1. [50 points] Given a modulating signal \( m(t) = 4 \cos(200\pi t) \) and a carrier signal \( \cos(2000\pi t) \),
   a. Hand-sketch the spectrum of \( m(t) \).
   b. Hand-sketch the spectrum of the DSB modulated signal \( m(t)\cos(2000\pi t) \).
   c. Hand-sketch the spectrum of the demodulated signal with the given carrier.
   (Hint: Follow the procedure covered in our lectures and discussions on the AM process.)

2. [50 points] Given \( m(t) = \cos(80\pi t) + \cos(120\pi t) \), \( t \in [-0.1,+0.1] \). Using MATLAB, perform the following:
   a. Plot the amplitude spectrum of \( m(t) \) and the modulated DSB signal \( S_{DSB}(t) = m(t)\cos(400\pi t) \).
   b. At the receiver, demodulate \( S_{DSB}(t) \) with the local carrier \( \cos(400\pi t) \). Design an LPF to suppress the carrier. Then, plot the amplitude spectrum of \( S_{DSB}(t) \) BEFORE and AFTER the LPF.
   (Hint: Some helpful MATLAB functions are \texttt{fft, fftshift, fir1, filter}, among others.)