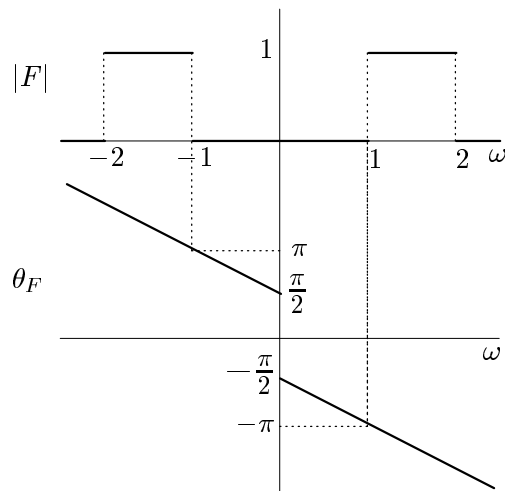1. Find the Fourier transforms of the following functions:

   a) $f(t) = u(t+1) - u(t-1)$.

   b) $f(t) = \cos(\pi t) + 1$.

   c) $f(t) = \begin{cases} \cos(\pi t) + 1 & \text{for } t \in [-1, 1] \\ 0 & \text{otherwise} \end{cases}$

2. Find the inverse Fourier transform of the function $F(i\omega)$ defined by the magnitude and phase plot below.

3. Use properties of the Fourier transform to compute the integrals

$$\text{a) } \int_{-\infty}^{\infty} \frac{\sin(t)}{t} dt; \qquad \text{b) } \int_{-\infty}^{\infty} \left[\frac{\sin(t)}{t}\right]^2 dt$$

4. A signal $f(t)$ has Fourier transform

$$F(i\omega) = \frac{1 + i\omega}{1 - i\omega}$$

   a) Sketch the magnitude and phase of $F(i\omega)$.

   b) Find the Fourier transform of $g(t) = f(1 - 2t)$

   c) Find the Fourier transform of $\int_{-\infty}^{t} f(\sigma) d\sigma$.