MAP 2302 — Midterm 2 Review Problems

The exam will cover sections 4.2, 4.3, 4.4, 4.5, and 4.6. All topics from this review sheet or from the suggested exercises are fair game.

1. Solve the following initial value problems.
   a. \( y'' - 4y' + 8y = 0; \quad y(0) = 1; \quad y'(0) = 0. \)
   b. \( y'' + 2y' - 3y = 0; \quad y(0) = 9; \quad y'(0) = -3. \)
   c. \( y'' - 4y = 0; \quad y(0) = 2; \quad y'(0) = -98. \)

2. What form of particular solution \( y_p \) would you guess in order to solve the following differential equations using the method of undetermined coefficients? Do not solve these problems.
   a. \( y'' - 4y' - 21y = 2e^{7t}. \)
   b. \( y'' - 2y' - 8y = 19t \cos(2t). \)
   c. \( y'' - 4y' + 5y = 7e^{2t} \sin t + t. \)

3. Solve the following differential equations.
   a. \( y'' + 4y = \tan 2t. \)
   b. \( y''' - 2y'' + 17y' = e^{3t}. \)
   c. \( y'' - 4y' + 4y = te^{2t}. \)

4. Solve the following initial value problems.
   a. \( y'' - 9y = 18t; \quad y(0) = 1; \quad y'(0) = 11. \)
   b. \( y'' - y' - 2y = 2e^{-t} + 4; \quad y(0) = 10; \quad y'(0) = -3. \)

5. Suppose that you know that the general solution to the homogeneous differential equation
   \[ t^2y'' - 3ty' + 4y = 0 \]
   for \( t > 0 \) is
   \[ y_h = Ct^2 + Dt^2 \ln t. \]
   Find the general solution to the differential equation
   \[ t^2y'' - 3ty' + 4y = t^2 \ln t. \]