

Continuous random variables

Question Paper 4

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Continuous random variables
Sub Topic	
Booklet	Question Paper 4

Time Allowed: 64 minutes

Score: /53

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 A continuous random variable X has probability density function given by

$$f(x) = \begin{cases} a + \frac{1}{3}x & 1 \leq x \leq 2, \\ 0 & \text{otherwise,} \end{cases}$$

where a is a constant.

(i) Show that the value of a is $\frac{1}{2}$. [3]

(ii) Find $P(X > 1.8)$. [2]

(iii) Find $E(X)$. [3]

- 2 A continuous random variable X has probability density function given by

$$f(x) = \begin{cases} 3(1-x)^2 & 0 \leq x \leq 1, \\ 0 & \text{otherwise.} \end{cases}$$

Find

(i) $P(X > 0.5)$, [3]

(ii) the mean and variance of X . [6]

- 3 The lifetime, x years, of the power light on a freezer, which is left on continuously, can be modelled by the continuous random variable with density function given by

$$f(x) = \begin{cases} ke^{-3x} & x > 0, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

(i) Show that $k = 3$. [2]

(ii) Find the lower quartile. [3]

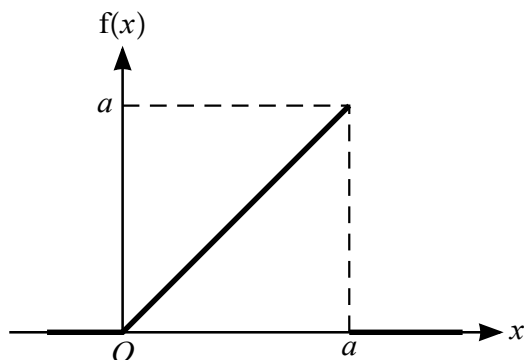
(iii) Find the mean lifetime. [6]

- 4 The average speed of a bus, $x \text{ km h}^{-1}$, on a certain journey is a continuous random variable X with probability density function given by

$$f(x) = \begin{cases} \frac{k}{x^2} & 20 \leq x \leq 28, \\ 0 & \text{otherwise.} \end{cases}$$

- (i) Show that $k = 70$. [3]
- (ii) Find $E(X)$. [3]
- (iii) Find $P(X < E(X))$. [2]
- (iv) Hence determine whether the mean is greater or less than the median. [2]

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The random variable X has probability density function, f , as shown in the diagram, where a is a constant. Find the value of a and hence show that $E(X) = 0.943$ correct to 3 significant figures [5]

- 6 The waiting time, T minutes, for patients at a doctor's surgery has probability density function given by

$$f(t) = \begin{cases} k(225 - t^2) & 0 \leq t \leq 15, \\ 0 & \text{otherwise,} \end{cases}$$

where k is a constant.

- (i) Show that $k = \frac{1}{2250}$. [3]
- (ii) Find the probability that a patient has to wait for more than 10 minutes. [3]
- (iii) Find the mean waiting time. [4]