**"QUIZ" for Lecture 9**

**NAME:** (print!) Fady Besada **Section:** 22

**E-MAIL SCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: q9FirstLast.pdf) ASAP BUT NO LATER THAN Oct. 5, 8:00pm**

**1.** Find $\frac{\partial f}{\partial r}$ and $\frac{\partial f}{\partial s}$ as **functions of** $r$ **and** $s$ , if

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

and the variables are related by $x = r + 2s$ and $y = 3r + 2s$. You do not need to simplify!

$\rightarrow \frac{\partial f}{\partial r} = \left(\frac{\partial f}{\partial x} \cdot \frac{\partial x}{\partial r}\right) + \left(\frac{\partial f}{\partial y} \cdot \frac{\partial y}{\partial r}\right)$

$\rightarrow \frac{\partial f}{\partial x} = 2x + 2y^2, \ \frac{\partial x}{\partial r} = 1, \ \frac{\partial f}{\partial y} = 4xy + 6y^2, \ \frac{\partial y}{\partial r} = 3$

$\rightarrow \frac{\partial f}{\partial r} = (2x + 2y^2) \cdot 1 + (4xy + 6y^2) \cdot 3 = 2x + 2y^2 + 12xy + 18y^2$

$\rightarrow \boxed{\frac{\partial f}{\partial r} = 20y^2 + 12xy + 2x}$

$\rightarrow \frac{\partial f}{\partial s} = \left(\frac{\partial f}{\partial x} \cdot \frac{\partial x}{\partial s}\right) + \left(\frac{\partial f}{\partial y} \cdot \frac{\partial y}{\partial s}\right)$

$\rightarrow \frac{\partial x}{\partial s} = 2, \ \frac{\partial y}{\partial s} = 2$

$\rightarrow \frac{\partial f}{\partial s} = (2x + 2y^2) \cdot 2 + (4xy + 6y^2) \cdot 2 = 4x + 4y^2 + 8xy + 12y^2$

$\rightarrow \boxed{\frac{\partial f}{\partial s} = 16y^2 + 8xy + 4x}$

**2.** Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ if

$$x^2 + y^2 + z^2 = 5xyz + 1 \quad .$$

$\rightarrow \frac{\partial z}{\partial x} \longrightarrow 2x + 2z\frac{\partial z}{\partial x} = 5y\frac{\partial z}{\partial x}$

$\rightarrow 2x = 5y\frac{\partial z}{\partial x} - 2z\frac{\partial z}{\partial x}$

$\rightarrow \boxed{\frac{\partial z}{\partial x} = \frac{2x}{5y - 2z}}$

$\rightarrow \frac{\partial z}{\partial y} \longrightarrow 2y + 2z\frac{\partial z}{\partial y} = 5x\frac{\partial z}{\partial y}$

$\rightarrow 2y = 5x\frac{\partial z}{\partial y} - 2z\frac{\partial z}{\partial y}$

$\rightarrow \boxed{\frac{\partial z}{\partial y} = \frac{2y}{5x - 2z}}$