"QUIZ" for Lecture 8

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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 $\langle 2,-1,-1\rangle$.

$f_x = y^2z^3 \qquad f_y = 2xyz^3 \qquad f_z = 3xy^2z^2$

$\nabla f = \langle y^2z^3, 2xyz^3, 3xy^2z^2 \rangle$

$|\langle 2,-1,-1\rangle| = \sqrt{2^2+(-1)^2+(-1)^2} = \sqrt{6}$

$u = \frac{1}{\sqrt{6}}\langle 2,-1,-1\rangle = \langle \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{-1}{\sqrt{6}}\rangle$

$\nabla f(2,1,1) = \langle 1,4,6\rangle$

$\langle 1,4,6\rangle \cdot \langle \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{-1}{\sqrt{6}}\rangle = \frac{2}{\sqrt{6}} + (\frac{-4}{\sqrt{6}}) + (\frac{-6}{\sqrt{6}}) = \boxed{\frac{-8}{\sqrt{6}}}$

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 is occurs.

$f_x = 2x \qquad f_y = 3y^2$

$\nabla f = \langle 2x, 3y^2\rangle$

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

$|\langle 4,3\rangle| = \sqrt{4^2+3^2} = 5$

maximum rate of change is 5 in the direction $\langle 4,3\rangle$