PROOF OF FORMULA 3.351.4

$$\int_u^\infty \frac{e^{-px}}{x^{n+1}} = \frac{(-1)^{n+1}p^n \text{Ei}(-pu)}{n!} + \frac{e^{-up}}{u^n}\sum_{k=0}^{n-1} \frac{(-1)^k (up)^k (n-k-1)!}{n!}$$

Formula 2.324.2 gives the indefinite integral

$$\int \frac{e^{ax}}{x^m} = \frac{a^{m-1}\text{Ei}(ax)}{(m-1)!} - \frac{e^{ax}}{(m-1)!}\sum_{k=0}^{m-1} \frac{a^{k-1}(m-k-1)!}{x^{m-k}}.$$

Put $p = -a$ and $m = n+1$ and evaluate at $x = u$ and $x = \infty$ to obtain the result. The parameter p must be positive, for convergence.