

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

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

**Draw a 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 velocity field

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

through the curve  $\vec{r}(t) = \langle t^2, 3t^3, \cos(\pi t) \rangle$  where  $0 \leq t \leq 1$ . (Hint: Use a potential function.)

4. Show that

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

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

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

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  $\iint_S 3z^2 d\sigma$  as a double iterated integral of  $\phi, \theta$ , 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:

---

Include extra scratch work below:

---