

HW1

CSCE633

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Problem 1. (1) Let $f(x, y) = x^2 + \ln(y) + xy + y^3$. Then:

$$\begin{aligned}\frac{\partial f}{\partial x}\bigg|_{(10, -10)} &= 2x + y\bigg|_{(10, -10)} = 10, \\ \frac{\partial f}{\partial y}\bigg|_{(10, -10)} &= \frac{1}{y} + x + 3y^2\bigg|_{(10, -10)} = \frac{3099}{10}, \\ \nabla f(x, y)\bigg|_{(10, -10)} &= \left(10, \frac{3099}{10}\right).\end{aligned}$$

(2) Let $f(x, y, z) = \tanh(x^2y^3) + \sin(x^2)$. Then:

$$\begin{aligned}\frac{\partial f}{\partial x}\bigg|_{(1, 0, \frac{\pi}{2})} &= \frac{3x^2y^3}{\cosh^2(x^3y^3)}\bigg|_{(1, 0, \frac{\pi}{2})} = 0, \\ \frac{\partial f}{\partial y}\bigg|_{(1, 0, \frac{\pi}{2})} &= \frac{3x^3y^2}{\cosh^2(x^3y^3)}\bigg|_{(1, 0, \frac{\pi}{2})} = 0, \\ \frac{\partial f}{\partial z}\bigg|_{(1, 0, \frac{\pi}{2})} &= 2z \cos(z^2)\bigg|_{(1, 0, \frac{\pi}{2})} = \pi \cos\left(\frac{\pi^2}{4}\right), \\ \nabla f(x, y, z)\bigg|_{(1, 0, \frac{\pi}{2})} &= \left(0, 0, \pi \cos\left(\frac{\pi^2}{4}\right)\right).\end{aligned}$$

Problem 2. (1)

$$\begin{pmatrix} 10 \\ -5 \\ 2 \\ 8 \end{pmatrix} (0 \quad 3 \quad 0 \quad 1) = \begin{pmatrix} 0 & 30 & 0 & 10 \\ 0 & -15 & 0 & -5 \\ 0 & 6 & 0 & 2 \\ 0 & 24 & 0 & 8 \end{pmatrix}$$

(2)

$$\begin{pmatrix} 1 & -1 & 6 & 7 \\ 9 & 0 & 8 & 1 \\ -8 & 1 & 2 & 3 \\ 10 & 4 & 0 & 1 \end{pmatrix} \begin{pmatrix} 6 & 2 & 0 \\ 0 & -1 & 1 \\ -3 & 0 & 4 \\ 3 & 4 & 7 \end{pmatrix} = \begin{pmatrix} 6+0-18+21 & 2+0-1+28 & 0-1+24+49 \\ 54+0-24+3 & 18+0+0+4 & 0+0+32+7 \\ -48+0-6+9 & -16-1+0+12 & 0+1+8+21 \\ 60+0+0+3 & 20-4+0+4 & 0+4+0+7 \end{pmatrix}$$

$$result = \begin{pmatrix} 9 & 31 & 72 \\ 33 & 22 & 39 \\ -45 & 5 & 30 \\ 63 & 20 & 11 \end{pmatrix}$$