Ch 13 Study Guide **Your Name:** ____________________________ **Class: 9am / 1pm**

Calculus III - Math 2630 - Fall 2012 **Instructor: Steven Clontz**

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

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1. Evaluate $\displaystyle\int_1^2 \int_{1/x}^{2/x} xe^x \, dy \, dx$.

- Correctly integrate inside function (4 pts)
- Correctly evaulate inside integral (3 pts)
- Correctly evaulate outside integral (3 pts)

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2. Evaluate $\displaystyle\int_0^1 \int_{\sqrt{y}}^1 \frac{3}{1+x^3}\,dx\,dy$.

- Draw region of integration correctly (3 pts)
- Set up new bounds of integration correctly (4 pts)
- Correctly evaulate new double iterated integral (3 pts)

3. Express the area of the region between the curves $y = 4 - x^2$ and $y = x^2 - 4$ as a double iterated integral. **Do not evaluate the integral.**

   - Use correct formula $A = \iint_R dA$ (3 pts)
   - Draw region of integration correctly (3 pts)
   - Set up bounds of integration correctly (3 pts)
   - Write correct double iterated integral (1 pt)

4. Express the average value of the function $f(x, y) = 3xy^2$ over the triangle with sides given by the lines $x = 4$, $y = 0$, $x = 2y$ as a multiple of a double iterated integral. **Do not evaluate the integral.**

   - Use correct formula $\frac{1}{\text{area of } R} \iint_R f(x, y)\, dA$ (3 pts)
   - Find area of the triangular/rectangular region (2 pts)
   - Set up bounds of integration correctly (3 pts)
   - Write correct multiple of double iterated integral (2 pts)

5. Evaluate $\int_0^1 \int_0^z \int_0^{x+z} 36xz\, dy\, dx\, dz$.

- Evaulate inner integral correctly (4 pts)
- Evaulate inner & middle integrals correctly (3 pts)
- Evaulte entire triple iterated integral correctly (3 pts)

6. Express the volume of the region in xyz space in the first octant bounded by the coordinate planes and the plane $x + 3y + 2z = 6$ as a triple iterated integral. **Do not evaluate the integral.**

   - Set up integral of the form $\int_{\text{constant}}^{\text{constant}} \int_{\leq 1 \text{ var}}^{\leq 1 \text{ var}} \int_{\leq 2 \text{ var}}^{\leq 2 \text{ var}} dV$ (4 pts)
   - Set up innermost bounds correctly (3 pts)
   - Set up all bounds correctly (3 pts)

7. Find a transformation $x(u,v)$, $y(u,v)$ from the triangle with coordinates $(0,0)$, $(1,0)$, and $(1,1)$ in the uv plane into the triangle with vertices $(0,0)$, $(2,2)$, and $(1,4)$ in the xy plane.

    - Draw picture of regions in uv and xy planes (2 pts)
    - Label sides of regions in both planes correctly (3 pts)
    - Relate sides of regions in both planes correctly (3 pts)
    - Solve the system of equations for the correct transformation (2 pts)

8. Using the transformation $x = 3u - 2v$, $y = 2u + 4v$ from the unit square in the uv plane into the parallelogram R with vertices $(0, 0)$, $(3, 2)$, $(1, 6)$, and $(-2, 4)$ in the xy plane, evaulate

$$\iint_R (2x - y)\ dx\, dy$$

- Substitute $x(u, v)$, $y(u, v)$ for x, y (2 pts)
- Evaulate the Jacobian correctly, multiply the entire function by its absolute value (3 pts)
- Set up the correct new bounds of integration (2 pts)
- Evaulate the integral correctly (3 pts)

9. Evaluate $\displaystyle\int_0^2 \int_0^{\sqrt{4-x^2}} 3\sqrt{x^2+y^2}\,dy\,dx$.

- Draw the region of integration correctly (3 pts)
- Set up new polar bounds of integration (3 pts)
- Replace x, y with $r\cos\theta, r\sin\theta$ and replace dA with $r\,dr\,d\theta$ (2 pts)
- Evaulate the integral correctly (2 pts)

10. Express the volume of the solid inside the sphere $x^2 + y^2 + z^2 = 4$ ($\rho = 2$) and above the cone $z = \frac{\sqrt{3}}{2}\sqrt{x^2 + y^2}$ ($\phi = \pi/6$) as a triple iterated integral using spherical coordinates. **Do not evaluate the integral.**

- Use volume formula $\iiint_D dV$ (3 pts)
- Set up spherical bounds of integration (4 pts)
- Replace dV with $\rho^2 \sin\phi \, d\rho \, d\phi \, d\theta$ (3 pts)

Include extra scratch work below:

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