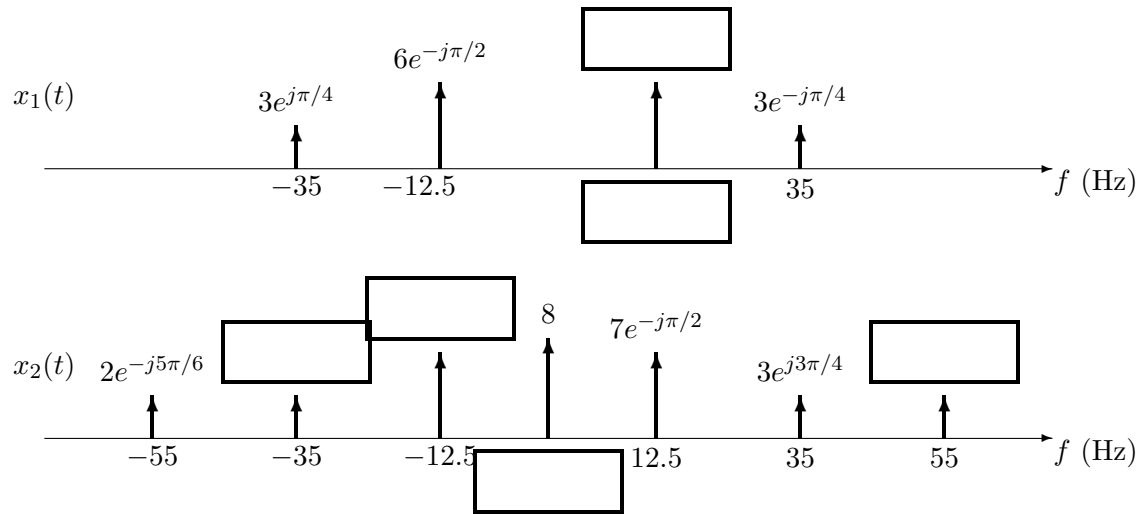


Problem F01-Q.1.1:

- (a) The incomplete spectra for two *real* signals $x_1(t)$ and $x_2(t)$ are shown in the following figures. Fill in the empty boxes for the missing components.



- (b) Write an equation for $x_2(t)$ in terms of cosine functions.

Problem F01-Q.1.2:

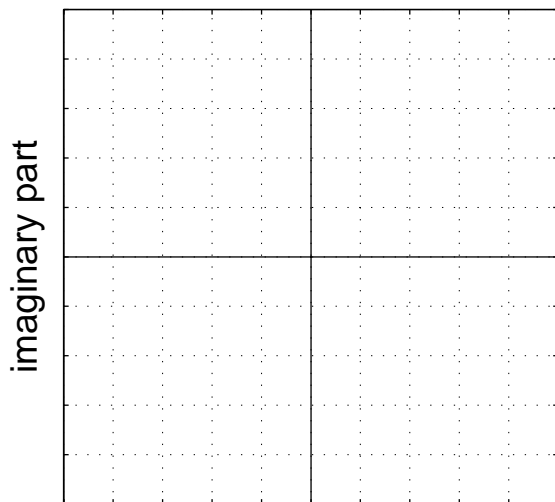
Define $x(t)$ as

$$x(t) = \sqrt{2} \cos(10\pi(t + .05)) + \cos(10\pi t - 3\pi/4)$$

- (a) Use phasor addition to express $x(t)$ in the form $x(t) = A \cos(\omega_0 t + \phi)$ by finding the numerical values of A and ϕ , as well as ω_0 .

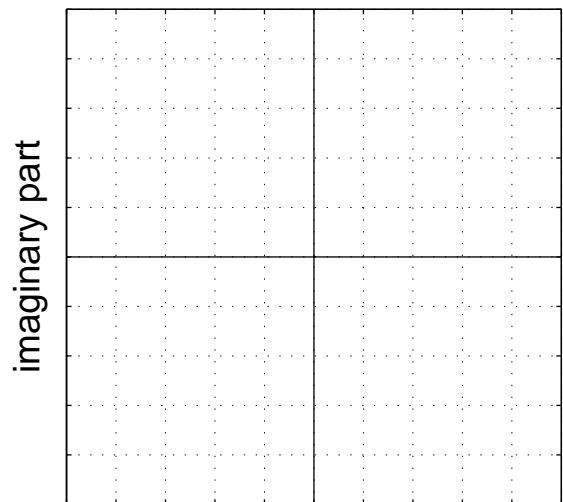
- (b) Make two complex plane plots to illustrate how complex amplitudes (phasors) were used to solve part (a). On the first plot, show the two complex amplitudes being added; on the second plot, show your solution as a vector and the addition of the two complex amplitudes as vectors (head-to-tail).

Two vectors here.



real part

Head-to-tail plot here.

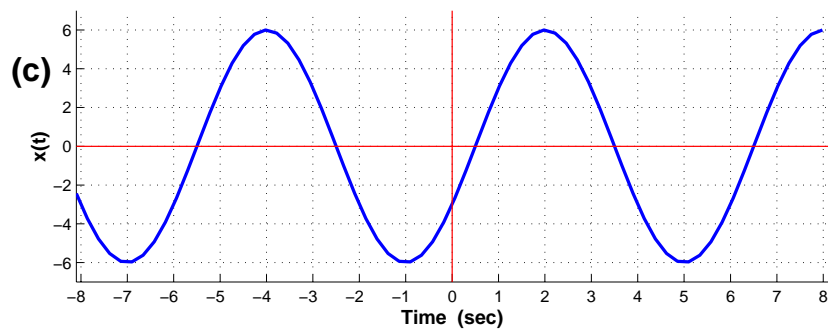
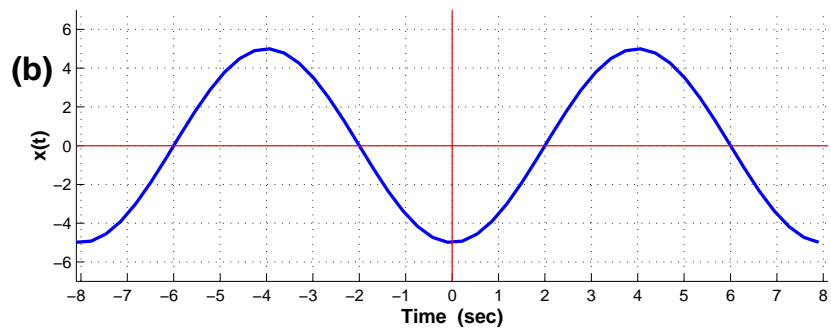
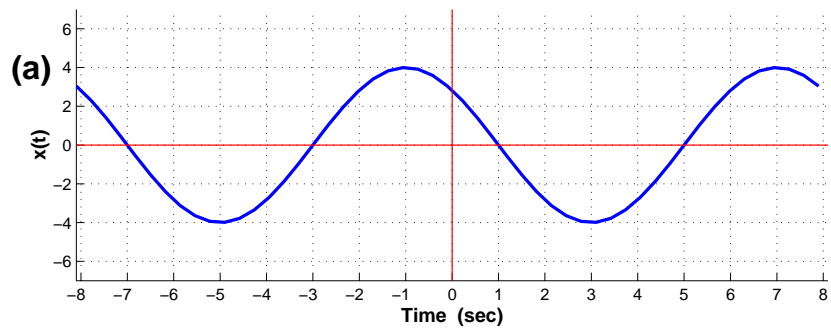


real part

Problem F01-Q.1.3:

Several sinusoidal signals are plotted below. For each plot (a)–(c), determine the amplitude, phase (in radians) and frequency (in Hz). Write your answers in the following table:

PLOT	(a)	(b)	(c)
AMPLITUDE			
PHASE (in radians)			
FREQUENCY (in Hz)			



Problem F01-Q.1.4:

Simplify the following complex-valued expressions. In each case reduce the answers to a **simple** numerical form. Let

$$V = -\sqrt{3} + j3.$$

(a) Express jV in polar form. In addition plot jV as a vector.

(b) Express the inverse of V in rectangular form. In addition plot $\frac{1}{V}$ as a vector.

(c) If $Z = \frac{|V|}{V^*}$, express Z in polar form. In addition plot Z as a vector.

(d) Express $\Re\{j^3 V e^{j15t}\}$ in the standard “cosine” form.

Problem F01-Q.1.5:

The signal $x(t)$ is formed from the signal $v(t)$ by AM modulation. Assume that

$$v(t) = 4 + 4 \cos(6t + \pi/2)$$

and that

$$x(t) = v(t) \cos(20t).$$

- (a) Draw the spectrum for $v(t)$. Your sketch should be clearly labeled and all complex amplitudes should be indicated.

- (b) Draw the spectrum for $x(t)$. Your sketch should be clearly labeled and all complex amplitudes should be clearly indicated.