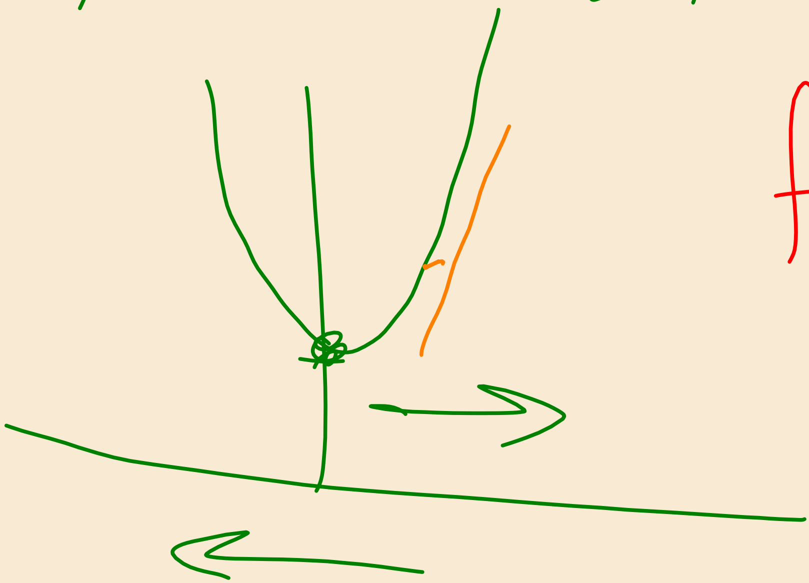
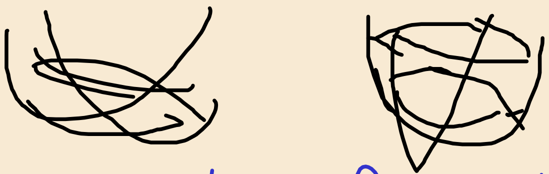
$f(x) = 3 + 3x^2$



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



Partial der

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$f(x,y)$ w.r.t the to x

wrt

$$\lim_{h \to 0} \frac{f(x+h, y) - f(x,y)}{h}$$

$\boxed{x^2+y^2}$ $\qquad x^2+50y$

$f'_x \qquad \frac{d f}{dx} \qquad \frac{\partial f}{\partial y} \qquad \frac{\partial y^2}{\partial x} = 0$

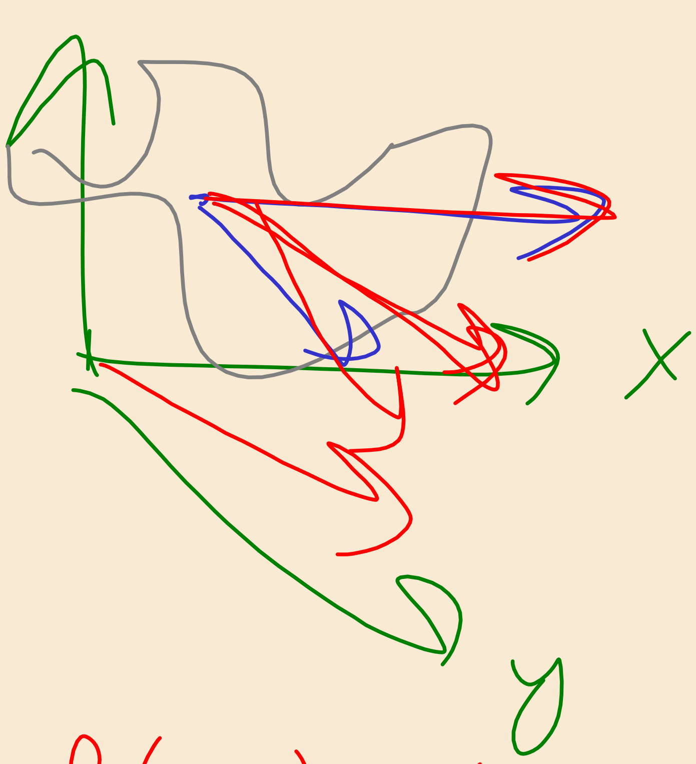
$f'_x = 2x \quad \| \quad f'_y = 2y$

$x^2+y^2+2xy \qquad 2\times 8$

$(x+y)^2 \qquad \frac{16}{x} \to 16$

$f_x = 2x+2y$

$f_y = 2y+2x$



derivat!:

f_x

f_y

$\frac{1}{2} f_x +$

$$\frac{\partial f(x,y) + g(x,y)}{\partial x} = \frac{\partial f(x,y)}{\partial x} + \frac{\partial g(x,}{\partial}$$

$$(cf)' = c f' \quad (f+g)' = f' + g'$$

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

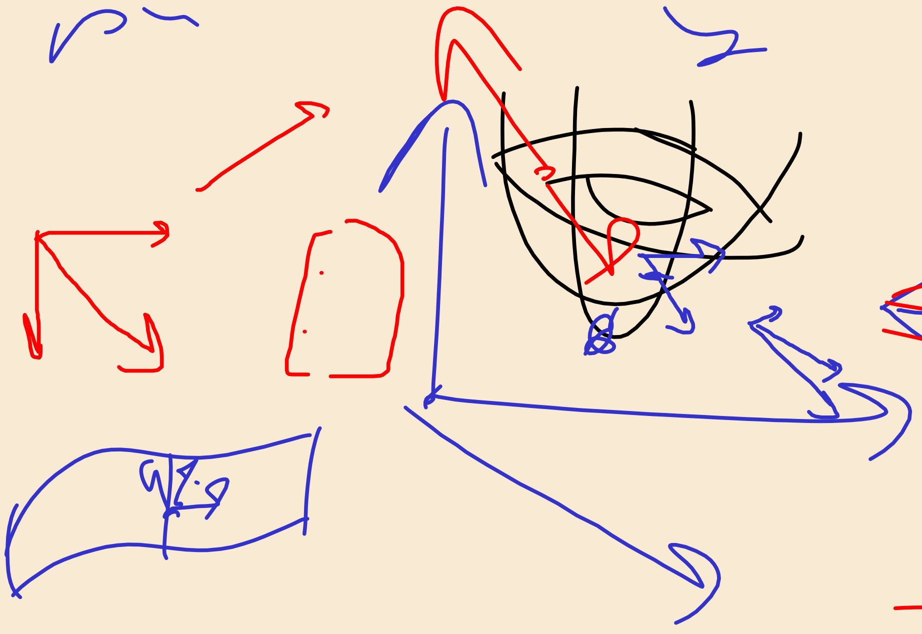
$$\frac{\partial f}{\partial x} \boxed{2x^2(4x+6y)} = \cancel{8x^3} + 12x^2 y$$

$$2x^2 \cdot 4 + (4x+6y)\,4x$$

$$\frac{\partial f}{\partial y} = 0 \cdot (4x+6y) + 2x^2 \cdot (0+6) = 12x^2$$

Chain

partial dx



$$\begin{bmatrix} f'_x \\ f'_y \end{bmatrix}$$

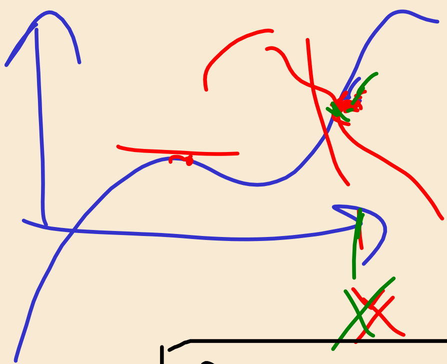
gradient

$$\nabla f = \begin{bmatrix} f'_x \\ f'_y \end{bmatrix}$$

∇f

$-\nabla f$

$\nabla f = 0$



$f(x) > 0$

$f(x) < 0$

$$\boxed{\begin{aligned} f_x &= 0 \\ f_y &= 0 \end{aligned}}$$

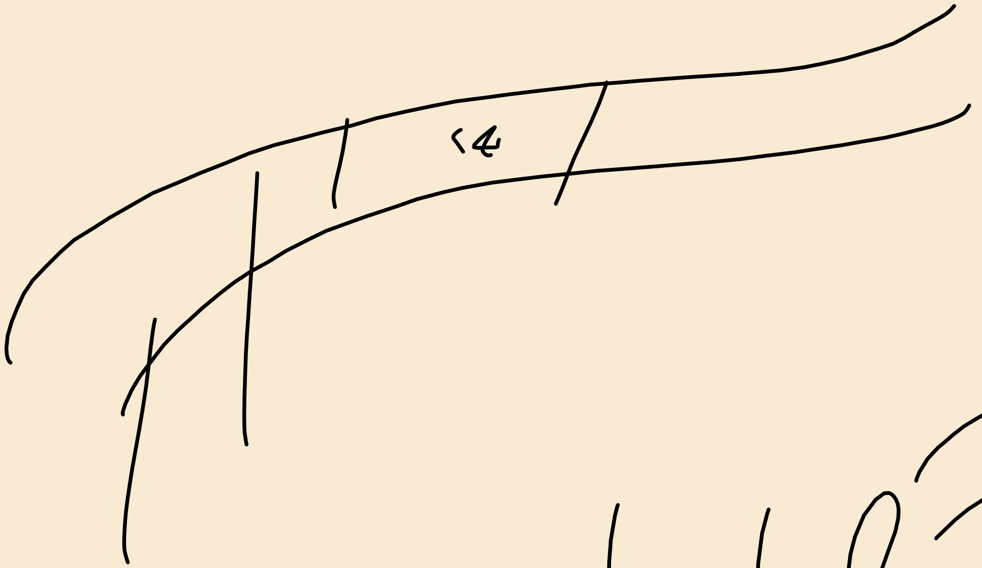
$$\boxed{f(x) = 0}$$

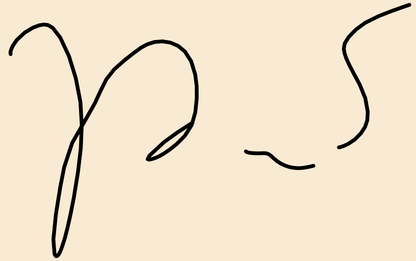
stat

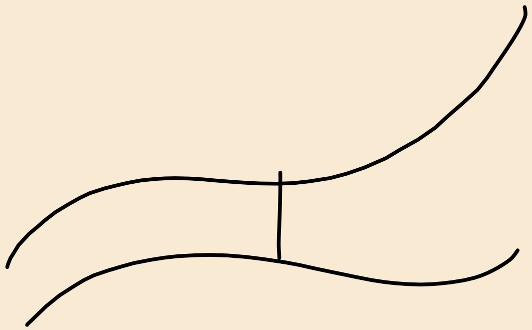
$x^0 = 1$

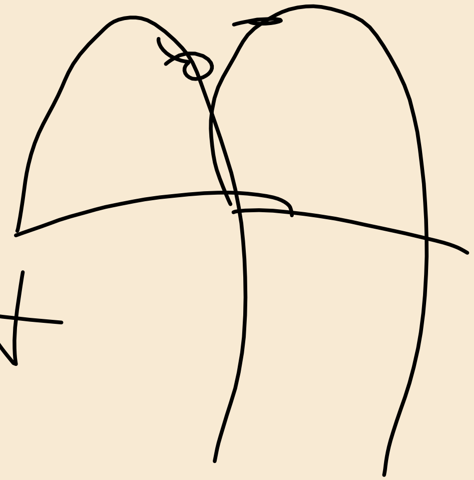
e^0

$3x^2 - 3 = 0$









saddle point

$$x^2 + 3xy - y^2$$

$$f_x' = 2x + 3y - 0$$

$$f_y' = 0 + 3x - 2y$$

$$\nabla f = \begin{bmatrix} 2x + 3y \\ 3x - 2y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$2x + 3y = 0$$

$$3x - 2y = 0$$

$$\boxed{2x = -3y}$$

$$3x = 2y$$

$$2x = -3 \cdot 0$$

$$1.5 \cdot 2x = 3 \cdot 0$$

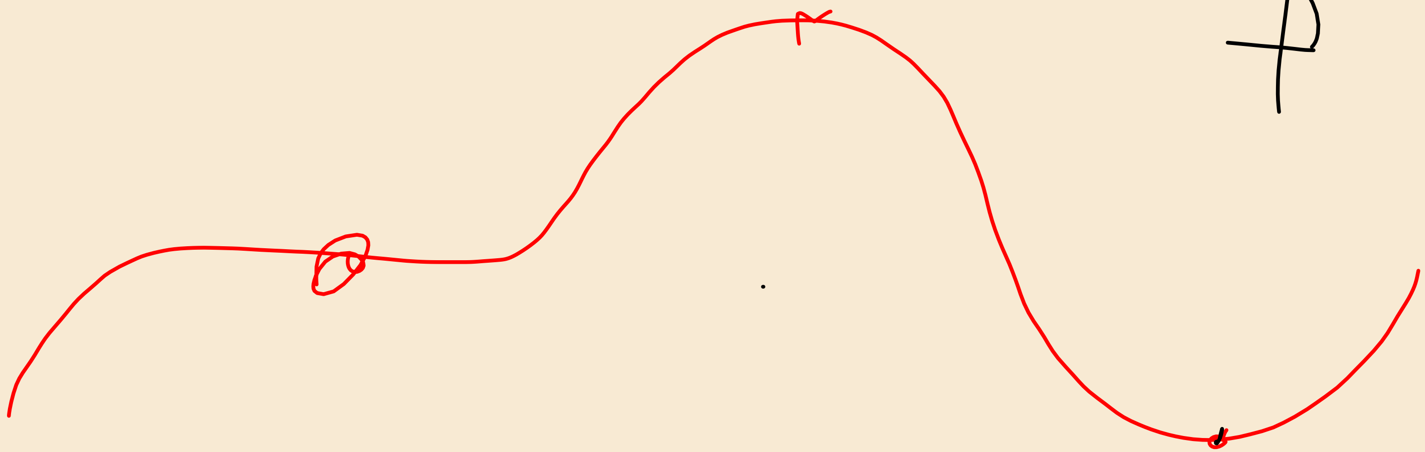
$$x = 0$$

$$1.5 \cdot 3y - 2y =$$

$$= -1.5 \cdot 3y - 2y =$$

$$= -6.5y = 0 \Rightarrow y = 0$$

$$f''(x) > 0$$



$$\nabla f = \begin{bmatrix} f_x \\ f_y \end{bmatrix} \qquad \begin{matrix} \boxed{2x + 3y} \\ 3x - 2y \end{matrix}$$

$$\nabla^2 f = \begin{bmatrix} f_{xx} & f_{xy} \\ f_{yx} & f_{yy} \end{bmatrix}$$

$2f_y$,1

$$f_{xx} > 0 \qquad \left[\begin{array}{c|c} 2 & 3 \\ \hline 3 & -2 \end{array}\right] \qquad f''(x) > 0$$

$$D = f_{xx} \cdot f_{yy} - f_{xy} f_{yx} > 0$$

$>$ {

$$f_{xx} = 2 > 0$$

$$D = -4 - 9 = -13$$

$D < 0 \to$ [illegible]

$D > 0, \; f_{xx} > 0$

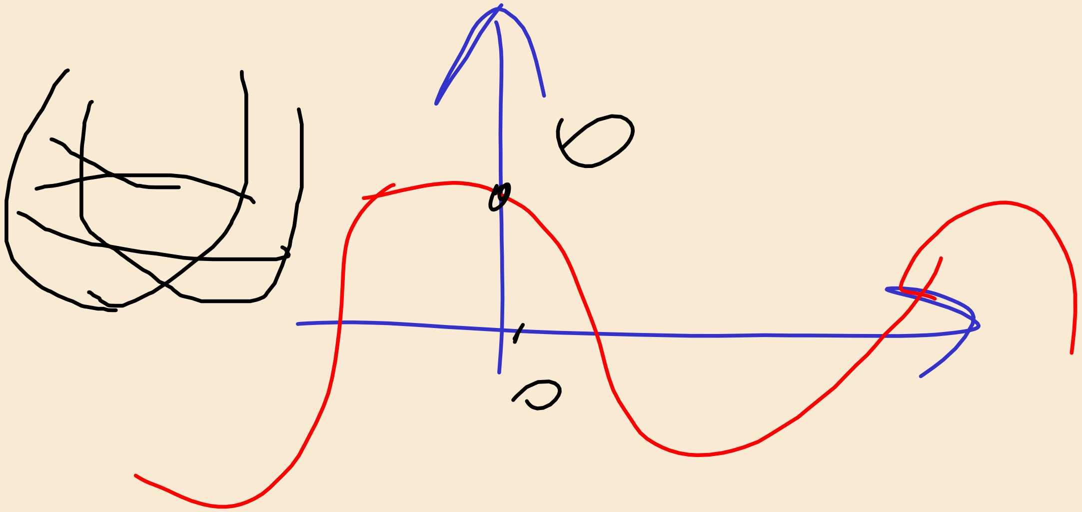
[illegible]

$D > 0 \; f_{xx} < 0$

$2x$	$3y$
$\sin x$	$\sin x \cos y$

Sol-r2

level (n)



$\cos x$

$a_0 + a_1 x + a_2 x^2 + \dots + a_n x^n$

$f(0) = P(0)$

$f'(0) =$

$$f(x) \approx f(a) + \frac{f'(a)}{1!}(x-a) + \frac{f''(a)}{2!}(x-a)^2$$

$$f(a) + \nabla f(a)(x-a) +$$

$$+ \frac{1}{2} \quad \underset{\nabla^2 f}{H}$$

$$\begin{bmatrix} \vdots \end{bmatrix} \begin{bmatrix} \ \end{bmatrix}$$

$n \times 1 \quad n \times 1$

$$(x-a)^2 = \underline{(x-a)}^T (x-a)$$

$$\begin{bmatrix} a & b & c \\ \hline d & e & f \end{bmatrix}^T = \underset{2 \times 3}{} = \begin{bmatrix} a & d \\ b & e \\ c & f \end{bmatrix}$$

$$\begin{bmatrix} \ \end{bmatrix}$$

$n \times m \quad k \times l =$

$n = k$