Cambridge International A Level

Cambridge International Examinations
Cambridge International Advanced Level

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER

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MATHEMATICS **9709/72**

Paper 7 Probability & Statistics 2 **(S2)** **February/March 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 In a survey, 36 out of 120 randomly selected voters in Hungton said that if there were an election next week they would vote for the Alpha party. Calculate an approximate 90% confidence interval for the proportion of voters in Hungton who would vote for the Alpha party. [4]

2 Karim has noted the lifespans, in weeks, of a large random sample of certain insects. He carries out a test, at the 1% significance level, for the population mean, μ. Karim's null hypothesis is $\mu = 6.4$.

(i) Given that Karim's test is two-tail, state the alternative hypothesis. [1]

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Karim finds that the value of the test statistic is $z = 2.43$.

(ii) Explain what conclusion he should draw. [2]

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(iii) Explain briefly when a one-tail test is appropriate, rather than a two-tail test. [1]

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3 The length, in centimetres, of a certain type of snake is modelled by the random variable X with mean 52 and standard deviation 6.1. A random sample of 75 snakes is selected, and the sample mean, $\overline{X}$, is found.

(i) Find $P(51 < \overline{X} < 53)$. [4]

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(ii) Explain why it was necessary to use the Central Limit theorem in the solution to part **(i)**. [1]

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4 At a doctors' surgery, the number of missed appointments per day has a Poisson distribution. In the past the mean number of missed appointments per day has been 0.9. Following some publicity, the manager carries out a hypothesis test to determine whether this mean has decreased. If there are fewer than 3 missed appointments in a randomly chosen 5-day period, she will conclude that the mean has decreased.

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

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(ii) State what is meant by a Type I error in this context. [1]

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(iii) Find the probability of a Type II error if the mean number of missed appointments per day is 0.2. [3]

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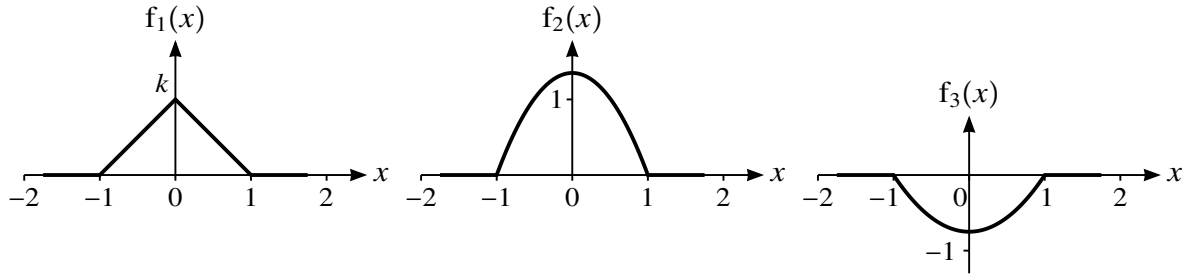
[Turn over

5 (a)



The diagram shows the graphs of three functions, f_1, f_2 and f_3. The function f_1 is a probability density function.

(i) State the value of k. [1]

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(ii) For each of the functions f_2 and f_3, state why it cannot be a probability density function. [2]

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(b) The probability density function g is defined by

$$g(x) = \begin{cases} 6(a^2 - x^2) & -a \leqslant x \leqslant a, \\ 0 & \text{otherwise,} \end{cases}$$

where a is a constant.

(i) Show that $a = \frac{1}{2}$. [3]

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(ii) State the value of $\mathrm{E}(X)$. [1]

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(iii) Find $\mathrm{Var}(X)$. [2]

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6 The masses, in kilograms, of cartons of sugar and cartons of flour have the distributions $N(78.8, 12.6^2)$ and $N(62.0, 10.0^2)$ respectively.

(i) The standard load for a certain crane is 8 cartons of sugar and 3 cartons of flour. The maximum load that can be carried safely by the crane is 900 kg. Stating a necessary assumption, find the percentage of standard loads that will exceed the maximum safe load. [5]

(ii) Find the probability that a randomly chosen carton of sugar has a smaller mass than a randomly chosen carton of flour. [5]

7 The number of planes arriving at an airport every hour during daytime is modelled by the random variable X with distribution Po(5.2).

(i) State two assumptions required for the Poisson model to be valid in this context. [2]

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(ii) **(a)** Find the probability that the number of planes arriving in a 15-minute period is greater than 1 and less than 4, [3]

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(b) Find the probability that more than 3 planes will arrive in a 40-minute period. [2]

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(iii) The airport has enough staff to deal with a maximum of 60 planes landing during a 10-hour day. Use a suitable approximation to find the probability that, on a randomly chosen 10-hour day, staff will be able to deal with all the planes that land. [4]

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