Math 231 Homework Problems #9

Differential Equations with Linear Algebra, by M. Boelkins, M. Potter, and J. Goldberg

4.2. Homogeneous equations: distinct real roots

• 1, 4, 6, 8, 11, 13

4.3. Homogeneous equations: repeated and complex roots

• 1, 4, 6, 9, 10, 13, 15, 18

4.4. Nonhomogeneous equations

• 1, 4, 8, 10, 11, 14, 20, 22, 24, 25
• 34 Find the general solution for the second-order ODE

\[ t^2 y'' - ty' + y = 4t \ln(t). \]

Two linearly independent solutions to the homogeneous problem are given by \( y_1(t) = t \) and \( y_2(t) = t \ln(t) \).

• 35 For each of the following problems state the general form of the particular solution that you would guess using the method of undetermined coefficients (do not actually find the particular solution):

(a) \( y''' + 2y' + y = 5te^{-t} + 6\sin(2t) \)
(b) \( y''' - 3y' - 4y = 3t \cos(4t) + 4e^{2t} \sin(3t) \)
(c) \( y''' + 2y' + 2y = 7e^{2t} + 5e^{-t} \cos(t) \).

4.6. Higher-order linear differential equations

• 1, 4, 5, 8, 11, 20, 29, 35, 38
• 43 For each of the following problems state the order of the ODE, and then find the general solution:

(a) \( (D - 1)(D + 3)^2(D - 5)y = 0 \)
(b) \( (D^2 + 8D + 41)(D - 2)^3(D + 4)^2 y = 0 \)
(c) \( (D - 7)(D^2 - 9)^2(D^2 + 9)^3 y = 0. \)

• 44 For each of the following problems state the general form of the particular solution that you would guess using the method of undetermined coefficients (do not actually find the particular solution):

(a) \( (D - 1)^2(D + 3)(D + 5)(D^2 + 2D + 5)y = 5t^2 e^t \)
(b) \( (D + 1)^3(D + 4)(D^2 + 25)(D^2 + 4D + 13)^4 y = 3t \cos(3t) - 9e^{-2t} \sin(3t) \)
(c) \( (D - 5)^2(D - 3)(D + 5)^4(D^2 - 8D + 41)y = -4t^2 + 3e^{5t}. \)