OCR
Oxford Cambridge and RSA

Level 3 Certificate
Quantitative Reasoning (MEI)
H866/02 Critical Maths

Wednesday 24 May 2017 – Morning
Time allowed: 2 hours

You must have:
- the Insert (inserted)

You may use:
- a scientific or graphical calculator

First name										
Last name										
Centre number						Candidate number				

INSTRUCTIONS
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided. If additional space is required, use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.
- 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.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **16** pages.
- Final answers should be given to a degree of accuracy appropriate to the context.

Answer **all** the questions.

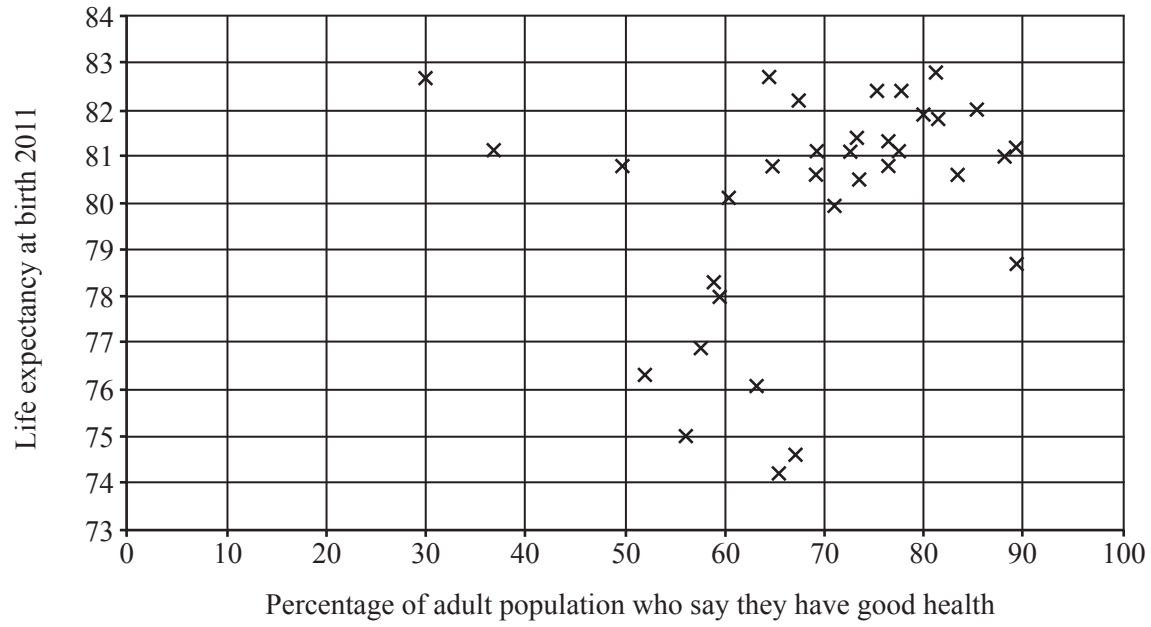
1 This question refers to the article "Life expectancy at birth". This was given out as pre-release material and is available as an insert.

In the scatter diagram below, life expectancy at birth is plotted against the percentage of the adult population who say they have good health. Each point represents an OECD country from the list in the pre-release information.

(i) (*A*) Circle the point on the scatter diagram which represents Mexico. **[1]**

(*B*) State the approximate percentage of the adult population in Mexico who say they have good health. **[1]**

1(i) (*A*)



(*B*)

(ii) Use the scatter diagram to decide which of the statements given below must be true. Write T in the box for the true statements and F for the false statements. **[3]**

1(ii)

☐ There is strong positive correlation in the scatter diagram with no outliers.

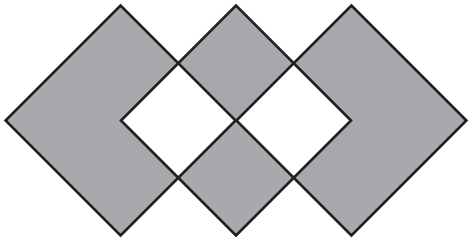
☐ Countries with over 70% of the adult population saying they have good health tend to have a high life expectancy.

☐ Countries with a low percentage of the adult population saying they have good health tend to have a low life expectancy.

☐ The majority of the adult population in most OECD countries say they have good health.

☐ The diagram shows that having a high percentage of the adult population saying they have good health causes high life expectancy.

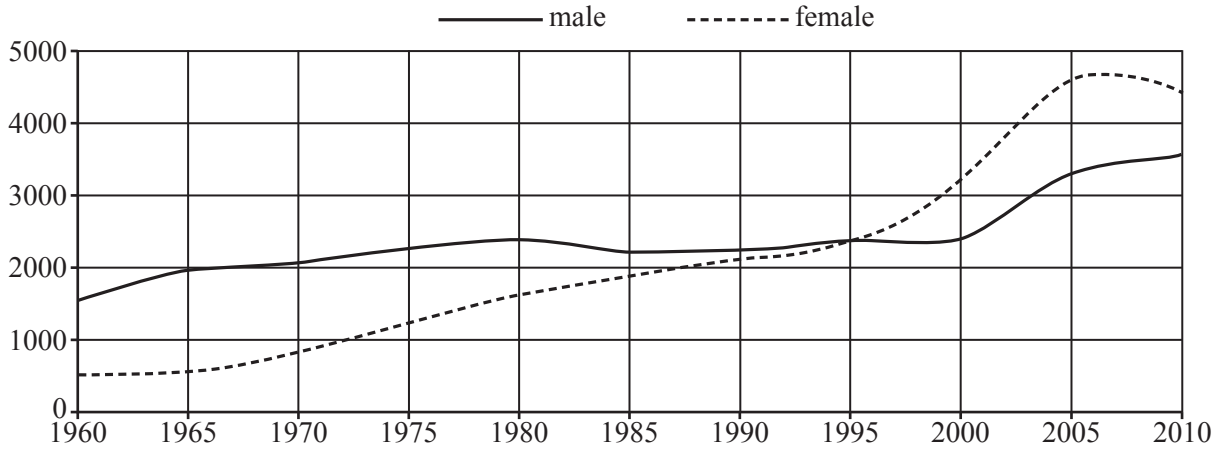
2 The design below is made from three overlapping squares. The squares are all the same size and intersect at midpoints of their sides. The design has two lines of symmetry.



The grey shaded area is bigger than the white area. Work out how many times bigger. Show your reasoning.
[3]

2	

3 The graph below shows numbers of people accepted onto medical degrees in the UK. The numbers in the table below the graph show the number of males accepted for every female in that year. The graph is correct but some of the numbers in the table are wrong.



males per female	3.11	3.58	2.54	1.84	1.48	1.19	1.06	1.01	1.33	1.39	1.24

(i) Work without a calculator in part (i).
In 1970, 2066 males and 812 females were accepted. Show that 2.54 males for every female, as shown in the table, is about right. **[3]**

3(i)	

(ii) Three of the numbers in the table are wrong. Which are they? **[2]**

3(ii)	

(iii) In 1960, 1528 males and 492 females were accepted. What percentage of those accepted onto medical degrees in 1960 were male? **[2]**

3(iii)	

(iv) A newspaper reports that it costs a quarter of a million pounds to train each medical student. Estimate the total cost of training those accepted onto medical degrees in 2010. Show your working and give your answer to a sensible degree of accuracy. **[3]**

3(iv)	

4 This question refers to the article "Changes to GCSE grades". This was given out as pre-release material and is available as an insert.

The percentages of candidates getting each GCSE Mathematics grade in June 2015 are shown in the table below.

Grade	A*	A	B	C	D	E	F	G
Percentage of candidates	6	10	17	30	18	8	4	3

(i) Estimate the percentages of candidates for GCSE Mathematics in June 2017 getting

(*A*) grade 7 and above, **[2]**

(*B*) grade 4 and above. **[2]**

4(i) (*A*)

(*B*)

(ii) Estimate the percentages of candidates for GCSE Mathematics in June 2017 getting each grade shown in the table below. Show your working. **[6]**

4(ii)

Grade	6	5	4
Percentage of candidates			

(iii) Eventually all GCSEs will be graded on the 9 to 1 scale.

A college wants to be able to compare students who have taken different numbers of subjects in the new GCSE. There are several ways this could be done. Describe **one** possible method.

Explain your method clearly and use it to put the three students in the table in order of overall performance.

Student	**GCSE grades**								
Hilary	6	4	8	3	9	5	4	8	4
Jay	2	3	7	7	4	4	6		
Nadia	8	8	6	7	3	5			

[5]

4(iii)

(iv) No method of comparing students is ideal. State one disadvantage of your method. **[1]**

4(iv)

5 **(i)** Estimate the length of a typical car in metres. **[1]**

(ii) A newspaper headline is shown below.

> Snow causes 10 mile long traffic jam

A mile is about 1.6 km. Estimate the number of cars in a 10 mile long traffic jam with two lanes of traffic. Show your reasoning. **[4]**

5(i)	
5(ii)	

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PLEASE DO NOT WRITE ON THIS PAGE

6 0.5% of online purchases using credit cards are fraudulent. This means that someone who is not the owner of the credit card is using it illegally.

A bank develops a fraud test for online use of credit cards. The test is not completely accurate.
90% of fraudulent purchases will be identified as fraud. However, 2% of legal purchases will also be identified as fraud.

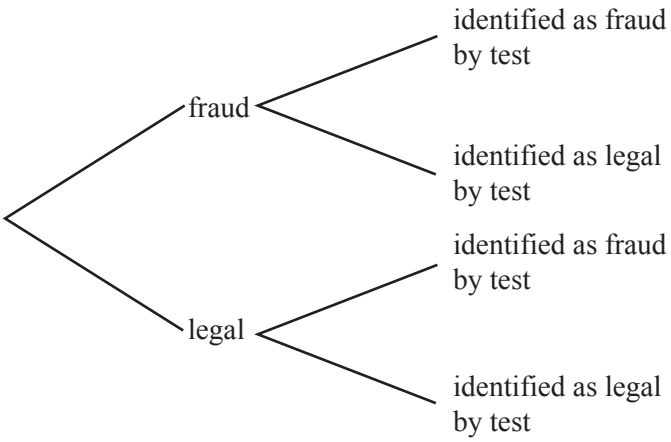
The bank uses the test for all online purchases using credit cards.

(i) (*A*) Complete the tree diagram below.
(*B*) Find the percentage of online purchases that will be identified as fraud. **[5]**

(ii) Show that 81.6% of purchases that are identified as fraud by the test are actually legal purchases. **[2]**

(iii) What should the bank do if the test identifies a purchase as fraudulent? **[1]**

6(i) (*A*)



(*B*)

6(ii)	
6(iii)	

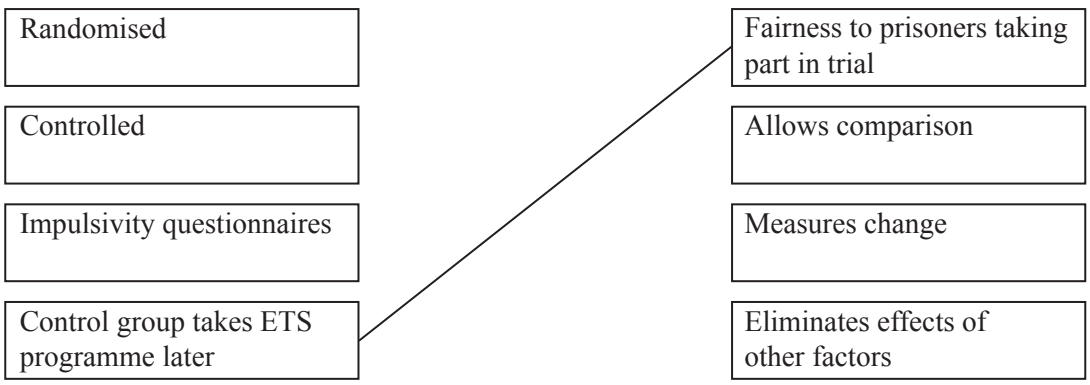
7 This question refers to the article "Educating prisoners". This was given out as pre-release material and is available as an insert.

Enhanced Thinking Skills (ETS) is an education programme used with prisoners. It aims to reduce the risk of re-offending when they have left prison. In 2005 to 2006 the ETS programme was evaluated using a randomised controlled trial.

- 408 prisoners took part in the trial. Each prisoner was allocated either to the intervention group or the control group.
- The intervention group took part in the ETS programme.
- Both groups answered impulsivity questionnaires at the start of the trial and when the intervention group had completed the ETS programme.
- The control group took the ETS programme after the trial was over.

(i) Draw lines to match each feature of the study to the best reason for using that feature. One line has been drawn for you. **[3]**

7(i)



(ii) The person analysing the questionnaires did not know which group they were from. Explain why this was important. **[1]**

7(ii)

Another evaluation of ETS compared a group of prisoners who had completed ETS with a matched group of prisoners who had not. The results for the two groups for the first year after leaving prison are shown in the table below.

	Re-conviction percentage (one-year)	**Re-offences per 100 released prisoners (one-year)**	**Severe offences re-conviction percentage (one-year)**
Treatment group	27.2%	60.7	0.8%
Matched control group	33.5%	120.8	0.9%
Treatment effect	–6.2%		–0.1%

(iii) (*A*) The "treatment effect" is the value for the treatment group minus the corresponding value for the matched control group. Work out the "treatment effect" for re-offences per 100 released prisoners. **[1]**

(*B*) How do the data show that the treatment group seemed to re-offend less than the control group? **[1]**

(*C*) Some released prisoners commit more than one crime in the first year after leaving prison. Explain how the numbers in the table show this. **[1]**

7(iii) (*A*)	
(*B*)	
(*C*)	

(iv) A large number of randomised controlled trials will be conducted in prisons across the country. In each trial, there will be a **total** of 400 people. Each of these people will be put into **either** an intervention group or a control group at random, with equal probability of being put into each group.

(*A*) What is the mean number of people in the intervention group? **[1]**

(*B*) What is the standard deviation of the number of people in the intervention group? **[2]**

7(iv) (*A*)	
(*B*)	

(v) If 239 of the 400 participants were in the intervention group, explain whether this provides evidence that the process used for putting participants into two groups did not give each person an equal chance of being in each group. **[3]**

7(v)	

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).