You must show all of your work for full credit. All answers should be simplified as much as reasonably possible. Calculators may NOT be used.

1. (20 points) Find the trigonometric Fourier series for the function

\[ x(t) = \sin\left(\frac{5t}{2}\right) + \sin\left(\frac{3t}{5}\right) + 2\cos^2\left(\frac{t + 2\pi}{3}\right). \]
2. (20 points) Consider the exponential Fourier series

\[ x(t) = e^{-2jt} + je^{-jt} + 2 + e^{2jt} - je^{jt}. \]

(a) Find the Fourier spectra (values of magnitude and phase angles \(|D_n|\) and \(\angle D_n\)), (You need not plot the spectra.)

(b) Find the trigonometric Fourier series for \(x(t)\).
3. (20 points) Where possible, determine the trigonometric Fourier series representation of the following functions:

(a) \( x_a(t) = 2 \cos^3(10t) \)

(b) \( x_b(t) = e^{j3\pi t/4} + e^{j\pi t/4} \)

(c) \( x_c(t) = 2t \sin(j\pi t) \)

(d) \( x_d(t) = 3 \cos(\pi t/3) + \sin^2(\pi t) \)

(e) \( x_e(t) = 3 \sin(5t + 7) + 5 \text{sinc}(2t + 1) \)
4. (20 points) Consider the system having transfer function

\[ H(s) = \frac{1}{s + 2}. \]  

(a) Find the output \( y_a(t) \) corresponding to the input \( x_a(t) = 2 \cos^3(10t) \).

(b) Find the output \( y_b(t) \) corresponding to the input \( x_b(t) = e^{-3t}u(t) \).
5. (20 points) Find the Fourier transform of the function $x(t)$ shown below.

\[ x(t) \]

\[ -\frac{\pi}{2} \quad \frac{\pi}{2} \]