Math 2263
Fall 2008
Midterm 3
November 25, 2008
Time Limit: 50 minutes

Name (Print): _____

Student ID: _____

Section Number: _____

Teaching Assistant: _____

Signature: _____

This exam contains 6 pages (including this cover page) and 5 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated. **Calculators may be used.** Please turn off cell phones. You may refer to your crib sheet, a half page on one side.

Do not give numerical approximations to quantities such as $\sin 5$, π, or $\sqrt{2}$. However, you should simplify $\cos \frac{\pi}{2} = 0$, $e^0 = 1$, and so on.

The following rules apply:

- **Show your work**, in a reasonably neat and coherent way, in the space provided. **All answers must be justified by valid mathematical reasoning.** To receive full credit on a problem, you must show enough work so that your solution can be followed by someone without a calculator.

- **Mysterious or unsupported answers will not receive full credit**. Your work should be mathematically correct and carefully and legibly written.

- **A correct answer, unsupported by calculations, explanation, or algebraic work will receive no credit**; an incorrect answer supported by substantially correct calculations and explanations might still receive partial credit.

1	15 pts	
2	15 pts	
3	20 pts	
4	25 pts	
5	25 pts	
TOTAL	100 pts	

1. (15 points) Let B be the box, or rectangular solid: $0 \leq x \leq 2$, $0 \leq y \leq 1$, $0 \leq z \leq 3$. Find

$$\iiint_B (x^2 + y)(x - z^2)\, dV.$$

2. (15 points) Let E be the cylindrical solid $x^2 + y^2 \leq 9$, $0 \leq z \leq 1$. Find

$$\iiint_E z e^{x^2+y^2} \, dV.$$

3. (20 points) The set E in $\mathbb{R}^3$ is described by the inequalities:

$$\sqrt{x^2 + y^2} \le z \le \sqrt{9 - x^2 - y^2}.$$

(a) (5 points) Write a description of E in **spherical coordinates**.

(b) (15 points) Compute the **volume** of E.

4. (25 points) Let C be the circle $x^2 + y^2 = 100$ in the (x, y)-plane, oriented counterclockwise. Find

$$\oint_C (2xy + e^x)\, dx + (x^2 - \sin y + 3x)\, dy.$$

Hint: try Green's theorem.

5. (25 points) C_1 and C_2 are oriented curves in the (x, y)-plane, each of which starts at $(0,0)$ and ends at $(2,2)$. C_1 is given by the parameterization $\vec{r}(t) = t\vec{i} + (3t - t^2)\vec{j}$, $0 \le t \le 2$; and C_2 is given by the parameterization $\vec{r}(t) = t\vec{i} + (t^2 - t)\vec{j}$, $0 \le t \le 2$.

   (a) (10 points) Find

$$\int_{C_1} xy \, dx + (y - 3x) \, dy.$$

   (b) (10 points) Find

$$\int_{C_2} xy \, dx + (y - 3x) \, dy.$$

   (c) (5 points) Is the vector field $\vec{F}(x, y) = xy\vec{i} + (y - 3x)\vec{j}$ **conservative**? Why or why not?