

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

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

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

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

$$\rightarrow |\langle 2, -1, -1 \rangle| = \sqrt{6}$$

$$\rightarrow \frac{1}{\sqrt{6}} \langle 2, -1, -1 \rangle = \left\langle \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{-1}{\sqrt{6}} \right\rangle$$

$$\rightarrow \langle 1, 4, 6 \rangle \cdot \left\langle \frac{2}{\sqrt{6}}, \frac{-1}{\sqrt{6}}, \frac{-1}{\sqrt{6}} \right\rangle = \frac{2}{\sqrt{6}} - \frac{4}{\sqrt{6}} - \frac{6}{\sqrt{6}} = \boxed{\frac{-8}{\sqrt{6}}}$$

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 it occurs.

$$\rightarrow f_x = 2x$$

$$\rightarrow f_y = 3y^2$$

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

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

$$\rightarrow |\langle 4, 3 \rangle| = \sqrt{16+9} = 5$$

$$\rightarrow \frac{1}{5} \langle 4, 3 \rangle = \boxed{\left\langle \frac{4}{5}, \frac{3}{5} \right\rangle}$$