Math 112 **Exam 1** February 9, 2005

Read each problem carefully. Please show all your work for each problem! Use only those methods discussed thus far in class. No calculators!

1. (15 points) Differentiate:

$$(a)\ f(x) = e^{2x}\sin 3x, \qquad (b)\ g(y) = \frac{\ln(y^2)}{y}, \qquad (c)\ h(z) = \log_x(2x).$$

2. (15 points) Integrate:

$$(a)\ \int x \cdot 3^{x^2} dx, \qquad (b)\ \int \frac{\log_4 x}{x} dx, \qquad (c)\ \int \frac{e^{2x}}{3+e^{2x}} dx.$$

3. (15 points) Evaluate the following limits:

$$(a)\ \lim_{x\to 0} \frac{\tan 3x}{\tan 5x}, \qquad (b)\ \lim_{x\to\infty} (x^2+2x+3)e^{-x}, \qquad (c)\ \lim_{x\to 0} \frac{1-\cos x}{\ln(1-x^2)}.$$

4. (15 points) Evaluate the following limits:

$$(a)\ \lim_{x\to 0^+} x^{\sqrt{x}}, \qquad (b)\ \lim_{z\to\infty} \left(1+\frac{1}{2z}\right)^z, \qquad (c)\ \lim_{t\to\infty} \frac{\ln t}{t^{0.01}}.$$

5. (14 points) Find the length of a curve

$$y = \frac{x^2}{2} - \frac{\ln x}{4}, \qquad 2 \le x \le 4.$$

6. (12 points) Find the area of the surface of revolution obtained by revolving the curve

$$y = \left(x - \frac{4}{9}\right)^{3/2}, \qquad 1 \le x \le 4,$$

around the y-axis.

7. (14 points) How much work is needed to fill a spherical tank of radius 20 ft with its center 30 ft above the ground, with water ($\rho = 63$ lb/ft^3) from the ground level?