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TAYLOR'S SERIES EXPANSION.
point (a,b); h=x-a; k=y-b
$f(x,y) = f(a,b) + \frac{1}{11} [hfx + kfy]$
+ 1 [hfxx+ k2fyy + 2hkfxy]
+ 1 [h3fxxxx + K3fyyy +
3h2kfxxy + 3k2hfxyy]
1. Expanol excosy as tailer series in
powers of a anal y upto third degree
$f(x,y) = e^x \cos y$ point is not given (a,b) = (0,0) = directly
(9,6) = (0,0) = directly
h = sc; K = y. tes but h = x - a f(a,b) = 6e cosb 6.66
$f(0,0) = e^{2} cog 0 = 1$
1201 79 =
$f(x,y) = e^{x} \cos y$ $fx = \frac{\partial f}{\partial x} = e^{x} \cos y$ $f(x,y) = e^{x} \cos y$
$fy = \frac{\partial f}{\partial y} = -e^x \sin y = -e^x \sin 0 = 0$
$fxx = \frac{\partial^2 f}{\partial x^2} = \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial x} \right) =$

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$$= \frac{\partial^{2} f}{\partial x} \left(\frac{\partial f}{\partial y} \right)$$

$$= \frac{\partial^{2} f}{\partial y^{2}} = \frac{\partial f}{\partial y} \left(\frac{\partial f}{\partial y} \right)$$

$$= \frac{\partial^{2} f}{\partial x^{2}} \left(\frac{\partial f}{\partial y} \right)$$

$$= -\frac{\partial^{2} f}{\partial x} \left(\frac{\partial f}{\partial y} \right)$$

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$fxxy = \frac{\partial}{\partial x} \left(\frac{\partial x}{\partial x} \frac{\partial y}{\partial y} \right) = \frac{\partial}{\partial x} \left(-e^{x} \sin y \right)$	
(a) Letsty y de Gesin 0=0.	
$fxyy = \frac{\partial}{\partial x} \left(\frac{\partial^2 f}{\partial y^2} \right)$ $= \frac{\partial}{\partial x} \left(-e^x \cos y \right)$ $= \frac{\partial}{\partial x} \left(-e^x \cos y \right)$	
$= \frac{\partial}{\partial x} \left(-e^{x} \cos y \right)$	
o = o = e = ex cosy ? s = typ?	
f(x1y) = f(a1b) + 11 [hfx + kfy]	ı
(pertil history + Kityy + 2HK fory)	
+ 1 h3foexx + k2fyyy +	-
3h2kfocxy+ 3hk2focxy	
$= 1 + \frac{1}{1!} \left[x(1) + y(0) \right] + \frac{1}{2!} \left[x^{2}(1) + y^{2}(-1) $	
+ 1/2 (x3(1)+y3(0) + 3x2y (0) + 3xy2(-	1)]
$= 1 + x + \frac{1}{2}(x^2 - y^2) + \frac{1}{6}(x^3 - 3xy^2) + \dots$	
- 1-6 - print	
2. $e^{x} \sin y$ at $(0,0)$ $f(x,y) = e^{x} \sin y$	
(a,b) = (0,0) = h=x; k=y	

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$f(a,b) = f(0,0) = e^{\circ} \sin 0 = 0$
$f(x,y) = e^x \sin y \qquad \text{at pt (0,0)}$
fx = e"siny e"sino = 0
$fy = e^{x} \cos y$ $e^{x} \cos y = 1$
fax = ex siny esino = 0
$fgy = -e^{x} siny - e^{x} sin o = 0$
$f \propto y = \frac{\partial^2 f}{\partial x \partial y} = e^{\circ} \cos 0 = 1$
$\frac{1}{3x}(e^{2t}\cos y)$
- e cosy
fasca = exsiny esino=1
$fyyy = -e^{x}\cos y - e^{x}\cos 0 = -1$
$-\int x xy = \frac{\partial x^2 \partial y}{\partial x^2 \partial y}$
$= \frac{9x(9x9h)}{9(9x4)} = \frac{9x(9x9h)}{9(9x4)}$
$= \frac{\partial}{\partial x} (e^{x} \cos y) = e^{x} \cos y$
$fxyy = \frac{\partial^3 f}{\partial x^2}$
326329
$=\frac{9x(\frac{95A}{954})}{9(\frac{95A}{954})}$ $-63u0=0$
$= \frac{\partial}{\partial x} \left(-e^x \sin y \right)$ $= -e^x \sin y$
- Sing

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f(x,y) = f(a,b) + 1 [hfoc + kfy] + 1 [h2fxx+
2hocfxy+K2fyy] + 1 [h3fxxxx+
3h2kfoxy+3hk2fxyy+k3fyyy]
$\frac{1}{1} = 0 + \frac{1}{1!} \left[x(0) + y(1) \right] + \frac{1}{3!} \left[x^{2}(0) + 2xy(1) \right]$
1.1 [2 (6) 1 9 (1)] = 1
+y2(0)] + 1 [x3(0) + 3x2y(1)+
31. 2
$3xy^{2}(0) + y^{3}(-1)^{3} + \cdots$
$= y + \frac{1}{a!} (2xy) + \frac{1}{3!} (3x^2y - y^3) + \cdots$
J a! (223) 3!
$= y + \frac{1}{2}(2xy) + \frac{1}{6}(3x^2y - y^3) + \cdots$
3. Expand et log (1+y) +in powers of or ry upto and degree.
a Expand e rog (1991
se by upto 2nd degree.
f(x,y) = ex log (1+y)
Targi - C
f(a, b) = (0,0) - (0)
h = 9c ; $K = Y$ $log 1 = 0$.
$h = 3c$; $K = y$ $\log 1 = 0$. $f(a,b) = f(0,0) = e^{0} \log (1+0)$
+(a,b) =+(0,0) == (d)
= 1(0) = 0
Y. A. D. REIL
f(o(,y) = ex log(1+y) ++ pt(0,0)
The state of the s
$fy = e^{x} \frac{1}{1+y} (x) + \frac{1}{2} (x) + \frac{1}{2} (x) = 0$
1+9
frey = 0f = 0 (0f) (1+0)
$focy = \frac{\partial^2 f}{\partial x \partial y} = \frac{\partial}{\partial x} \left(\frac{\partial}{\partial y} \right)^{-1} $
$= e^{x} - (d_{i}p) + d_{i}p$
1+4

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$$f(x,y) = f(a,b) + \frac{1}{1!} [hfx + kfy] + \frac{1}{2!} [h^2fxx + 2hxfxy + k^2fyy] + \frac{1}{2!} [h^2fxx + 3h^2k fxxy + k^2fyyy]$$

$$= 0 + \frac{1}{1!} [x(0) + y(1)] + \frac{1}{2!} [x^2(0) + 2xy(1)]$$

$$= 0 + \frac{1}{2!} [x^2(0) + y^2(-1)] + \frac{1}{2!} [x^2(0) + 2xy(1)]$$

$$= y + \frac{1}{2!} (2xy) + \frac{1}{2!} (3x^2y - y^3) + \dots$$

$$= y + \frac{1}{2!} (2xy) + \frac{1}{2!} (3x^2y - y^3) + \dots$$

$$= y + \frac{1}{2!} (2xy) + \frac{1}{2!} (3x^2y - y^3) + \dots$$

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$$= y + \frac{1}{2!} (2xy) + \frac{1}{2!} (3x^2y - y^3) + \dots$$

$$= y + \frac{1}{2!} (2xy) + \frac{1}{2$$

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$$f_{\alpha x} = e^{x} \log (1+y)$$

$$f_{yy} = e^{x} \left(\frac{-1}{(1+y)^{2}}\right) (1)$$

$$f_{(x,y)} = f_{(a,b)} + \frac{1}{1!} \left[hf_{x} + kf_{y}\right] + \frac{1}{2!} \left[h^{2}f_{xx} + 2hh f_{xy} + k^{2}f_{yy}\right]$$

$$= 0 + \frac{1}{1!} \left[x(0) + y(1)\right] + \frac{1}{2!} \left[x^{2}(0) + 2xy(0) + 2y(0)\right]$$

$$= \frac{1}{1!} (0+y) + \frac{1}{2!} (0+2xy-y^{2})$$

$$= y + \frac{1}{2!} (2xy-y^{2}) + \cdots$$
4. Expand $x = y^{2} + 2x - 3y$ is powers of $(x+2)$ and $(y-1)$ upto second degree.
$$f_{(x,y)} = xy^{2} + 2x - 3y$$

$$f_{(x,y)} = xy^{2}$$

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$f(x,y) = xy^{2} + 2\pi x - 3y$ $fx = y^{2} + 2$ $fy = 2xy - 3$ $fx = 0$ $fy = 2x$ $fxy = \frac{\partial^{2}f}{\partial x \partial y}$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$ $= \frac{\partial}{\partial x} \left(\frac$	
$foc = 4^{2} + 2$ $fy = 2xy - 3$ $fxx = 0$ $fyy = 2x$ $fxy = \frac{\partial^{2}f}{\partial x \partial y}$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$ $= \frac{\partial}{\partial x}$	
$fy = 2xy^{-3}$ $fxx = 0$ $fyy = 2x$ $fxy = \frac{\partial^2 f}{\partial x \partial y}$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$	$f_{22} = 9^2 + 2$
$fyy = 2x$ $fxy = \frac{\partial^2 f}{\partial x \partial y}$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial$	
$fyy = 2x$ $fxy = \frac{\partial^2 f}{\partial x \partial y}$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial$	forec = 0
$f = \frac{\partial^2 f}{\partial x \partial y}$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$ $= $	fyy = 2x
$= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right)$ $= \frac{\partial}{\partial x} \left(\frac{\partial f}{\partial y} \right$	
$f(x,y) = f(a,b) + \frac{1}{1!} [hfx + kfy] + \frac{1}{2!}$ $[h^2 f_{xx} + 2hkf_{yy}] + k^2 f_{yy}] + \cdots$ $= -9 + \frac{1}{1!} [(x+2)^2 + (y-1)(-1)]$ $+ \frac{1}{2!} [(x+2)^2 + (x+2)(y-1)^2 + (y-1)^2 + $	2(1) = 2
$f(x,y) = f(a,b) + \frac{1}{1!} [hfx + kfy] + \frac{1}{2!}$ $[h^2 f_{xx} + 2hkfouy + k^2 f_y y] + \cdots$ $= -9 + \frac{1}{1!} [(x + 2)3 + (y - 1)(-1)]$ $+ \frac{1}{2!} [(x + 2)^2 + 2(x + 2)(y - 1)^2 + (y - 1)^2 (-1)^2 + (y - 1)^2 + (y - $	$=\frac{3}{3}\left(\frac{9}{3+1}\right)$
$f(x,y) = f(a,b) + \frac{1}{1!} [nfx + kfy] + \frac{1}{2!}$ $[h^2 f_{xx} + 2hkf_{xy} + k^2 f_{yy}] + \cdots$ $= -9 + \frac{1}{1!} [(x+2)^2 + (y-1)(-1)]$ $+ \frac{1}{2!} [(x+2)^2 + (y+2)(y-1)^2 + (y-1)^2(-1)]$ $= -9 + 1[3x + 6 - 7y + 7] + \frac{1}{2} [x^2 + 14 + 4x + (y-2) + (y^2 + 1 - 2)(-1)]$ $= -9 + 3x - 7y + 13 + \frac{1}{2} [x^2 + 14 + 4x + (y-2) + (y^2 + 1 - 2)(-1)]$	and the residence of the control of
$[h^{2}f_{xx} + 2\pi k f_{xy}] + k^{2}f_{yy}] + j^{2}$ $= -9 + \frac{1}{1!} [(x+2)^{2} + (y-1)(-1)]$ $+ \frac{1}{2!} [(x+2)^{2} + (x+2)(y-1)^{2} + (y-1)^{2}(-1)^{2}$ $= -9 + 1[3x + 6 - 7y + 7] + \frac{1}{2} [x^{2} + 4 + 4x + (y-1)(-1)]$ $= -9 + 3x - 7y + 13 + \frac{1}{2} [x^{2} + 4 + 4x + (y-1)(-1)]$ $= -9 + 3x - 7y + 13 + \frac{1}{2} [x^{2} + 4 + 4x + (y-1)(-1)]$	
$= -9 + \frac{1}{1!} \left[(x+2)^2 + (y-1)(-1) \right]$ $+ \frac{1}{2!} \left[(x+2)^2 + (y+2)(y-1)^2 + (y-1)^2 + ($	
$= -9 + \frac{1}{1!} \left[(x+2)^2 + (y-1)(-1) \right]$ $+ \frac{1}{2!} \left[(x+2)^2 + (x+2)(y-1)^2 + (y-1)^2 (-1) \right]$ $= -9 + \frac{1}{1!} \left[(x+2)^2 + (y+1) \right] + \frac{1}{2} \left[x^2 + y + 4x + (y+1) \right]$ $= -9 + \frac{3}{2} x - \frac{1}{2} y + \frac{1}{2} \left[x^2 + y + 4x + (y+1) \right]$ $= -9 + \frac{3}{2} x - \frac{1}{2} y + \frac{1}{2} \left[x^2 + y + 4x $	[h2focx + 2Hkfocy + K2fyy] + 5.
$+\frac{1}{2!} \left[(x+2)^2 + 3(x+2)(y-1)^2 + \frac{1}{2!} \left[(x+2)^2 + 4 + 4x + 4x + \frac{1}{2!} \left[(x+2)^2 + 4 + 4x + 4x + 4x + 4x + 4x + 4x + 4x$	9 + 11 (6x +2)3+(4-1)(-1)
$= -9 + 3x - 7y + 13 + \frac{1}{2} \left[x^2 + 4 + 4x + \frac{1}{2} \left[x^2 + 4x + 4x + 4x + \frac{1}{2} \left[x^2 + 4x + 4x + 4x + \frac{1}{2} \left[x^2 + 4x + 4x + 4x + 4x + \frac{1}{2} \left[x^2 + 4x + 4$	P0 x6
$= -9 + 3x - 7y + 13 + \frac{1}{2} \left[x^2 + 4 + 4x + \frac{1}{2} \left[x^2 + 4x + 4x + 4x + \frac{1}{2} \left[x^2 + 4x + 4x + 4x + \frac{1}{2} \left[x^2 + 4x + 4x + 4x + 4x + \frac{1}{2} \left[x^2 + 4x + 4$	$+\frac{1}{2!}\left[(x+2)^2 + 2(x+2)(y-1)^2 + 1(y-1)^2 + 1(y-1$
$H(2xy-x+2y-2)+(y^2+1-2)(-4)]$ $=-9+3x-7y+13+\frac{1}{2}[x^2+4+4x+4]$	
= -9+3x-Ty+13+ = [x2+4+4xx+	
= -9+3x-7y+13+ = [x2+4+4x+ 4xy-4x+8y-8-4y2-	H(5cy-x+2y-2)+(y2+1-2)(-4)]
Hay-4x+8y-8-4y2-	
Hay-4x+8y-8-4y-	= -9+32-19 +13+-3 2+4+42+
M+47	4xy-4xy-8-442-
9118)	9118
= -9+ 3x-7y+13+1 [x2+3y+	= -9+ 3x-7y+13+1= [x2+1y2+3y+
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