Exam 2 **Name**______________________________

Math 231-02 **Calculus III** **March 9, 2018**

Guidelines

- **Calculators are not allowed.**
- Read the questions carefully. You have 65 minutes; use your time wisely.
- You may leave your answers in symbolic form, like $\sqrt{3}$ or $\ln(2)$, unless they simplify further like $\sqrt{9} = 3$ or $\cos(3\pi/4) = -\sqrt{2}/2$.
- Put a box around your final answers when relevant.
- Show all steps in your solutions and make your reasoning clear. Answers with no explanation will not receive full credit, even when correct.
- Use the space provided. If necessary, write ”see other side” and continue working on the back of the same page.
- $\vec{u} \cdot \vec{v} = ||\vec{u}||||\vec{v}|| \cos\theta$ and $||\vec{u} \times \vec{v}|| = ||\vec{u}||||\vec{v}|| \sin\theta$

Question	Points	Score
1	8	
2	8	
3	12	
4	8	
5	8	
6	8	
7	8	
8	8	
9	14	
10	10	
11	8	
Total:	100	

1. (8 points) Complete test corrections.

2. (8 points) Find and sketch the domain of $f(x, y) = \dfrac{1}{\sqrt{x^2 + y^2 - 25}}$.

3. (12 points) Evaluate each limit or show it does not exist.

a. $\displaystyle \lim_{(x,y)\to(0,0)} \tan^{-1}\left(\frac{1}{x^2 + y^2}\right)$

b. $\displaystyle \lim_{(x,y)\to(0,0)} \frac{4xy}{3x^2 + y^2}$

4. (8 points) If $w = e^{xyz}$, compute $\dfrac{\partial^3 w}{\partial y^2 \partial x}$.

5. (8 points) Find an equation of the tangent plane to $z = \ln(1 + xy)$ at the point $(1, 2)$.

6. (8 points) Let $w = \dfrac{x - z}{y + z}$ where $x = s + t$, $y = st$, and $z = s - t$. Compute $\dfrac{\partial w}{\partial s}$.

7. (8 points) Find a function $f(x, y)$ satisfying $\nabla f(x, y) = \langle 21x^2y^2+4y^2+3y+8, 14x^3y+8xy+3x+8y \rangle$, if such an f exists.

8. (8 points) Find parametric equations for the tangent line to the surface $z = x^2 + 2xy - y^3$ at the point $(3, 2)$ and in the direction of $\mathbf{v} = \langle 4, 3 \rangle$.

9. (14 points) Find the local maxima, local minima, and saddle points of $f(x, y) = x^4 + 4x^2y - 8x^2 + 8y^2 - 16y + 16$.

10. (10 points) Find the extreme values of $f(x, y) = 2x^2 + y^2 + 2$ subject to the constraint $x^2 + 4y^2 = 4$.

11. (8 points) Find the maximum rate of change of $f(x, y) = 4 + x^2 + 3y^2$ at the point $\left(2, -\frac{1}{2}\right)$ and the direction in which it occurs.