The Fourier transform of a function $f : \mathbb{R} \to \mathbb{R}$ is given by

$$\hat{f}(s) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(t)e^{-ist} \, dt.$$

Find the Fourier transform of the following functions

(a) $f(t) = 1$ for $|t| \leq \pi$ and $f(t) = 0$ for $|t| > \pi$.

(b) $f(t) = t$ for $|t| \leq 1$ and $f(t) = 0$ for $|t| > 1$.

(c) $f(t) = e^{-|t|}$. (Hint: split the integral into positive and negative parts).