Find $\int_0^\infty e^{-x}dx$

1) This is an improper integral because the upper limit is infinite.
2) You can find the antiderivative using u substitution.

$$\int_0^\infty e^{-x}dx = \lim_{t \to \infty} \int_0^t e^{-x}dx$$ First put in the upper limit as t

$$= \lim_{t \to \infty} -e^{-x} \Big]_0^t$$ Antidifferentiate

$$= \lim_{t \to \infty} -e^{-t} - (-e^{0})$$ Plug in the limits of integration

$$= \lim_{t \to \infty} \frac{-1}{e^{t}} + 1$$ $e^{0} = 1$

$$= \frac{-1}{e^{\infty}} + 1$$ Pretend to plug infinity for t. Not strictly legal.

$$=0+1$$
$$=1$$