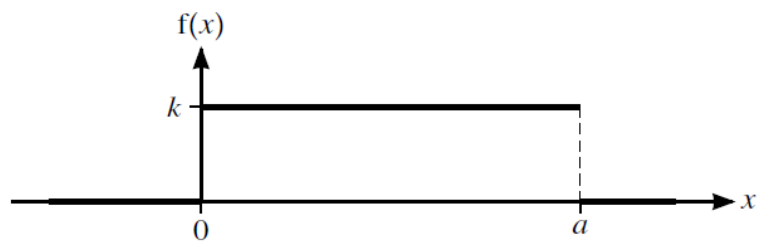


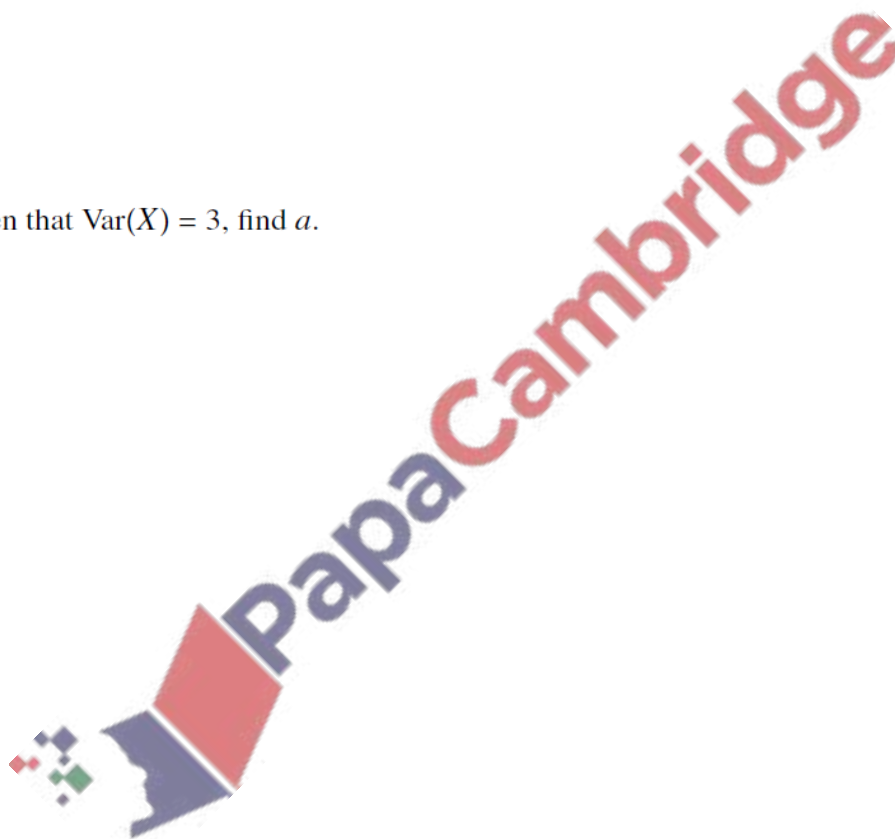
1. Nov/2020/Paper_9709/61/No.4



The diagram shows the probability density function, $f(x)$, of a random variable X . For $0 \leq x \leq a$, $f(x) = k$; elsewhere $f(x) = 0$.

(a) Express k in terms of a . [1]

(b) Given that $\text{Var}(X) = 3$, find a . [4]



2. June/2020/Paper_9709/61/No.6

The length of time, T minutes, that a passenger has to wait for a bus at a certain bus stop is modelled by the probability density function given by

$$f(t) = \begin{cases} \frac{3}{4000}(20t - t^2) & 0 \leq t \leq 20, \\ 0 & \text{otherwise.} \end{cases}$$

(a) Sketch the graph of $y = f(t)$. [1]

(b) Hence explain, without calculation, why $E(T) = 10$. [1]

(c) Find $\text{Var}(T)$. [3]

(d) It is given that $P(T < 10 + a) = p$, where $0 < a < 10$.

Find $P(10 - a < T < 10 + a)$ in terms of p . [2]

(e) Find $P(8 < T < 12)$. [3]

(f) Give one reason why this model may be unrealistic. [1]

3. June/2020/Paper_9709/62/No.6

A random variable X has probability density function given by

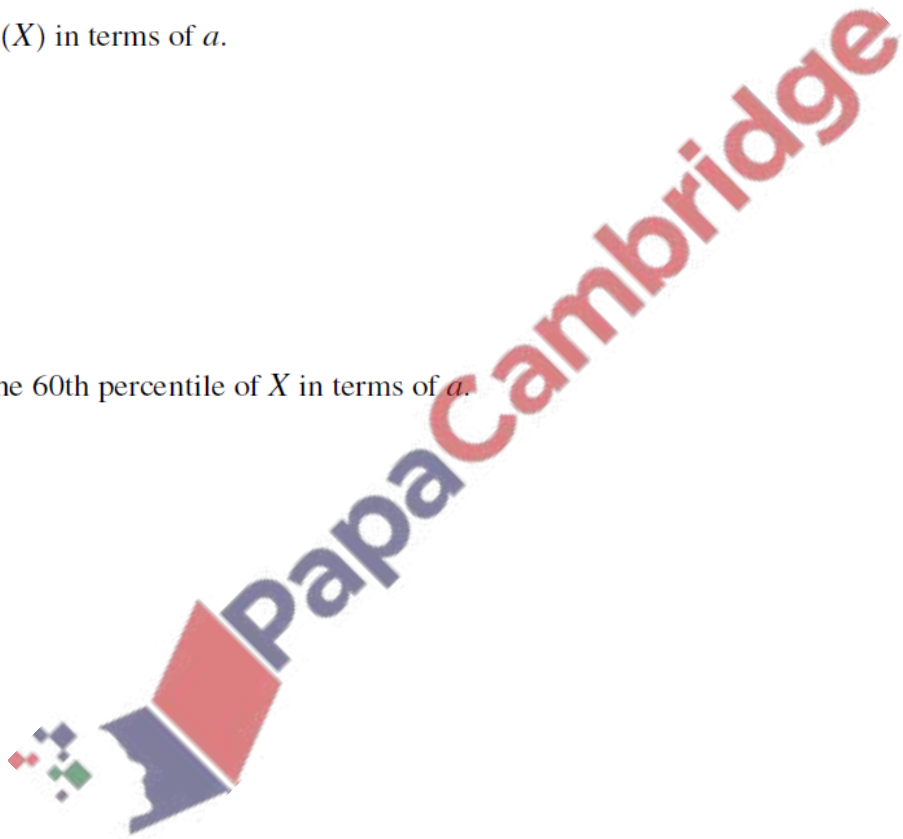
$$f(x) = \begin{cases} \frac{k}{x^2} & 1 \leq x \leq a, \\ 0 & \text{otherwise,} \end{cases}$$

where k and a are positive constants.

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

(b) Find $E(X)$ in terms of a . [3]

(c) Find the 60th percentile of X in terms of a . [4]



4. June/2020/Paper_9709/63/No.6

The length, X centimetres, of worms of a certain type is modelled by the probability density function

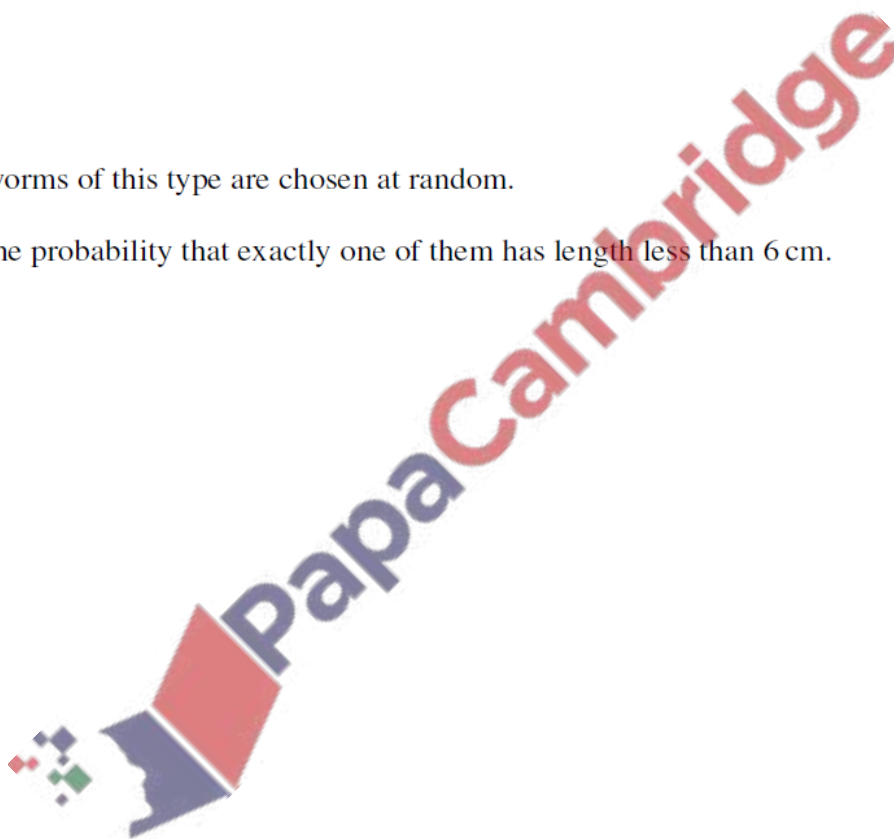
$$f(x) = \begin{cases} \frac{6}{125}(10-x)(x-5) & 5 \leq x \leq 10, \\ 0 & \text{otherwise.} \end{cases}$$

(a) State the value of $E(X)$. [1]

(b) Find $\text{Var}(X)$. [3]

(c) Two worms of this type are chosen at random.

Find the probability that exactly one of them has length less than 6 cm. [5]



5. March/2020/Paper_9709/62/No.5

Bottles of Lanta contain approximately 300 ml of juice. The volume of juice, in millilitres, in a bottle is $300 + X$, where X is a random variable with probability density function given by

$$f(x) = \begin{cases} \frac{3}{4000}(100 - x^2) & -10 \leq x \leq 10, \\ 0 & \text{otherwise.} \end{cases}$$

(a) Find the probability that a randomly chosen bottle of Lanta contains more than 305 ml of juice. [3]

(b) Given that 25% of bottles of Lanta contain more than $(300 + p)$ ml of juice, show that

$$p^3 - 300p + 1000 = 0. \quad [4]$$

(c) Given that $p = 3.47$, and that 50% of bottles of Lanta contain between $(300 - q)$ and $(300 + q)$ ml of juice, find q . Justify your answer. [2]

