Problem 3.1: This problem is a review of complex numbers.

(a) Determine the magnitude and phase of the complex number

$$Z = \frac{1}{4}(e^{-j\pi/2} + 2e^{-j\pi} + 3e^{-j3\pi/2}).$$

(b) Make a single plot of the following two vectors in the complex plane. Do this by placing the tail of the vector arrow at the origin. Use a straightedge. Label the axes. Draw the unit circle for context. Label all important features like angles, lengths, and arrow head locations.

(I.) $Z_1 = -2 + j2$

(II.) $Z_2 = 1.5e^{j\pi/3}$

Problem 3.2: Make two separate plots of the real and the imaginary parts of the signal $x(t) = \begin{cases} e^{(-2+j)t}, & t \geq 0 \\ 0, & \text{else} \end{cases}$. Show your reasoning. Label all axes and use a straightedge. Show all important features. Label the origin for context.

Problem 3.3: For each of the following discrete-time signals: Is the signal periodic? If yes, what is its fundamental period? Fundamental frequency?

(a) $x_1[n] = 3\sin\left(\frac{2\pi}{7}n + \frac{\pi}{2}\right)$

(b) $x_2[n] = 1.5\cos\left(\frac{1}{3}n\right)$

Problem 3.4: For each of the following continuous-time signals: Is the signal periodic? If yes, what is its fundamental period? Fundamental frequency?

(a) $y_1(t) = 1.5\cos\left(\frac{1}{3}t\right)$

(b) $y_2(t) = 0.3\cos\left(20t + \pi\right) + 0.7\sin(15t)$

(c) $y_3(t) = e^{-j3.5t}$

Optional, but Testable, Problems: From the textbook, Problems 1.9, 1.10, 1.11, 1.49.