

Provide a clear and organized presentation. Show all of your work and completely simplify your answer. Solve the following differential equation:

$$\left(4x^3 \ln y + 3x^2 y + \frac{x^2}{2+x+x^2}\right) dx + \left(\frac{x^4}{y} + x^3 + e^y\right) dy = 0$$