

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 10 minutes to finish these **THREE** problems for 10 points.

Formulas:

$$\int \frac{1}{x} dx = \ln |x| + C, \quad \int a^x dx = \frac{a^x}{\ln a} + C$$

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

$$\begin{aligned} \int \frac{1}{x \ln x} dx & \quad u = \ln x, \quad du = \frac{1}{x} dx \\ &= \int \frac{1}{u} du \\ &= \ln |u| + C \\ &= \boxed{\ln |\ln x| + C} \end{aligned}$$

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

$$f(x) = \log_3 3^x = x \Rightarrow \boxed{f'(x) = 1}$$

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

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

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

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

$$e^y = x^2 + C, \quad y(1) = 0 \Rightarrow x=1, y=0$$

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

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

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

Caution: $y = \ln x^2 \neq 2 \ln x$
 $y = \ln x^2 = 2 \ln |x|$