1. Show that $y = C_1 \cos(x) + C_2 \sin(x) + x \sin(x) + \cos(x) \ln(\cos(x))$ is the general solution to $y'' + y = \sec(x)$ on the interval $(0, \pi/4)$.

2. Given that $y_1(t) = t$ is a solution to $y'' - y'/t + y/t^2 = 0$ for $t > 0$, find a second linearly independent solution $y_2(t)$ and state the general solution.

3. The differential equation $(\sin(t))y'' - 2(\cos(t))y' - (\sin(t))y = 0$ has a solutions of either $y = \sin(t)$ or $y = \cos(t)$ on the interval $(0, \pi)$. Figure out which, find a second linearly independent solution, and state the general solution. (In your simplifications it may help to recall that $1 + \cot^2(\theta) = \csc^2(\theta)$.)

4. Solve the initial value problem:
$$y'' - 6y' + 9y = 0, \quad y(0) = 2, \quad y'(0) = \frac{25}{3}$$

5. Find the general solution of
$$y''' - 7y'' + 7y' + 15y = 0$$

6. Find the general solution of
$$y'' + 10y' + 41y = 0$$

7. Solve the initial value problem:
$$y''' - 4y'' + 7y' - 6y = 0, \quad y(0) = 1, \quad y'(0) = 0, \quad y''(0) = 0$$

8. Find the general solution of
$$y'' - 5y' + 6y = xe^x$$

9. Solve the initial value problem:
$$y'' + y' - 12y = e^t + e^{2t} - 1, \quad y(0) = 1, \quad y'(0) = 3$$