1. Solve the IVP

\[ y'' - 2y' + y = 1 + e^x \]
\[ y(0) = 0 \]
\[ y'(0) = 2 \]
2. A system is modeled by the differential equation

\[ 2x'' + 16x' + 50x = -256 \cos t - 128 \sin t \]

(a) What does the differential equation tell you about the system being modeled? (include a description of all constants)

(b) Find the general equation of the system.

(c) What is the long-term behavior of the solution? Does it depend on the initial conditions? Express the steady periodic solution as a single oscillation.
3. Find the eigenvalues and eigenfunctions for

\[ y'' + 2y' + \lambda y = 0 \]
\[ y(0) = y(1) = 0 \]
4. Consider

\[ y'' + y = 1 + \sec(x). \]

(a) Can you use the method of undetermined coefficients to solve this ODE? If so, explain why. If not, what method should you use?

(b) Find the general solution
5. (a) Find the Fourier series for \( f \) on the interval \([-3, 3]\).

\[
f(t) = 3 + |2t|
\]

(b) Sketch the function to which \( f \) converges on the interval \([-9, 9]\).