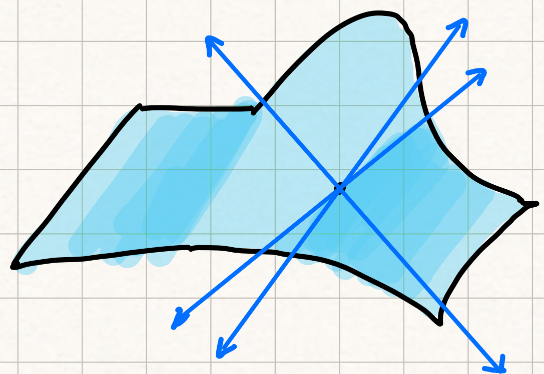
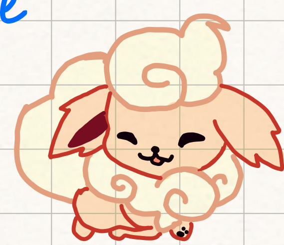
11.13.22

LECTURE 35

The instantaneous rate of change of f depends not only on the input point but also the direction in which we move from the input point



these points all have different slopes!



DEFINITION

The partial derivative of f wrt x at (x_0, y_0) denoted $f_x(x_0, y_0)$ is

$$\frac{d}{dx} f(x, y_0)\Big|_{x=x_0} = f_x(x_0, y_0) = \lim_{h \to 0} \frac{f(x_0+h, y_0) - f(x_0, y_0)}{h}$$

- This is just the normal derivative wrt x of $f(x, y_0)$ @ x_0
- we can also apply this to y

EXAMPLE

$f(x,y) = x^2y^3 - 5xe^{3y}$. Compute f_x and f_y @ (x_0, y_0)

$$\frac{d}{dx} f(x, y_0)\Big|_{x=x_0} = \frac{d}{dx}\left(x^2y^3 - 5xe^{3y}\right) = 2xy_0^3 - 5e^{3y_0}$$

$$\frac{d}{dy} f(x_0, y)\Big|_{y=y_0} = \frac{d}{dy}\left(x_0^2y^3 - 5x_0e^{3y}\right) = 3y_0^2x_0^2 - 15x_0e^{y}$$

$$f_x(x,y) = 2xy^3 - 5e^{3y}, \quad f_y(x,y) = 3x^2y^2 - 15xe^{3y}$$

LECTURE 35

Lecture 35 Problems

1) $f(x,y) = x^2 y e^{x+y}$ $\quad c = f_x(1,1)$ and $d = f_y(1,1)$

at $f(x,1)$, the function is $x^2 e^{x+1}$

diffrentiating wrt x, $\frac{d}{dx} x^2 e^{x+1} = 2xe^{x+1} + x^2 e^{x+1}$

at $x=1$, this gives $3e^2$ $\quad \boxed{D}$

2) $f(x,y) = \dfrac{e^{xy}\sin(x+y)}{\ln(x^2+1)}$ what is $f_x(\pi,0)$ $\quad \boxed{C}$

take $y=0$.

$$\frac{d}{dx}\bigg|_{x=\pi} \frac{\sin(x)}{\ln(x^2+1)} = \frac{-1}{\ln(\pi^2+1)}$$

3) $f(x,y) = \sin(xy) + x^3y - y^2$

$g(x,y) = f_x(x,y)$ $\quad y\cos(xy) + 3yx^2$

$h(x,y) = g_y(x,y)$ $\quad \cos(xy) - xy\sin(xy) + 3x^2$ $\quad \boxed{D}$