

Name: \_\_\_\_\_ Section: \_\_\_\_\_

You must show all your work to receive credit. Calculators are allowed.

**Problem 1:** (3 points) Find the implicit general solution to the equation

$$\frac{dy}{dx} = \frac{-1 - ye^{xy}}{2y + xe^{xy}}$$

$$(1 + ye^{xy}) dx + (2y + xe^{xy}) dy = 0$$

$$\begin{array}{ccc} \downarrow \partial/\partial x & & \downarrow \partial/\partial y \\ e^{xy} + xy e^{xy} & & e^{xy} + xy e^{xy} \end{array}, \text{ they agree, so is } \underline{\text{exact}}$$

Need to find  $H(x,y)$  with

$$\begin{cases} \frac{\partial H}{\partial x} = 1 + ye^{xy} & (1) \\ \frac{\partial H}{\partial y} = 2y + xe^{xy} & (2) \end{cases}$$

$$\text{From (1), } H = \int (1 + ye^{xy}) dx = x + e^{xy} + C(y)$$

$$\text{then } \frac{\partial H}{\partial y} = xe^{xy} + C'(y)$$

$$\text{From (2), } 2y + xe^{xy} = \frac{\partial H}{\partial y} = xe^{xy} + C'(y)$$

$$\text{so } C'(y) = 2y, \quad C(y) = y^2$$

thus general soln. is

$$\boxed{x + e^{xy} + y^2 = C}$$