

MATH 202: VECTOR CALCULUS
FRIDAY WEEK 4 HANDOUT

Problem 1. Find an equation for the plane tangent to the graph of $z = 4\cos(xy)$ at the point $(\pi/3, 1, 2)$.

Problem 2. Find an equation for the tangent hyperplane tangent to the 4-dimensional paraboloid $x_5 = 10 - (x_1^2 + 3x_2^2 + 2x_3^2 + x_4^2)$ at the point $(2, -1, 1, 3, -8)$.

Problem 3. Suppose that you have the following information concerning a differentiable function f :

$$f(2, 3) = 12, \quad f(1.98, 3) = 12.1, \quad f(2, 3.01) = 12.2.$$

(a) Give an approximate equation for the plane tangent to the graph of f at $(2, 3, 12)$.

(b) Use the result of part (a) to estimate $f(1.98, 2.98)$.

Problem 4. Let

$$f(x, y) = \begin{cases} xy(x^2 - y^2)/(x^2 + y^2) & \text{if } (x, y) \neq (0, 0), \\ 0 & \text{if } (x, y) = (0, 0). \end{cases}$$

Find $D_1f(x, y)$ and $D_2f(x, y)$ for $(x, y) \neq (0, 0)$. Find the partial derivatives $D_1(0, y)$ and $D_2(x, 0)$. Find the values of $D_{12}f(0, 0)$ and $D_{21}f(0, 0)$. What gives?