NAME: **Section:**

MATH 251 (4-6), Dr. Z. , Mid-Term #2, 12:00-1:20 , Mon., Nov. 20, 2006

1. (a) Find a function f such that $\mathbf{F} = \bigtriangledown f$ and (b) use part (a) to evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$ along the given curve C.

$$\mathbf{F}(x,y,z) = 2xy^2z^2\,\mathbf{i} + 2x^2yz^2\,\mathbf{j} + 2x^2y^2z\,\mathbf{k} \quad ,$$

$$C : x = t^3 \quad , \quad y = t^2+1 \quad , \quad z = 2t+1 \quad , \quad 0 \leq t \leq 1 \quad .$$

Ans. to (a): $f =$

Ans. to (b):

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2. Evaluate the line integral

$$\int_C y^2\,dx + x^2\,dy + xyz\,dz \quad ,$$

where $C : x = t^2\,,\ y = 3t\,,\ z = t^3\,,\ 0 \le t \le 1.$

Ans.:

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3. Evaluate

$$\int\int\int_E (5x^2 + 5y^2 + 5z^2)\, dV \quad ,$$

where E is bounded by the yz-plane and the hemispheres $x = -\sqrt{1 - y^2 - z^2}$ and $x = -\sqrt{4 - y^2 - z^2}$.

Ans.:

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4. Evaluate the triple integral

$$\int\int\int_E 20yz\cos(x^5)\,dV \quad ,$$

where

$$E = \{(x, y, z)\,|\,0 \le x \le 1\,,\ 0 \le y \le x\,,\ x \le z \le 2x\,\} \quad .$$

Ans.:

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5. Find the Jacobian of the transformation from (x, y, z)-space to (u, v, w)-space.

$$x = uv \quad , \quad y = uw \quad , \quad z = vw.$$

Ans.:

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6. Evaluate the integral

$$\int\int_D 4e^{-2x^2-2y^2}\, dA \quad ,$$

where D is the region bounded by the semi-circle $y = -\sqrt{9-x^2}$ and the x-axis.

Ans.:

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7. Sketch the region of integration and change the order of integration.

$$\int_0^2 \int_{4x}^8 F(x, y)\, dy\, dx$$

Ans.:

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8. Calculate the iterated integral

$$\int_1^2 \int_0^1 (6x + 6y^2)\, dx\, dy \quad .$$

Ans.:

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9. Use Lagrange multipliers to find the maximum and minimum values of $f(x, y) = 4x + 6y$ subject to the constraint $x^2 + y^2 = 13$.

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maximum value:

minimum value:

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10. Find the local maximum and minimum **values** and saddle point(s) of the function $f(x, y) = (1 + xy)(x + y)$

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local maximum value(s):

local minimum value(s):

saddle point(s):
