2-10 Problems

P-2.1 Define $x(t)$ as

$$x(t) = 3\cos(\omega_0 t - \pi/4)$$

For $\omega_0 = \pi/5$, make a plot of $x(t)$ that is valid over the range $-10 \le t \le 20$.

P-2.2 Figure P-2.2 is a plot of a sinusoidal wave. From the plot, determine values for the amplitude (A), phase (ϕ), and frequency (ω_0) needed in the representation:

$$x(t) = A\cos(\omega_0 t + \phi)$$

Give the answer as numerical values, *including the units* where applicable.

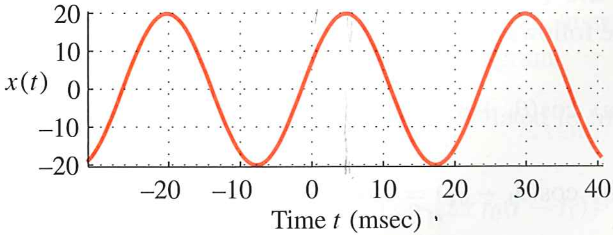

Figure P-2.2

P-2.4 Use the series expansions for e^x, $\cos(\theta)$, and $\sin(\theta)$ given here to verify Euler's formula.

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

$$\cos(\theta) = 1 - \frac{\theta^2}{2!} + \frac{\theta^4}{4!} + \cdots$$

$$\sin(\theta) = \theta - \frac{\theta^3}{3!} + \frac{\theta^5}{5!} + \cdots$$

P-2.5 Use complex exponentials (i.e., phasors) to show the following trigonometric identities:

(a) $\cos(\theta_1 + \theta_2) = \cos(\theta_1)\cos(\theta_2) - \sin(\theta_1)\sin(\theta_2)$

(b) $\cos(\theta_1 - \theta_2) = \cos(\theta_1)\cos(\theta_2) + \sin(\theta_1)\sin(\theta_2)$

Hint: Write the left-hand side of each equation as the real part of a complex exponential.

P-2.15 Define $x(t)$ as

$$x(t) = 5\cos(\omega t + \tfrac{1}{3}\pi) + 7\cos(\omega t - \tfrac{5}{4}\pi) + 3\cos(\omega t)$$

Express $x(t)$ in the form $x(t) = A\cos(\omega t + \phi)$. Use complex phasor manipulations to obtain the answer. Explain your answer by giving a phasor diagram.