

## STEP II, 2003, Q13

- 13 The random variable  $X$  takes the values  $k = 1, 2, 3, \dots$ , and has probability distribution

$$P(X = k) = A \frac{\lambda^k e^{-\lambda}}{k!},$$

where  $\lambda$  is a positive constant. Show that  $A = (1 - e^{-\lambda})^{-1}$ . Find the mean  $\mu$  in terms of  $\lambda$  and show that

$$\text{Var}(X) = \mu(1 - \mu + \lambda).$$

Deduce that  $\lambda < \mu < 1 + \lambda$ .

Use a normal approximation to find the value of  $P(X = \lambda)$  in the case where  $\lambda = 100$ , giving your answer to 2 decimal places.



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