Cambridge Assessment International Education

Cambridge IGCSE™

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CENTRE NUMBER						CANDIDATE NUMBER			

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/52**

Paper 5 Investigation (Core) **May/June 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.

[Turn over

Answer **all** the questions.

INVESTIGATION **DOTTY POLYGONS**

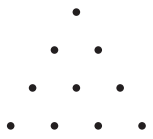
This investigation is about the number of dots in shapes that are regular polygons.

For any dotty polygon

- p is the number of sides
- n is the number of dots on one side
- there are the same number of dots on each side.

Example

This is a dotty triangle.



In this dotty triangle, $p = 3$ and $n = 4$.

1 **(a)** Look at the numbers of dots in each row of the example.

Complete this sum for the total number of dots in the dotty triangle.

1 + 2 + 3 + ... = ... [2]

(b) For a dotty triangle where $n = 10$, complete this sum and find the total number of dots.

1 + 2 + 3 + ... + ... + ... + ... + ... + ... + ... = ... [2]

(c) Show that $\frac{n^2}{2} + \frac{n}{2}$ gives the correct number of dots when $n = 10$.

[2]

2 The diagram shows the first four dotty triangles.
The number of dots added each time is d.

$n = 1$	$n = 2$	$n = 3$	$n = 4$
$d = 1$	$d = 2$	$d = 3$	$d = 4$

So, for dotty triangles, $d = n$.

This diagram shows the first three dotty squares.

$n = 1$	$n = 2$	$n = 3$	$n = 4$
$d = 1$	$d = 3$	$d = 5$	$d = 7$

(a) Draw the dotty square for $n = 4$ in the space above. [1]

(b) **(i)** Write down the total number of dots in each of the first four dotty squares.

..... , ... , ... , ... [1]

(ii) Write down an expression, in terms of n, for the **total** number of dots in the nth dotty square.

..... [1]

(c) For dotty squares, find a formula for d in terms of n.

..... [3]

(d) A formula for d, in terms of p (the number of sides) and n is

$$d = (p-2)n - p + 3.$$

By substituting appropriate values for p, show that this formula gives

(i) the formula for dotty triangles,

[2]

(ii) your formula for dotty squares.

[2]

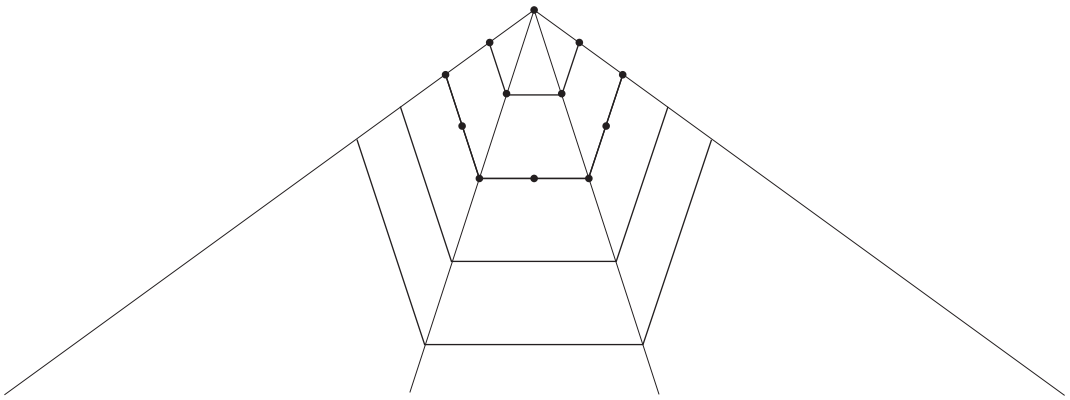
3 **(a)** For dotty pentagons, show that the formula in **Question 2(d)** becomes $d = 3n - 2$.

[1]

(b) This diagram shows the first three dotty pentagons.

$d = 1$	$d = 4$	$d = 7$
total = 1	total = 5	total = 12

Dotty pentagons grow along the grey lines.
This diagram shows how to form the first three dotty pentagons.



(i) Use $d = 3n - 2$ to find the number of dots that you add to the 3rd dotty pentagon to make the 4th dotty pentagon.

..... [2]

(ii) Complete the diagram to show the 4th and 5th dotty pentagons. [2]

(iii) Complete the final statement.

1st pentagon	+	4 dots	=	2nd pentagon
2nd pentagon	+	7 dots	=	3rd pentagon
⋮		⋮		⋮
.....th pentagon	+	52 dots	=	.....th pentagon

[2]

4 **(a)** This table shows the **total** number of dots in some dotty polygons.

Use **Question 2**, **Question 3** and any patterns you notice to help you complete this table.

		Position of dotty polygon in its sequence						
Polygon	p	1st	2nd	3rd	4th	5th		nth
Triangle	3	1	3	6	10			$\frac{n^2}{2}+\frac{n}{2}$
Square	4	1	4	9				
Pentagon	5	1	5	12				
Hexagon	6	1	6					

[8]

(b)

The number of dots in a dotty pentagon × 3	=	The number of dots in a dotty triangle

(i) Give two examples from the table that show this statement is true.

[2]

(ii)

The number of dots in the 4th dotty pentagon × 3	=	The number of dots in the kth dotty triangle

Find the value of k.

..... [3]

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