Continuous random variables – A2 Further Mathematics Statistics

1. June/2022/Paper_7367/03S/No.2

    The random variable X has probability density function

    $$f(x) = \begin{cases} 1 & 0 < x \le \frac{1}{2} \\ \frac{3}{8}x^{-2} & \frac{1}{2} < x \le \frac{3}{2} \\ 0 & \text{otherwise} \end{cases}$$

    Find $P(X < 1)$

    Circle your answer.

    [1 mark]

    $$\frac{1}{8} \qquad\qquad \frac{3}{8} \qquad\qquad \frac{5}{8} \qquad\qquad \frac{7}{8}$$

2. June/2022/Paper_7367/03S/No.8

    The continuous random variable X has cumulative distribution function $F(x)$ where

    $$F(x) = \begin{cases} 0 & x = 0 \\ e^{kx} - 1 & 0 \le x \le 5 \\ 1 & x > 5 \end{cases}$$

(a)   Show that $k = \frac{1}{5}\ln 2$

    [2 marks]

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(b) Show that the median of X is $a\dfrac{\ln b}{\ln 2} - c$, where a, b and c are integers to be found.

[3 marks]

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(c) Show that the mean of X is $p - \dfrac{q}{\ln 2}$, where p and q are integers to be found.

[6 marks]

3. June/2022/Paper_7367/03S/No.9

Lianne models the maximum time in hours that a rechargeable battery can be used, before needing to be recharged, with a rectangular distribution with values between 8 and 12

(a) The probability that the maximum time the battery can be used before needing to be recharged is more than 10.5 hours is equal to p

Lianne will only buy the battery if p is more than 0.4

Determine whether Lianne will buy the battery.

[2 marks]

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(b) A histogram is plotted for 100 recharges showing the maximum time the battery can be used before needing to be recharged.

Frequency density

8   10   12   Maximum time between recharges (hours)
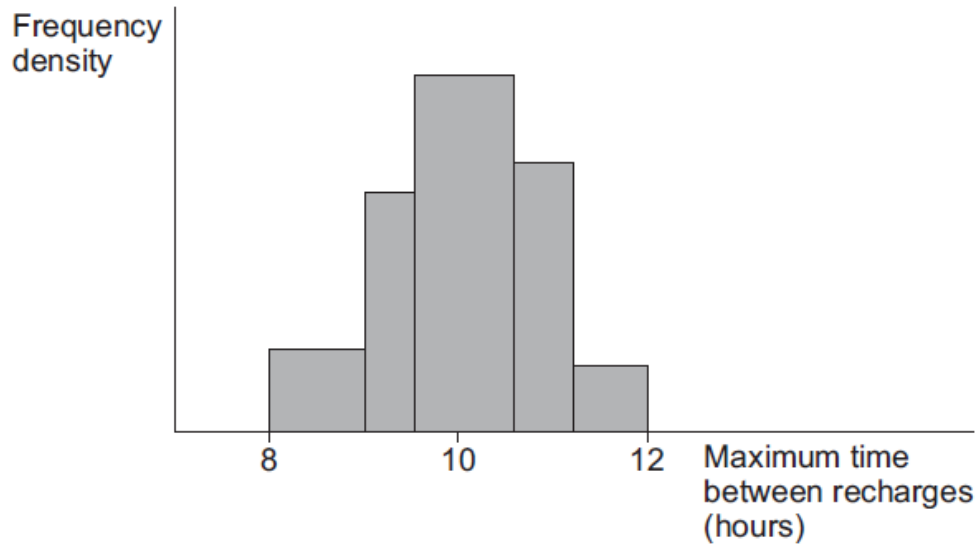
Explain why the model used in part (a) may not be valid and suggest the name of a different distribution that could be used to model the maximum time between recharges.

[2 marks]

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