



## Cambridge International AS & A Level

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**MATHEMATICS**

**9709/62**

Paper 6 Probability & Statistics 2

**February/March 2020**

**1 hour 15 minutes**

You must answer on the question paper.

You will need: List of formulae (MF19)

### INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- If additional space is needed, you should use the lined page at the end of this booklet; the question number or numbers must be clearly shown.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

### INFORMATION

- The total mark for this paper is 50.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **12** pages. Blank pages are indicated.

- 1 The booklets produced by a certain publisher contain, on average, 1 incorrect letter per 30 000 letters, and these errors occur randomly. A randomly chosen booklet from this publisher contains 12 500 letters.

Use a suitable approximating distribution to find the probability that this booklet contains at least 2 errors. [3]

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- 2 Lengths of a certain species of lizard are known to be normally distributed with standard deviation 3.2 cm. A naturalist measures the lengths of a random sample of 100 lizards of this species and obtains an  $\alpha\%$  confidence interval for the population mean. He finds that the total width of this interval is 1.25 cm.

Find  $\alpha$ .

[5]

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3 In the past, the mean time taken by Freda for a particular daily journey was 39.2 minutes. Following the introduction of a one-way system, Freda wishes to test whether the mean time for the journey has decreased. She notes the times,  $t$  minutes, for 40 randomly chosen journeys and summarises the results as follows.

$$n = 40 \quad \Sigma t = 1504 \quad \Sigma t^2 = 57\,760$$

(a) Calculate unbiased estimates of the population mean and variance of the new journey time. [3]

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(b) Test, at the 5% significance level, whether the population mean time has decreased. [5]

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4 The number of accidents on a certain road has a Poisson distribution with mean 0.4 per 50-day period.

(a) Find the probability that there will be fewer than 3 accidents during a year (365 days). [3]

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(b) The probability that there will be no accidents during a period of  $n$  days is greater than 0.95.  
Find the largest possible value of  $n$ . [4]

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- 5 Bottles of Lanta contain approximately 300 ml of juice. The volume of juice, in millilitres, in a bottle is  $300 + X$ , where  $X$  is a random variable with probability density function given by

$$f(x) = \begin{cases} \frac{3}{4000}(100 - x^2) & -10 \leq x \leq 10, \\ 0 & \text{otherwise.} \end{cases}$$

- (a) Find the probability that a randomly chosen bottle of Lanta contains more than 305 ml of juice. [3]

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- (b) Given that 25% of bottles of Lanta contain more than  $(300 + p)$  ml of juice, show that

$$p^3 - 300p + 1000 = 0. \quad [4]$$

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- (c) Given that  $p = 3.47$ , and that 50% of bottles of Lanta contain between  $(300 - q)$  and  $(300 + q)$  ml of juice, find  $q$ . Justify your answer. [2]

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6 The volumes, in millilitres, of large and small cups of tea are modelled by the distributions  $N(200, 30)$  and  $N(110, 20)$  respectively.

(a) Find the probability that the total volume of a randomly chosen large cup of tea and a randomly chosen small cup of tea is less than 300 ml. [4]

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7 A national survey shows that 95% of year 12 students use social media. Arvin suspects that the percentage of year 12 students at his college who use social media is less than the national percentage. He chooses a random sample of 20 students at his college and notes the number who use social media. He then carries out a test at the 2% significance level.

(a) Find the rejection region for the test.

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(b) Find the probability of a Type I error. [1]

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(c) Jimmy believes that the true percentage at Arvin’s college is 70%. Assuming that Jimmy is correct, find the probability of a Type II error. [3]

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**Additional Page**

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