MAT 397 CAL III Section M005 Spring 2016

Solutions

Quiz 4

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1. Let $f(r,s) = e^{-r}\sin(2s)$. Find f_{rs}.

$$f_r = \frac{\partial f}{\partial r} = -e^{-r}\sin 2s$$

$$f_{rs} = \frac{\partial}{\partial s}\left(\frac{\partial f}{\partial r}\right) = \frac{\partial f}{\partial r \partial s} = -2e^{-r}\cos 2s$$

2. Find an equation of the tangent plane to the surface $z = 2xe^{xy}$ at $x = 1$ and $y = 0$.

$$z = f(x,y) = 2xe^{xy}$$

$$f(1,0) = 2(1)e^{1(0)} = 2$$

$$f_x = \frac{\partial f}{\partial x} = 2e^{xy} + 2xye^{xy}\Big|_{(1,0)} = 2$$

$$f_y = \frac{\partial f}{\partial y} = 2x^2e^{xy}\Big|_{(1,0)} = 2$$

$$z = 2 + 2(x-1) + 2(y-0)$$

$$z = 2 + 2x - 2 + 2y$$

$$z = 2x + 2y$$

$$\boxed{2x + 2y - z = 0}$$

3. If $v = x^2 \sin y + ye^{xy}$, where $x = s + 3t$ and $y = st$, use the Chain Rule to find $\partial v/\partial s$ when $s = 0$ and $t = 1$.

$$\frac{\partial v}{\partial s} = \frac{\partial v}{\partial y}\frac{\partial y}{\partial s} + \frac{\partial v}{\partial x}\frac{\partial x}{\partial s}$$

When $s=0$ & $t=1$, then $x = 0+3(1) = 3$ and $y = 0(1) = 0$

So $\begin{cases} s=0 \\ t=1 \\ x=3 \\ y=0 \end{cases}$

$$\frac{\partial v}{\partial y} = x^2\cos y + e^{xy} + xye^{xy}\Big|_{(3,0)} = 3^2(1) + e^0 + 0$$
$$= 9 + 1 = 10$$

$$\frac{\partial y}{\partial s} = t\Big|_{t=1} = 1$$

$$\frac{\partial v}{\partial x} = 2x\sin y + y^2e^{xy}\Big|_{(3,0)} = 2(3)\sin 0 + 0$$
$$= 6\cdot 0 = 0$$

$$\frac{\partial x}{\partial s} = 1\Big|_{s=0} = 1$$

$$\frac{\partial v}{\partial s} = \frac{\partial v}{\partial y}\frac{\partial y}{\partial s} + \frac{\partial v}{\partial x}\frac{\partial x}{\partial s}$$
$$= 10(1) + 0(1)$$
$$= 10$$