

$$\begin{aligned} E[X] &= \sum_{x=1}^{\infty} \frac{x e^{-\lambda} \lambda^x}{x!} \\ &= \lambda \sum_{x=1}^{\infty} \frac{\lambda^{x-1} e^{-\lambda}}{(x-1)!} \\ &= \lambda \sum_{y=0}^{\infty} \frac{\lambda^y e^{-\lambda}}{y!} = \lambda \end{aligned}$$