Cambridge Assessment International Education

Cambridge IGCSE™

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7460435561

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/51**

Paper 5 Investigation (Core) **October/November 2020**

1 hour 10 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 36.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages. Blank pages are indicated.

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[Turn over

Answer **all** the questions.

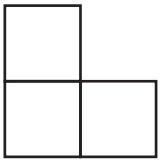
INVESTIGATION **PILING SQUARES**

This investigation looks at different ways of piling squares.
All the squares are the same size.

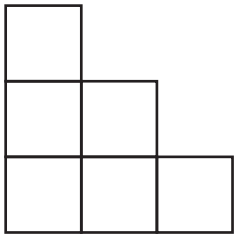
1 Squares are piled in a pattern, like this:



1 square on the bottom row
Total = 1 square

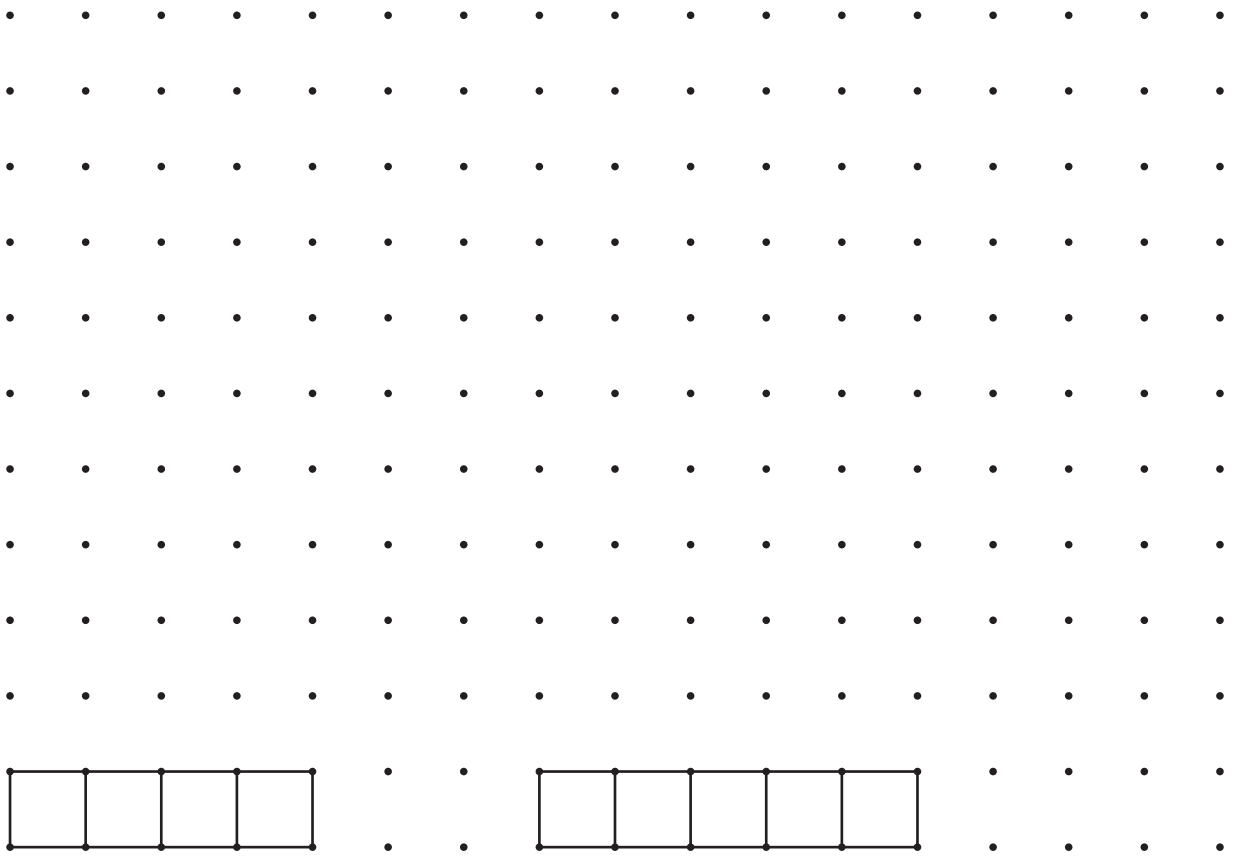


2 squares on the bottom row
Total = 3 squares



3 squares on the bottom row
Total = 6 squares

(a) On the dotty paper, complete the next two diagrams in this sequence.



[2]

(b) (i) Complete the table.

Number of squares on the bottom row (s)	1	2	3	4	5	6
Total number of squares (T)	1	3	6			

[3]

(ii) When the number of squares on the bottom row is 3 the total number of squares is 6.

Use this information to explain how to calculate the total number of squares when there are 4 squares on the bottom row.

..... [1]

(c) (i) Write down the number of **extra** squares needed to change a pattern with 9 squares on the bottom row to one with 10 squares on the bottom row.

..... [1]

(ii) Calculate the **total** number of squares when there are 10 squares on the bottom row.

..... [2]

(d) (i) A formula for finding the total number of squares, T, in terms of the number of squares on the bottom row, s, is

$$T = ks^2 + \frac{1}{2}s, \qquad \text{where } k \text{ is a constant.}$$

Use the results in **part (b)(i)** to find the value of k.

..... [2]

(ii) A pattern has 12 squares on the bottom row.
Show that your formula in **part (i)** gives the correct total number of squares.

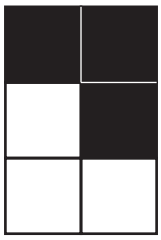
[3]

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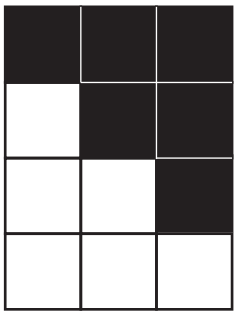
2 Black squares and white squares are now piled on top of each other like this:



1 square on the bottom row
Height = 2 squares
Total = 2 squares

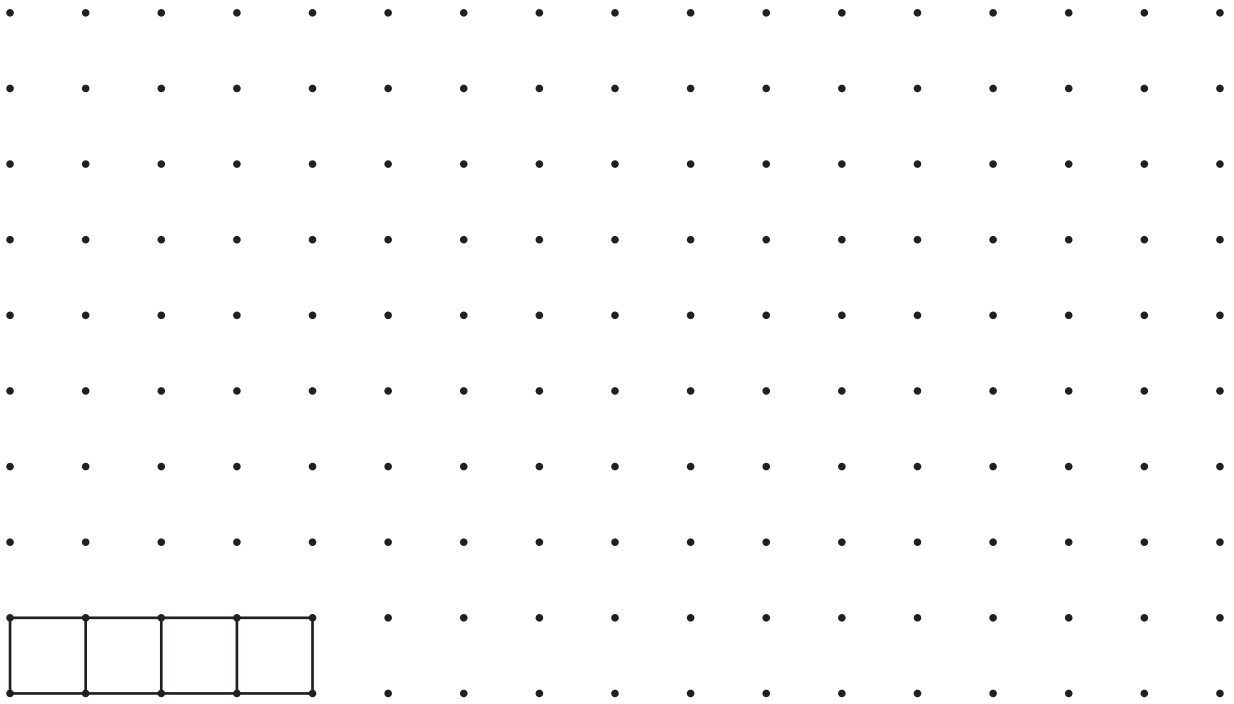


2 squares on the bottom row
Height = 3 squares
Total = 6 squares



3 squares on the bottom row
Height = 4 squares
Total = 12 squares

(a) On the dotty paper, complete the next diagram in the sequence.



[1]

(b) (i) Complete the table.

Number of squares on the bottom row (s)	1	2	3	4	5	6
Height (H)	2	3	4			

[1]

(ii) Write down a formula for the height, H, in terms of the number of squares on the bottom row, s.

..... [1]

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(c) (i) Complete the table.

Number of squares on the bottom row (s)	1	2	3	4	5	6
Total number of squares (T)	2	6	12			

[3]

(ii) Find a formula for the total number of squares, T, in terms of the number of squares on the bottom row, s.

..... [4]

(iii) Find the total number of squares in a pattern with 15 squares on the bottom row.

..... [2]

(d) Write down a formula to calculate the number of black squares, N, in a pattern with s squares on the bottom row.

..... [1]

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(e) Calculate the number of white squares, the number of black squares and the total number of squares in a pattern with 50 squares on the bottom row.

Number of white squares = ...

Number of black squares = ...

Total number of squares = ... [3]

(f) **(i)** A pattern of black squares and white squares has 561 black squares.
Find the number of squares in the bottom row.

..... [3]

(ii) Is it possible to have a pattern of black squares and white squares with a total of 480 squares?
Give a reason for your answer.

..... because .....

..... [3]

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