Math 208 Spring 2020 **Exam 1.c** **Print Your 8 Digits NU ID:** _____

Print Your Name Legibly: _____ **Score:** _____

Instructions: You must show supporting work to receive full and partial credits. Textbook, notes, cheat sheets, calculators are not allowed.

1(12pts) For function $z = f(x, y) = -2x + y - 1$, sketch the $y = 0$ section curve, the $z = 1$ section curve, each in a separate coordinate plot.

2(15pts) Let $\vec{u} = \langle 1, 0, 1 \rangle$, $\vec{v} = \langle 1, 1, 1 \rangle$. Find the following.

(a) Find the angle between $\vec{u}$ and $\vec{v}$.

(b) Find the area of the triangle with $\vec{u}$ and $\vec{v}$ being its two adjacent sides.

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3(10pts) An object moves from point $Q = (1, -1, 1)$ to $R = (1, 0, 2)$, and a force, $\vec{F} = \langle 3, 2, 1 \rangle$, acts on the object. Find the projection of $\vec{F}$, $\vec{F}_{\text{parallel}}$, in the direction of $\vec{QR}$.

4(10pts) For $\lim_{(x,y)\to(0,0)} \dfrac{xy}{x^2 + y^2}$, find the limit if it exists. If the limit does not exist, explain why not.

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5(15pts) (a) For function $w = f(x, y, z) = xy + y^2 - z$, find the directional derivative at $(0, 1, -5)$ in the direction of $\langle 4, 0, 3 \rangle$.

(b) Find the direction at which the value of the function decreases the most.

6(12pts) Verify that the point $(2, 2, 1)$ is on the surface defined by the equation $y = x^2 - z^2 - 1$. Then viewing the surface as a level surface of a function $f(x, y, z)$ to find a vector perpendicular to the surface.

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7(12pts) Find an equation of the tangent plane to the graph of the function $z = f(x, y) = x + y + e^{y^2}$ at $(x, y) = (2, 0)$.

8(14pts) (a) For functions $z = f(x, y) = xe^y$, $x = u(s, t) = \sin(s + t)$, and $y = v(s, t) = \ln s$, use the chain rule to find $\dfrac{\partial z}{\partial s}$. (Simplification is not needed.)

(b) Find the value of $\dfrac{\partial z}{\partial s}$ at $(s, t) = (1, -1)$.

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2 Bonus Points: Calculus was discovered in: (a) the 16th century, (b) the 17th century, (c) the 18th century, (d) the 19th century.

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