

"QUIZ" for Lecture 8

NAME: (print!) Shaun Goda Section: 23

E-MAIL SCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: qXFirstLast.pdf) ASAP BUT NO LATER THAN Oct. 1, 2020, 8:00pm

1. Find the directional derivative of the function $f(x, y, z) = xy^2z^3$ at the point $(2, 1, 1)$ in the direction $\langle 2, -1, -1 \rangle$.

$$\begin{aligned}\frac{\partial f}{\partial x} &= y^2 z^3 \\ \nabla f &= \frac{\partial f}{\partial x} \mathbf{i} + \frac{\partial f}{\partial y} \mathbf{j} + \frac{\partial f}{\partial z} \mathbf{k} = \langle y^2 z^3, 2xy z^3, 3x y^2 z^2 \rangle \\ \frac{\partial f}{\partial z} &= 3x y^2 z^2\end{aligned}$$

$$\begin{aligned}\nabla f(2, 1, 1) &= \langle 1, 4, 6 \rangle \\ \langle 1, 4, 6 \rangle \cdot \langle 2, -1, -1 \rangle &= (2 - 4 - 6) \\ &= -8\end{aligned}$$

2. Find the maximum rate of change of $f(x, y) = x^2 + y^3$ at the point $(2, 1)$ and the direction in which it occurs.

$$\begin{aligned}\nabla f &\Rightarrow \frac{\partial f}{\partial x} = 2x \\ &\frac{\partial f}{\partial y} = 3y^2 \\ &\Rightarrow \langle 2x, 3y^2 \rangle\end{aligned}$$

$$\nabla f(2, 1) = \langle 4, 3 \rangle$$

$$|\nabla f(2, 1)| = \sqrt{4^2 + 3^2} = \underline{\underline{5}}$$