1. Find the general solution of the following differential equations
   a) $xy' - y = y^3$ b) $xyy' = 1 - x^2$
   c) $y' \tan x = y$ d) $y' = 10^{x+y}$

2. Find the solution of the following initial value problems
   a) $(x^2 - 1)y' + 2xy^2 = 0, \quad y(0) = 1$
   b) $y' \sin x = y \ln y, \quad y(\frac{\pi}{2}) = 1$

3. Find the general solution of the following differential equations
   a) $y' + y = xy^3$
   b) $x^2 y' = y(x + y)$
   c) $y' + x\sqrt[3]{y} = 3y$

4. Find the general solution of the following differential equations

   a) $y' = \dfrac{2xy}{x^2 + y^2}$ b) $x - y \cos\left(\dfrac{y}{x}\right) + x \cos\left(\dfrac{y}{x}\right) y' = 0$

5. Find the solution of the initial value problem $2xyy' + x^2 - y^2 = 0$, $y(1) = 0$.

6. If possible, find the values of α and β such that the equation $xy^\beta y' = 3x^\alpha + x^3 y^3$ is
   a) linear;   b) separable;   c) homogeneous;   d) Bernoulli?

7. Find α and β such that the following equations are exact:
   a) $x^\alpha y^2 + x^3 y^\beta y' = 0$
   b) $6x^\beta e^y \, dx + x^{\beta+\alpha} e^y \, dy = 0$
   c) $e^{\alpha x + \beta y}(3 + y') = 0$

8. Find the general solution of the following differential equations
   a) $(2 - 9xy^2)x \, dx + (4y^2 - 6x^3)y \, dy = 0$ b) $1 + y^2 \sin 2x - 2yy' \cos^2 x = 0$
   c) $x \, dx + y \, dy = \dfrac{xdy - ydx}{x^2 + y^2}$

9. Find the general solution of the following differential equations.
   a) $y' = 2xy + x$
   b) $2xy' = y$
   c) $x^2 + 2xy^3 + (y^2 + 3x^2 y^2)y' = 0$

10. Use the appropriate existence and uniqueness theorem to find the largest interval (a, b) on which the solution to each the following equations is guaranteed to exist:

a) $y' + \dfrac{t}{t^2 - 1}y = \sqrt{5 - t}, \quad y(4) = -3$

b) $(t - 6)y' + ty = \ln\left(t - \dfrac{4}{t}\right), \quad y(3) = 7$

11. Find the general solution of the following differential equations
   a) $(1 + 2y)y' + 2(y + y^2) = 0$;
   b) $\left(x^2 + \dfrac{x}{\cos^2 y}\right)y' + 3xy + 2tany = 0.$