Continuous Random Variables – 2021 A2

1. June/2021/Paper_9709/61/No.3

The graph of the probability density function of a random variable X is symmetrical about the line $x = 4$.

Given that $\mathrm{P}(X < 5) = \frac{20}{27}$, find $\mathrm{P}(3 < X < 5)$. [2]

2. June/2021/Paper_9709/61/No.6

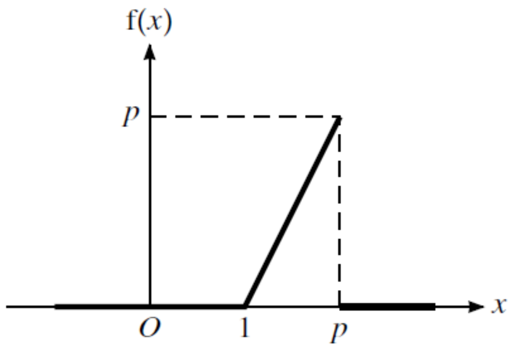
The probability density function, f, of a random variable X is given by

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

where k is a constant.

State the value of $\mathrm{E}(X)$ and show that $\mathrm{Var}(X) = \frac{9}{5}$. [6]

3. June/2021/Paper_9709/62/No.3



The random variable X takes values in the range $1 \leqslant x \leqslant p$, where p is a constant. The graph of the probability density function of X is shown in the diagram.

(a) Show that $p = 2$. [2]

(b) Find $\mathrm{E}(X)$. [5]

4. June/2021/Paper_9709/63/No.6

Alethia models the length of time, in minutes, by which her train is late on any day by the random variable X with probability density function given by

$$f(x) = \begin{cases} \frac{3}{8000}(x-20)^2 & 0 \leqslant x \leqslant 20, \\ 0 & \text{otherwise.} \end{cases}$$

(a) Find the probability that the train is more than 10 minutes late on each of two randomly chosen days. [4]

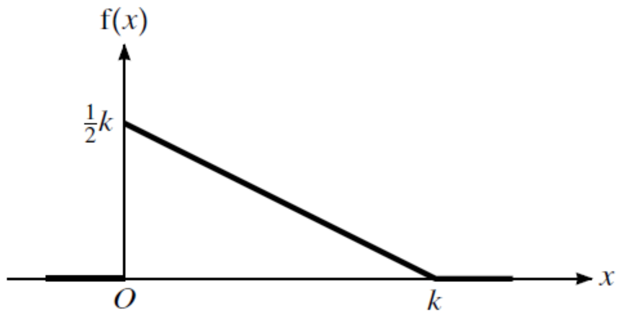
(b) Find $E(X)$. [4]

(c) The median of X is denoted by m.

Show that m satisfies the equation $(m-20)^3 = -4000$, and hence find m correct to 3 significant figures. [4]

(d) State one way in which Alethia's model may be unrealistic. [1]

5. March/2021/Paper_9709/62/No.2



The diagram shows the graph of the probability density function, f, of a random variable X.

(a) Find the value of the constant k. [2]

(b) Using this value of k, find $\mathrm{f}(x)$ for $0 \leqslant x \leqslant k$ and hence find $\mathrm{E}(X)$. [3]

(c) Find the value of p such that $\mathrm{P}(p < X < 1) = 0.25$. [4]