

Please PRINT your name \_\_\_\_\_

**No calculators, cell phones, computers, notes, etc.**

Circle your answer. Make your work **correct, complete** and **coherent**.

The quiz is worth 5 points. The solutions will be posted on my website later today.

**Quiz 16, October 30, 2019**

Let  $z = 4e^x \ln y$ ,  $x = \ln(u \cos v)$  and  $y = u \sin v$ . Express  $\frac{\partial z}{\partial u}$  as a function of  $u$  and  $v$ . Do the problem two ways.

- (a) First write  $z$  as a function of  $u$  and  $v$  and then take  $\frac{\partial z}{\partial u}$ .  
(b) First use the chain rule to calculate  $\frac{\partial z}{\partial u}$  as a function of  $x, y, u, v$ . Then substitute  $x(u, v)$  for  $x$  and  $y(u, v)$  for  $y$  to express  $\frac{\partial z}{\partial u}$  as a function of  $u, v$ .

**ANSWER:**

First method:

$$z = 4e^{\ln(u \cos v)} \ln(u \sin v)$$

$$z = 4u \cos v \ln(u \sin v)$$

$$\frac{\partial z}{\partial u} = 4u \cos v \frac{\sin v}{u \sin v} + 4 \cos v \ln(u \sin v)$$

$$\frac{\partial z}{\partial u} = 4 \cos v + 4 \cos v \ln(u \sin v)$$

Second method:

$$\frac{\partial z}{\partial u} = \frac{\partial z}{\partial x} \frac{\partial x}{\partial u} + \frac{\partial z}{\partial y} \frac{\partial y}{\partial u}$$

$$\frac{\partial z}{\partial u} = 4e^x \ln y \frac{\cos v}{u \cos v} + \frac{4e^x}{y} \sin v$$

$$\frac{\partial z}{\partial u} = 4e^{\ln(u \cos v)} \ln(u \sin v) \frac{1}{u} + \frac{4e^{\ln(u \cos v)}}{u \sin v} \sin v$$

$$\frac{\partial z}{\partial u} = 4u \cos v \ln(u \sin v) \frac{1}{u} + \frac{4u \cos v}{u \sin v} \sin v$$

$$\frac{\partial z}{\partial u} = 4 \cos v \ln(u \sin v) + 4 \cos v$$

Of course, we got the same answer both times.