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Cambridge Assessment International Education

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 Investigation and Modelling (Extended) **October/November 2024**

1 hour 40 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer both part **A** (Questions 1 to 4) and part **B** (Questions 5 to 10).
- 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 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages.

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[Turn over

Answer **both** parts **A** and **B**.

A INVESTIGATION (QUESTIONS 1 TO 4)

REVERSE DIFFERENCES (30 marks)

You are advised to spend no more than 50 minutes on this part.

This investigation looks at what happens when you reverse the digits of a number and then find the difference between the new number and the original number. This is called the *reverse difference*.

STEP 1 Write down a 2-digit number.
STEP 2 Reverse the digits of the number.
STEP 3 Find the **positive** difference between the two numbers.

Example 1			Example 2	
STEP 1	Write a number	52	STEP 1	13
STEP 2	Reverse the digits	25	STEP 2	31
STEP 3	Find the difference	$52 - 25 = 27$	STEP 3	$31 - 13 = 18$

1 **(a)** Complete the three steps for each 2-digit number in the table.

STEP 1	12	13	14	15	16	17	18
STEP 2	21	31	41	51			
STEP 3		18			45		63

[2]

(b) Complete this table of 2-digit numbers and their reverse differences.
Use **part (a)** and any patterns you notice to help you.

Number	Reverse difference	Number	Reverse difference	Number	Reverse difference	Number	Reverse difference
10	9	20	18	30	27	40	36
11		21	9	31	18	41	27
12		22		32	9	42	
13	18	23	9	33		43	
14		24		34		44	
15		25	27	35		45	
16	45	26	36	36		46	
17		27	45	37	36	47	
18	63	28	54	38	45	48	
19		29	63	39	54	49	45

[3]

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(c) Complete the statement with the largest number possible.

The reverse difference is always a multiple of ..... [1]

(d) The table in **part (b)** is extended to the right.
These two columns are part of the extended table.

Number	Reverse difference
A	
	9

What is the value of the 2-digit number *A*?

..... [2]

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2 You can find reverse differences for 3-digit numbers using the same steps.

Example

STEP 1	Write a number	138
STEP 2	Reverse the digits	831
STEP 3	Find the difference	$831 - 138 = 693$

(a) The table continues to the right until 199.

Complete the **first** column of reverse differences.

Number	Reverse difference	Number	
100	99	110	
101	0	111	
102			
103	198		
104	297		
105	396		
106			
107			
108	693		
109	792		

[2]

(b) Explain why each column of reverse differences has the same sequence of reverse differences.

.....

..... [1]

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(c) Complete the statement with the largest number possible.

The reverse difference is always a multiple of ..... [1]

(d) A 3-digit number abc has first digit a, second digit b and third digit c.
In this part $a > c$.

So the number 601 has $a = 6$, $b = 0$ and $c = 1$.

(i) Anna says that a is the hundreds digit, b is the tens digit and c is the units digit.
She says the value of abc is $100a + 10b + c$.

Anna writes the value of the reverse number cba. $100c + 10b + a$

She writes the difference between the two numbers. $(100a + 10b + c) - (100c + 10b + a)$

Complete Anna's working and factorise the result.

..... [2]

(ii) A 3-digit number has $a = 8$ and a reverse difference of 594.

Find **three** possible 3-digit numbers.

..... [2]

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3 Use your result from **Question 2(d)(i)** to answer both parts of this question.

Anna uses 3-digit numbers to find reverse differences.

(a) The reverse difference for a 3-digit number is 99.
Comment on the values of each of the three digits.

.....

..... [3]

(b) The table in **Question 2(a)** is extended to 999.

Find all the possible reverse differences for 3-digit numbers.

..... [2]

4 **(a)** Find an expression for the reverse difference for the 5-digit number *abcde*, where $a > e$.

..... [3]

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(b) The 5-digit number $a158e$ has a reverse difference of 33 066 and $a > e$.

(i) Find the connection between a and e.

..... [4]

(ii) Find all the 5-digit numbers $a158e$ with a reverse difference of 33 066.

..... [2]

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B MODELLING (QUESTIONS 5 to 10)

NEWSPRINT (30 marks)

You are advised to spend no more than 50 minutes on this part.

This task looks at the amount of *newsprint* in a newspaper and the number of trees used to make the newspaper.

Newsprint is the amount of paper that makes a newspaper.
Newsprint is always rectangular.

5 A sheet of newsprint measures 560 mm by 430 mm.
Each square metre of newsprint has a mass of 42 g.

(a) Show that the mass of one sheet of newsprint is 0.0101 kilograms, correct to 3 significant figures.

[3]

(b) A newspaper uses 20 sheets of newsprint.

Work out the mass of this newspaper in kilograms.

..... [1]

(c) Give a practical reason why your answer to **part (b)** is slightly less than the actual mass of the newspaper.
You may assume all measurements are accurate.

..... [1]

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(d) *Circulation* is the number of copies of a newspaper made in a day.
The newspaper has an average circulation of 950 000.

(i) Use your answer to **Question 5(b)** to work out the total mass of these newspapers.
Give your answer in tonnes.

..... [2]

(ii) The newspaper is made every day from Monday to Friday each week.

Work out the mass of newsprint, in tonnes, used in a year of 52 weeks.
Give your answer correct to the nearest thousand.

..... [2]

6 There are different sizes of newsprint.

A sheet of newsprint measures L mm by W mm.
The mass of one square metre of newsprint is d grams.
Each newspaper has S sheets of newsprint.
The circulation is C newspapers per day, Monday to Friday.

(a) Write a model for the mass of newsprint, M tonnes, that is used to make the newspaper in a year.

..... [2]

(b) The company that makes the newspaper now uses newsprint with a mass of 43 g per square metre.
All other figures remain the same as in **Question 5**.

Calculate the mass, in tonnes, of newsprint that the company now uses in a year.

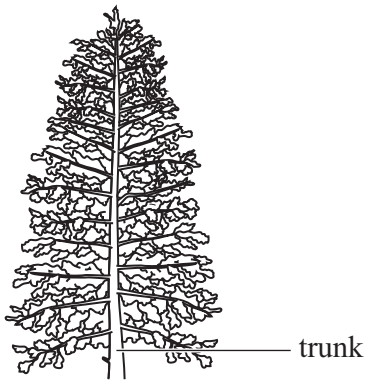
..... [2]

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7 Newsprint is made from the wood of fast-growing fir trees.

There are four stages to make newsprint:

- Cut down the tree.
- Saw off the branches to leave the trunk.
- Grind down the trunk to make wood pulp.
- Turn the wood pulp into newsprint.



(a) Complete this statement.

The best mathematical shape to model the trunk of a fir tree is a cone because .....

..... [1]

(b) Trees are cut down when the diameter at the base is 21 cm.
The average height of the trunk is 14 metres.
The mass of one cubic metre of wood is 530 kg.

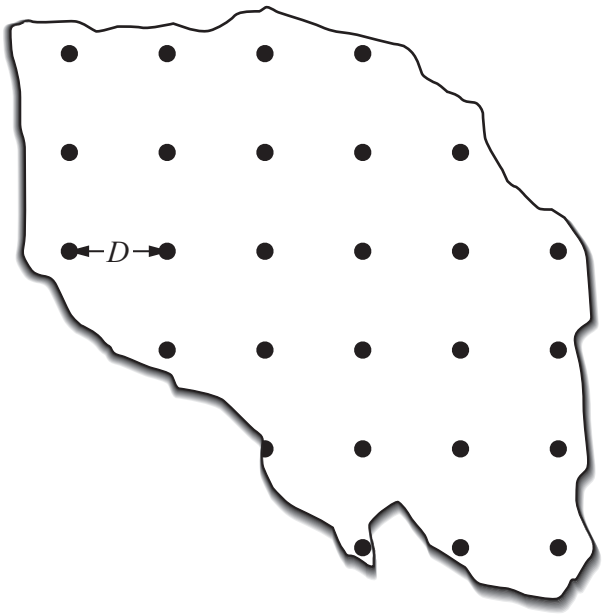
Volume, V, of cone of radius r, height h.	$V = \frac{1}{3}\pi r^2 h$

Show that it takes approximately 12 trees to make one tonne of wood pulp.

[5]

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8 Trees are usually planted in grids to make them easier to look after.
This is part of a plan showing some planted trees.
Each dot is a tree.



The distance between a tree and its nearest neighbour is D metres.

Find a model, in terms of D, for the number of trees, N, in a 100 m by 100 m square.

..... [3]

Questions 9(a), 9(b) and 10 are printed on the next page.

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9 **(a)** Sketch your model from **Question 8**, for values of D between 0 and 10.



[2]

(b) An internet site recommends a distance of 4.2 m between trees.
A company plants a grid of 620 trees in a 100 m by 100 m square.

Use your graph to find if the company has used the recommended distance between trees.

..... [2]

10 When wood pulp is turned into newsprint the mass remains the same.
12 trees make 1 tonne of wood pulp.
There are 620 trees in each 100 m by 100 m square.

The company needs the mass of newsprint in **Question 6(b)**.

Work out the area of trees that the company needs.

..... [4]

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