a) $$\int_0^\infty \lambda e^{-\lambda x}\,dx = \lambda\left[\frac{e^{-\lambda x}}{-\lambda}\right]_0^\infty = \lim_{x\to\infty} -e^{-\lambda x} + 1 = 1$$

b) $$\int_0^\infty x\lambda e^{-\lambda x}\,dx = \frac{1}{-\lambda}\int_0^\infty x\lambda\left(e^{-\lambda x}\right)'dx = \frac{1}{-\lambda}\left(\lambda\left[xe^{-\lambda x}\right]_0^\infty - \int_0^\infty \lambda e^{-\lambda x}\,dx\right) \overset{a)}{=} -\left[xe^{-\lambda x}\right]_0^\infty - \frac{1}{-\lambda} = -\lim_{x\to\infty}\frac{x}{e^{\lambda x}} + \frac{1}{\lambda} = \frac{1}{\lambda}$$

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