Department of Mathematics
University of Notre Dame
MATH 20550 - Calculus III
Summer 2015

Name ________________________________

Final Exam

July 24, 2015

This exam has ? problems worth a total of **? points**. You will have 105 minutes to work on it. All answers should be given as exact, closed form numbers as opposed to decimal approximations. **For full credit, you must show all work.** Calculators and all other electronic devices are strictly forbidden.

Please read and sign the Honor Pledge:

Honor Pledge: As a member of the Notre Dame community, I will not participate in or tolerate academic dishonesty.

Signature: ________________________________

Question	Points	Score
1	0	
2	0	
3	0	
4	0	
5	0	
6	0	
7	0	
Total:	0	

1. Compute

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

where $\vec{F}(x, y, z) = \langle x^2y, \frac{1}{3}x^3, xy \rangle$ and C is the curve of intersection of the hyperbolic paraboloid $z = y^2 - x^2$ and the cylinder $x^2 + y^2 = 1$ oriented counterclockwise as viewed from above.

2. Compute the surface integral

$$\iint_S (x^2 y + y^2 z)\, dS$$

where S is the hemisphere $x^2 + y^2 + z^2 = 4\ z \geq 0$.

3. Compute the center of mass of the hemisphere $x^2 + y^2 + z^2 = a^2$ and $z \geq 0$, if it has constant density.

4. Compute

$$\iint_S \vec{F} \cdot d\vec{S}$$

where $\vec{F} = \langle z, y, zx \rangle$ and S is the surface of the tetrahedron enclosed by the doordinate plances and the plane

$$\frac{x}{a} + \frac{y}{b} + \frac{z}{c} = 1$$

where a, b, c are positive numbers.

5. Let C be a simple closed smooth curve that lies in the plane $x + y + z = 1$. Show that the line integral

$$\int_C z\,dx - 2x\,dy + 3y\,dz$$

depends only on the area of the region enclosed by C and not on the shape of C or its location in the plane.

6. Compute

$$\iint_S \vec{F} \cdot d\vec{S}$$

where $\vec{F} = \langle z^2 x, \frac{1}{3}y^3 + \tan z, x^2 z + y^2 \rangle$ where S is the top half of the sphere $x^2 + y^2 + z^2 = 1$.

7. Compute

$$\iint_S \vec{F} \cdot d\vec{S}$$

where $\vec{F} = xy\hat{\imath} + 4x^2\hat{\jmath} + yz\hat{k}$ and S is the surface $z = xe^y$, $0 \leq x \leq 1$, $0 \leq y \leq 1$ with the upward orientation.