MATH 2400: Calculus III, Fall 2013
MIDTERM #3

November 13, 2013

YOUR NAME:

Circle Your CORRECT Section

001 E. Angel .... (9am)
002 E. Angel .... (10am)
003 A. Nita .... (11am)
004 K. Selker .... (12pm)
005 I. Mishev .... (1pm)
006 C. Farsi .... (2pm)
007 R. Rosenbaum .... (3pm)
008 S. Henry .... (9am)

Important note: SHOW ALL WORK. BOX YOUR ANSWERS. Calculators are not allowed. No books, notes, etc. Throughout this exam, please provide exact answers where possible. That is: if the answer is 1/2, do not write 0.499 or something of that sort; if the answer is π, do not write 3.14159.

Problem	**Points**	**Score**
1	25	
2	25	
3	25	
4	25	
TOTAL	100	

"On my honor, as a University of Colorado at Boulder student, I have neither given nor received unauthorized assistance on this work."

SIGNATURE:

NAME: **SECTION:**

1. (25 points) Let W be the three–dimensional solid that is bounded below by the cone $z = \sqrt{\dfrac{x^2+y^2}{3}}$ and bounded above by the sphere $x^2+y^2+z^2=9$. Evaluate the following integral

$$\int\int\int_W e^{(x^2+y^2+z^2)^{3/2}} dxdydz.$$

NAME:	SECTION:

2. (25 points) Use the change of variables $s = y$, $t = y - x^3$ to evaluate $\int\int_R x^2\,dx\,dy$ over the region R bounded by $y = 2$, $y = 8$, $y = x^3$, and $y = x^3 + 8$.

NAME:	SECTION:

3. Let

$$\vec{F}(x,y) = (3x)\,\vec{i} + (-3y)\,\vec{j}\,.$$

(a) **(15 points)** Find a parametrization for the flow line of $\vec{F}$ that passes through the point (1,3).

(b) **(10 points)** Write Cartesian equations for the flow lines of the vector field $\vec{F}(x,y)$. Cartesian equations are equations involving the standard calculus variables x and y, as well as constants.

NAME:	SECTION:

4. Consider the vector field

$$\vec{F}(x,y) = 4\left[(1+x^2y^2)xy^2\right]\vec{i} + 4\left[(1+x^2y^2)x^2y+1\right]\vec{j}$$

(a) **(10 points)** Let C be the segment of the hyperbola $y = \frac{1}{x}$ from $(1,1)$ to $(2,1/2)$. Evaluate the line integral

$$\int_C \vec{F}\cdot d\vec{r}$$

by parametrizing C. Do **not** use the Fundamental Theorem of Calculus for Line Integrals.

NAME:	**SECTION:**

(b) **(10 points)** Show that $\vec{F}$ is a conservative vector field by finding a potential function f for $\vec{F}$: this means finding a function f such that $\nabla f = \vec{F}$.

$$f(x, y) = \underline{\hspace{6cm}}.$$

(c) **(5 points)** Use the Fundamental Theorem of Calculus for Line Integrals to evaluate $\int_C \vec{F} \cdot d\vec{r}$, where C is the segment of the hyperbola $y = \frac{1}{x}$ from $(1, 1)$ to $(2, 1/2)$ given in part (a).