QUIZ 15 SOLUTIONS: LESSON 19
OCTOBER 15, 2018

Write legibly, clearly indicate the question you are answering, and put a box or circle around your final answer. If you do not clearly indicate the question numbers, I will take off points. Write as much work as you need to demonstrate to me that you understand the concepts involved. If you have any questions, raise your hand and I will come over to you.

Let $f(x,y) = xe^{x^2y}$.

1. [3 pts] Find f_x.

Solution: f_x is the derivative of f with respect to x. We hold y constant and write

$$\begin{aligned}
f_x &= \frac{\partial}{\partial x}(xe^{x^2y}) \\
&= \underbrace{x\left[\frac{\partial}{\partial x}e^{x^2y}\right] + \left[\frac{\partial}{\partial x}(x)\right]e^{x^2y}}_{\text{Product Rule}} \\
&= \underbrace{x\left[\frac{\partial}{\partial x}(x^2y)\right]e^{x^2y}}_{\text{Chain Rule}} + e^{x^2y} \\
&= x\left[y\frac{\partial}{\partial x}(x^2)\right]e^{x^2y} + e^{x^2y} \\
&= x\left[y(2x)\right]e^{x^2y} + e^{x^2y} \\
&= 2x^2ye^{x^2y} + e^{x^2y} \\
&= \boxed{(2x^2y+1)e^{x^2y}}
\end{aligned}$$

2. [2 pts] Evaluate $f_x(160, 0)$.

Solution: $f_x = (2x^2y+1)e^{x^2y}$, we find $f_x(160, 0)$:

$$\begin{aligned}
f_x(160,0) &= (2(160)^2(0)+1)e^{(160)^2\cdot 0} \\
&= (0+1)e^0 \\
&= \boxed{1}
\end{aligned}$$

3. [3 pts] Find f_y.

Solution: f_y is the derivative of f with respect to y. We hold x constant and write

$$\begin{aligned}
f_y &= \frac{\partial}{\partial y}(xe^{x^2y}) \\
&= x\left[\frac{\partial}{\partial y}e^{x^2y}\right] \\
&= \underbrace{x\left[\frac{\partial}{\partial y}(x^2y)\right]e^{x^2y}}_{\text{Chain Rule}} \\
&= x\left[x^2\frac{\partial}{\partial y}(y)\right]e^{x^2y} \\
&= \boxed{x^3e^{x^2y}}
\end{aligned}$$

4. [2 pts] Evaluate $f_y(-1, \ln 2)$.

Solution: $f_y = x^3e^{x^2y}$, we find $f_y(-1, \ln 2)$:

$$\begin{aligned}
f_y(-1, \ln 2) &= (-1)^3e^{(-1)^2(\ln 2)} \\
&= -e^{\ln 2} \\
&= \boxed{-2}
\end{aligned}$$