Name:

Show all work to receive full credit. Scientific calculators only.

1. (8 pts each) Find the derivative of each of the following expressions with respect to x. **You are not required to simplify.**

   (a) $f(x) = e^{-3x}\ln(x^2 - 1)$

   (b) $f(x) = \tan^{-1}(3^x)$

   (c) $y = (\cos x)^x$ using logarithmic differentation.

2. Integrate the following

(a) (8 pts) $\int \frac{\sin x}{1-\cos x} dx$

(b) (8 points) $\int \frac{1}{x\sqrt{1-(\ln x)^2}}\, dx$

(c) (8 pts) $\int_0^1 y^2 e^{3y^3}\, dy$

3. Use the curves $y = e^x$, $x = 0$, and $y = e$ to answer the following questions.

(a) (7 pts) Graph the region bounded by the curves.

(b) (9 pts each) **Draw the solid and SET UP (do not evaluate)** an integral representing the volume of the solid created when rotating the region about the given lines

i. x-axis using disks/washers

ii. y-axis using cylindrical shells

iii. y-axis using disks/washers

iv. $x = 1$ using cylindrical shells

4. (5 points) Circle True or False to the following statements.

(a) T / F $\sin^{-1}(\sqrt{2}/2) = \pi/4$

(b) T / F $\displaystyle\int \frac{1}{\sqrt{x}}\,dx = \ln|\sqrt{x}| + C$

(c) T / F $\displaystyle\lim_{x\to-\infty} e^x = 0$

(d) T / F $\displaystyle\lim_{x\to-\infty} \tan^{-1}(x) = \pi/2$

(e) T / F $\displaystyle\frac{d}{dx}\left[\cot^{-1} x\right] = -\frac{1}{1+x^2}$