Definitions:

- Fourier Transform:
  \[ \tilde{f}(\omega) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\infty} f(t)e^{-i\omega t} \, dt. \]

- The magnitude \(|z|\) of a complex number \(z\) is defined by
  \[ |z| = \sqrt{zz^*}, \]
  where \(z^*\) is the complex conjugate of \(z\).

Questions:

1. [6 points] Compute the Fourier transform of \(f(t) = \begin{cases} \sin(t) & \text{for } 0 < t < \pi, \\ 0 & \text{otherwise.} \end{cases}\)

2. [4 points] Show that the magnitude of the Fourier transform of \(f(t)\) is
  \[ |\tilde{f}(\omega)| = \sqrt{\frac{2}{\pi}} \left| \frac{\cos(\pi\omega/2)}{1 - \omega^2} \right|. \]

3. [2 points] Compute the Fourier transform of \(g(t) = \begin{cases} \cos(t) & \text{for } \pi/2 < t < \pi/2, \\ 0 & \text{otherwise.} \end{cases}\)
   Notice that \(g(t) = f(t + \pi/2)\), so there is a simple relation between \(\tilde{g}(\omega)\) and \(\tilde{f}(\omega)\).