

# Cambridge IGCSE<sup>™</sup>

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	
CAMBRIDGE	INTERNATIONAL MATHE	EMATICS	0607/52
Paper 5 Investi	gation (Core)		February/March 2021
			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 [].

### **CONSECUTIVE NUMBERS (36 marks)**

This task is about what happens when consecutive numbers are changed from positive to negative and added.

Consecutive numbers are sequences of integers which increase by 1 from term to term.

Examples 0, 1, 2, 3, 4 or 5, 6, 7 or 46, 47, 48, 49, 50, 51 or 3, 4, 5, ..., 120.

In this investigation use this **method** throughout.

- Add the positive consecutive numbers.
- Find all the possible additions and totals when you make **one** of the numbers negative.
- Find all the possible additions and totals when you make **two** of the numbers negative.
- Continue in this way until all the numbers are negative.
- 1 1, 2 is a sequence of two consecutive numbers.
  - (a) (i) Complete the table using the method with 1 and 2 to find all the possible totals.

	A	Total			
All positive	1	+	2	=	3
One negative	-1	+	2	=	
One negative	1	+	-2	=	
All negative	-1	+	-2	=	-3

[1]

(ii) Using the consecutive numbers 1 and 2 the highest total is 3 and the lowest total is -3.

You cannot make all the integers between the highest total and the lowest total using the method.

Write down all the integers between 3 and -3 that **cannot** be made using 1 and 2. Remember: 0 is an integer.

<b>(b)</b>	(i)	Complete the table using the method with the consecutive numbers 2 and 3.
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	A	Total			
All positive	2	+	3	=	5
One negative	-2	+		=	1
One negative	2	+		=	
All negative	-2	+	-3	=	

[2]

(ii) Using the table in **part** (i), complete these statements.

(c) (i) Complete the table using the method with two consecutive numbers.

	Ac	Total		
All positive		+	 =	15
One negative		+	 =	
One negative		+	 =	
All negative		+	 =	-15

[2]

(ii) Find the number of integers between 15 and -15 that **cannot** be made using these consecutive numbers.

......[1]

- 2 a and a + 1 are two consecutive numbers.
  - (a) Find expressions for the four totals that can be made using a and a + 1. Give each expression in its simplest form.

4

(b) An expression for the number of integers between the highest total and the lowest total that cannot be made using a and a + 1 is 4a - 1.

Show that this gives the correct number when a = 10.

- 3 (a) There are now three consecutive numbers.
  - (i) Complete the table using the method with the consecutive numbers 3, 4 and 5.

Addition						Total
3	+	4	+	5	=	12
-3	+	4	+	5	=	6
	+	-4	+		=	4
	+		+		=	2
-3	+	-4	+		=	-2
-3	+		+	-5	=	
	+		+		=	
-3	+	-4	+	-5	=	-12
	-3  -3 -3 	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$

(ii) Find the number of integers that **cannot** be made between 12 and -12.

https://xtremepape.rs/

[2]

(b) There are now four consecutive numbers.

				Add	ition				Total
All positive	3	+	4	+	5	+	6	=	18
	-3	+	4	+	5	+	6	=	12
One negative		+	-4	+	5	+	6	=	10
One negative	3	+	4	+	-5	+	6	=	8
		+		+		+		=	
	-3	+	-4	+	5	+	6	=	
	-3	+	4	+		+	6	=	2
Two magative	-3	+	4	+	5	+	-6	=	0
Two negative	3	+	-4	+		+	6	=	0
	3	+	-4	+		+	-6	=	
	3	+	4	+	-5	+	-6	=	-4
	-3	+	-4	+		+		=	
Three positive	-3	+	-4	+		+		=	-8
Three negative	-3	+	4	+	-5	+		=	-10
	3	+		+		+		=	-12
All negative	-3	+	-4	+	-5	+	-6	=	-18

Complete the table using the method and the consecutive numbers 3, 4, 5 and 6.

[3]

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# TURN OVER FOR QUESTION 4

7

4 (a) There are 16 additions in the table on page 6.

Complete the table below. Use **Question 1** and **Question 3** to help you.

Number of consecutive numbers	Number o	ions	
2		=	
3		=	2 <sup>3</sup>
4	16	=	2 <sup>4</sup>
5	32	=	
n			

(b) Complete this table. Use **Question 2(a)** to help you.

Number of consecutive numbers	Consecutive numbers	Expression for the highest total in terms of <i>a</i>
2	<i>a</i> , <i>a</i> + 1	
3		3a + 3
4		
5	a, a + 1, a + 2, a + 3, a + 4	
n		$+\frac{n(n-1)}{2}$

[2]

[5]

- (c) Anna uses this method to work out the number of integers that **cannot** be made.
  - Use **Question 4(b)** to find the highest total.
  - Find the number of integers from the highest total to the lowest total.
  - Use **Question 4(a)** to find the number of additions.
  - Subtract the number of additions from the number of integers.

### Example

There are three consecutive numbers. The first number is 4.

The highest total is  $3a + 3 = 3 \times 4 + 3 = 15$ . The number of integers from 15 to -15 is 31. The number of additions is  $2^3$ . The number of integers that **cannot** be made is  $31 - 2^3 = 23$ .

(i) There are two consecutive numbers.

Use Anna's method to find the number of integers that **cannot** be made when the first number is 9.

.....[3]

(ii) Anna uses her method to find the number of integers that cannot be made with the three consecutive numbers 1, 2 and 3. Her method gives the answer 5.

Explain why her method gives the wrong answer.

## .....[3]

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11

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