Academic conduct statement [3 points] Please write out the statement "I am aware that this exam, like any exam, is governed by the Boston University academic conduct code."

Please print your name:

Please sign your name:

Please write your BU ID number:

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Practice Final Exam – MA 225 – Fall 2016

Name: _____ BU ID: _____

Discussion section (circle one):

B2: W 9-10, B3: W 2-3, B4: W 1-2, B5: Th 830-930, B6: Th 930-1030

Instructions: Please write clearly and **show all work. If an answer is not justified, no points will be awarded.** Points may be deducted for messy, unclear, or poorly explained work. Books, notes, and calculators are NOT permitted during this exam.

Do not write in the following box.

Problem	Possible	Score
Academic Conduct Statement	3	
Name, BU ID, discussion	2	
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
Total	100	

Question 1 [10 points] Evaluate

$$\iint_R \sin(9x^2 + 9y^2)\mathrm{d}A$$

where R is the region in the first quadrant bounded by the circle $x^2 + y^2 = 16$.

Question 2 [10 points]

(i) **[4 points]** Suppose $\mathbf{b} = \langle b_1, b_2, b_3 \rangle$ is a vector and $\mathbf{F} = \mathbf{F}(x, y, z)$ is a vector field in $\mathbf{R}^3$. Is the following quantity meaningful?

$$\mathbf{b} \times (\nabla \cdot \mathbf{F})$$

If so, is it a scalar or a vector? (Make sure you justify your answer.)

(ii) **[5 points]** Are the following lines parallel?

$$\mathbf{r}_1(t) = \langle 1 + 2t, 3t, 4 - t \rangle, \qquad \mathbf{r}_2(t) = \langle -5 + 4t, 7 + 6t, 1 - 2t \rangle, \qquad -\infty < t < \infty$$

Question 3 [10 points] Evaluate

$$\int_C xy\mathrm{d}x + y\mathrm{d}y,$$

where C is the curve given by $\mathbf{r}(t) = \langle \cos t, \sin t \rangle$ for $0 \leq t \leq \pi/2$.

Question 4 [10 points]

Consider $\iint_S \mathbf{F} \cdot \mathbf{n} d\sigma$ where $\mathbf{F}(x, y, z) = \langle y, z - y, x \rangle$ and S is the surface of the tetrahedron with vertices $(0, 0, 0)$, $(1, 0, 0)$, $(0, 1, 0)$, and $(0, 0, 1)$. Write down, but do not evaluate, an equivalent triple integral. Be sure to specify the limits and order of integration in the triple integral.

Question 5 [10 points]

(i) Evaluate the integral

$$\int_{-3}^{3}\int_{-\sqrt{9-y^2}}^{\sqrt{9-y^2}}\int_{-\sqrt{9-x^2-y^2}}^{\sqrt{9-x^2-y^2}}(x^2z+y^2z+z^3)\mathrm{d}z\mathrm{d}x\mathrm{d}y.$$

(ii) Determine the equation of the plane that contains the point $(0,1,0)$ and does not intersect the xz-plane.

Question 6 [10 points]

Determine whether or not the limit exists. If it exists, find its value. (Make sure to justify your answer.)

$$\lim_{(x,y)\to(0,0)} \frac{x^2}{3x^2+2y^2}$$

Question 7 [10 points]

Sketch the solid whose volume is given by the integral

$$\int_0^1 \int_0^{1-x^2} (1-x)\mathrm{d}y\mathrm{d}x.$$

Question 8 [10 points]

Determine the area of the surface consisting of the part of the paraboloid $z = x^2 + y^2$ that lies inside the cylinder $x^2 + y^2 = 9$.

Question 9 [10 points]

Show that the ellipsoid $3x^2 + 2y^2 + z^2 = 9$ and the sphere $x^2 + y^2 + z^2 - 8x - 6y - 8z + 24 = 0$ are tangent to each other at the point $(1, 1, 2)$. (This means they have the same tangent plane at that point.)

Question 10 [10 points]

(i) Find f_z if

$$f(x, y, z) = e^{\sin(xyz)} + \frac{x^2 y}{1 + z^2}.$$

(ii) Find the directional derivative of $f(x, y, z) = x^2 yz$ at the point $(1, 2, 3)$ in the direction of the vector $\langle 1, 0, 1 \rangle$.