

$$f(x, y, z) = \sqrt{xy} \ln z$$

$$f_x = \frac{1}{2} \frac{y \ln z}{\sqrt{xy} \ln z}$$

$$f_y = \frac{1}{2} \frac{x \ln z}{\sqrt{xy} \ln z}$$

$$f_z = \frac{1}{2} \frac{xy}{\sqrt{xy} \ln z}$$

$$f_{xz} = \frac{1}{2} \frac{xy \ln z}{\sqrt{xy} \ln z} - \frac{1}{2} \frac{xy}{\sqrt{xy} \ln z} = \frac{1}{2} \frac{\sqrt{xy} \ln z - \frac{1}{2} \frac{xy}{\ln z}}{\sqrt{xy} \ln z}$$

$$f_{zx} = \dots$$

Definition: $f(x, y): E_2 \rightarrow \mathbb{R}$

$$f_{xy}(x, y) = \lim_{t \rightarrow 0} \frac{1}{t} (f_x(x, y+t) - f_x(x, y))$$

$$= \lim_{t \rightarrow 0} \frac{1}{t} (h_2 \frac{1}{s} (f(x+s, y+t) - f(x, y+t)) - f_x(x, y+t) - f_x(x, y))$$

with rule: $f_{xy}(x, y) = \lim_{t \rightarrow 0} \frac{1}{t} (f(x+t, y+t) - \dots)$

no limit to $g(x, y) = f(x+t, y) - f(x, y)$

$g(x, y) = f(x+t, y) - f(x, y)$

$$g(x, y+t) - g(x, y) = t \cdot g_y(x, y+t_0)$$

$$g_y = f_y(x+t, y) - f_y(x, y)$$

$$\varphi(x, y, t) = \frac{1}{t} g_y(x, y+t_0)$$

$$= \frac{1}{t} (f_y(x+t, y+t_0) - f_y(x, y+t_0))$$

$$\varphi(x, y, t) = f_{yx}(x+t, y+t_0)$$

$$= f_{yx}(x, y)$$

$$(x(t_1), y(t_1)) = (x_0 + t\xi, y_0 + t\eta)$$

$$(f(x(t_1), y(t_1)))' = f'_x(x_0, y_0) \cdot x'(t) + f'_y(x_0, y_0) \cdot y'(t)$$

$$\begin{aligned} \| (f(x(t_1), y(t_1)))' \|^2 &= f'^2_{xx}(x_0, y_0) \cdot \xi^2 + f'^2_{xy}(x_0, y_0) \cdot \eta\xi + \\ &+ f'^2_{yx}(x_0, y_0) \cdot \eta\xi + f'^2_{yy}(x_0, y_0) \cdot \eta^2 \end{aligned}$$

$$f: E_2 \rightarrow \mathbb{R} \quad f(x, y) = xy \sin y \quad P = [\pi, \pi]$$

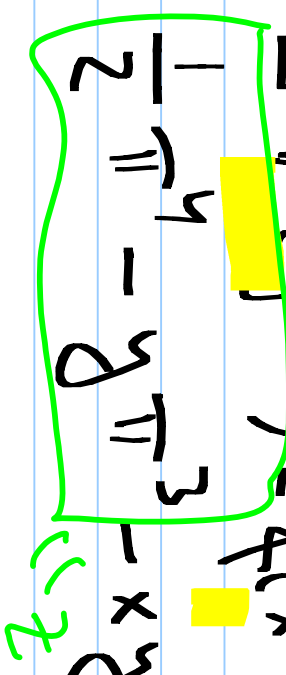
$$\underline{I_2} f(x, y) = f(\pi, \pi) + f_x(\pi, \pi)(x - \pi) + f_y(\pi, \pi)(y - \pi) + \frac{B}{2} [0, \pi, \pi, 0]$$

$$= -\pi^2 + (y \sin y)'_P (x - \pi) + (x \sin y - xy \sin y)'_P (y - \pi)$$

$$+ \frac{1}{2} (0 + 2(\sin y - y \sin y))'_P (x - \pi)(y - \pi) + (-x \sin y - x \sin y - x \sin y \cos y - x \sin y)$$

$$= -\frac{1}{2} \pi^2 - \pi(x - \pi) = f(x - \pi)(y - \pi)$$

$$+ \frac{1}{2} \pi^2 (y - \pi)^2 = \frac{1}{2} \pi^4 - y \pi^3 - x y + \frac{1}{2} \pi^2 y^2$$



$$f(x, y) = x^2 y + y^2 x - x y$$

Extrem?

$$f_x = 2xy + y^2 - y = 0$$

$$f_y = x^2 + 2yx - x = 0$$

$$\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix} \begin{pmatrix} 0 & 1 \\ 1 & 2 \end{pmatrix} \cdot \cdot \cdot \left| \begin{array}{c|c} 2/3 & 1/3 \\ \hline 1/3 & 2/3 \end{array} \right| = 7/9$$

$$[0, 0] \quad [1, 0] \quad [0, 1] \quad [1/3, 1/3] \quad \checkmark$$