1. Verify that the given differential equation is exact. If it is, then solve it.

\[(4x - y) + (6y - x) \frac{dy}{dx} = 0\]

Solution: Let \( M(x, y) = 4x - y \) and \( N(x, y) = 6y - x \). Since \( \frac{\partial M}{\partial y} = -1 = \frac{\partial N}{\partial x} \), we have this is an exact equation. We must have \( C = \int M(x, y) \, dx + h_1(y) = \int N(x, y) \, dy + h_2(x) \Rightarrow 2x^2 - xy + h_1(y) = 3y^2 - xy + h_2(x) \). This shows that \( h_1(y) = 3y^2 \) and \( h_2(x) = 2x^2 \). Therefore, \( 2x^2 - xy + 3y^2 = C \).

2. Find the general solution of \( y^2y' + 2xy^3 = 6x \)

Solution: Suppose \( v = y^3 \). Then \( v' = 3y^2y' \Rightarrow \frac{1}{3}v' = y^2y' \). So \( y^2y' + 2xy^3 = 6x \Rightarrow \frac{1}{3}v' + 2xv = 6x \Rightarrow v' + 6xv = 18x \). Let \( \rho(x) = e^{3x^2} \). Then \( \{v(x) \rho(x)\}' = 18\rho(x) \Rightarrow v(x)e^{3x^2} = 3e^{3x^2} + C \Rightarrow v(x) = 3 + Ce^{-3x^2} \Rightarrow y(x) = \left\{3 + Ce^{-3x^2}\right\}^{1/3} \)

3. Find the general solution of \( y'' - 3y' + 2y = 0 \)

Solution: Let assume \( y = e^{rx} \). Then \( (r^2 - 3r + 2)y = 0 \Rightarrow r^2 - 3r + 2 = 0 \Rightarrow (r - 1)(r - 2) = 0 \Rightarrow r = 1, 2 \). This implies that \( y(x) = c_1e^x + c_2e^{2x} \).

4. Find the general solution \( y'' - 10y' + 25y = 0 \)

Solution: Let assume \( y = e^{rx} \). Then \( (r^2 - 10r + 25)y = 0 \Rightarrow (r - 5)^2 = 0 \Rightarrow r = 5 \) with multiplicity two. This implies that \( y(x) = (c_1 + c_2x)e^{5x} \).