

"QUIZ" for Lecture 8

NAME: (print!) Brianna Patnandu Section: _____

E-MAIL SCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: qXFfirstLast.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 $(2, -1, -1)$.

$$P(2, 1, 1) \quad Q(2, -1, -1)$$

$$\vec{PQ} = (2, -1, -1) - (2, 1, 1)$$

$$\vec{PQ} = \langle 0, -2, -2 \rangle$$

$$u = \frac{\langle 0, -2, -2 \rangle}{\sqrt{8}} = \left\langle 0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \right\rangle$$

$$f_x = y^2 z^3 \rightarrow f_x(2, 1, 1) = 1$$

$$f_y = 2xy z^3 \rightarrow f_y(2, 1, 1) = 4$$

$$f_z = 3xy^2 z^2 \rightarrow f_z(2, 1, 1) = 6$$

$$\begin{aligned} D_u f(2, 1, 1) &= \nabla f(2, 1, 1) \cdot u \\ &= \langle 1, 4, 6 \rangle \cdot \left\langle 0, -\frac{1}{\sqrt{2}}, -\frac{1}{\sqrt{2}} \right\rangle \\ &= 0 + \frac{-4}{\sqrt{2}} + \frac{-6}{\sqrt{2}} \\ &= \frac{-10}{\sqrt{2}} \end{aligned}$$

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.

$$\nabla f(x, y) = \langle f_x, f_y \rangle = \langle 2x, 3y^2 \rangle$$

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

$$|\nabla f(2, 1)| = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = 5$$

max rate of change is 5.