Cambridge Assessment International Education

Cambridge IGCSE®

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

0123456789

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 8

[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 $0.278x$.

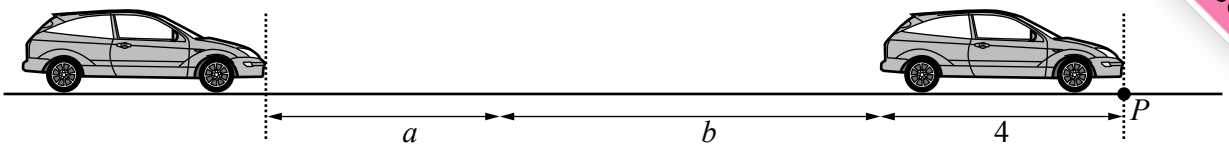
[1]

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

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

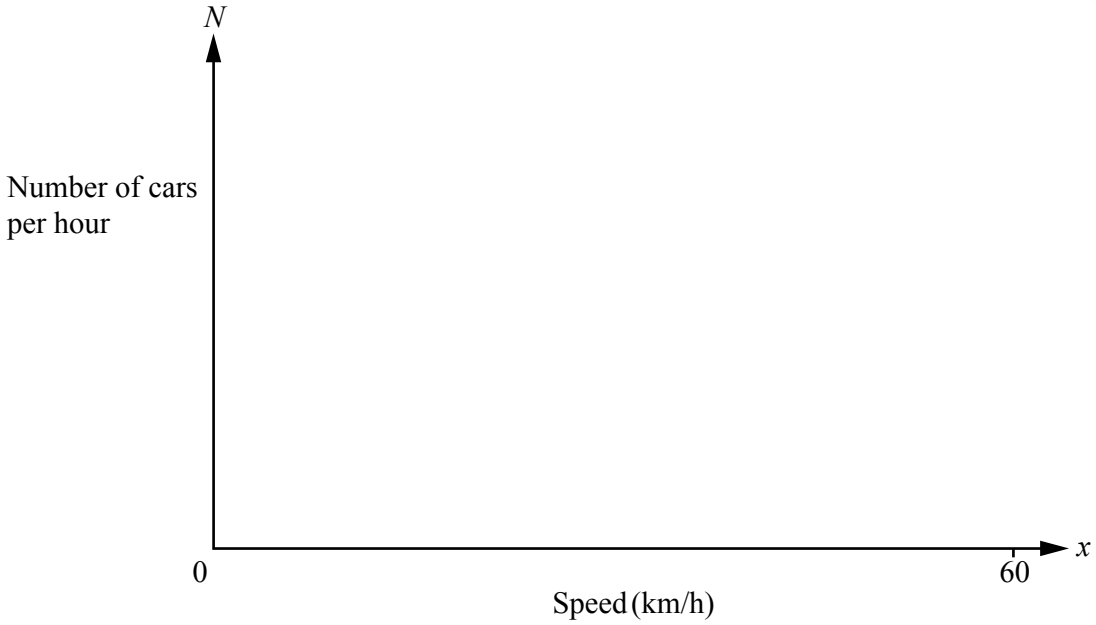
where x km/h is the speed of the cars and k has the value you found in **question 9**.

.....

.....

..... [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]

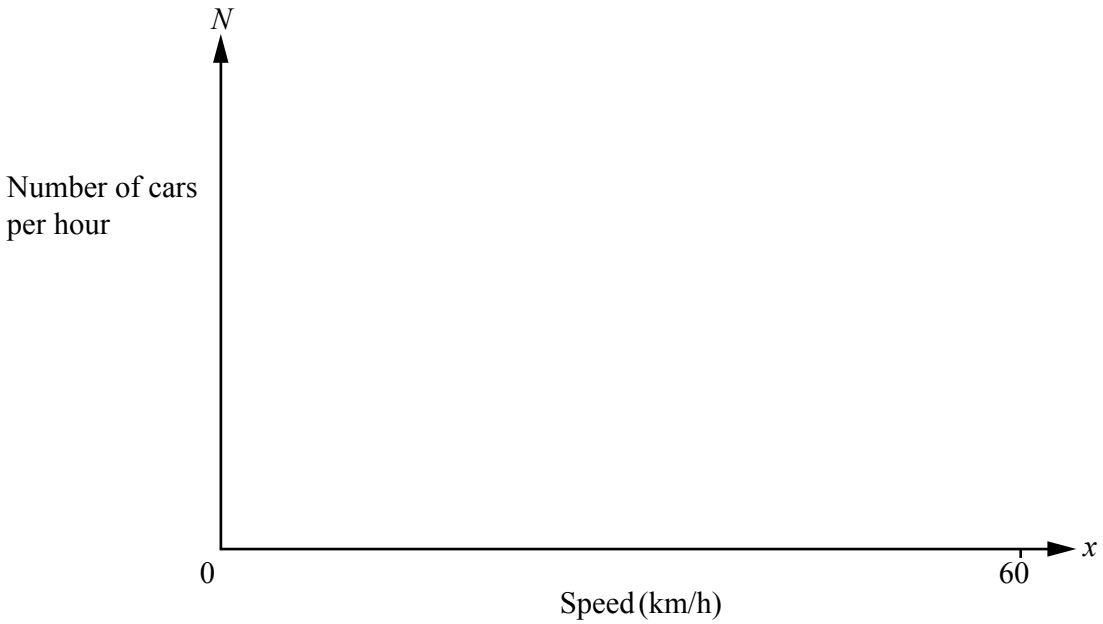
11 A revised model for traffic flow does not include the braking distance, b.
This is because the car in front also travels the same braking distance. So the revised model us

The model also allows 2 seconds, instead of 1 second, for the driver to react to the car in front stopp
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
Find this speed.

..... [3]

BLANK PAGE