

**Math 260 – Quiz # 2a**

Name: \_\_\_\_\_ Sec. \_\_\_\_\_ ID: \_\_\_\_\_ Ser. # \_\_\_\_\_

Solve the following IVP by using two different methods:  $y' = xy - x$ ,  $y(1) = 0$ .

Method 1: {Separating the variables}

$$\frac{dy}{dx} = x(y-1)$$

$$\frac{dy}{y-1} = x dx$$

$$\ln|y-1| = \frac{1}{2}x^2 + C_1$$

$$|y-1| = e^{\frac{1}{2}x^2 + C_1}$$

$$y-1 = C e^{\frac{x^2}{2}}$$

$$y = 1 + C e^{\frac{x^2}{2}}$$

$$y(1) = 0 \Rightarrow 0 = 1 + C e^{\frac{1}{2}} \Rightarrow C = -e^{-\frac{1}{2}}$$

$$\Rightarrow \boxed{y = 1 - e^{\frac{x^2-1}{2}}}$$

Method 2: [Linear]

$$\frac{dy}{dx} - xy = x$$

$$f(x) = e^{\int -x dx} = e^{-\frac{x^2}{2}}$$

$$\frac{d}{dx} \left[ y e^{-\frac{x^2}{2}} \right] = -x e^{-\frac{x^2}{2}}$$

$$y e^{-\frac{x^2}{2}} = \int -x e^{-\frac{x^2}{2}} dx = e^{-\frac{x^2}{2}} + C$$

$$y = 1 + C e^{\frac{x^2}{2}}$$

$$y(1) = 0 \Rightarrow C = -e^{-\frac{1}{2}}$$

$$\boxed{y = 1 - e^{\frac{x^2-1}{2}}}$$