Edexcel Maths S2

Topic Questions from Papers

Continuous Uniform Distribution

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2. The continuous random variable X is uniformly distributed over the interval $[2, 6]$.

(a) Write down the probability density function $f(x)$.

(2)

Find

(b) $E(X)$,

(1)

(c) $Var(X)$,

(2)

(d) the cumulative distribution function of X, for all x,

(4)

(e) $P(2.3 < X < 3.4)$.

(2)

Leave blank

2. The continuous random variable L represents the error, in mm, made when a machine cuts rods to a target length. The distribution of L is continuous uniform over the interval $[-4.0, 4.0]$.

Find

(a) $P(L < -2.6)$,

(1)

(b) $P(L < -3.0 \text{ or } L > 3.0)$.

(2)

A random sample of 20 rods cut by the machine was checked.

(c) Find the probability that more than half of them were within 3.0 mm of the target length.

(4)

Leave blank

1. A string AB of length 5 cm is cut, in a random place C, into two pieces. The random variable X is the length of AC.

(a) Write down the name of the probability distribution of X and sketch the graph of its probability density function.

(3)

(b) Find the values of E(X) and Var(X).

(3)

(c) Find P($X > 3$).

(1)

(d) Write down the probability that AC is 3 cm long.

(1)

Leave blank

1. Jean regularly takes a break from work to go to the post office. The amount of time Jean waits in the queue to be served at the post office has a continuous uniform distribution between 0 and 10 minutes.

(a) Find the mean and variance of the time Jean spends in the post office queue.

(3)

(b) Find the probability that Jean does not have to wait more than 2 minutes.

(2)

Jean visits the post office 5 times.

(c) Find the probability that she never has to wait more than 2 minutes.

(2)

Jean is in the queue when she receives a message that she must return to work for an urgent meeting. She can only wait in the queue for a further 3 minutes.

Given that Jean has already been queuing for 5 minutes,

(d) find the probability that she must leave the post office queue without being served.

(3)

Leave blank

Question 1 continued

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2. The continuous random variable X is uniformly distributed over the interval $[-2, 7]$.

(a) Write down fully the probability density function $f(x)$ of X.

(2)

(b) Sketch the probability density function $f(x)$ of X.

(2)

Find

(c) $E(X^2)$,

(3)

(d) $P(-0.2 < X < 0.6)$.

(2)

Leave blank

3. A rectangle has a perimeter of 20 cm. The length, X cm, of one side of this rectangle is uniformly distributed between 1 cm and 7 cm.

Find the probability that the length of the longer side of the rectangle is more than 6 cm long.

(5)

Leave blank

3. The continuous random variable X is uniformly distributed over the interval [–1,3]. Find

(a) E(X)

(1)

(b) Var(X)

(2)

(c) E(X^2)

(2)

(d) P($X < 1.4$)

(1)

A total of 40 observations of X are made.

(e) Find the probability that at least 10 of these observations are negative.

(5)

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Question 3 continued

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4. In a game, players select sticks at random from a box containing a large number of sticks of different lengths. The length, in cm, of a randomly chosen stick has a continuous uniform distribution over the interval [7, 10].

A stick is selected at random from the box.

(a) Find the probability that the stick is shorter than 9.5 cm.

(2)

To win a bag of sweets, a player must select 3 sticks and wins if the length of the longest stick is more than 9.5 cm.

(b) Find the probability of winning a bag of sweets.

(2)

To win a soft toy, a player must select 6 sticks and wins the toy if more than four of the sticks are shorter than 7.6 cm.

(c) Find the probability of winning a soft toy.

(4)

Leave blank

1. The time in minutes that Elaine takes to checkout at her local supermarket follows a continuous uniform distribution defined over the interval [3, 9].

Find

(a) Elaine's expected checkout time,

(1)

(b) the variance of the time taken to checkout at the supermarket,

(2)

(c) the probability that Elaine will take more than 7 minutes to checkout.

(2)

Given that Elaine has already spent 4 minutes at the checkout,

(d) find the probability that she will take a total of less than 6 minutes to checkout.

(3)

Leave blank

1. A manufacturer produces sweets of length L mm where L has a continuous uniform distribution with range [15, 30].

(a) Find the probability that a randomly selected sweet has a length greater than 24 mm.

(2)

These sweets are randomly packed in bags of 20 sweets.

(b) Find the probability that a randomly selected bag will contain at least 8 sweets with length greater than 24 mm.

(3)

(c) Find the probability that 2 randomly selected bags will both contain at least 8 sweets with length greater than 24 mm.

(2)

Leave blank

4. The continuous random variable X is uniformly distributed over the interval $[-4, 6]$.

(a) Write down the mean of X.

(1)

(b) Find $\mathrm{P}(X \leqslant 2.4)$

(2)

(c) Find $\mathrm{P}(-3 < X - 5 < 3)$

(2)

The continuous random variable Y is uniformly distributed over the interval $[a, 4a]$.

(d) Use integration to show that $\mathrm{E}(Y^2) = 7a^2$

(4)

(e) Find $\mathrm{Var}(Y)$.

(2)

(f) Given that $\mathrm{P}(X < \frac{8}{3}) = \mathrm{P}(Y < \frac{8}{3})$, find the value of a.

(3)

Leave blank

Question 4 continued

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3. The random variable X has a continuous uniform distribution on $[a, b]$ where a and b are positive numbers.

Given that $E(X) = 23$ and $Var(X) = 75$

(a) find the value of a and the value of b.

(6)

Given that $P(X > c) = 0.32$

(b) find $P(23 < X < c)$.

(2)

Leave blank

4. A continuous random variable X is uniformly distributed over the interval $[b, 4b]$ where b is a constant.

(a) Write down E(X).

(1)

(b) Use integration to show that $\text{Var}(X) = \frac{3b^2}{4}$.

(3)

(c) Find Var(3 – 2X).

(2)

Given that $b = 1$ find

(d) the cumulative distribution function of X, F(x), for all values of x,

(2)

(e) the median of X.

(1)

Leave blank

Question 4 continued