1. For each of the following differential equations: identify the dependent and independent variables, give the order and state whether it is linear or nonlinear.

(a) $x^2 y'' + 2xy' + 5y = 0$;
(b) $x \frac{dx}{dt} + 3t^2 = c$, $c$ is a constant;
(c) $xdy + ydx = 0$.

2. Verify that $x^2 y^4 + x^3 - 27 = 0$ is a solution of $4xy^3 \frac{dy}{dx} + 2y^4 + 3x = 0$. 
3. Find general solutions of the following differential equations:

(a) \( x \tan y - y' \sec x = 0; \)
(b) \( y' \cos x = y \sin x + \sin 2x, \ -\frac{\pi}{2} < x < \frac{\pi}{2}; \)
(c) \( ydx - (x + \sqrt{y^2 - xy})dy = 0; \)
(d) \( (3x^2 - 2xy + 3y^2)dx = 4xydy; \)
(e) \( (ye^{xy} - 2y^3)dx + (xe^{xy} - 6xy^2 - 2y)dy = 0; \)
(f) \( 2x^3ydx + (x^4 + y^4)dy = 0, \ x > 0, \ y > 0. \)
4. For each of the following differential equations: find a suitable substitution and then identify the resulting equation. (DO NOT SOLVE THE RESULT EQUATION AFTER FINDING THE RIGHT SUBSTITUTION)

(a) \( \cos x \, dx - (\cos y \sin x - y \sin^2 x) \, dy \);
(b) \( y' = \cos(x + y - 3) \);
(c) \( (2\sqrt{x + y} + 1) \, dx + (1 - x - y) \, dy = 0 \).