

**ADVANCED SUBSIDIARY GCE
MATHEMATICS (MEI)**
Statistics 1

4766

Candidates answer on the Answer Booklet

OCR Supplied Materials:

- 8 page Answer Booklet
- Graph paper
- MEI Examination Formulae and Tables (MF2)

Other Materials Required:

None

**Monday 19 January 2009
Afternoon**

Duration: 1 hour 30 minutes



INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the spaces provided on the Answer Booklet.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- You are permitted to use a 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 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 **72**.
- This document consists of **8** pages. Any blank pages are indicated.

Section A (36 marks)

- 1 A supermarket chain buys a batch of 10 000 scratchcard draw tickets for sale in its stores. 50 of these tickets have a £10 prize, 20 of them have a £100 prize, one of them has a £5000 prize and all of the rest have no prize. This information is summarised in the frequency table below.

Prize money	£0	£10	£100	£5000
Frequency	9929	50	20	1

- (i) Find the mean and standard deviation of the prize money per ticket. [4]
- (ii) I buy two of these tickets at random. Find the probability that I win either two £10 prizes or two £100 prizes. [3]
- 2 Thomas has six tiles, each with a different letter of his name on it.
- (i) Thomas arranges these letters in a random order. Find the probability that he arranges them in the correct order to spell his name. [2]
- (ii) On another occasion, Thomas picks three of the six letters at random. Find the probability that he picks the letters T, O and M (in any order). [3]
- 3 A zoologist is studying the feeding behaviour of a group of 4 gorillas. The random variable X represents the number of gorillas that are feeding at a randomly chosen moment. The probability distribution of X is shown in the table below.

r	0	1	2	3	4
$P(X = r)$	p	0.1	0.05	0.05	0.25

- (i) Find the value of p . [1]
- (ii) Find the expectation and variance of X . [5]
- (iii) The zoologist observes the gorillas on two further occasions. Find the probability that there are at least two gorillas feeding on both occasions. [2]
- 4 A pottery manufacturer makes teapots in batches of 50. On average 3% of teapots are faulty.
- (i) Find the probability that in a batch of 50 there is
- (A) exactly one faulty teapot, [3]
- (B) more than one faulty teapot. [3]
- (ii) The manufacturer produces 240 batches of 50 teapots during one month. Find the expected number of batches which contain exactly one faulty teapot. [2]

5 Each day Anna drives to work.

- R is the event that it is raining.
- L is the event that Anna arrives at work late.

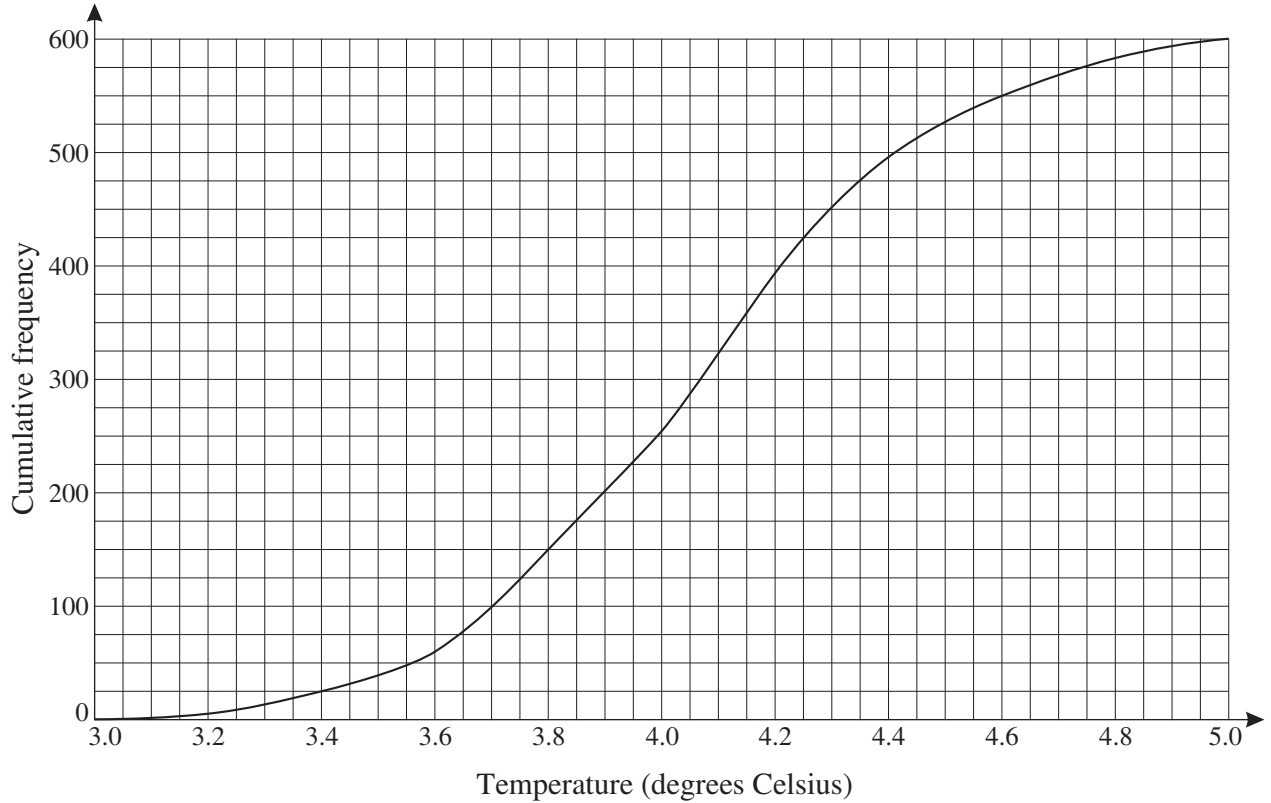
You are given that $P(R) = 0.36$, $P(L) = 0.25$ and $P(R \cap L) = 0.2$.

- (i) Determine whether the events R and L are independent. [2]
- (ii) Draw a Venn diagram showing the events R and L . Fill in the probability corresponding to each of the four regions of your diagram. [3]
- (iii) Find $P(L | R)$. State what this probability represents. [3]

[Question 6 is printed overleaf.]

Section B (36 marks)

- 6 The temperature of a supermarket fridge is regularly checked to ensure that it is working correctly. Over a period of three months the temperature (measured in degrees Celsius) is checked 600 times. These temperatures are displayed in the cumulative frequency diagram below.



- (i) Use the diagram to estimate the median and interquartile range of the data. [3]
- (ii) Use your answers to part (i) to show that there are very few, if any, outliers in the sample. [4]
- (iii) Suppose that an outlier is identified in these data. Discuss whether it should be excluded from any further analysis. [2]
- (iv) Copy and complete the frequency table below for these data. [3]

Temperature (t degrees Celsius)	$3.0 \leq t \leq 3.4$	$3.4 < t \leq 3.8$	$3.8 < t \leq 4.2$	$4.2 < t \leq 4.6$	$4.6 < t \leq 5.0$
Frequency			243	157	

- (v) Use your table to calculate an estimate of the mean. [2]
- (vi) The standard deviation of the temperatures in degrees Celsius is 0.379. The temperatures are converted from degrees Celsius into degrees Fahrenheit using the formula $F = 1.8C + 32$. Hence estimate the mean and find the standard deviation of the temperatures in degrees Fahrenheit. [3]

7 An online shopping company takes orders through its website. On average 80% of orders from the website are delivered within 24 hours. The quality controller selects 10 orders at random to check when they are delivered.

(i) Find the probability that

(A) exactly 8 of these orders are delivered within 24 hours, [3]

(B) at least 8 of these orders are delivered within 24 hours. [2]

The company changes its delivery method. The quality controller suspects that the changes will mean that fewer than 80% of orders will be delivered within 24 hours. A random sample of 18 orders is checked and it is found that 12 of them arrive within 24 hours.

(ii) Write down suitable hypotheses and carry out a test at the 5% significance level to determine whether there is any evidence to support the quality controller's suspicion. [7]

(iii) A statistician argues that it is possible that the new method could result in either better or worse delivery times. Therefore it would be better to carry out a 2-tail test at the 5% significance level. State the alternative hypothesis for this test. Assuming that the sample size is still 18, find the critical region for this test, showing all of your calculations. [7]