

Calc III - Math 311
Exam 3
July 3, 2008

Name: _____

Show work if you desire partial credit. Circle or box your final answers where appropriate. Questions worth 10 points except where noted.

1. Evaluate

$$\int_0^2 \int_{-1}^1 \int_0^2 (2xy - 3xz^2) dx dy dz$$

2. Find the potential function to the conservative vector field

$$\mathbf{F}(x, y, z) = \langle 3z - 6x^2e^y, -ze^{-yz} - 2x^3e^y, 3x - ye^{-yz} + z \cos z^2 \rangle.$$

3. (15pts) Consider the region bounded by $y = -x$ and $y = 2x - x^2$.

(a) Sketch the region

(b) Set up the integral to evaluate $\iint_R f(x, y) dA$ with both possible orders of integration. **Note:** One way is easy. One way is harder. If you can't figure out the limits of integration use generic limits, i.e. $g_1(x)$ to $g_2(x)$.

(c) Evaluate the integral using $f(x, y) = x$ and the easiest integration order you found in part (b).

4. Find the surface area of the portion of $2x + 4y + z = 8$ in the first octant.

5. Set up the integral $\iiint_Q \sin(x^2 + y^2 + z^2)^{1/3} dV$ where Q is the region inside of $x^2 + y^2 + z^2 = 16$ and outside of $x^2 + y^2 + z^2 = 8$, with $x \leq 0$ and $z \leq 0$.

6. Use cylindrical coordinates to set up a triple integral $\int \int \int_Q f(x, y, z) dV$ where Q is the region bounded by $y = \sqrt{x^2 + z^2}$ and $y = 9$. **Note:** If you don't know how to start, a hint is available for 2 points.

7. Set up the integral to find the volume of the solid bounded by $z = 1 + x^2 + y^2$, $z = -1 - x^2 - y^2$, $y = 1 - x^4$, and $y = 0$.

8. Use polar coordinates to set up an integral to find the volume bounded by $z = 14 - 2x^2 - 3y^2$ and $z = 4x^2 + y^2 - 10$ and outside of $x^2 + y^2 = 1$.