

Problem 26

In each of Problems 25 through 28, determine whether the given integral converges or diverges.

$$\int_0^{\infty} te^{-t} dt$$

Solution

$$\begin{aligned}\int_0^{\infty} te^{-t} dt &= \int_0^{\infty} t \frac{d}{dt}(-e^{-t}) dt \\ &= t(-e^{-t}) \Big|_0^{\infty} - \int_0^{\infty} (1)(-e^{-t}) dt \\ &= \int_0^{\infty} e^{-t} dt \\ &= -e^{-t} \Big|_0^{\infty} \\ &= e^0 - e^{\infty} \\ &= 1\end{aligned}$$

The integral converges.