Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/52**

Paper 5 Investigation (Core) **May/June 2025**

1 hour 15 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 40.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **8** pages. Any blank pages are indicated.

[Turn over

INVESTIGATION   **THE CORE AND SHELL OF SEQUENCES**

In this investigation you will look at the values of the shell and the core in sequences of positive integers. Each sequence has an odd number of terms.

The *core integer* is the integer in the middle of the sequence.
The *shell integers* are the integer at the beginning and the integer at the end of the sequence.

<u>Example</u>   core integer

For the sequence   6   9   12   15   18   21   24   the core integer is 15 and the shell integers are 6 and 24.
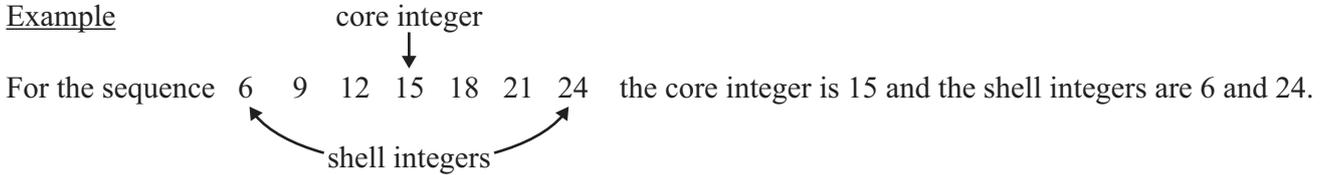
shell integers

1   (a) Write down the core integer and the shell integers for the sequence

5   6   7   8   9   10   11   12   13.

Core integer ....

Shell integers .... and ....
                                                                    [1]

(b) You calculate the *value of the core*, C, by multiplying the core integer by itself.
In the example $C = 15 \times 15 = 225$.

Calculate C for the sequence in **part (a)**.

.... [1]

(c) You calculate the *value of the shell*, S, by multiplying the two shell integers together.
In the example $S = 6 \times 24 = 144$.

Calculate S for the sequence in **part (a)**.

.... [1]

2   Exponential sequences

In an *exponential sequence* the term-to-term rule is multiply by the same number.

<u>Examples</u>

Sequence: 1   2   4   8   16   Term-to-term rule: $\times 2$

Sequence: 1   5   25   125   625   Term-to-term rule: $\times 5$

(a) Calculate C and S for the exponential sequence   2   6   18   54   162.

$C =$ ....

$S =$ ....

[2]

(b) (i) Complete the 4th and 5th terms in this exponential sequence.

3   6   12   ....   [1]

(ii) Calculate C and S.

$C =$ ....

$S =$ ....

[2]

(c) Write down what you notice about C and S for the sequences in **part (a)** and **part (b)**.

.... [1]

(d) (i) The 1st term of an exponential sequence is a.
To get the next term you multiply by m.

Write expressions for the 3rd and 5th terms of this sequence.

a am .... am^3 ....   [1]

(ii) Use algebra to show that your answer in **part (c)** is always true.

[2]

(e) An exponential sequence has 5 terms.
The 1st term is 2 and the middle term is 722.

Use **part (c)** to find the 5th term.

.... [3]

0607/52/M/J/25   **[Turn over**

3 **Fibonacci sequence**   1   1   2   3   5   8   13   …

In the Fibonacci sequence you find the next term by adding the previous two terms.
For example   5th term + 6th term = 7th term   so $5 + 8 = 13$.

(a) Calculate C and S for these sequences of 3 consecutive terms in the Fibonacci sequence.

   (i) The 2nd, 3rd and 4th terms.   1   2   3

$C =$ ....

$S =$ ....
                [1]

   (ii) The 4th, 5th and 6th terms.   3   5   8

$C =$ ....

$S =$ ....
                [1]

   (iii) The 6th, 7th and 8th terms.

$C =$ ....

$S =$ ....
                [2]

(b) In the Fibonacci sequence there are 3 consecutive terms where the value of their shell is $S = 17\,480\,760$.

Use what you notice in your answers to **part (a)** to calculate the middle term.

.... [2]

4 Linear sequences with three terms

In a linear sequence the term-to-term rule is add the same number.
This number is the *common difference*, d.

(a) F is the difference between the value of the core and the value of the shell.
So $F = C - S$.

Complete the table.

Linear sequence			Common difference d	F
17	18	19	1	1
24	27	30		
14	20	....		36
20	....	40		

[5]

(b) Use **part (a)** to find a formula for F in terms of d.

.... [2]

(c) A linear sequence of 3 terms has $F = 49$.
The 1st term is 11.

Complete the sequence.

11, ... , ... [2]

5 Sequences of consecutive integers

(a) Complete the table.

Consecutive integers									Number of integers n	F
17	18	19							3	1
20	21	22	23	24					5	
13	14	15	16	17	18	19				9
1	2	3	4	5	6	7	8	9		

[3]

(b) A formula for F is $F = k(n-1)^2$ where k is a fraction.

Find the value of k.

.... [2]

(c) Find the value of F for a sequence of 99 consecutive integers.

.... [2]

(d) In a sequence of consecutive integers, the difference in the value of the core and the value of the shell is 529.

Find the number of integers in the sequence.

.... [3]

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