## QUIZ 11: LESSON 19 MARCH 3, 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. If you have any questions, raise your hand and I will come over to you.

- 1. Find  $f_x, f_y$  of the following:
  - (a) [4 pts]  $f(x, y) = x^2 \cos(y)$

 $\underline{Solution}: Write$ 

$$f_x(x,y) = \frac{\partial}{\partial x} (x^2 \cos(y))$$
$$\stackrel{(\star)}{=} \cos(y) \frac{\partial}{\partial x} (x^2)$$
$$= \cos(y)(2x) = 2x \cos(y)$$

where  $(\star)$  follows because we think of  $\cos(y)$  as a constant with respect to x. Moreover,

$$f_y(x,y) = \frac{\partial}{\partial y} (x^2 \cos(y))$$
$$\stackrel{(\star\star)}{=} x^2 \frac{\partial}{\partial y} (\cos(y))$$
$$= x^2 (-\sin y) = -x^2 \sin(y)$$

where  $(\star\star)$  follows because we think of  $x^2$  as a constant with respect to y.

(b) [4 pts]  $f(x,y) = \frac{x+y}{y}$ 

 $\underline{Solution}: Write$ 

$$f_x(x,y) = \frac{\partial}{\partial x} \left( \frac{x+y}{y} \right)$$
$$\stackrel{\dagger}{=} \frac{1}{y} \frac{\partial}{\partial x} (x+y)$$
$$= \frac{1}{y} (1) = \frac{1}{y}$$

where (†) follows because we think of  $\frac{1}{y}$  as a constant with respect to x.

Next,

$$\begin{split} f_y(x,y) &= \frac{\partial}{\partial y} \left( \frac{x+y}{y} \right) \\ &\stackrel{(\ddagger \dagger)}{=} \frac{(y) \left[ \frac{\partial}{\partial y} (x+y) \right] - (x+y) \left[ \frac{\partial}{\partial y} (y) \right]}{y^2} \\ &= \frac{y(1) - (x+y)(1)}{y^2} \\ &= \frac{-x}{y^2} \end{split}$$

where  $(\dagger\dagger)$  follows by the quotient rule.

2. [2 pts] Given

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

find  $f_x(1, 1)$ .

**<u>Solution</u>**: We first find  $f_x(x, y)$ . Write

$$f_x(x,y) = \frac{\partial}{\partial x} \left( (x+y)e^{2x+y} \right)$$
  
$$\stackrel{(\diamond)}{=} (x+y) \left[ \frac{\partial}{\partial x}e^{2x+y} \right] + \left[ \frac{\partial}{\partial x}(x+y) \right] e^{2x+y}$$
  
$$= (x+y) \left( 2e^{2x+y} \right) + (1)e^{2x+y}$$
  
$$= 2(x+y)e^{2x+y} + e^{2x+y}$$

where  $(\diamond)$  follows by the product rule. Hence,

$$f_x(1,1) = 2(1+1)e^{2(1)+1} + e^{2(1)+1} = 2(2)e^3 + e^3 = 5e^3.$$