Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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7995208937

MATHEMATICS **9709/62**

Paper 6 Probability & Statistics 2 **October/November 2022**

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 **16** pages. Any blank pages are indicated.

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1 Each of a random sample of 80 adults gave an estimate, h metres, of the height of a particular building. The results were summarised as follows.

$$n = 80 \qquad \Sigma h = 2048 \qquad \Sigma h^2 = 52\,760$$

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

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(b) Using this sample, the upper boundary of an α% confidence interval for the population mean is 26.0.

Find the value of α. [4]

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2 In the past, the mean length of a particular variety of worm has been 10.3 cm, with standard deviation 2.6 cm. Following a change in the climate, it is thought that the mean length of this variety of worm has decreased. The lengths of a random sample of 100 worms of this variety are found and the mean of this sample is found to be 9.8 cm.

Assuming that the standard deviation remains at 2.6 cm, carry out a test at the 2% significance level of whether the mean length has decreased. [5]

3 1.6% of adults in a certain town ride a bicycle. A random sample of 200 adults from this town is selected.

(a) Use a suitable approximating distribution to find the probability that more than 3 of these adults ride a bicycle. [4]

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(b) Justify your approximating distribution. [2]

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4 The number of faults in cloth made on a certain machine has a Poisson distribution with mean 2.4 per $10\,m^2$. An adjustment is made to the machine. It is required to test at the 5% significance level whether the mean number of faults has decreased. A randomly selected $30\,m^2$ of cloth is checked and the number of faults is found.

(a) State suitable null and alternative hypotheses for the test. [1]

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(b) Find the probability of a Type I error. [3]

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Exactly 3 faults are found in the randomly selected $30\,m^2$ of cloth.

(c) Carry out the test at the 5% significance level. [2]

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Later a similar test was carried out at the 5% significance level, using another randomly selected $30\,m^2$ of cloth.

(d) Given that the number of faults actually has a Poisson distribution with mean 0.5 per $10\,m^2$, find the probability of a Type II error. [2]

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5 X is a random variable with distribution B(10, 0.2). A random sample of 160 values of X is taken.

(a) Find the approximate distribution of the sample mean, including the values of the parameters. [3]

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(b) Hence find the probability that the sample mean is less than 1.8. [3]

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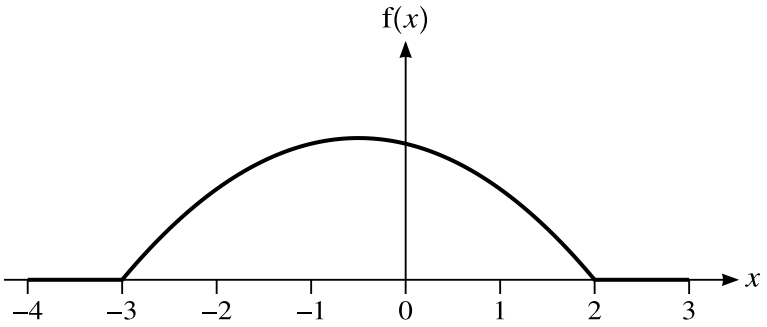
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6 The masses, in grams, of small and large bags of flour have the distributions N(510, 100) and N(1015, 324) respectively. André selects 4 small bags of flour and 2 large bags of flour at random.

(a) Find the probability that the total mass of these 6 bags of flour is less than 4130 g. [5]

(b) Find the probability that the total mass of the 4 small bags is more than the total mass of the 2 large bags. [5]

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The diagram shows the graph of the probability density function, f, of a random variable X which takes values between −3 and 2 only.

(a) Given that the graph is symmetrical about the line $x = -0.5$ and that $\mathrm{P}(X < 0) = p$, find $\mathrm{P}(-1 < X < 0)$ in terms of p. [2]

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(b) It is now given that the probability density function shown in the diagram is given by

$$\mathrm{f}(x) = \begin{cases} a - b(x^2 + x) & -3 \leqslant x \leqslant 2, \\ 0 & \text{otherwise,} \end{cases}$$

where a and b are positive constants.

(i) Show that $30a - 55b = 6$. [3]

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(ii) By substituting a suitable value of x into $f(x)$, find another equation relating a and b and hence determine the values of a and b. [3]

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Additional Page

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