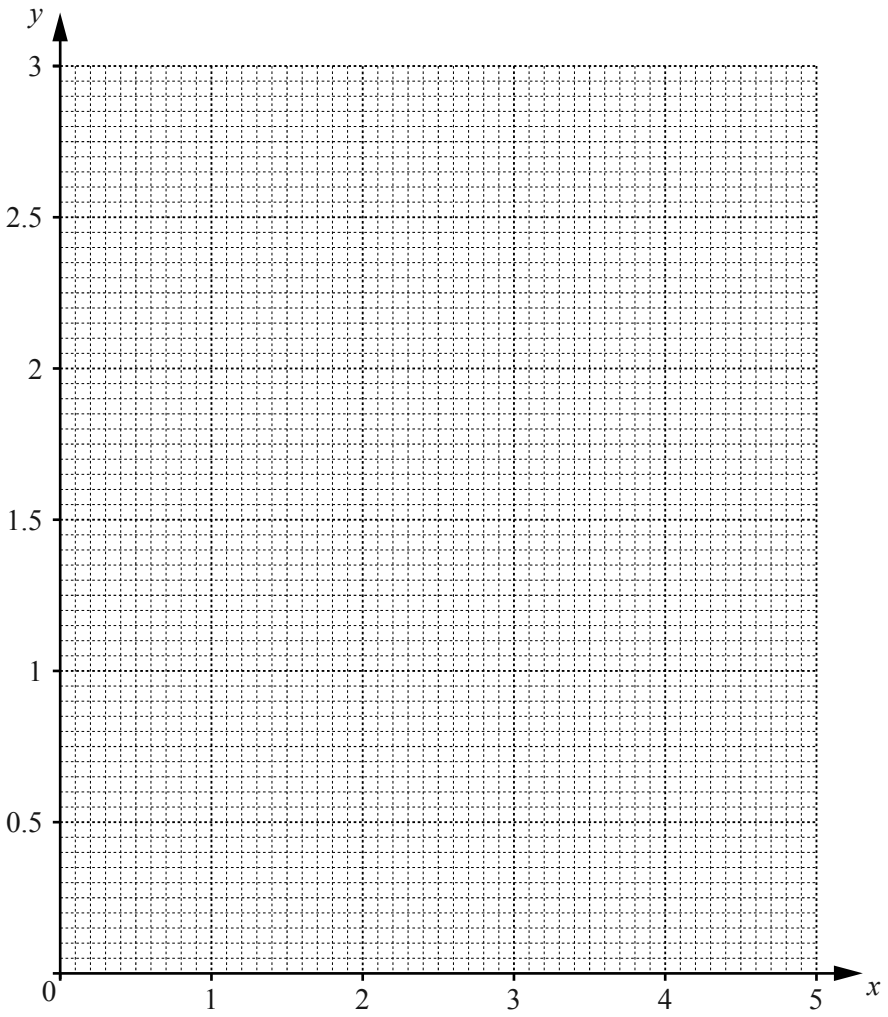
Time in days (x)	1	2	3	4	5
Number of bacteria (n)	120	170	250	370	530
log n (y)	2.08				

(b) Find the mean value of x and the mean value of y.

Mean value of x .....

Mean value of y .....

(c) On the grid below, plot y against x and draw a line of best fit.



(d) The equation of the line of best fit is $y = mx + c$.

(i) Estimate the value of c from your graph.

.....

(ii) Find the value of m.

.....

(e) Another model for the number of bacteria, n, is $\log n = mx + c$.

Rewrite this model substituting your values for m and c.

Use this model to estimate the number of bacteria at the end of the seventh day.

.....

(f) Use this model to estimate the number of bacteria at the start of the experiment.

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Question 4 is printed on the next page.

4 Compare the models in **question 2(d)(i)** and **question 3(e)**.

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