Math 20B.
Midterm Exam 1
January 26, 2005

Turn off and put away your cell phone.
No calculators or any other electronic devices are allowed on this exam.
You may use one page of notes, but no books or other assistance on this exam.
Read each question carefully, answer each question completely, and show all of your work.
Write your solutions clearly and legibly; no credit will be given for illegible solutions.
If any question is not clear, ask for clarification.

1. (4 points) Evaluate the following integrals.
   (a) \( \int x \sin(3x^2) \, dx \)
   (b) \( \int_{e^3}^{e^4} \frac{dx}{x(\ln x)^2} \)
2. (4 points) Find the area enclosed by one loop of the polar curve $r = 5 \sin(3\theta)$. 
3. A vehicle travels along a line so that its velocity at time $t$ is $v(t) = 9 - t^2$ meters per second.

(a) (2 points) Find the displacement (net distance traveled) of the vehicle from $t = 0$ to $t = 4$ seconds.

(b) (4 points) Find the total distance traveled by the vehicle from $t = 0$ to $t = 4$ seconds.
4. (4 points) Find the fourth roots of \(-81\) and express them in polar form. (Note that \(81 = 3^4\).)
5. (4 points) A spherical water tank of radius $A$ feet is filled to a depth $D$ feet. Find the volume of water in the tank.