1. Find the general solution of the following differential equation.

$$2 x y y' = x + 8 y^2$$

2. Find the general solution of the following differential equation.

$$x^2 y'' - 4 x y' + 6 y = x^6 e^x$$

3. Solve the differential equation by using the Laplace Transform method.

$$y'' + 2 t y' - 4 y = 6 \quad y(t = 0) = 0, \quad y'(t = 0) = 0$$

4. By using the Frobenius method, find and solve the first three nonzero terms of two linearly independent solutions for the following differential equation.

$$2 x^2 y'' - 3 x y' - (2 x^2 + 3) y = 0$$

5. Find the general solution for the system of linear differential equations.

$$\begin{align*}
x' &= x + 2 y + z \\
y' &= 6 x - y \\
z' &= - x - 2 y - z
\end{align*}$$

(where $x' = \frac{dx}{dt}$, $y' = \frac{dy}{dt}$, $z' = \frac{dz}{dt}$)