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Cambridge Assessment International Education

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/51**

Paper 5 Investigation (Core) **October/November 2024**

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 [ ].

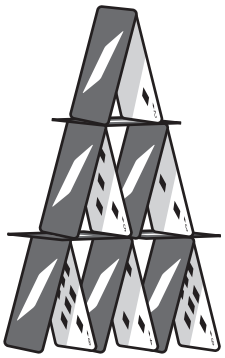
This document has **8** pages.

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[Turn over

Answer **all** the questions.

INVESTIGATION **HOUSE OF CARDS**



This investigation looks at the number of cards in a house of cards.
The diagram shows a house of cards with three rows.

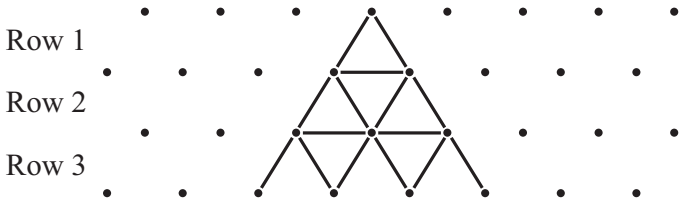
Rows are counted down from the top of the house.

In this investigation

—— is a horizontal card and / \ are diagonal cards.

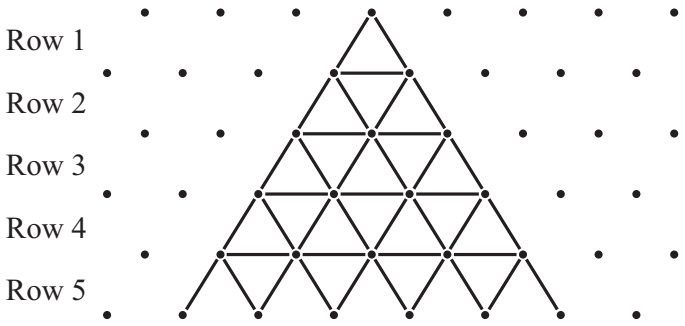
Example 1

This house of cards has 3 rows of cards.



Example 2

This house of cards has 5 rows of cards.



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1 This is Row 1 in a house of cards.



There are 0 horizontal cards.

There are 2 diagonal cards.

There are 2 cards in total.

This is Row 2 in a house of cards.



There is 1 horizontal card.

There are 4 diagonal cards.

There are 5 cards in total.

(a) This is Row 3 in a house of cards.



Complete these statements for Row 3.

There are ..... horizontal cards.

There are ..... diagonal cards.

There are ..... cards in total. [1]

(b) **(i)** On the grid, draw Row 4 in a house of cards.



[1]

(ii) Complete these statements for Row 4.

There are ..... horizontal cards.

There are ..... diagonal cards.

There are ..... cards in total. [1]

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(c) Complete the table.
Use your answers to **part (a)**, **part (b)(ii)** and any patterns you notice.

	Row (n)	Number of horizontal cards	Number of diagonal cards	Total number of cards
	1	0	2	2
	2	1	4	5
part (a)	3			
part (b)(ii)	4			
	5			

[2]

(d) Find an expression, in terms of n, for

(i) the number of horizontal cards in Row n

..... [1]

(ii) the number of diagonal cards in Row n

..... [1]

(iii) the total number of cards in Row n.
Give your answer in its simplest form.

..... [2]

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(e) Work out the number of horizontal cards, the number of diagonal cards and the total number of cards in Row 40.

Number of horizontal cards .....

Number of diagonal cards .....

Total number of cards ..... [3]

(f) The total number of cards in Row p is 368.

Work out how many **diagonal** cards are in Row p.

..... [4]

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2 The house number is the number of rows in the house.

This is House 1.

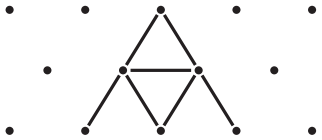


There are 0 horizontal cards.

There are 2 diagonal cards.

There are 2 cards in total.

This is House 2.

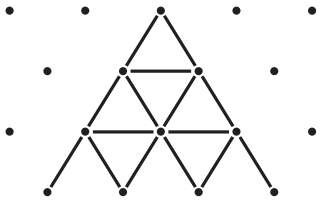


There is 1 horizontal card.

There are 6 diagonal cards.

There are 7 cards in total.

(a) This is House 3.



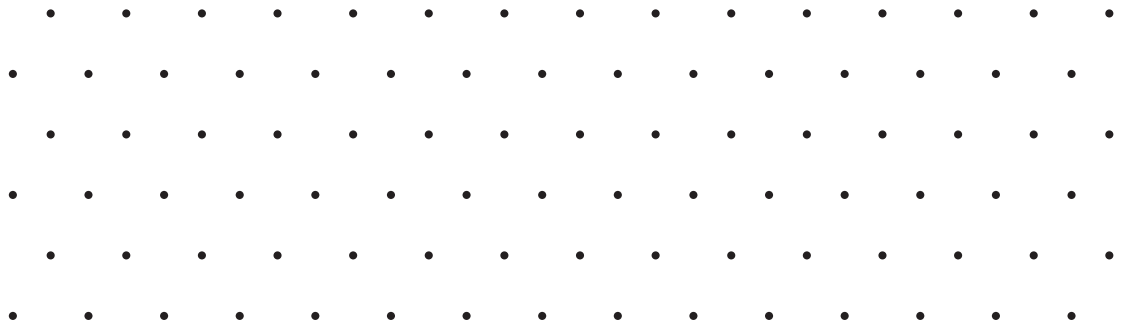
Complete these statements for House 3.

There are ..... horizontal cards.

There are ..... diagonal cards.

There are ..... cards in total. [2]

(b) On this grid, draw House 4.



[1]

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(c) Complete the table.
Use your answers to **part (a)**, **part (b)** and any patterns you notice.

	House (h)	Number of horizontal cards	Number of diagonal cards	Total number of cards
	1	0	2	2
	2	1	6	7
part (a)	3			
part (b)	4			
	5			

[4]

(d) Write down the rule to continue the sequence for the number of horizontal cards.

..... [1]

(e) This is an expression for the number of horizontal cards in House h.

$$0.5h(h-1)$$

Show that this expression gives the same result as your rule in **part (d)** when $h = 6$.

[3]

(f) Find an expression, in terms of h, for the number of diagonal cards in House h.

..... [3]

Questions 2(g) and 2(h) are printed on the next page.

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(g) Use the expression from **part (e)** and your answer from **part (f)** to find an expression for the total number of cards in House h.
Give your answer in its simplest form.

..... [3]

(h) Lee makes a house with 100 cards.

Find the number of cards in the bottom row.

..... [3]

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