### Al-Mustaqbal University Department of of Power Mechanics Engineering Techniques Class (2nd)

Subject (Math-2)

	- s	al Derivativ	كدام شاقيه
1 Tangent	Plane to	Surface so	
		the de	سيتون الماس
		ivatives topic,	
		slopes of trac	
		out a little	
		at is tangent	to the sur
as a posint	) <u>-</u>		1.
		, ,	, -
		s a plane Fu	
The gener	ral equation	of a plane	3 given by
2100 000		2(2 2) ==	
a (x-16)-	10 (y - yo) +	C(2-20) = 0	
1.hour 12	W 2 1 65	a and that	is on the
		eg= of the p	
we can p	enths the	T- or The p	The way Fo
	90001	b (u u )	
2 2 -	9 (x-x0)	E (y-y6)	
7-20 = -			
7-30 = -	a e		
2-20 = -	a s		

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	1 - 0	C. V. 1	PCH H	1	
00 2	2-20 = A	(X-X0) +	<del>B(9-9</del> -	•)	
We	need to	determine	values	For A	8 B.
* Lets	assume	y = y o			
. 2	-20 = 1	2(x-X0)	_ 6	7= 0 = li	he and n
		, 0,	6	e tangent	to the so
100000	AND AND		P	art of to	ngent plan
A	= 2-20 X-X0	= 510 pc	e at ix		
g. A	- 3F (K	= fx()	(0, yo)		
* Lets	<del>_assume</del>	x=Xo			
: 2	-20 - B	(y-y-)	< 6	ge of line	and must
			()	ngent to the	e surface of
100		Control of the Control		angent pla	
: B	2-80	= 510pe	at Wor	00/	
	7-40				
2. B	- DF / (XO)	= fy (x	(o140)		
		of the f	anget pl		he surface



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Lecturers (Dr Hussein K. Halwas & M.Sc. Hiba Mohsin Abid) 1<sup>st</sup> term – Lect. (Applications of Partial Derivatives)

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Solution really asking for the

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	For the surface 2 = 4 Cos (x-y) at (2/2,2)?  1 Solutions
	(xoryo, 20) = (2,2,2), F(X,y)= 2 = y COS(X-y)  The general Form of tangent plane to surface of  ?\$ : [2 = f(x,y) + fx(Xo,yo) (X-Ko) + fy(Xo,yo) (y-yo)]
	(CKoryo) = 70 = 2 (2,2,2)
	$\begin{aligned} & f_{K}(X_{17}) = y(-sin(X_{-1}) *1) = -y sin(X_{-1}) \\ & f_{K}(X_{0175}) = f_{K}(2,2) = -2 sin(2-2) = 200 \\ & f_{Y}(X_{17}) = y(-sin(X_{-1}) *(-1)) + cos(X_{-1}) *(-1) + f_{Y}(X_{0175}) = y sin(X_{-1}) + cos(X_{-1}) \\ & f_{Y}(X_{0175}) = f_{Y}(2,21 = 2 sin(2-2) + cos(2-2) = 1 \end{aligned}$
	2=2+2en (x2)+1(y2)=2+4-2 1=y Ans
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	Normal Line to surface so by 6 goods bell
	IF we recall the equation of a plane that has a point (Xo, 4, 20) with a normal vector N-airbjack
	which is given by;
	a(x-Ko) +b(y-ys) + c(2-20) = (From vectors) ledure
	The gradient vector of (xoryorzo) is orthogonal to the
	level surface f(Ky,2)=K at the point (K, y, 20).
	From this Fact, the gradient vector is always normal to the surface of a point!!
	Note ] The gradient veelor is Dr= = in the product of the product veelor is Dr= = in the product of the product
	The targest plane to the surface given by  (Ky/2)-K at (Ko/ys/20) has the equation;
	(fx (x0,40,20) (X-10) + fy (x0,40,20) (4-40) + fe(x0,40,20) (2-20)=0)
	And the eq = of the normal line are General Form of Tangon Plane to Surface
CS	y= yo+ fy(xo,y,12)t (0, 1/2)t (2000)
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	EXI Find the dangent plane equation of the
	normal line on the surface FG(y,7)=x2-y2,
	2-9=0 at the point (1,2,4) 2
	(Xo, yo, 20)=(1,2,4)
	fx(x0,14,20) (X X0) + fy(X0,140,20) (4-40) + fz(x0,15,20)(2-2)-
	Fx(Koryor20) = 2K => Fx(1,2,4) = 2x1 = 2
	Py (x0, y020) = 24 - (4)
	(2(x0, y0, 20) = 1 = F2(1,2,4) = []
	: 2(x-1)+4(y-2)+1(2-4)=0 Bx
	0x [2x+4y+2=14] = 59:05 tangent place
	The eges of the normal line gre;
	X=16+fx(1,2,4) t = 1+2+7 Pro
	y = y + fy (1/2/4) t = 2 +4t   = 5955 OF mormal  2 = 20 + fz(1/2/4) t = 4 + t
	. , , , , , , , , , , , , , , , , , , ,
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Subject (Math-2)

	Tangent line to Curvesa Gold on 14 251
	To Find a targent line equation, we need a stope and a post (xxy) then by using the equation
	y-y,=m(x-x,) , m = slope
	Ex) Find the equation of a tangent line to The curve $y = 3x^4 - 6x^3 + 6x + 8$ at $x = 1$ ?
	In this case, we need to Find the point (Ky)
	that has $X=1$ , by plugging $Y=1$ into the $q=$ $y=3(1)^4-8(1)^3+6(1)+8=[12]$
	: the point 13 (1:12)
	Now to Find the slope, we need to Find the
	1st derivative dis of plugging the post in
	$\frac{dy}{dx} = 3 + 4x^3 + 3 + 3x^2 + 6 \implies \frac{dy}{dx} = shipe = 12(1)^3 - 15(1)^2$
	: ds = 6lope = 12-15 +6 = 3 = m
	20(y-y=m(x-x1)) => y-12=3(x-1)
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	Notes To Find the equation of tangent line to cure, there is another usful form y=m x+13 which we can use as well
	to solve the previous example by using this form, we need to find the value of B, by plugging in m & (x,y) as tollows
	12 = 3(1) +B => B = 12 - 3 = 9
	EX Find the equation of tangent line to
	the curve $y = 2x^3 - 6x^2 + 5x + 1$ et $x = 2$ Solutions  As we learned From the previous example,
	when need to pind a poset (x,y) of stope (x,y) $y = 2(2)^3 - 6(2)^2 + 5(2) + 1$ $= 16 - 24 + 10 + 1$
	y=31 3. The punt is (2,3) Now we need to Find a slope of the egs at 12
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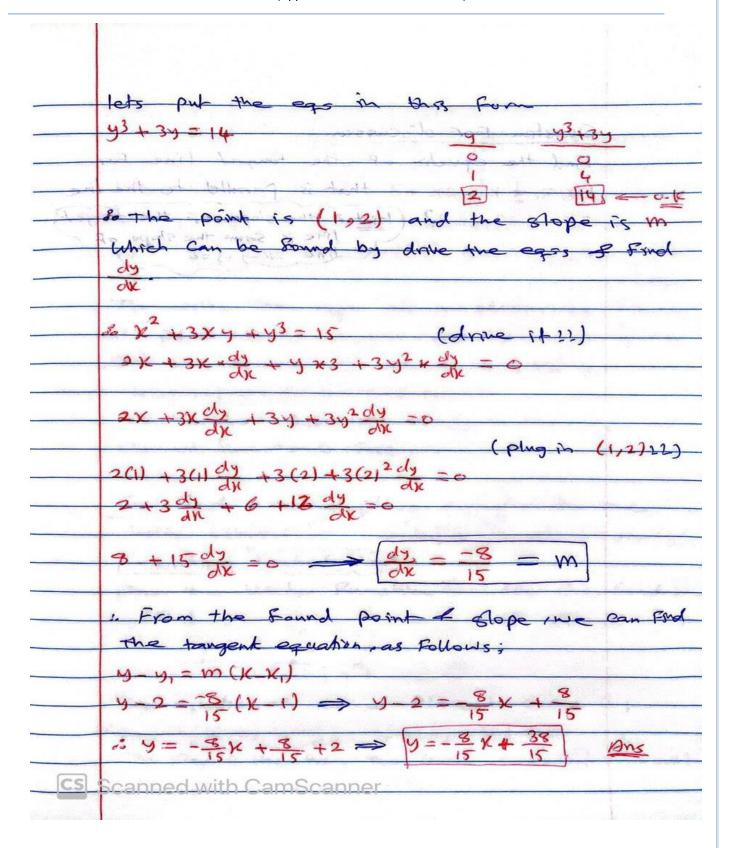
Subject (Math-2)

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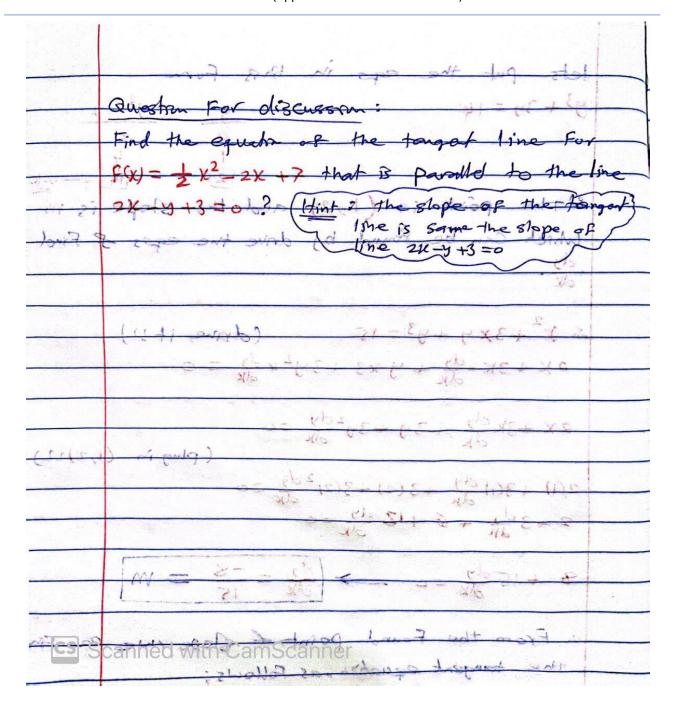


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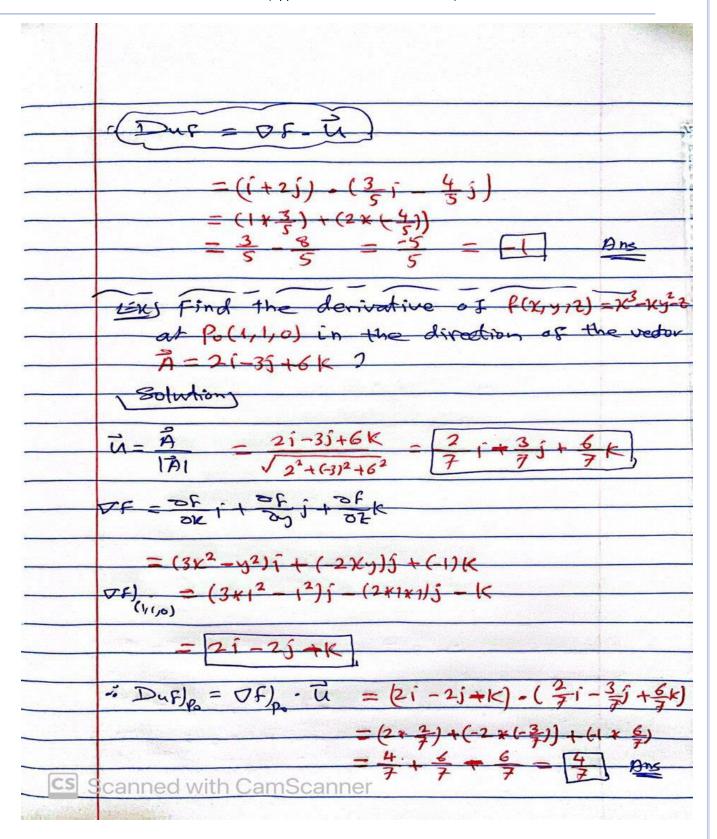
$\nabla F)_{(3,2,n)} = (2^2 \times 1^3) (1 + (2 \times 3 \times 2 \times 1^3) (3 + (3 \times 3 \times 2^2 \times 1^2)) K$
(3,2,1) = 4 i + 12 j + 36 K
Dus)p = (VS)p · Ū
$= (4(+)2j+36k) - \frac{1}{\sqrt{6}}(2i+j+k)$ $= \frac{1}{\sqrt{6}}(4*2+12*1+36*1)$
$= \frac{1}{\sqrt{6}} (8 + 12 + 36) = \frac{56}{\sqrt{6}} \text{ Ams}$
EX) Find the derivative of f(x,y)= Xe + cos(x)
1 = 31-4j ? (Solution)
V=31-45?
31-4j?  (Solution)  (1-1) - 31+4j - 3+4j
$\frac{1}{100} = \frac{3i + 4j}{\sqrt{3^2 + 4^2}} = \frac{3i + 4j}{5i}$

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Subject (Math-2)

	Maxima & Minima of Two Variables Function go
	If fixy) is a function of two independent
	variables (Xy) and its 1st & 2nd partial derivatings are continuous throughout a disk centered at
	(a,b) and that Fx = fy = o at point Ca,b). Then,
	Of has a local maximum at (a, b) if fix <0 5
(	2) S has a local minimum at lablif fxx>0 s.  Fxx fyy - fxy >0 at (a,b).
(	3) I has a saddle point at (a, b) if fixfy-fix (o at (a, b)
(	The best is inconclusive (doubtful at Ca, b) if
	hax fry - fry =0 at (a,b). Need to Find some other way 11
	Notes  The expression by for fix is called the discriminant
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	EXI Find the local extreme values of
	$f(x,y) = \chi^2 + y^2$
	LSolution)
	Sx = 2x =0 -> (X =0) = q
	fy = 2y =0 -> [y=0] = b
	Fxx = 2 >0
	Byy = 2
	fry = 0 -> fry = 0
	- fxx fyy - 8xy = 2x2-0=4 >0
	= fxx >0 5 fxx byg- fxy >0, then the point
	(0,0) is critical point of the Function flky)=
	x2 mas local minimum at (o)
Links and the second	Exi Find the extreme value of the function
	R(xx) = xy -x2-y2-2x-2y+4?
	Solutions
	FK = y - 2x -2 -> fxx = -2 <0
	Ev =12 V 2 2 0 0
10	fy = x -2y -2 = fyy = -2
CS	fy = X -2y -2 → Fyy = -2  fy = > 2y +X -2 =0 ②  Scanned with (知识Sicalangly 8 で) ② の はいしい ゆ

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Applications of Partial Derivatives, Tangent Plane to " نهاية محاضرة المعافرة " Surface, Normal Line to Surface, angent line to Curve, Normal Plane to Curve, Directional Derivatives, Maxima and Minimaof Plane to Curve, Directional Derivatives, Maxima and Minimaof المماس للمنحنى، المستوى المماس للسطح، الخط المماس للمنحنى، المستوى العمودي على المنحنى، المشتقات الاتجاهية، القيم العضمى والصغرى للدوال بمتعيرين"--