9. Find $\int_1^\infty \frac{x}{e^x}dx = \lim_{b\to\infty}\left(-xe^{-x} + \int e^{-x}dx\right)\Big]_1^b = \lim_{b\to\infty} -xe^{-x} - e^{-x}\Big]_1^b$

$u = x \quad v = -e^{-x}$

$du = dx \quad dv = e^{-x}dx$

$\frac{d}{dx}(PA) = +xe^{-x} - e^{-x} + e^{-x}$ ✓

$= \lim_{b\to\infty} \frac{-b}{e^b} - \frac{1}{e^b} - \left(-\frac{1}{e} - \frac{1}{e}\right) = \lim_{b\to\infty} \frac{-1}{e^b} - 0 + \frac{2}{e} = \frac{2}{e}$

$t, b \to \infty$

10. Consider the series $\sum_{k=1}^{\infty} \ln(\frac{k}{k+1})$. Find a closed formula for the partial sum $s_n = \sum_{k=1}^{n} \ln(\frac{k}{k+1})$. (In other words, I want you to find a formula which is equal to s_n. Your formula is not allowed to contain any "dots" or any summation signs.) Does the original series converge or diverge? Find the limit of the series, if possible.

$s_n = \ln\left(\frac{1}{2}\right) + \ln\left(\frac{2}{3}\right) + \ln\left(\frac{3}{4}\right) + \cdots + \ln\left(\frac{n}{n+1}\right)$

$(\underbrace{\ln 1}_{0} - \cancel{\ln 2}) + (\cancel{\ln 2} - \cancel{\ln 3}) + (\cancel{\ln 3} - \cancel{\ln 4}) + \cdots + (\cancel{\ln n} - \ln(n+1)) = -\ln(n+1)$

The original series diverges to $-\infty$