

# MATH 2400: CALCULUS 3

April 18, 2007

## MIDTERM 3

I have neither given nor received aid on this exam.

Name: \_\_\_\_\_

**001** E. KIM ..... (9AM)

**004** M. DANIEL ..... (12AM)

**002** E. ANGEL ..... (10AM)

**005** A. GOROKHOVSKY ..... (1PM)

**003** I. MISHEV ..... (11AM)

If you have a question raise your hand and remain seated. In order to receive full credit your answer must be **complete**, **legible** and **correct**. Show all of your work, and give adequate explanations.

**DO NOT WRITE IN THIS BOX!**

<b>Problem</b>	<b>Points</b>	<b>Score</b>
<b>1</b>	14 pts	
<b>2</b>	12 pts	
<b>3</b>	14 pts	
<b>4</b>	12 pts	
<b>5</b>	12 pts	
<b>6</b>	12 pts	
<b>7</b>	24 pts	
<b>TOTAL</b>	100 pts	

1. (14 pt) Compute  $\int_0^1 \int_0^{\sqrt{1-x^2}} (x^2 + y^2) dy dx$

2. (12 pt) Find the volume of the solid that lies inside the sphere  $\rho = 3$  and above the cone  $r = z$  ( $\phi = \frac{\pi}{4}$ ).

3. (14 pt) Find the volume of the solid bounded by

$$z = 6, \quad z = 2y, \quad y = x^2, \quad y = 2 - x^2.$$

4. (12 pt) Find the surface area of the portion of the cone  $z^2 = 4x^2 + 4y^2$  that is above the region in the first quadrant bounded by the line  $y = x$  and the parabola  $y = x^2$ .

5. (12 pt) Find the area of the region bounded by the curves

$$y = x^2, \quad y = 3x^2, \quad xy = 1, \quad xy = 4.$$

6. (12 pt) Evaluate  $\int_C yz^2 ds$  along the helix

$$C : \mathbf{r}(t) = 2t \mathbf{i} + 3 \sin t \mathbf{j} + 3 \cos t \mathbf{k}, \quad 0 \leq t \leq \frac{\pi}{2}.$$

7. Given the force field  $\mathbf{F}(x, y) = e^{2y} \mathbf{i} + (1 + 2xe^{2y}) \mathbf{j}$  and curve

$$C : \mathbf{r}(t) = te^t \mathbf{i} + (1 + t) \mathbf{j}, \quad 0 \leq t \leq 1,$$

(a) (12 pt) Find the potential function for  $\mathbf{F}$ .

(b) (12 pt) Find the work done moving a particle along  $C$  in the force field  $\mathbf{F}$ .