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Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

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* 4836720288 *

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/52**

Paper 5 Investigation (Core) **May/June 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. Any blank pages are indicated.

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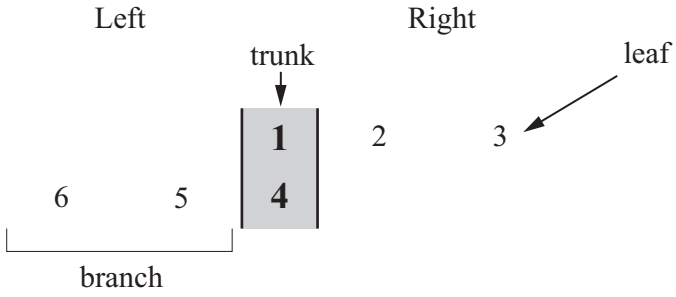
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Answer **all** the questions.

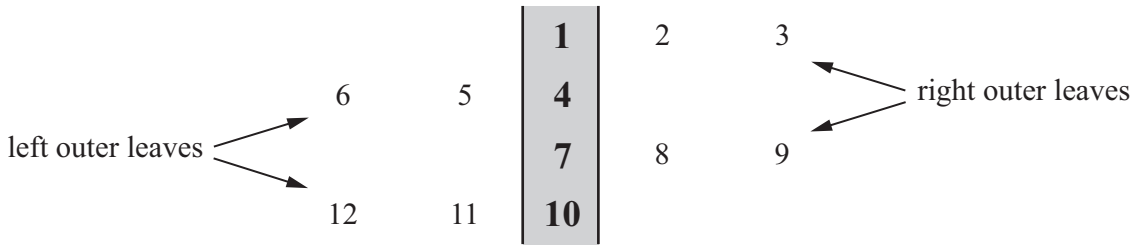
INVESTIGATION **INTEGER TREES**

This investigation looks at patterns when integers are arranged in the shape of a tree.
A tree uses consecutive integers starting with 1 at the top.
Each tree has a *trunk*, *branches* and *leaves*.
The integers always increase going away from the trunk, on both the right and the left.
The first branch is always on the right.

This tree uses the integers 1 to 6.
It has 2 branches with 2 leaves on each branch.



This tree uses the integers 1 to 12.
It has 4 branches with 2 leaves on each branch.
The leaves furthest from the trunk are the *outer leaves*.



A is the sum of the left outer leaves.

B is the sum of the right outer leaves.

T is the sum of the integers in the trunk.

Example

For the tree with 4 branches,

$A = 6 + 12 = 18$

$B = 3 + 9 = 12$

$T = 1 + 4 + 7 + 10 = 22$.

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In **Questions 1** to **5**, the number of branches, n, is always even.

1 This tree has 6 branches with 2 leaves on each branch.

		1	2	3
6	5	**4**		
		7	8	9
12	11	**10**		
		13	14	15
18	17	**16**		

(a) Complete the calculation for A.

$A = 6 + 12 + 18 =$ ..... [1]

(b) Find the value of B.

..... [2]

(c) Find the value of T.

..... [2]

2 **(a)** Complete the table for trees with 2 leaves on each branch.
Use your answers to **Question 1** to help you.

Number of branches (n)	A	B	T	$A-B$	$A+B-T$
2	6	3	5	3	4
4	18	12	22	6	8
6				9	
8	60				16

[4]

(b) **(i)** Use values from the table to give an example to show that $A - B = 1.5n$.

..... [1]

(ii) Write an expression for $A + B - T$ in terms of n.

..... [1]

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3 In this question trees have 3 leaves on each branch.
This tree has 6 branches.

			1	2	3	4
8	7	6	**5**			
			9	10	11	12
16	15	14	**13**			
			17	18	19	20
24	23	22	**21**			

(a) Complete the table.

Number of branches (n)	A	B	T	$A-B$	$A+B-T$
2	8	4	6	4	6
4	24	16	28	8	12
6			66		18
8	80				

[4]

(b) (i) Write an expression for $A-B$ in terms of n.

..... [1]

(ii) Write an expression for $A+B-T$ in terms of n.

..... [1]

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4 In this question trees have 4 leaves on each branch.
The table shows values of $A-B$ and $A+B-T$.

Complete the last row of the table with expressions in terms of n.

Number of branches (n)	$A-B$	$A+B-T$
2	5	8
4	10	16
6	15	24
8	20	32
n		

[2]

5 **(a)** Complete the table.
Use your answers from **Questions 2(b)(ii)**, **3(b)** and **4** to help you.

Number of branches	Number of leaves on each branch (x)	$A-B$	$A+B-T$
n	2	$1.5n$	
n	3		
n	4		
n	5		

[2]

(b) A tree has an even number of branches, n, with x leaves on each branch.

Complete the expressions for $A-B$ and $A+B-T$ in terms of n and x.

$A-B = \frac{n}{2}$ (.....)

$A+B-T =$ ..... [2]

(c) A tree has 16 branches and 7 leaves on each branch.

Show that $A-B=64$ and $A+B-T=112$.

[2]

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6 In this question trees have an **odd** number of branches.
Trees have more than one branch.

This tree has 5 branches with 2 leaves on each branch.

		1	2	3
6	5	**4**		
		7	8	9
12	11	**10**		
		13	14	15

(a) Find the value of $A-B$ and the value of $A+B-T$ for this tree.

$A-B=$ .....

$A+B-T=$ ..... [4]

(b) Show that your expression for $A-B$ in **Question 5(b)** does not give the correct value for this tree.

[2]

(c) Show that your expression for $A+B-T$ in **Question 5(b)** gives the correct value for this tree.

[1]

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(d) There are different trees with odd numbers of branches where $A + B - T = 18$.

Find the number of branches and the number of leaves on each branch for all of these trees.

..... [4]

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