2.

a) $$\sum_{k=0}^{\infty} e^{-\lambda} \frac{\lambda^k}{k!} = e^{-\lambda} \underbrace{\sum_{k=0}^{\infty} \frac{\lambda^k}{k!}}_{\text{Taylor}} = e^{-\lambda} \cdot e^{\lambda} = \frac{1}{e^{\lambda}} e^{\lambda} = 1$$

b) $$\sum_{k=0}^{\infty} k \cdot e^{-\lambda} \frac{\lambda^k}{k!} = \sum_{k=1}^{\infty} k \cdot e^{-\lambda} \frac{\lambda^k}{k!} = \sum_{k=1}^{\infty} e^{-\lambda} \frac{\lambda^k}{(k-1)!} = e^{-\lambda} \sum_{k=1}^{\infty} \frac{\lambda^k}{(k-1)!} =$$

$$= e^{-\lambda} \lambda \sum_{k=1}^{\infty} \frac{\lambda^{(k-1)}}{(k-1)!} = e^{-\lambda} \lambda \underbrace{\sum_{k=0}^{\infty} \frac{\lambda^k}{k!}}_{\text{Taylor}} = \frac{1}{e^{\lambda}} e^{\lambda} \lambda = \lambda$$