"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 <2,−1,−1>.

$f_x = 1 \cdot y^2z^3$, $f_y = 2yxz^3$, $f_z = 3z^2xy^2$

$u = \left\langle \frac{2}{\sqrt{2^2+(-1)^2+(-1)^2}}, \frac{-1}{\sqrt{2^2+(-1)^2+(-1)^2}}, \frac{-1}{\sqrt{2^2+(-1)^2+(-1)^2}} \right\rangle = \left\langle \frac{2}{2}, \frac{-1}{2}, \frac{-1}{2} \right\rangle \rightarrow a = 1,\ b = -\frac{1}{2},\ c = -\frac{1}{2}$

$D_u f = (2,1,1) = 1(1-1) + -\frac{1}{2}(2-1) + -\frac{1}{2}(2-1) = -\frac{1}{2} - \frac{1}{2} = \boxed{-1}$

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.

$f(x,y) = x^2 + y^3$

$\nabla f(x,y) = \left\langle \frac{\partial f}{\partial x}, \frac{\partial f}{\partial y} \right\rangle = \langle 2xy^3, 3y^2x^2 \rangle$

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

$\nabla f(2,1) = \boxed{\langle 4, 12 \rangle}$ → max rate of change in direction

$|\nabla f(2,1)| = \sqrt{4^2 + 12^2} = \sqrt{16+144} = \boxed{\sqrt{160}}$ → magnitude of max r.o.c.