1. Solve $y'' - y = \sin(3x)$ subject to the boundary conditions $y(0) = y'(0) = 0$.

2. Find the general solution to $y'' + 6y' + 9y = e^x + \sin(2x) + e^{-3x}$.

3. Find the solution to $x^2y'' + xy' - 4y = x + x^2$ with $y(1) = 0$ and $y(0)$ bounded.

4. Find the general solution to $(x - 1)^2y'' + (x - 1)y' + 4y = x^2 + 3$ (hint: introduce a new independent variable $t = x - 1$).

5. Find the general solution to $x^2y'' - (1 + 2x^2)y' + (1 + x^2)y = 1$.

6. Find the general solution to $y'' - 2y' \tan x - y = \sin x$ by reduction of order (note that $y_1 = \sec x$ satisfies the homogeneous equation).

7. Find the general solution to $x^2y'' - 4xy' + 6y = x^4 \sin x$ by reduction of order, knowing that $y_2 = x^3$ is one of the solutions to the complementary homogeneous equation (note that we have solved this problem in class using the other independent solution $y_1 = x^2$).

8. Find the general solution to $x^2y'' - 4xy' + 6y = x^4 \sin x$ by variation of parameters.

9. Solve the problem $y'' + 2y' + y = \frac{1}{1+x^6}$, $y(0) = 0$, $\lim_{x \to \infty} e^x y(x) = \text{finite}$ using variation of parameters.

10. Find the general solution to $y'' - 2y' + y = 2xe^x$ using variation of parameters.