Cambridge Assessment International Education

Cambridge IGCSE®

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CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/06**

Paper 6 Investigation and Modelling (Extended) **For examination from 2020**

SPECIMEN PAPER **1 hour 40 minutes**

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer both part **A** (Questions 1 to 7) and part **B** (Questions 8 to 12).
- 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 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. Blank pages are indicated.

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

A INVESTIGATION (QUESTIONS 1 TO 7)

SUMS OF CONSECUTIVE INTEGERS (30 marks)

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

This investigation looks at the results when the terms of a sequence of consecutive positive integers are added together.

1 The mean of 6 positive integers is 4.5 .

Calculate the sum of the 6 integers.

..... [2]

2 **(a)** Complete the table for sequences of two or more consecutive positive integers.

Sequence	Number of terms	Mean	Sum of all the terms
5, 6, 7, 8, 9, 10	6		
10, 11, 12, ... , 40	31	25	
2, 3, 4, 5, 6, 7, 8			35
	4		42
			49

[9]

(b) Describe how to calculate the mean using only the first term and the last term of a sequence of consecutive integers.

.....

..... [2]

3 $k, k + 1, k + 2, \ldots\ldots, k + 99$ is a sequence of consecutive integers.

(a) Write down the number of terms in this sequence.

..... [1]

(b) Use the first term and the last term to find an expression for the mean in terms of k.

..... [1]

(c) Use your answers to **part (a)** and **part (b)** to write down an expression for the sum of all the terms of the sequence.

..... [1]

4 Use the method of **question 3** to show that the sum of the integers $k, k + 1, k + 2, \ldots\ldots, k + (n - 1)$ is

$$n \times \frac{2k + n - 1}{2}.$$

[2]

5 **(a)** If n is odd, explain why the value of the expression $\frac{2k+n-1}{2}$ must be an integer.

.....

.....

..... [2]

(b) If n is even, explain why the value of the expression $\frac{2k+n-1}{2}$ must end in .5 .

.....

.....

..... [2]

6 The sum of a sequence of consecutive positive integers is 84.

(a) Using **question 4** and **question 5**, find all the possible values of n and the corresponding values for the mean.

[4]

(b) Write down all the possible sequences of consecutive positive integers whose sum is 84.

[2]

7 Find a number, bigger than 20, which cannot be written as the sum of consecutive positive integers.

..... [2]

B MODELLING (QUESTIONS 8 TO 12)

TRAFFIC FLOW (30 marks)

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

This task looks at maximising the number of cars that can safely pass a point on a road in an hour.

8 It takes one second to react to an emergency when driving.

(a) The speed of a car is 54 km/h.

Calculate the number of metres that it travels in 1 second.

..... [2]

(b) The speed of a car is x km/h.

Show that the number of metres, a, travelled in 1 second is approximately $0.278x$.

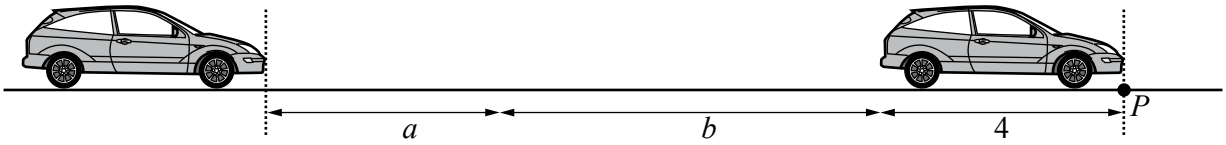
[1]

9 The speed of a car is x km/h.
When the driver brakes, the number of metres, b, that the car travels before stopping is kx^2.
When $x = 50$, $b = 20$.

Find an expression for b in terms of x.

..... [3]

10 For safety, the distance between cars travelling at x km/h must be $a + b$.



The average length of a car is 4 metres.
So the number of metres between corresponding points on a road is $a + b + 4$.

(a) At a speed of x km/h, how many metres does a car travel in one hour?

..... [1]

(b) Explain why a model for the number of cars, N, safely passing point P in one hour is

$$N = \frac{1000x}{0.278x + kx^2 + 4}$$

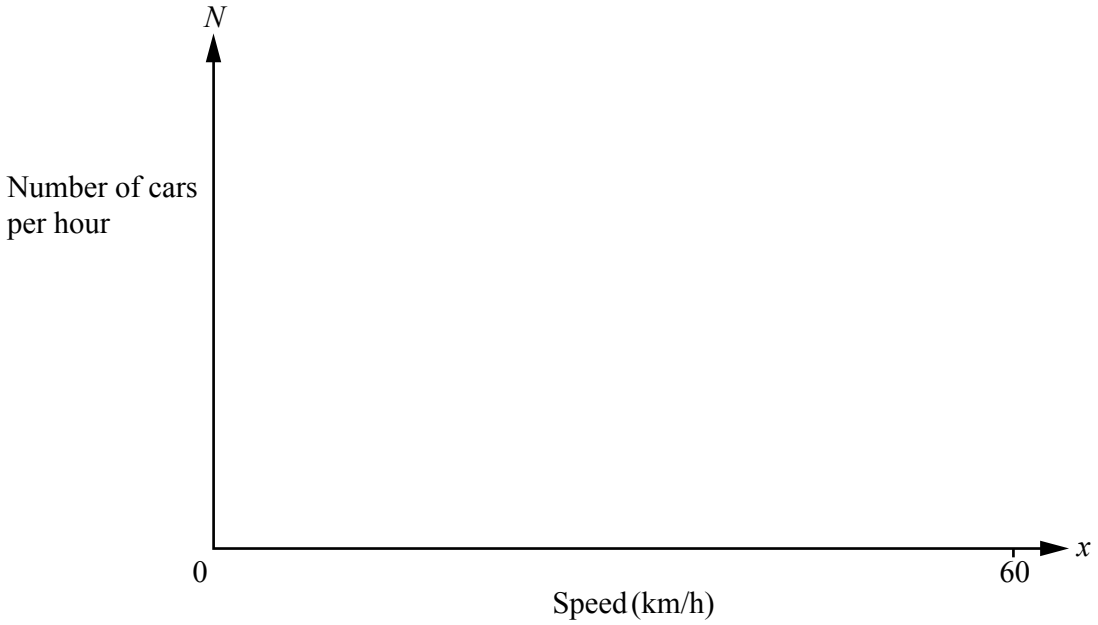
where x km/h is the speed of the cars and k has the value you found in **question 9**.

.....

.....

..... [1]

(c) Using your value for k from **question 9**, sketch the graph of N for $0 \leqslant x \leqslant 60$.



[4]

(d) Find the maximum possible number of cars which can safely pass point P in one hour.

..... [1]

(e) **(i)** Find, correct to one decimal place, the speed that gives this maximum.

..... [2]

(ii) Make a statement about the size of this answer.

..... [1]

(f) When you increase the average length of a car, what is the effect on

(i) the maximum number of cars that can pass point P in one hour,

..... [1]

(ii) the speed at which this maximum is possible?

..... [1]

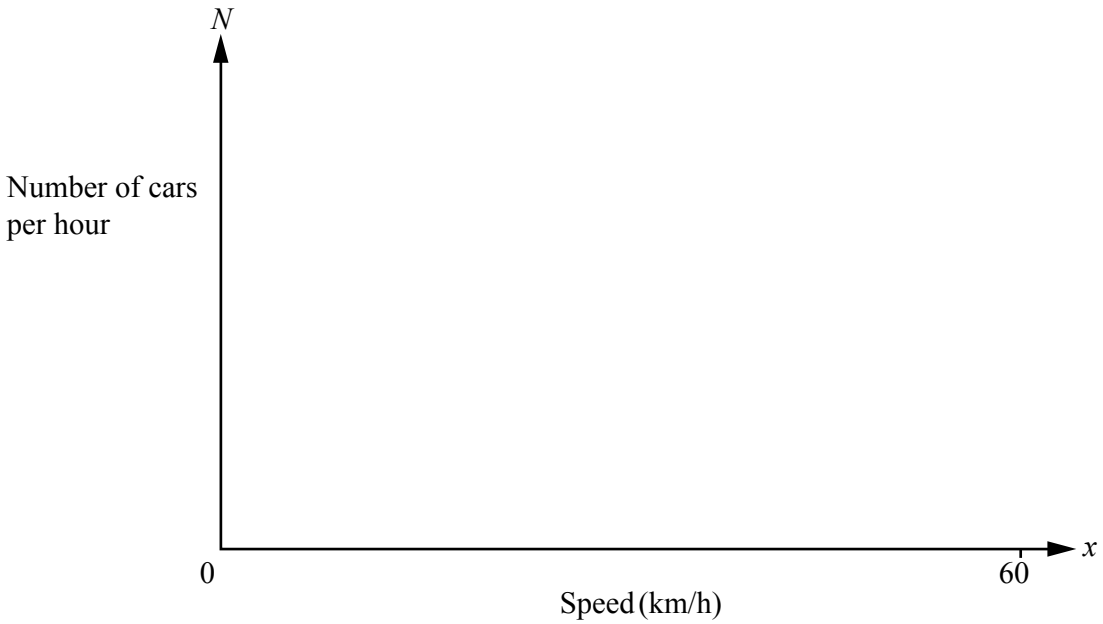
11 A revised model for traffic flow does not include the braking distance, b.
This is because the car in front also travels the same braking distance. So the revised model uses $k = 0$.

The model also allows 2 seconds, instead of 1 second, for the driver to react to the car in front stopping quickly.
Assume the average length of a car is 4 metres.

(a) Revise the model in **question 10(b)**.

$N =$ ..... [2]

(b) Sketch the graph of N for $0 \leqslant x \leqslant 60$ for your revised model.



[3]

(c) Can 1800 cars safely pass point P in one hour?
Use algebra to explain your answer.

[4]

12 There is one speed, greater than 0 km/h, at which both models give the same number of cars per hour. Find this speed.

..... [3]

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