Name: _____ **ID:** _____

Clear your desk of everything except pens, pencils and erasers. Show all work clearly and in order. No notes, phones and calculators. You have 15 minutes to finish these three problems for 10 points.

1. (3 points) Evaluate the following indefinite integral:

$$\int \frac{1}{x \ln x} dx$$

u-sub: $u = \ln x$, $du = \frac{1}{x} dx$

$$= \int \frac{1}{\ln x} \cdot \frac{1}{x} dx$$

$$= \int \frac{1}{u} \cdot du$$

$$= \ln|u| + C = \boxed{\ln|\ln x| + C}$$

2. (2 points) Find $f'(x)$ if $f(x) = \log_3 3^x$

$$f(x) = \log_3 3^x = \frac{\ln 3^x}{\ln 3} = \frac{x \cdot \ln 3}{\ln 3} = x$$

$$\Rightarrow f'(x) = (x)' = \boxed{1}$$

3. (5 points) Solve the initial value problem $y' = 2xe^{-y}, y(1) = 0$.

$$y' = \frac{dy}{dx} = 2x \cdot e^{-y}$$

$$\Leftrightarrow e^y dy = 2x \cdot dx$$

$$\Rightarrow \int e^y dy = \int 2x \cdot dx$$

$$\Rightarrow e^y = x^2 + C$$

$y(1) = 0 \Rightarrow x = 1, y = 0$

$$e^0 = 1^2 + C$$

$$e^0 = 1 \Rightarrow C = 0$$

$$\Rightarrow e^y = x^2 \Rightarrow \boxed{y = \ln x^2}$$

Caution: If you want to simplify the answer, it should be $y = 2\ln|x|$.

(Do not forget the abstract value)