Cambridge International A Level

**Cambridge International Examinations**
Cambridge International Advanced Level

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| CANDIDATE NAME | |
| CENTRE NUMBER | CANDIDATE NUMBER |

*0902873428*

**MATHEMATICS** **9709/73**

Paper 7 Probability & Statistics 2 **(S2)** **May/June 2017**

**1 hour 15 minutes**

Candidates answer on the Question Paper.

Additional Materials: List of Formulae (MF9)

**READ THESE INSTRUCTIONS FIRST**

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

This document consists of **11** printed pages and **1** blank page.


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**1** A residents' association has 654 members, numbered from 1 to 654. The secretary wishes to send a questionnaire to a random sample of members. In order to choose the members for the sample she uses a table of random numbers. The first line in the table is as follows.

1096 4357 3765 0431 0928 9264

The numbers of the first two members in the sample are 109 and 643. Find the numbers of the next three members in the sample. [3]

**2** In a random sample of 200 shareholders of a company, 103 said that they wanted a change in the management.

**(i)** Find an approximate 92% confidence interval for the proportion, $p$, of all shareholders who want a change in the management. [3]

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**(ii)** State the probability that a 92% confidence interval does not contain $p$. [1]

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**3** The mass, in tonnes, of iron ore produced per day at a mine is normally distributed with mean 7.0 and standard deviation 0.46. Find the probability that the total amount of iron ore produced in 10 randomly chosen days is more than 71 tonnes. [5]

**4** Last year the mean level of a certain pollutant in a river was found to be 0.034 grams per millilitre. This year the levels of pollutant, $X$ grams per millilitre, were measured at a random sample of 200 locations in the river. The results are summarised below.

$$n = 200 \qquad \Sigma x = 6.7 \qquad \Sigma x^2 = 0.2312$$

**(i)** Calculate unbiased estimates of the population mean and variance. [3]

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**(ii)** Test, at the 10% significance level, whether the mean level of pollutant has changed. [5]

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**[Turn over**

**5** **(i)** A random variable $X$ has the distribution Po(42).

**(a)** Use an appropriate approximating distribution to find $P(X \geqslant 40)$. [4]

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**(b)** Justify your use of the approximating distribution. [1]

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**(ii)** A random variable $Y$ has the distribution B(60, 0.02).

**(a)** Use an appropriate approximating distribution to find $P(Y > 2)$. [3]

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**(b)** Justify your use of the approximating distribution. [1]

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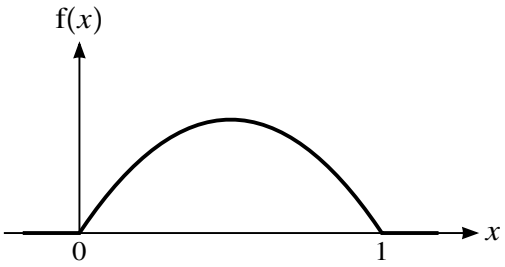
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**6**




The diagram shows the graph of the probability density function, f, of a continuous random variable $X$, where f is defined by

$$f(x) = \begin{cases} k(x - x^2) & 0 \leqslant x \leqslant 1, \\ 0 & \text{otherwise.} \end{cases}$$

**(i)** Show that the value of the constant $k$ is 6. [3]

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**(ii)** State the value of $E(X)$ and find $Var(X)$. [4]

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**(iii)** Find $P(0.4 < X < 2)$. [3]

**7** In the past the number of accidents per month on a certain road was modelled by a random variable with distribution Po(0.47). After the introduction of speed restrictions, the government wished to test, at the 5% significance level, whether the mean number of accidents had decreased. They noted the number of accidents during the next 12 months. It is assumed that accidents occur randomly and that a Poisson model is still appropriate.

**(i)** Given that the total number of accidents during the 12 months was 2, carry out the test. [6]

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**(ii)** Explain what is meant by a Type II error in this context. [1]

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It is given that the mean number of accidents per month is now in fact 0.05.

**(iii)** Using another random sample of 12 months the same test is carried out again, with the same significance level. Find the probability of a Type II error. [4]

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