Announcements: Exam 2 is next week! | Tentative Zoom Review

*Formula sheet?

Oct 10, 8:30-10PM on | on Oct 9, 7-8:30 PM

LIT215

lectures 10-18 (same room)

FLINT 0050

Partial Derivatives & Chain Rule Practice

X12 #3 Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ of $z = x\cos(5xy)$

"del" Treat every variable, except as a constant

$$z_x \quad \frac{\partial z}{\partial x} = (1)(\cos(5xy)) + x(5y)(-\sin(5xy))$$

$$= \cos(5xy) - 5xy\sin(5xy)$$

$$\frac{\partial z}{\partial y} = x(5x)(-\sin(5xy)) = -5x^2\sin(5xy)$$

X12 #9

$x \neq 0$

For $f(x,y) = \frac{5}{x} + \frac{25}{y} + xy$, find all values of x

$5x^{-1}$ $\quad$ $25y^{-1}$

and y such that $f_x = f_y = 0$ simultaneously.

$$f_x = -5x^{-2} + y = \frac{-5}{x^2} + y = 0 \qquad ①$$

$$f_y = -25y^{-2} + x = \frac{-25}{y^2} + x = 0$$

$$\frac{-5}{x^2} + y = 0 \quad \Rightarrow \quad y = 5/x^2 \qquad ②$$

$+ 5/x^2$ $\quad$ $+5/x^2$

$$\frac{-25}{(5/x^2)^2} + x = 0 \qquad ③$$

$$\frac{-25}{(25/x^4)} + x = 0 \qquad ④$$

$(1, 5)$

$$\frac{-\cancel{25} \cdot x^4}{\cancel{25}} + x = 0 \qquad ⑤$$

$$-x^4 + x = 0 \qquad ⑥$$

$$-x(x^3 - 1) = 0 \qquad ⑦$$

$\cancel{x = 0}$ & $x = 1$ $\qquad y = 5/1^2 = 5 \qquad ⑧$

X14 #3 Use the chain rule to find $\frac{\partial z}{\partial s}$ and

"del" $\rightarrow \frac{\partial z}{\partial t}$ if $z = (x-y)^6$, $x = s^2 t$, $y = st^2$.

$x(s,t) = s^2 t$ $y(s,t) = st^2$

When to use chain rule?. → Functions of functions

$$\frac{\partial z}{\partial s} = \frac{\partial z}{\partial x} \cdot \frac{\partial x}{\partial s} + \frac{\partial z}{\partial y} \cdot \frac{\partial y}{\partial s}$$

$$6(x-y)^5 (2st) + 6(x-y)^5 (-1)(t^2)$$

$$6(s^2 t - st^2)^5 (2st) - 6(s^2 t - st^2)^5 (t^2)$$

:)

$$\frac{\partial z}{\partial t} = \frac{\partial z}{\partial x} \cdot \frac{\partial x}{\partial t} + \frac{\partial z}{\partial y} \cdot \frac{\partial y}{\partial t}$$

$x(s,t) = s^2 t$ $y(s,t) = st^2$

$$6(s^2 t - st^2)^5 (s^2) - 6(s^2 t - st^2)^5 (2st)$$

2018 Exam 2 #7

Let $f(x,y,z) = x^3 + yz^2$ where $x = u+v$, $y = u^2 - v^2$, $z = uv$.

Find $\left.\dfrac{\partial f}{\partial u}\right|_{\substack{u=1\\ v=1}}$

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

$$= (3x^2)(1) + (z^2)(2u) + (2yz)(v)$$

$$\frac{\partial f}{\partial u} = 3(u+v)^2 + (uv)^2(2u) + \cancel{2\underbrace{(u^2-v^2)}_{1^2-1^2=0}(uv)v}$$

$$\left.\frac{\partial f}{\partial u}\right|_{u,v=1,1} = 3(2)^2 + (1)^2(2) = 3\cdot 4 + 2 = 12 + 2 = 14$$

Partial Derivative w/ 3 variables *A*

$$D(x,y,z) = e^{2xyz} + \cos(xy)$$

Find $\dfrac{\partial D}{\partial x}$ and $\dfrac{\partial D}{\partial z}$

$$\frac{\partial D}{\partial x} = 2yze^{2xyz} + y(-\sin(xy)) = 2yze^{2xyz} - y\sin(xy)$$

$$\frac{\partial D}{\partial z} = 2xye^{2xyz}$$