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 Midterm 2 – 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	15	
2	10	
3	15	
4	15	
5	10	
6	10	
7	10	
8	10	
Total	100	

Question 1 [15 points]

(i) **[8 points]** Determine the domain and range of the following function. Please be sure to justify your answer.

$$f(x, y) = 5e^{-\sqrt{4-x^2-y^2}}$$

(ii) **[7 points]** Sketch the level curves of the following function.

$$f(x, y) = 3\ln(x - 2y^2 + 4)$$

Question 2 [10 points]

(i) **[5 points]** True or false: if

$$\lim_{(x,0)\to(0,0)} f(x,0) = L, \qquad \lim_{(0,y)\to(0,0)} f(0,y) = L,$$

then $\lim_{(x,y)\to(0,0)} f(x,y)$ necessarily exists and is equal to L. Be sure to justify your answer.

(ii) **[5 points]** Evaluate the following limit or determine that it does not exist.

$$\lim_{(x,y)\to(0,1)} \frac{y \sin x}{x(y+1)}$$

Question 3 [15 points]

(i) **[8 points]** Given $f(x, y) = x^2 + y^2 - 3$, compute $f_x(1, 1)$ using the limit definition of the partial derivative.

(ii) **[7 points]** Let $g(x, y) = ye^{x^2}$, $x(t) = 2t^2$, and $y(t) = \sin t$. Compute dg/dt. Make sure your answer is in terms of t only.

Question 4 [15 points]

(i) **[5 points]** Compute the directional derivative of the following function at the given point in the direction of the given vector.

$$h(x, y) = 15 + 2x^2 - 4y^2, \qquad P(1, 4), \qquad \langle 1, 2 \rangle.$$

(ii) **[5 points]** For the above function $h(x, y)$ in part (i), find a vector that points in a direction of no change in the function at $P(1, 4)$.

(iii) **[5 points]** For the above function $h(x, y)$ in part (i), find a vector that points in a direction of greatest change in the function at $P(1, 4)$.

Question 5 [10 points]

(i) **[5 points]** Find the normal line to the surface $x^2 - e^{xy} - y^2 \sin z = 0$ at the point $(1, 0, 0)$.

(ii) **[5 points]** Find the linearization of $f(x, y) = e^{2y-x}$ at the point $(1, 2)$.

Question 6 [10 points] Use the method of Lagrange multipliers to find the dimensions of the rectangle of largest perimeter that can be inscribed in the ellipse $x^2/a^2 + y^2/b^2 = 1$ with sides parallel to the coordinate axes. What is the largest perimeter?

Question 7 [10 points]

(i) **[5 points]** Evaluate the following integral using a method of your choice.

$$\int_0^2 \int_0^{4-y} (x+y)\mathrm{d}x\mathrm{d}y$$

(ii) **[5 points]** Set up, but do not evaluate, a double integral that represents the volume of the part of the cylinder $x^2+y^2=1$ bounded above by the plane $z=12-x-y$ and below by $z=0$. Make sure you clearly state the limits of integration and order of integration.

Question 8 [10 points] Consider the following integral

$$\int_0^2 \int_0^{4-x^2} \frac{xe^{2y}}{4-y} \mathrm{d}y\mathrm{d}x$$

(i) **[5 points]** Sketch the region of integration.

(ii) **[5 points]** Write down an equivalent integral, with the order of integration reversed. Make sure you clearly state the limits of integration. (Note, you do not need to evaluate the resulting integral.)