Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

CAMBRIDGE INTERNATIONAL MATHEMATICS **0607/62**

Paper 6 (Extended) **May/June 2016**

1 hour 30 minutes

Candidates answer on the Question Paper.

Additional Materials: Graphics calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.
You may use an HB pencil for any diagrams or graphs.
DO **NOT** WRITE IN ANY BARCODES.

Answer both parts **A** and **B**.
You must show all relevant working to gain full marks for correct methods, including sketches.
In this paper you will also be assessed on your ability to provide full reasons and communicate your mathematics clearly and precisely.
At the end of the examination, fasten all your work securely together.
The total number of marks for this paper is 40.

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

A INVESTIGATION SUMS OF CONSECUTIVE INTEGERS (20 marks)

You are advised to spend no more than 45 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.

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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

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

.....

.....

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

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

.....

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

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(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.

.....

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

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

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

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.....

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

.....

.....

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.

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

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

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B MODELLING TRAFFIC FLOW (20 marks)

You are advised to spend no more than 45 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.

1 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.

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

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

2 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.

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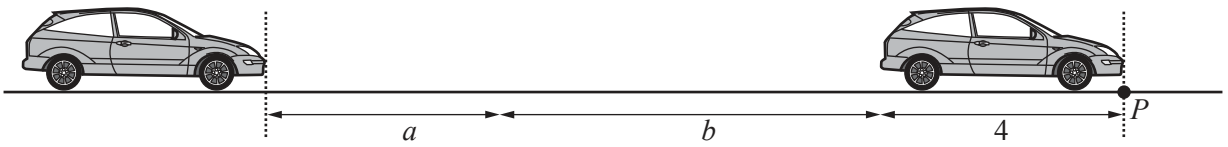
3 For safety, the distance between cars travelling at x km/h must be $a + b$.



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?

.....

(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 2**.

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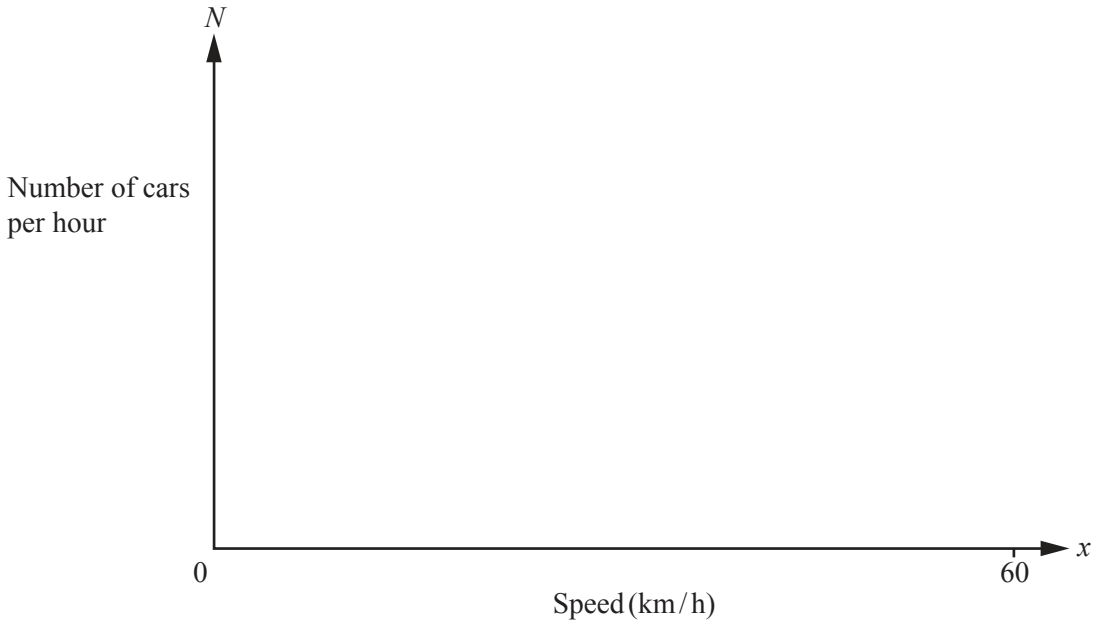
(c) Using your value for k from **question 2**, sketch the graph of N for $0 \leqslant x \leqslant 60$.



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

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

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(ii) Comment on the size of this answer.

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(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,

.....

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

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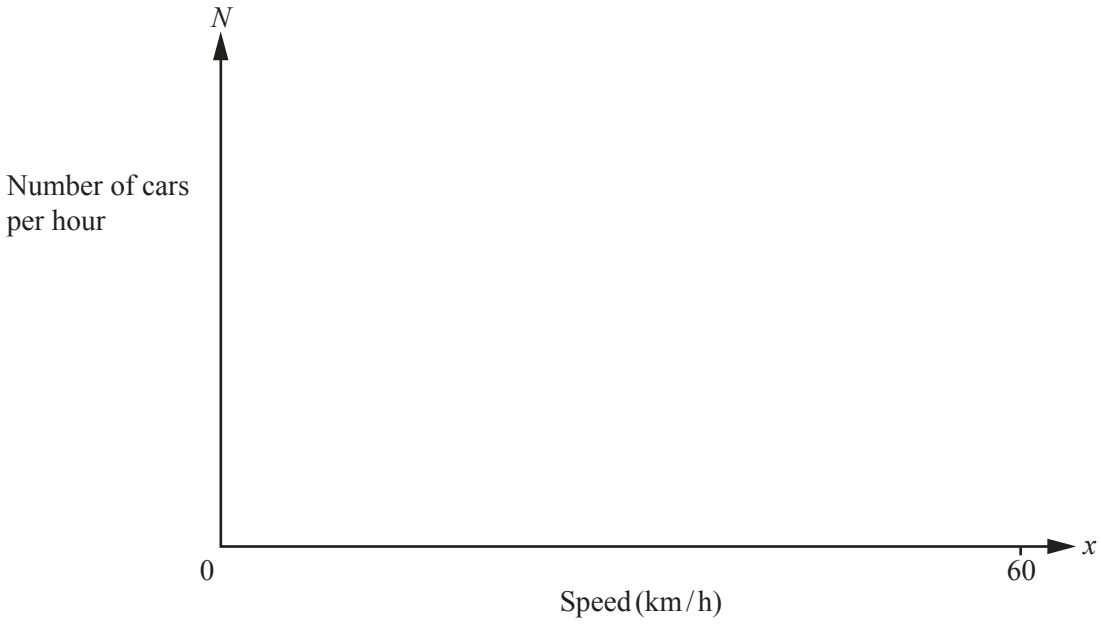
4 A revised model for traffic flow does not include the braking distance, b.
This is because the car in front also travels the same braking distance. So the revised model uses $k = 0$.

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 3(b)**.

$N =$ .....

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



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

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

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