Final Study Guide **Your Name:** ___________________________ **Class: 9am / 1pm**

Calculus III - Math 2630 - Spring 2013 **Instructor: Steven Clontz**

Draw a $\boxed{\text{box}}$ around your answer. Show your work. Calculators not allowed.

The first 12 questions are based upon the previous four tests, covering Chapters 10-13, based upon three questions from each test. Use these questions (and similar ones from the textbook) as your study guide:

- Ch 10 Test/Study Guide: #5, #6, #10
- Ch 11 Test/Study Guide: #3, #6, #8
- Ch 12 Test/Study Guide: #3, #5, #8
- Ch 13 Test/Study Guide: #2, #5, #9

The last 4 questions are based upon the Chapter 14 material, and will be based upon some subset of the questions on the following pages.

1. Evaluate

$$\int_C xy^3 \, ds$$

where C is the arc on the circle $x^2 + y^2 = 4$ oriented clockwise from $(0, 2)$ to $(\sqrt{3}, 1)$.

2. Compute the work done by the force

$$\vec{F} = \langle y, z, x \rangle$$

over the line segment from $(1, 1, 2)$ to $(3, -2, 1)$.

3. Compute the flow of the vector field

$$\vec{F} = \left\langle 2xy, x^2 - z^2, -2yz \right\rangle$$

through the curve $\vec{r}(t) = \langle t2^t, 3t^3, \cos(\pi t) \rangle$ where $0 \leq t \leq 1$. (Hint: Use a potential function.)

4. Show that

$$\int\limits_C (ye^{xy} - 4yz)\,dx + (xe^{xy} - 4xz)\,dy + (-4xy)\,dz = 0$$

where C is the pentagon in the xz plane with vertices $(1,0,0)$, $(2,0,1)$, $(2,0,3)$, $(0,0,2)$, and $(0,0,0)$ oriented clockwise with respect to the y-axis.

5. Express the outward flux of

$$\vec{F} = \left\langle x + y, x^2 + y^2 \right\rangle$$

across the triangle with vertices $(0, 0)$, $(1, 0)$, and $(1, 1)$ as a double iterated integral. **Do not evaluate the integral.**

6. Use spherical coordinates to give a parametrization corresponding to the portion of the surface

$$z^2 = x^2 + y^2$$

between the planes $z = 1$ and $z = 2$.

7. Use the cylindrical coordinate-based parametrization

$$\vec{r}(\theta, z) = \langle 2\cos\theta, 2\sin\theta, z\rangle$$

to express the area of the surface $x^2 + y^2 = 4$ between the planes $x = 0$ and $x = 2$ as a double iterated integral. **Do not evaluate the integral.**

8. Use the spherical coordinate-based parametrization

$$\vec{r}(\phi, \theta) = \langle \sin\phi\cos\theta, \sin\phi\sin\theta, \cos\phi \rangle$$

to express the surface integral $\iint\limits_S 3z^2\, d\sigma$ as a double iterated integral of ϕ, θ, where S is the upper half of the unit sphere $z = \sqrt{1 - x^2 - y^2}$. **Do not evaluate the integral.**

Include extra scratch work below:

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