

## PROBLEM:

An amplitude modulated (AM) cosine wave is represented by the formula

$$x(t) = [3 + \sin(\pi t)] \cos(13\pi t + \pi/2)$$

- (a) Use *phasors* to show that  $x(t)$  can be expressed in the form:

$$x(t) = A_1 \cos(\omega_1 t + \phi_1) + A_2 \cos(\omega_2 t + \phi_2) + A_3 \cos(\omega_3 t + \phi_3)$$

where  $\omega_1 < \omega_2 < \omega_3$ ; i.e., find  $A_1, A_2, A_3, \phi_1, \phi_2, \phi_3, \omega_1, \omega_2, \omega_3$  in terms of  $A, \omega_0$ , and  $\omega_c$ .

- (b) Sketch the two-sided spectrum of this signal on a frequency axis. Be sure to label important features of the plot. Label your plot in terms of the numerical values of the  $A_i$ 's  $\phi_i$ 's and  $\omega_i$ 's.
- (c) Determine the minimum sampling rate that can be used to sample  $x(t)$  without any aliasing.