4.

a)
$$\int_0^\infty \lambda e^{-\lambda x}\, dx = \lambda \int_0^\infty e^{-\lambda x}\, dx = \left| \begin{array}{c} t = -\lambda x \\ dt = -\lambda\, dx \\ \Downarrow \\ dx = \frac{dt}{-\lambda} \end{array} \right| = \lambda \int_0^{-\infty} -\frac{1}{\lambda} e^t\, dt =$$

$$= \lambda \cdot \left(-\frac{1}{\lambda}\right) \int_0^{-\infty} e^t\, dt = -\int_0^{-\infty} e^t = -\left(\lim_{x \to \infty} e^t - e^0\right) = 1$$

b)
$$\int_0^\infty x \lambda e^{-\lambda x}\, dx = \left|\begin{array}{c} \\ \end{array}\right|_0^\infty -\frac{x}{e^{\lambda x}} + \int_0^\infty e^{-\lambda x}\, dx = \lim_{x \to \infty} \frac{-x}{e^{\lambda x}} + \frac{0}{e^0} + \frac{1}{\lambda} = \frac{1}{\lambda}$$

$$\underset{\downarrow}{} \quad \underset{\substack{\Downarrow \\ 0}}{} \quad \underset{\substack{= \\ 0}}{}$$

$$\begin{array}{|c c|}
\hline
D & I \\
x & \lambda e^{-\lambda x} \\
& \\
1 & -e^{-\lambda x} \\
\hline
\end{array}$$