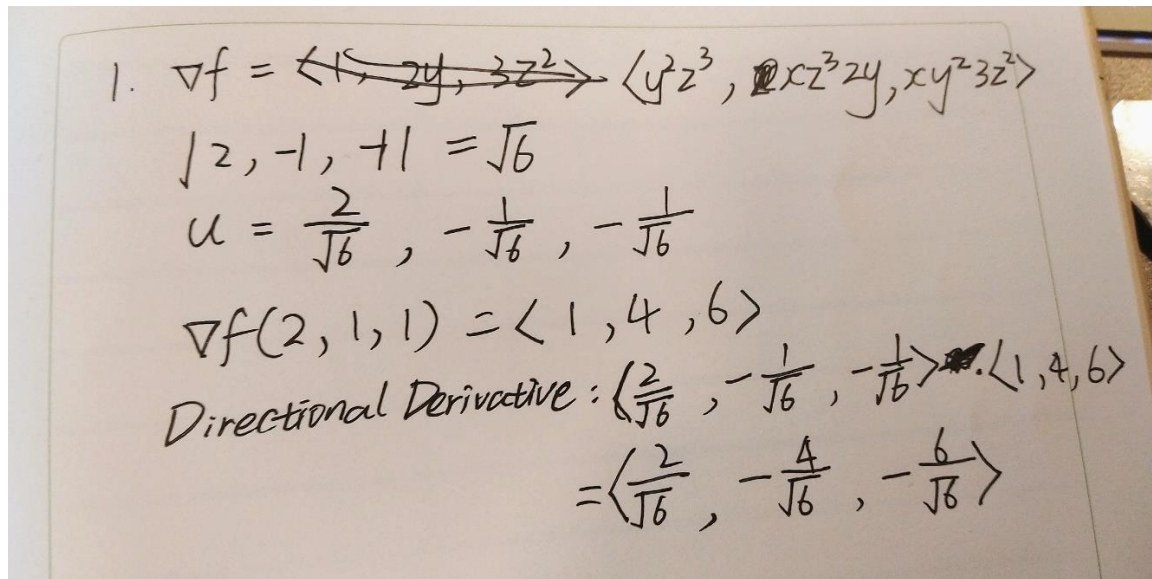


"QUIZ" for Lecture 8

NAME: (print!) Yongshan Li 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

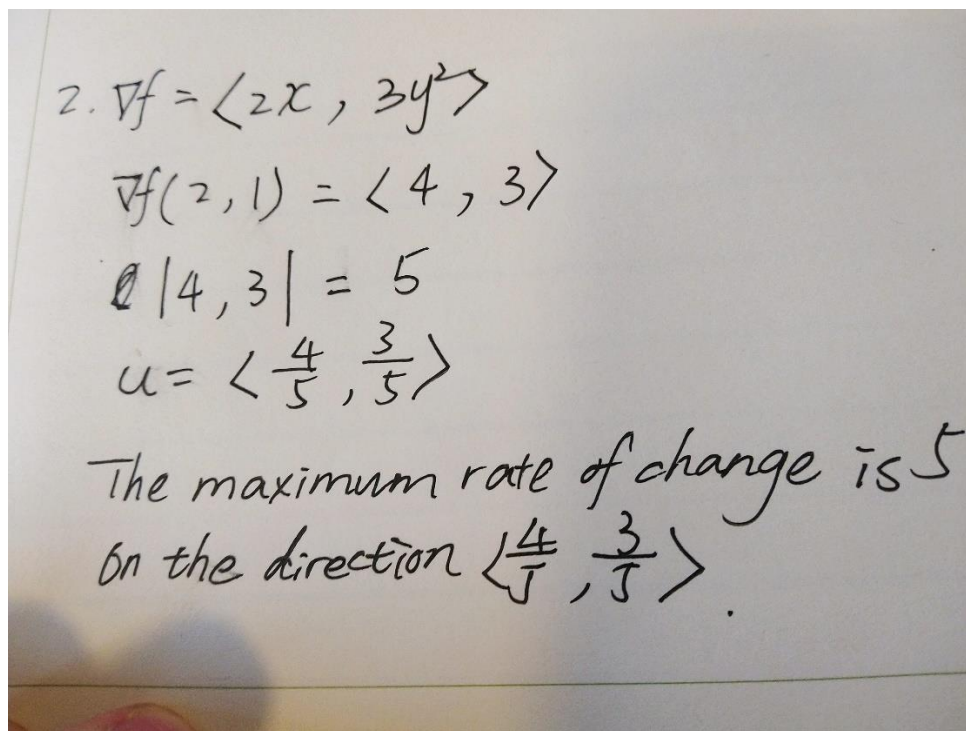
1. Find the directional derivative of the function $f(x, y, z) = xy^2z^3$ at the point $(2, 1, 1)$ in the direction $\langle 2, -1, -1 \rangle$.



Handwritten solution for problem 1:

$$1. \nabla f = \langle \cancel{1}, \cancel{2y}, \cancel{3z^2} \rangle \langle y^2z^3, xz^3y, xy^2z^2 \rangle$$
$$|\langle 2, -1, -1 \rangle| = \sqrt{6}$$
$$u = \left\langle \frac{2}{\sqrt{6}}, -\frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}} \right\rangle$$
$$\nabla f(2, 1, 1) = \langle 1, 4, 6 \rangle$$
$$\text{Directional Derivative: } \left\langle \frac{2}{\sqrt{6}}, -\frac{1}{\sqrt{6}}, -\frac{1}{\sqrt{6}} \right\rangle \cdot \langle 1, 4, 6 \rangle$$
$$= \left\langle \frac{2}{\sqrt{6}}, -\frac{4}{\sqrt{6}}, -\frac{6}{\sqrt{6}} \right\rangle$$

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.



Handwritten solution for problem 2:

$$2. \nabla f = \langle 2x, 3y^2 \rangle$$
$$\nabla f(2, 1) = \langle 4, 3 \rangle$$
$$|\langle 4, 3 \rangle| = 5$$
$$u = \left\langle \frac{4}{5}, \frac{3}{5} \right\rangle$$

The maximum rate of change is 5
on the direction $\left\langle \frac{4}{5}, \frac{3}{5} \right\rangle$.