Oxford Cambridge and RSA

Level 3 Certificate
Quantitative Reasoning (MEI)

H866/02 Critical Maths

Wednesday 23 May 2018 – 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.

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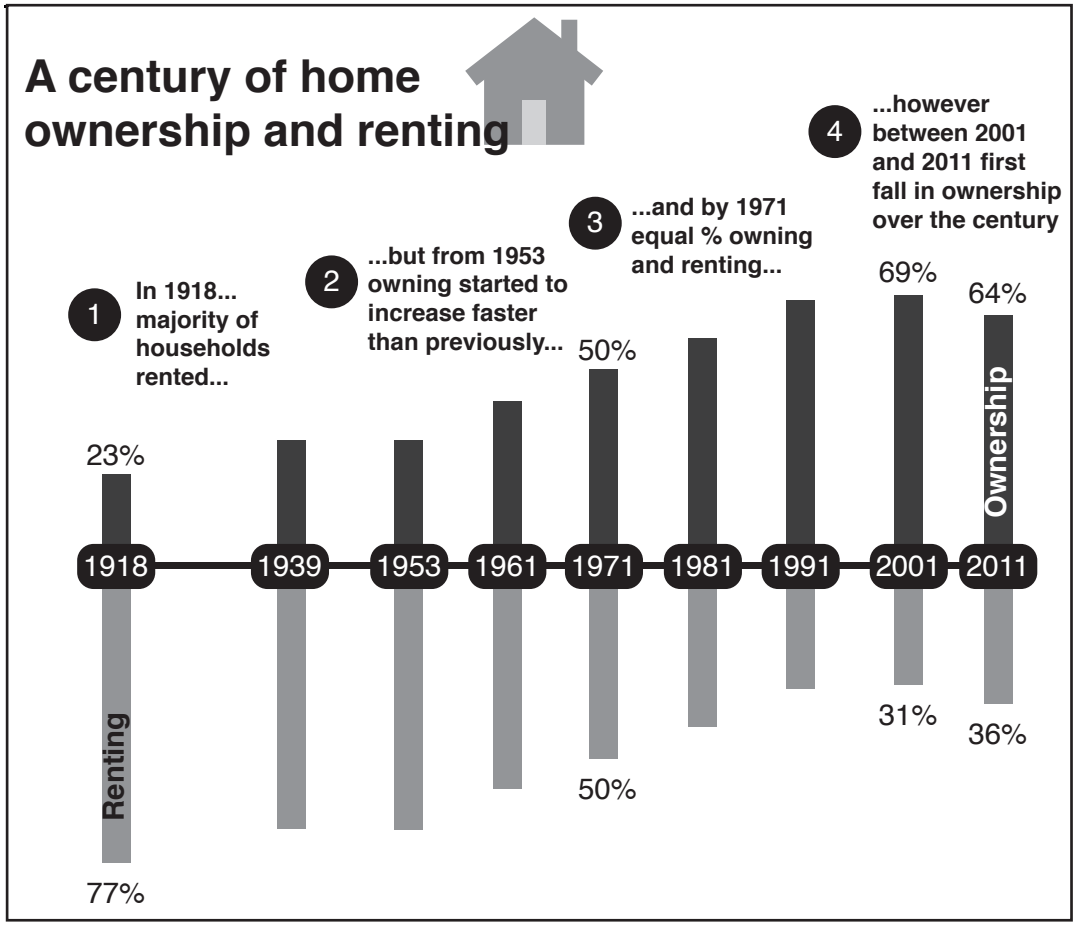
Answer **all** the questions.

1 The chart below shows the changes in home ownership and renting for households in England and Wales.



(i) (*A*) Estimate the percentage for "renting" in 1991.

(*B*) Find the percentage for "ownership" in 1991. **[2]**

(ii) Write down the percentage point decrease in "ownership" from 2001 to 2011. **[1]**

1(i) (*A*)	
(*B*)	
1(ii)	

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(iii) There were 21.7 million households in England and Wales in 2001 and 23.4 million in 2011. Were there fewer households in the "ownership" category in 2011 than there were in 2001? You must explain your reasoning. **[4]**

1(iii)	

(iv) The total number of households has changed over time but the sum of the lengths of the "ownership" and "renting" bars for each year is the same. Explain why. **[1]**

1(iv)	

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2 A competition has five judges. Each judge gives each contestant a whole number score between 0 and 10 (inclusive). The five scores are combined to decide who has won the competition. Two different rules are proposed for combining the scores of each contestant.

Average all rule	***Eliminate extremes rule***
• Find the mean of all five scores.	• Cross out the highest and lowest score. • If there is more than one highest score, just one of them is crossed out. Similarly for lowest scores. • Find the mean of the remaining three scores.

(i) A contestant receives the following five scores from the judges.

7	4	4	2	5

(*A*) Find the combined score using the *average all rule*.

(*B*) Find the combined score using the *eliminate extremes rule*. **[3]**

2(i) (*A*)	
(*B*)	

(ii) Find a possible set of five scores where the *eliminate extremes rule* gives a higher combined score than the *average all rule*. Give evidence that your answer is correct. **[3]**

(iii) Find a possible set of five scores where the *eliminate extremes rule* gives the same combined score as the *average all rule*. Give evidence that your answer is correct. **[2]**

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2(ii)	
2(iii)	

(iv) (*A*) Give one advantage of the *average all rule*.

(*B*) Give one advantage of the *eliminate extremes rule*. **[2]**

2(iv) (*A*)	
(*B*)	

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3 An advert for a product to help people stop smoking contains the following words.

> People who used it were 180% more likely to stop smoking.

(i) For every 200 people who try to stop smoking without the product, on average 10 people succeed.

Assume the claim in the advert is true. Work out how many on average would succeed out of 200 people using the product. **[2]**

3(i)

Number stopping smoking without the product	Number stopping smoking with the product
10	

(ii) Would it be correct to say that people who try to stop smoking without using the product are 180% less likely to stop? Explain your reasoning. **[1]**

3(ii)

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Stoptober is a national campaign to encourage smokers to stop smoking for 28 days in October. The advertising for Stoptober 2015 included the following words.

> Stop smoking for 28 days and you're 5 times more likely to stop for good.

(iii) In general, 5% of attempts to stop smoking are successful. Fill in the missing percentage in the table below. **[1]**

3(iii)

Percentage stopping smoking for good out of all who start	Percentage stopping smoking for good after stopping for 28 days
5%	

(iv) A quarter of a million people started the 28 days of Stoptober 2014. About half of them completed the full 28 days; estimate how many of these people stopped smoking for good. **[3]**

3(iv)

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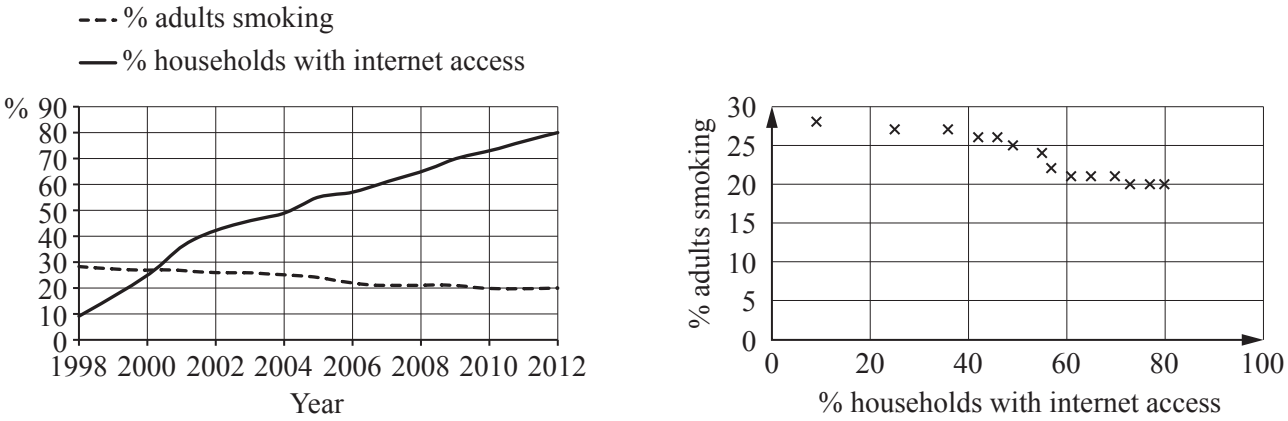
The graphs show the percentage of adults who smoke in Great Britain and the percentage of households with internet access.



(v) Describe the relationship between the percentage of adults smoking and the percentage of households with internet access. **[1]**

(vi) Stella says that the greater availability of the internet has caused a reduction in smoking. Comment on her statement. **[1]**

3(v)	
3(vi)	

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4 Ofcom reports regularly on communications technology use by UK adults aged 16+.

> People in the UK took an estimated 1.2 billion 'selfies' in the past year. Nearly a third (31%) of UK adults admit to taking a selfie, with one in ten (11%) doing so at least once a week.
>
> Ofcom, August 2015

A selfie is a photograph of oneself. A billion is 1000 million.

(i) (*A*) Write down an estimate of the **total** population of the UK.

(*B*) Use this to estimate how many **adults** admit to taking selfies. Show your working. **[6]**

(ii) Assume all the 1.2 billion selfies were taken by the adults in part **(i)**. How often, on average, did each of them take a selfie? Show your working. **[3]**

(iii) Use the Ofcom statement to find the median number of selfies taken by each UK adult. **[1]**

4(i) (*A*)	
(*B*)	

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4(ii)	
4(iii)	

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5 **(i)** Sports competitors are sometimes given medals on ribbon to hang around their necks.

For a competition, 30 medals like this will be given out. Estimate the total length of ribbon needed. Show your working. **[3]**

5(i)	

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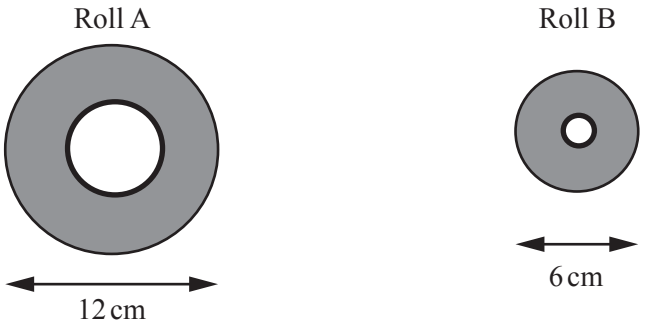
(ii) Ribbon is sold in rolls A and B. The roll of ribbon is wound around a cardboard cylinder.



The **total** diameter of roll A of ribbon is 12 cm; the diameter of the centre cylinder is 7 cm.
The **total** diameter of roll B of ribbon is 6 cm; the diameter of the centre cylinder is 1 cm.
The ribbon on both rolls is of the same kind.

Decide which, if either, roll has a longer length of ribbon on it. Explain your reasoning. **[3]**

5(ii)	

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6 This question refers to the article 'The polygraph'. This was given out as pre-release material and is available as an insert.

(i) Using the information from the British Psychological Society, find upper and lower limits for the probability that someone who is telling the truth will pass the polygraph test. **[3]**

6(i)	

A businessman reads that one third of workers cheat their bosses. He runs a large business and decides to have all 300 of his workers take a polygraph test.

(ii) Assume that one third of the workers will lie and two thirds will tell the truth. Assume that the polygraph will correctly identify 85% of people who are lying and will falsely identify as liars 5% of people who are telling truth.

(A) Find the probability that a worker who fails the test is actually telling the truth.

(B) Find the probability that a worker who passes the test is actually lying. **[7]**

6(ii)	
(A)	
(B)	

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John assumes that a polygraph correctly identifies liars 50% of the time. In an experiment, 400 people deliberately lie during a polygraph test.

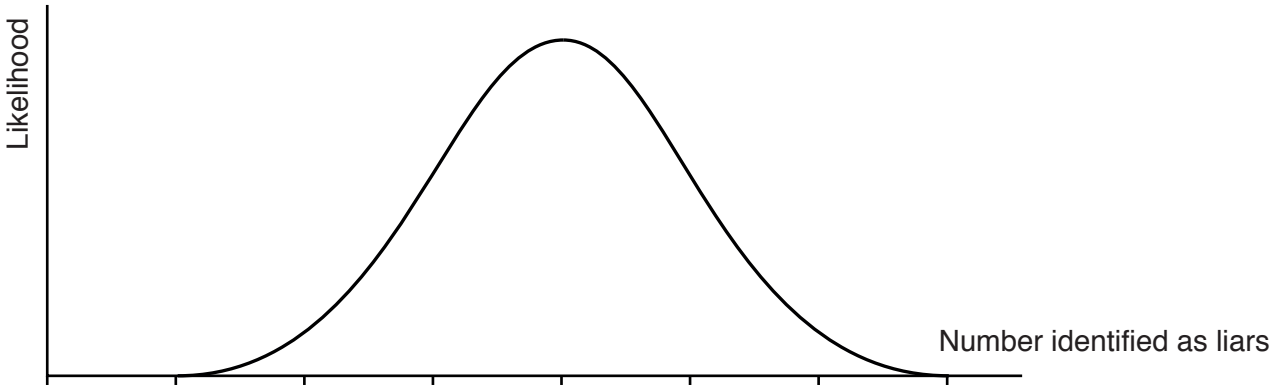
(iii) Assume John is correct.

(*A*) On average, how many of the 400 people will the polygraph identify as liars? **[1]**

(*B*) What is the standard deviation of the number identified as liars? **[2]**

6(iii) (*A*)	
(*B*)	

(*C*) The graph below models the likelihood of different numbers of liars being identified by the experiment. Number the horizontal axis appropriately. **[2]**



(iv) The polygraph in the experiment identifies 257 liars. What can you say about John's assumption? **[2]**

6(iv)	

END OF QUESTION PAPER

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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).

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