1. Differentiate

$$(a) \quad f(x) = 3^{\tan^{-1} x} \qquad\qquad (b) \quad f(x) = (x+1)^{(\ln x)^2}$$

2. Let $f(x) = e^{e^x}$. (a) Show that $0 < f''(x) \leq 2e$ for all x in $[-4, 0]$. (Hint: What does $f'''(x)$ tell you?) (b) Use the Error Bound for the Midpoint Rule to determine how large N must be to approximate

$$\int_{-4}^{0} e^{e^x}\, dx$$

by M_N to within 10^{-5}. (Leave your answer in the form $N =$ an expression that could be computed with a calculator.)

3. Calculate the limits.

$$(a) \quad \lim_{x \to 0+} (\cos x)^{1/x^2} \qquad\qquad (b) \quad \lim_{x \to \infty} x e^{1/x} - x$$

4. Evaluate the integrals

$$(a) \quad \int x \log_3(x^2+1)\, dx \qquad\qquad (b) \quad \int (\sin x)(\sinh x)\, dx$$

5. Calculate the limit

$$\lim_{x \to 0} \frac{1}{x^3} \int_0^x \sin^{-1}(t^2)\, dt$$

Note: There is no antiderivative formula for $\sin^{-1}(t^2)$, so don't try to find one.