1. Simplify the following.

(a) \( \log_5 \frac{1}{125} \) 

(b) \( 27^{-\frac{2}{3}} \)

2. Compute the derivative \( y' \) of the following.

(a) \( y = x^3 e^{2x} \)
(10) 3. Find the antiderivatives.

(a) \[ \int \frac{e^{\sqrt{x}}}{\sqrt{x}} \, dx \]

(b) \[ \int \frac{(\ln x)^2}{x} \, dx \]

(10) 4. Compute \( \frac{dy}{dx} \) using implicit differentiation or logarithmic differentiation, whichever is appropriate.

\[ x = ye^y \]
(9) 5. At the start of an experiment there are 1,000 bacteria present in a colony. After 4 hours the number of bacteria present has doubled. How long until there are 6,000 bacteria present in the colony?
6. Compute the derivative of $y = (\cosh x)(\sinh x)$.

7. Integrate.

$$
\int \frac{dx}{\sqrt{1 - x^2}}
$$
(10) 8. Evaluate the limit.
\[
\lim_{x \to 0} \frac{e^{3x} - e^{-3x}}{2x}
\]

(21) 9. Integrate.

(a) \( \int (\cos^4 x)(\sin^3 x) \, dx \)
(b) $\int_{0}^{\pi/6} (\sec^3 t) (\sin t) \, dt$

(c) $\int \frac{\ln x}{x^3} \, dx$ \quad Hint: Use integration by parts.