Instructions: Show all work. Use exact answers unless otherwise asked to round.

1. Solve the homogeneous differential equation $xy' = y(\ln x - \ln y)$.

2. Solve the Bernoulli equation $y' - \frac{2}{x}y = \frac{x}{y^2}$.

3. Classify the differential equation by order, linearity and whether it is ordinary or partial.

   a. $\frac{d^2 y}{dx^2} = x \cos y$

   b. $\left(\frac{\partial u}{\partial x}\right)^3 - \frac{\partial^2 u}{\partial x \partial y} = uxy$