OCR

Wednesday 18 June 2014 – Afternoon

A2 GCE MATHEMATICS (MEI)

4754/01B Applications of Advanced Mathematics (C4) Paper B: Comprehension

QUESTION PAPER

Duration: Up to 1 hour
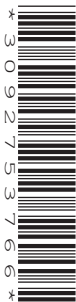
Candidate forename		Candidate surname	

Centre number					Candidate number				

INSTRUCTIONS TO CANDIDATES

* The Insert will be found inside this document.
* Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
* Use black ink. HB pencil may be used for graphs and diagrams only.
* Answer **all** the questions.
* Read each question carefully. Make sure you know what you have to do before starting your answer.
* Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
* Do **not** write in the bar codes.
* The insert contains the text for use with the questions.
* You are permitted to use a scientific or graphical calculator in this paper.
* Final answers should be given to a degree of accuracy appropriate to the context.

INFORMATION FOR CANDIDATES

* The number of marks is given in brackets **[ ]** at the end of each question or part question.
* You may find it helpful to make notes and do some calculations as you read the passage.
* You are **not** required to hand in these notes with your question paper.
* You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.
* The total number of marks for this paper is **18**.
* This document consists of **8** pages. Any blank pages are indicated.

Turn over

1 The example illustrated in Table 1 in the article referred to the members of a racing club.

This question is about a similar club and the equivalent table is given below. The club has 150 members and each of them belongs to one of the groups P, Q, R or S.

For each group the probability of an accident and the average cost is given in the table below.

Group	P	Q	R	S
Proportion of people	10%	20%	40%	30%
Probability of an accident	0.1	0.15	0.05	0.2
Average cost per accident	£5000	£2000	£1000	£500

(i) Complete the table below. **[3]**

(ii) Calculate the premium if each member of the club pays the same amount and the total of the premiums is equal to the total average cost of accidents per year. **[2]**

(iii) The club management decides that the total of the premiums should be 50% more than the total average cost of accidents per year, and that each group should pay an amount proportional to its contribution to the total average cost.

Calculate the premium for a member of group S. **[2]**

1 (i)	Group	P	Q	R	S
	Number of people	15			
	Average number of accidents in a year		4.5		
	Average cost of accidents per year	£7500	£9000		

1 (ii)

1 (iii)

PLEASE DO NOT WRITE IN THIS SPACE

2 In lines 97 to 100, the article says

"Most insurance companies have a maximum no-claims discount of 65%. One way of interpreting this practice is that the figure arrived at by applying the maximum no-claims discount is actually the basic cost of the insurance, and that drivers who have not earned the so-called discount are actually paying a surcharge."

A new driver without any no-claims discount pays k times "the basic cost of the insurance".

Find the value of k. **[2]**

2	

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3 On June 1st 2007 Louise paid her first car insurance premium. She did not have any no-claims discount.

She retained her policy with the same insurance company. She had no accidents and so did not make any claim on her insurance. Her no-claims discount followed the pattern in Table 7. Apart from her no-claims discount, her basic premium remained the same.

On May 31st 2014, Louise calculated that so far her no-claims discount had saved her £3875.

What premium did Louise pay on June 1st 2007? **[3]**

Turn over

4 In lines 68 to 69, the article says

"Clearly the role of inexperience goes down with age. A possible mathematical model is that it decays exponentially."

This question investigates this in the case of male drivers. The relevant part of Table 4 is reproduced here.

Age (in years)	18.0	20.5	23.0	27.5	45.0
Male %	36	15	6	2.5	1

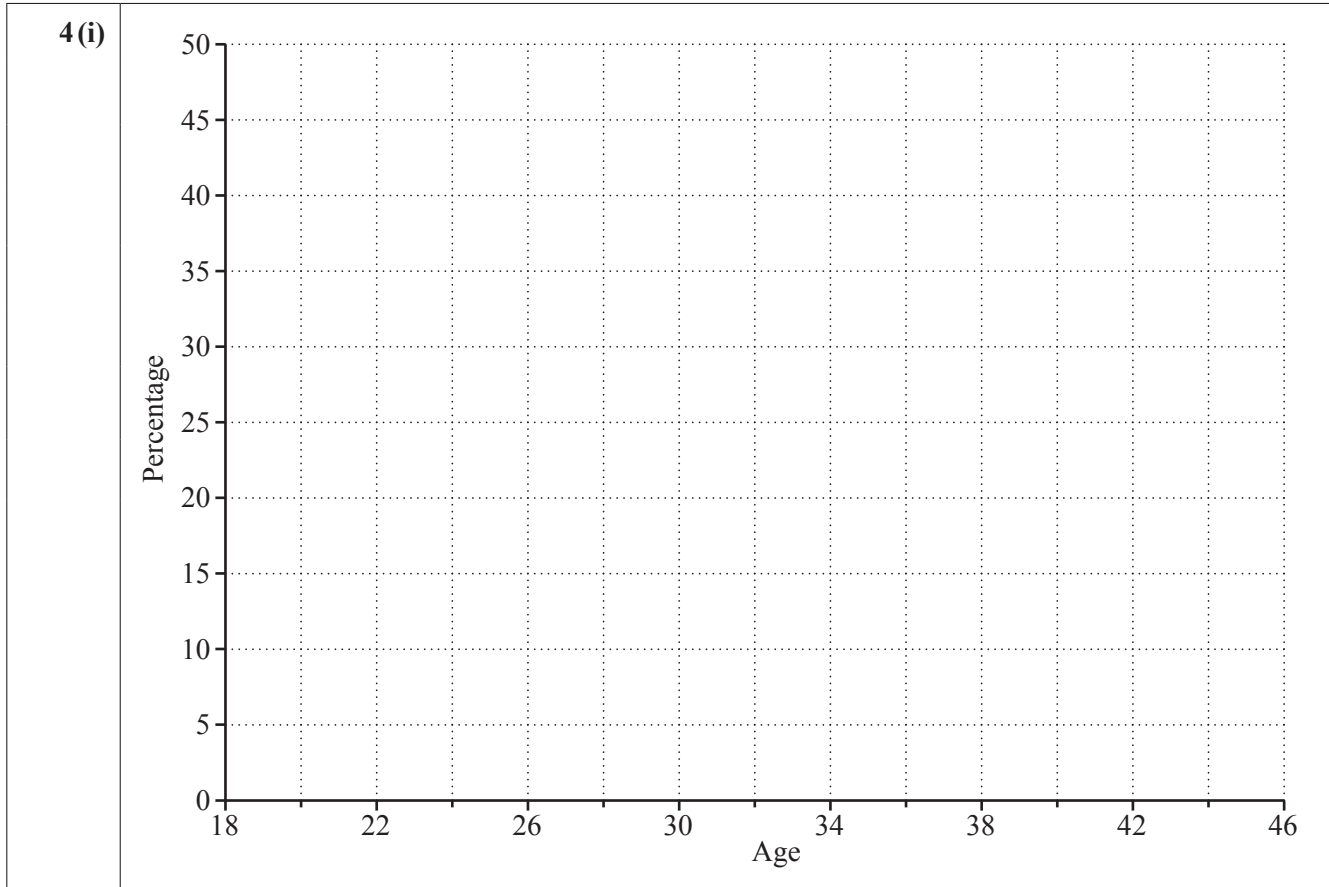A model is proposed in which

$$y = a + b\mathrm{e}^{-k(x-17)},$$

where

- x is the age of the driver,
- y is the percentage of accidents in which inexperience played a role,
- a, b and k are constants to be determined.

(i) Draw a sketch graph of y against x for values of x between 18 and 45. **[1]**

(ii) Explain why the graph justifies putting $a = 1$. **[1]**

(iii) Taking $a = 1$ and using the first two data points, it is estimated that $b = 50.5$ and $k = 0.3665$. Investigate whether these values are consistent with the point (23, 6). **[2]**

4(i)

4 (ii)

4 (iii)

5 In this question the number of points on a driver's licence for motoring offences is denoted by n.

When calculating a driver's premium, a particular insurance company takes account of such offences by multiplying the premium by an amount M, where

$$M = 1 \quad \text{if } n \leqslant 3,$$

$$M = 2^{\frac{n}{6}} \quad \text{if } 3 < n < 12.$$

A driver who is insured with this company is paying a premium of £520. Initially he has no points on his licence.

He is convicted of a speeding offence and so receives 3 points on his licence. He is then convicted for dangerous driving and receives a further 6 points on his licence.

Calculate his premium

(*A*)   after his first offence,

(*B*)   after his second offence.   **[2]**

5 (*A*)	

5 (*B*)	