Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/51**

Paper 5 (Core) **October/November 2016**

1 hour

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 **all** the questions.
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 to 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 24.

This document consists of **7** printed pages and **1** blank page.

CAMBRIDGE International Examinations

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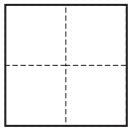
Answer **all** the questions.

INVESTIGATION SQUARES ON GRIDS

This investigation looks at the number of squares drawn on square grids.

All squares are drawn using gridlines.

1 Here is a 2 by 2 grid.



Explain why there are 5 squares on a 2 by 2 grid.

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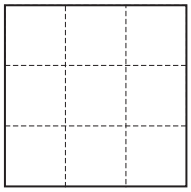
2 Here is a 3 by 3 grid.



Complete these statements about the numbers of different sized squares on a 3 by 3 grid.

The number of 1 by 1 squares on a 3 by 3 grid is .....

The number of 2 by 2 squares on a 3 by 3 grid is 4

The number of 3 by 3 squares on a 3 by 3 grid is .....

So the total number of squares on a 3 by 3 grid is .....

3 Complete these statements about the numbers of different sized squares on a 4 by 4 grid.
You may use the grids below to help you.

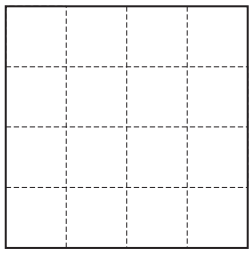
The number of 1 by 1 squares on a 4 by 4 grid is .....

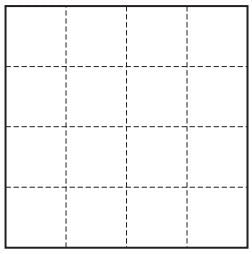
The number of 2 by 2 squares on a 4 by 4 grid is .....

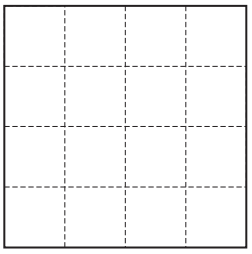
The number of 3 by 3 squares on a 4 by 4 grid is .....

The number of 4 by 4 squares on a 4 by 4 grid is .....

So the total number of squares on a 4 by 4 grid is 30







4 **(a)** Use your results from **questions 1**, **2** and **3** to help you complete this table.

Size of grid	Number of….						Total number of squares
	1 by 1 squares	2 by 2 squares	3 by 3 squares	4 by 4 squares	5 by 5 squares	6 by 6 squares	
1 by 1	1						1
2 by 2							5
3 by 3		4					
4 by 4							30
5 by 5							
6 by 6							

(b) What is the mathematical name for the numbers in the **1 by 1 squares** column?

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(c) Work out the **total** number of squares on an 8 by 8 grid.

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(d) Here is part of a table for an n by n grid.
It only has columns for 1 by 1 squares up to 6 by 6 squares.

Complete the table using expressions in terms of n.

Size of grid	Number of….					
	1 by 1 squares	2 by 2 squares	3 by 3 squares	4 by 4 squares	5 by 5 squares	6 by 6 squares
n by n					$(n-4)^2$	

(e) Write an expression, in terms of n, for the number of 12 by 12 squares on an n by n grid.

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(f) **(i)** Find the number of 5 by 5 squares on a 20 by 20 grid.

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(ii) The number of 5 by 5 squares on an n by n grid is 36.

Find the value of n.

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5 Here is a formula for the total number of squares, T, on an n by n grid.

$$T = \frac{n^3}{3} + \frac{n^2}{2} + \frac{n}{6} + d$$

(a) The total number of squares on a 1 by 1 grid is 1.

Show that $d = 0$.

(b) Show that the formula gives the correct total number of squares on a 4 by 4 grid.

(c) Find the total number of squares on a 10 by 10 grid.

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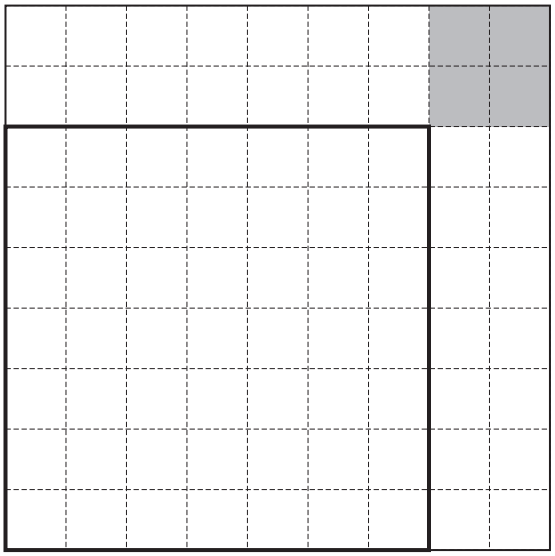
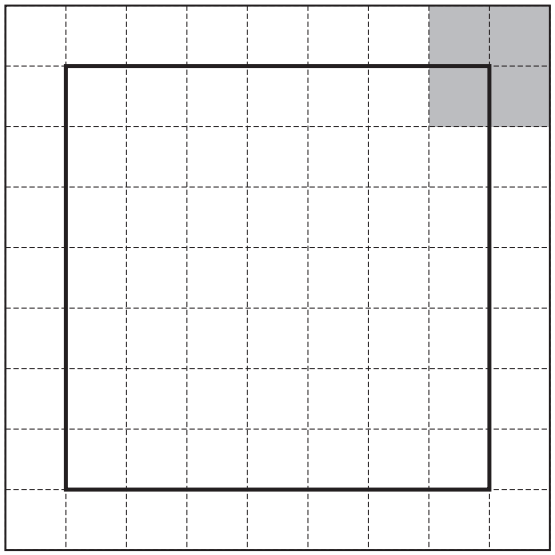
6 **(a)** There are nine 7 by 7 squares on a 9 by 9 grid.
The diagrams show a 7 by 7 square drawn in two positions on a 9 by 9 grid.
In each diagram the same 2 by 2 square is shaded.





Consider the possible positions of the 7 by 7 square.

Explain how the shaded 2 by 2 square can be used to calculate the number of 7 by 7 squares on a 9 by 9 grid.

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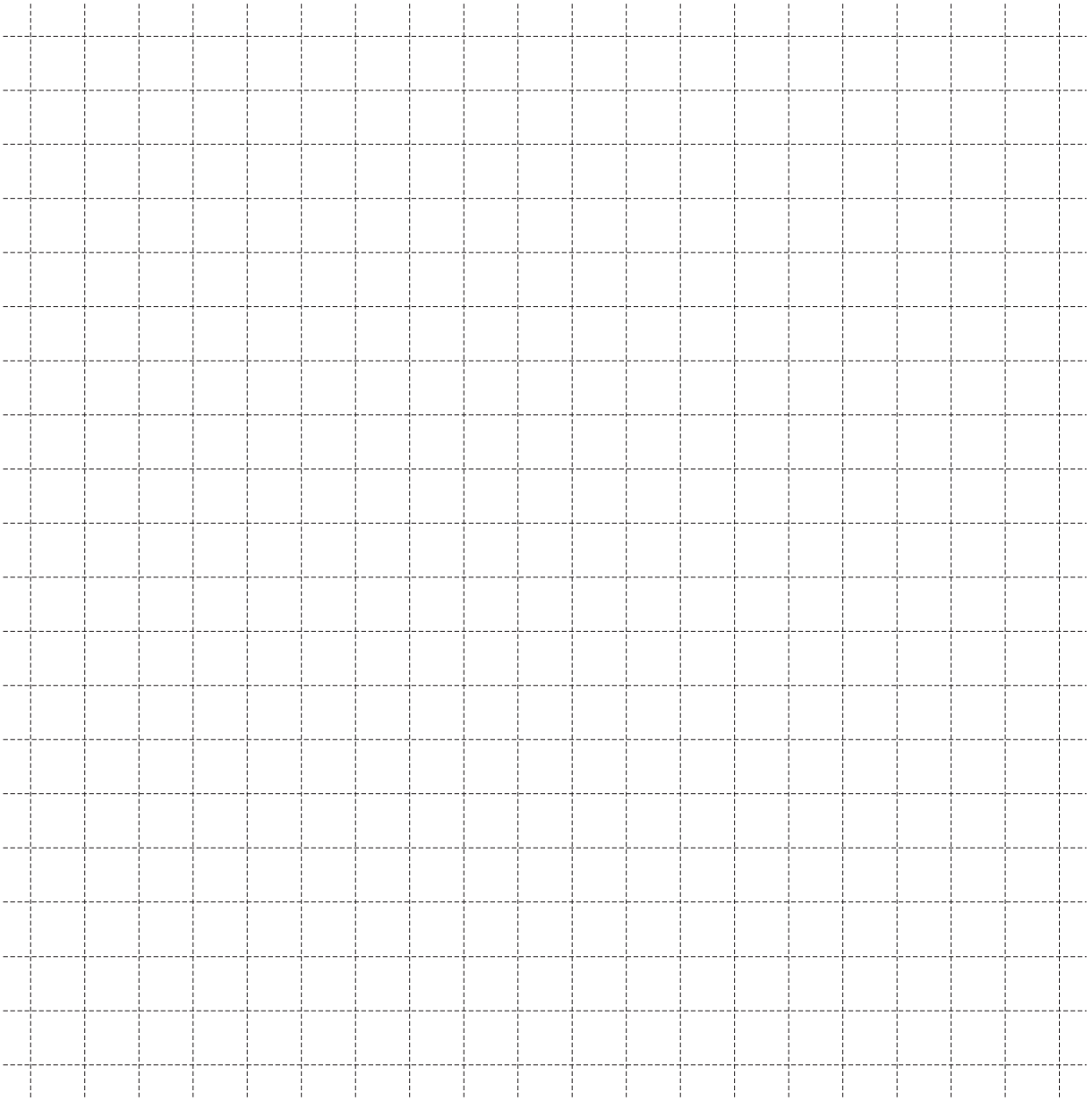
(b) A square which is bigger than 9 by 9 is drawn on a square grid.
It is only possible to draw 25 of these squares on the square grid.

Find two possible sizes for the square and the grid it is drawn on.
You may use the grid below to help you.

Square size ..... by ..... on a ..... by ..... grid.

Square size ..... by ..... on a ..... by ..... grid.



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