University of California, San Diego
Department of Mathematics

Name: _____ PID: _____

Discussion Section: _____

Instructions

 1. Write your *Name*, *PID*, *Section*, and *Exam Version* on the front of your Blue Book.

 2. No calculators or other electronic devices are allowed during this exam.

 3. You may use one page of notes, but no books or other assistance during this exam.

 4. Read each question carefully, and answer each question completely.

 5. Write your solutions clearly in your Blue Book.

    (a) Carefully indicate the number and letter of each question and question part.

    (b) Present your answers in the same order they appear in the exam.

    (c) Start each problem on a new page.

 6. Show all of your work. No credit will be given for unsupported answers, even if correct.

 7. Turn in your exam paper with your Blue Book.

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 0. Carefully read and complete the instructions at the top of this exam sheet and any additional   (1)
    instructions written on the chalkboard during the exam.

 1. Let $f(x, y, z) = x^3 y + z$ and $P = (1, 0, 5)$.   (9)

    (a) Compute the directional derivative of f at P in the direction of the vector $\langle 2, 2, 1 \rangle$.

    (b) Compute the maximal rate of change of f at the point P.

 2. Find an equation for the tangent plane at the point $(1, 1, 1)$ for the surface: (10)

$$x \ln y + x^2 y^3 + z^2 = 2.$$

    Write your answer in the form $Ax + By + Cz = D$.

 3. Let $g(x, y) = x^3 + 2y^2 - 6xy + 6x$. Find the critical points for g and identify each one as the   (10)
    location of a local maximum, local minimum, or a saddle point.

 4. Let h be a differentiable function of x and y and let   (10)

$$z = h(r \cos \theta, r^2 + r\theta + \theta^2).$$

    If $h_x(2, 4) = 7$ and $h_y(2, 4) = 3$, then compute $\left. \dfrac{\partial z}{\partial r} \right|_{(r,\theta)=(2,0)}$ and $\left. \dfrac{\partial z}{\partial \theta} \right|_{(r,\theta)=(2,0)}$.

(This exam is worth 40 points.)