Q1. (10 Points - Suggested time: 5 minutes) State if each of the following statements is true or false:

1. If \( y_1 \) and \( y_2 \) are solutions of some linear ODE, then \( c_1 y_1 + c_2 y_2 \) is also a solution of the same ODE.

2. The number of integrating factors for a non-exact first-order ODE is infinite (provided it has one).

3. Every IVP of the first-order has a unique solution.

4. Every Bernoulli first-order ODE can be transformed into a linear ODE.

5. Every separable first-order ODE \( \frac{dy}{dx} = g(x)h(y) \) is exact.

Q2. (20 Points - Suggested time: 10 minutes) Solve the following IVP:

\[
(y - 1) \, dx + x \, dy = 0, \quad y(1) = 2.
\]
Q3. (60 Points - Suggested time: 50 minutes) Solve each of the following ODE's (showing all details).

1. \((x^2 - y^2) \, dx + (xy) \, dy = 0.\)

2. \((4x^2 - 4xy + y^2 - 3) \, dx - dy = 0.\)
3. \((x^2y - xy^3)\,dx + \,dy = 0\).
4. \((x^2 + y^2 - 1)dx - (y + xy)\, dy = 0\)
Q4. (10 Points - Suggested time: 10 minutes) Show that any linear differential equation
\[ y' + p(x)y = f(x), \]
(with \( p(x) \) and \( f(x) \) continuous functions) becomes exact after being multiplied with \( \mu(x) = e^{\int p(x) dx} \).