Math 125 D and H - Spring 2004
Mid-Term Exam Number One
April 22, 2004

Name: ____________________________  Section: _____________

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- Complete all questions.
- You may use a scientific calculator during this examination. Graphing calculators, and other calculating devices are not allowed.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 80 minutes to complete the exam.
1. Evaluate each of the following indefinite integrals.

(a) \[ \int \frac{x^2}{x^3 + 5} \, dx \]

(b) \[ \int (x^2 + 3)^2 \, dx \]

(c) \[ \int x^3 \sqrt{x^2 + 4} \, dx \]

(d) \[ \int \frac{1}{x \ln x} \, dx \]
2. Alice falls from a plane at an altitude of 3000 meters. She falls in such a way that she is
accelerating at a rate of

\[-9.8 + 0.3t \text{ m/s}^2\]

t seconds after the start of her fall. Assume her initial velocity is zero.

(a) What is her velocity after 6 seconds?

(b) How far off the ground will she be after falling for 6 seconds?
3. The graph of \( f(x) \) is given below. Let \( A(x) = \int_0^x f(t) \, dt \).

Evaluate each of the following:

(a) \( A(2) \)

(b) \( A'(3) \)

(c) \( A(6) \)

(d) \( A(4) - A(3) \)
4. Let $R$ be the region in the first quadrant bounded by $y = 2 - x^2$, $y = x^2$, and the $y$-axis.

(a) Find the volume of the solid of revolution created by revolving $R$ about the $y$-axis.

(b) Find the volume of the solid of revolution created by revolving $R$ about the $x$-axis.
5. Let $R$ be the region bounded by $y = x$, $y = \ln(x^2 + 1)$, and $x = 3$. The curves are shown in the figure.

Determine the volume of the solid of revolution created by revolving $R$ about the line $x = 5$. 
6. Here is a graph of $y = e^{\cos x}$ on the interval $0 \leq x \leq 3$:

Use the midpoint rule with $n=3$ to approximate the value of the following integral:

$$\int_{0}^{3} e^{\cos x} \, dx$$
7. Find the value of \( m \) so that the region bounded by \( y = \sqrt{x} \) and \( y = mx \) has an area of 4.