

STEP II, 2010, Q12

- 12** The continuous random variable X has probability density function $f(x)$, where

$$f(x) = \begin{cases} a & \text{for } 0 \leq x < k \\ b & \text{for } k \leq x \leq 1 \\ 0 & \text{otherwise,} \end{cases}$$

where $a > b > 0$ and $0 < k < 1$. Show that $a > 1$ and $b < 1$.

- (i) Show that

$$E(X) = \frac{1 - 2b + ab}{2(a - b)}.$$

- (ii) Show that the median, M , of X is given by $M = \frac{1}{2a}$ if $a + b \geq 2ab$ and obtain an expression for the median if $a + b \leq 2ab$.

- (iii) Show that $M < E(X)$.



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