MA227, Calculus III
March 9, 2015
Dr. Li

Name and section: ______________________________

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1. **Do not open this exam until you are told to do so.**
2. This exam has 11 pages including this cover. There are 11 questions, for a total of 100 points and 10 bonus points. Note that the problems are not of equal difficulty, so you may want to skip over and return to a problem on which you are stuck.
3. Do not separate the pages of this exam. If they do become separated, write your name on every page and point this out to your instructor when you hand in the exam.
4. Please read the instructions for each individual problem carefully.
5. **Organize your work,** in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive little credit.
6. Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.
7. Show an appropriate amount of work for each problem, so that graders can see not only your answer but how you obtained it.

Do not write in the table below.

Question	Bonus	Bonus Points	Score
1	10	0	
2	10	0	
3	10	0	
4	10	0	
5	10	0	
6	10	0	
7	10	0	
8	10	0	
9	10	0	
10	10	0	
11	0	10	
Total:	100	10	

1. [10 points] Find the partial dirivative g_{xyz} if $g(x, y, z) = e^{xy+z}$.

2. [10 points] Use implicit differentiation to find $\dfrac{\partial z}{\partial x}$ and $\dfrac{\partial z}{\partial y}$, if

$$yz + x \ln y = z^2.$$

3. [10 points] Let $z = \sin\left(\frac{x}{y}\right)$, and $x = 2s + 3t$, $y = 3s - 2t$. Find partial derivatives $\frac{\partial z}{\partial s}$ and $\frac{\partial z}{\partial t}$.

4. [10 points] Let $z = \sqrt{xy}$. Find equation of the tangent plane at point $(1, 4)$. (DO NOT simplify.)

5. [10 points] Find the linearization of $z = x \ln y + xy$ at $(1, 1)$. (DO NOT simplify.)

6. [10 points] Find equation of the tangent plane to the surface

$$x + y + z - e^{xyz} = 0$$

at point $(0, 0, 1)$. (DO NOT simplify.)

7. [10 points] Find maximum rate of change of the function $f(x, y) = x^2yz$ at point $(1, 2, 1)$ and the direction in which it occurs.

8. [10 points] Find the directional derivative of $f(x, y) = x^4 - x^2y^3$ at point $(2, 1)$ along the vector $< 1, 3 >$.

9. [10 points] Find local maximum, minimum, and saddle points (if any) of the function

$$f(x,y) = x^2 - y^2 + 2xy - 2x - 2y + 3.$$

10. [10 points] Find the dimension of a rectangular box with largest volume if the total surface area is given as 64cm^2.

11. [10 points (bonus)] Find the absolute maximum and absolute minimum of the function $f(x, y) = x^2 + y^2 - 2x$ on the region $0 \leq x \leq 1$, $0 \leq y \leq 1$. Be sure to provide coordinates of the points and the values of absolute maximum and minimum.