Math 32A - Winter 2019
Exam 2

Full Name: ______________________________

UID: ______________________________

Circle the name of your TA and the day of your discussion:

Qi Guo   Talon Stark   Tianqi (Tim) Wu

Tuesday   Thursday

Instructions:

- Read each problem carefully.
- Show all work clearly and circle or box your final answer where appropriate.
- Justify your answers. A correct final answer without valid reasoning will not receive credit.
- Simplify your answers as much as possible.
- Include units with your answer where applicable.
- Calculators are not allowed but you may have a 3×5 inch notecard.

Page	Points	Score
1	32	
2	26	
3	22	
4	20	
Total:	100	

1. (20 points) Consider the surface defined by $ze^{2x} + x^2y + y = 3 + 2e^{z+1}$.

   (a) Find an equation of the tangent plane to the surface at the point $P = (0, 5, -1)$.

   (b) Find a vector equation for the line passing through the surface at $P = (0, 5, -1)$ orthogonal to the plane found in part (a).

2. (12 points) Either give an example of a function $f(x, y)$ with $f_x(x, y) = 2x + y^2e^x$ and $f_y(x, y) = x^2 + y^2e^x$ or show that no such function f can exist.

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3. (16 points) Reparameterize the curve $\mathbf{r}(t) = \langle \sqrt{15}\, t^2, \cos(t^2), \sin(t^2) \rangle$ where $t \geq 0$ with respect to arc length.

4. (10 points) Show the following limit does not exist.

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

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5. (22 points) Consider the function $f(x, y) = \sqrt{10 - x^2 - 5y^2}$.

(a) Use a linear approximation to $f(x, y)$ at the point $(2, 1)$ to estimate the value of $f(1.95, 1.04)$.

(b) Find the directional derivative of f at the point $(2, 1)$ in the direction of $\langle 4, 3\rangle$.

(c) Find the maximum rate of change of f at the point $(2, 1)$.

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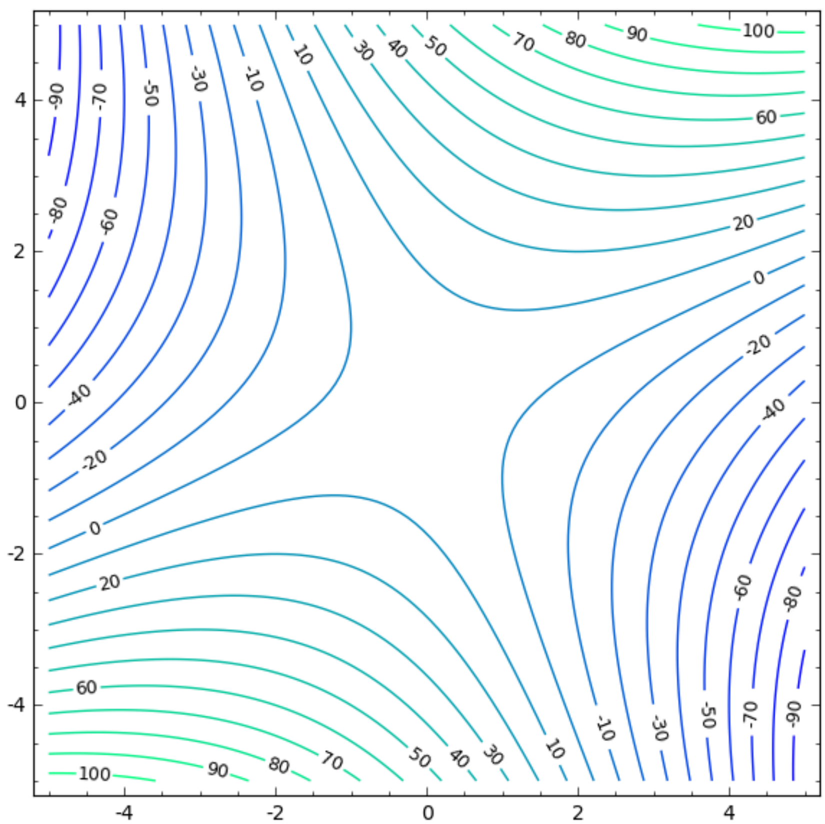
6. (20 points) Consider the contour plot for $f(x, y)$ below.



(a) Determine the sign of each of the following derivatives.

$f_x(3, 0)$ ________ $f_y(3, 0)$ ________

$f_{xx}(3, 0)$ ________ $f_{xy}(3, 0)$ ________ $f_{yy}(3, 0)$ ________

(b) Give the components of a unit vector in the direction of the steepest decline at the point $(-1, 0)$. (You may estimate as necessary.)

(c) Give the components of a unit vector orthogonal to $\nabla f(2, 2)$. (You may estimate as necessary.)

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You may use this page for scratch work. Work found on this page will not be graded unless clearly indicated in the exam.