

QUIZ 13 SOLUTIONS: LESSON 19
OCTOBER 16, 2017

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

$$f(x, y) = e^{x^2y} + x(x + y)^3.$$

1. [6 pts] Find the partial derivatives of $f(x, y)$.

Solution:

$$\begin{aligned} f_x(x, y) &= \frac{\partial}{\partial x}(e^{x^2y} + x(x + y)^3) \\ &= \frac{\partial}{\partial x}(e^{x^2y}) + \frac{\partial}{\partial x}(x(x + y)^3) \\ &= \underbrace{\left[\frac{\partial}{\partial x}(x^2y) \right] \cdot e^{x^2y}}_{\text{chain rule}} + x \underbrace{\left[\frac{\partial}{\partial x}(x + y)^3 \right] + (x + y)^3 \left[\frac{\partial}{\partial x}(x) \right]}_{\text{product rule}} \\ &= 2xye^{x^2y} + x \underbrace{\left(3 \left[\frac{\partial}{\partial x}(x + y) \right] (x + y)^2 \right)}_{\text{chain rule}} + (x + y)^3 \\ &= 2xye^{x^2y} + x(3(x + y)^2) + (x + y)^3 \\ &= \boxed{2xye^{x^2y} + 3x(x + y)^2 + (x + y)^3} \\ f_y(x, y) &= \frac{\partial}{\partial y}(e^{x^2y} + x(x + y)^3) \\ &= \frac{\partial}{\partial y}(e^{x^2y}) + \frac{\partial}{\partial y}(x(x + y)^3) \\ &= \underbrace{\left[\frac{\partial}{\partial y}(x^2y) \right] \cdot e^{x^2y}}_{\text{chain rule}} + \underbrace{3x \left[\frac{\partial}{\partial y}(x + y) \right] (x + y)^2}_{\text{chain rule}} \\ &= \boxed{x^2e^{x^2y} + 3x(x + y)^2} \end{aligned}$$

2. [2 pts] Find $f_x(1, 1)$.

Solution:

$$f_x(1, 1) = 2(1)(1)e^{(1)^2(1)} + 3(1)(1+1)^2 + (1+1)^3 = 2e^1 + 3(2)^2 + 2^3 = \boxed{2e + 20}$$

3. [2 pts] Find $f_y(1, 1)$.

Solution:

$$f_y(1, 1) = (1)^2e^{(1)^2(1)} + 3(1)(1+1)^2 = e^1 + 3(2)^2 = \boxed{e + 12}$$