

Batch:	P4-1	. (	. Rol	l No.:	160	1042	3076
Name	: Rites	<u>S</u>	. J	ha		-1	
Course	-MA:	I	14				_ H 88 _
Experir	nent ! assi	gnme	nt / tut	orial N	۷o	. 5	
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	$\lambda = -1$
	Assignment -1 Partial Differentiation
	Yartial Vitterentiation
	$-0$ $xy^{2}$ $0$ $-1$ $+1$ $+1$ $+1$ $+1$ $+1$ $+1$ $+1$ $+$
1	If $u = e^{xy^2}$ , Prove that $\frac{\partial^3 u}{\partial x \partial y \partial z} = (1 + 3xyz + x^2y^2z^2)e^{xyz}$
	axdy dz
	747 .
Soln	$\partial u = \pi y e^{\pi y^2}$
	97
	$\frac{\partial z}{\partial u} = \frac{\partial (xye^{xy^2})}{\partial y}$ $\frac{\partial z}{\partial z} = \frac{\partial z}{\partial y} \frac{\partial z}{\partial z} + e^{xy^2} \frac{\partial (xy)}{\partial z}$ $= \frac{\partial z}{\partial z} = \frac{\partial z}{\partial y} + e^{xy^2} \frac{\partial z}{\partial z}$ $= \frac{\partial z}{\partial z} + e^{xy^2} + e^{xy^2} \frac{\partial z}{\partial z}$ $= \frac{\partial z}{\partial z} + e^{xy^2} + e^{xy^2}$
35.	∂y \∂z / ∂y
	$\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial x^2} + e^{\frac{\partial^2 u}{\partial x^2}} + e^{\partial$
	2492 2y 2y
	$= \chi y (\chi z) e^{\chi y^2} + e^{\chi y^2 V} (\chi)$
	$= \chi_y(\chi z) e^{\chi y^2} + \chi e^{\chi y^2}$
	$= \chi^2 yz \cdot e^{\chi y^2} + \chi e^{\chi y^2}$
	$\partial^2 u = (x^2 y^2 + x) e^{xy^2}$
	20 dz
	$\frac{\partial}{\partial x} / \frac{\partial^2 u}{\partial y^2} = \frac{\partial}{\partial y^2} \left[ (x^2 yz + x) e^{xy^2} \right]$
	$\partial x (\partial u \partial z) \partial x$
	$\frac{\partial y \partial z}{\partial x (\partial y \partial z)} = \frac{\partial \left[ (x^2 y z + x) e^{x y^2} \right]}{\partial x (\partial y \partial z)}$ $\frac{\partial^3 u}{\partial x \partial y \partial z} = (x^2 y z + x) \frac{\partial (e^{x y^2}) + e^{x y^2}}{\partial x} \frac{\partial (x^2 y z + x)}{\partial x}$ $\frac{\partial^3 u}{\partial x \partial y \partial z} = \frac{\partial^2 u}{\partial x} = $
	$\frac{\partial x}{\partial y} \frac{\partial y}{\partial z} = \frac{\partial x}{\partial x}$
	$= (x^2yz+x)yz \cdot e^{xy^2} + e^{xy^2} (2xyz+1)$
	$= e^{xy^{2}} \left( x^{2} + xyz + 2xyz + 1 \right)^{y}$
	$\frac{\partial x}{\partial y} \frac{\partial z}{\partial z} = \frac{\partial x}{\partial x}$ $= (x^{2}yz+x) yz \cdot e^{xy^{2}} + e^{xy^{2}} (2xyz+1)$ $= e^{xy^{2}} (x^{2}y^{2}z^{2} + xyz + 2xyz+1)$ $\frac{\partial^{3}y}{\partial z^{2}} = (1 + 3xyz + x^{2}y^{2}z^{2}) e^{xy^{2}}$
	27 24 27
A 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LHS = RHS
	Hence Proved
	Hence Hoved
2	The $z = x^2 \tan^{-1}(\frac{4}{x})$ , prove that $\frac{1}{2}z = \frac{2}{2}z = \frac{2}{x^2 - 4^2}$
2	Tf $z = x^2 \tan^{-1}(\frac{4}{x})$ , prove that $\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x} = \frac{\chi^2 - y^2}{\chi^2 + y^2}$
	$\frac{-y^{2} + 4n(y)}{2x^{2} + y^{2}}$
610	2 (4) (X)
Sol	$Z = \chi^2 \tan^{-1}\left(\frac{1}{2}\right) - y^2 \tan^{-1}\left(\frac{\chi}{y}\right)$
	[1] - '라스티앤 레이스 마스 마스 마스를 하는데, 그런 그런 아이스 마스 마스 프랑스 마스트 그는 이번 모든 다른데 바로 다른데



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$\frac{\partial z}{\partial y} = x^{2} \frac{1}{1 + (x^{2})^{2}} \frac{1}{x} - \int y^{2} \frac{\partial [tan]}{\partial y}$	$\left[-\frac{2}{y}\right] + \tan^{-1}\left(\frac{2}{y}\right) + 2\left(\frac{4}{y}\right)$
$= \chi^3 - \sqrt{y^2} + \sqrt{(-\chi)} + \chi^2 + \sqrt{y^2}$	
$= \frac{\chi^3}{\chi^2 + \chi^2} + \frac{\chi^2}{\chi^2 + \chi^2} - \frac{2y \tan^{-1}(\frac{x}{2})}{\chi^2 + \chi^2}$ $= \frac{\chi(\chi^2 + \chi^2)}{\chi^2 + \chi^2} - \frac{2y \tan^{-1}(\frac{x}{2})}{\chi^2 + \chi^2}$	<u>x</u> )
$= \chi(\chi^2 + y) - 2y \tan^{-1}(y)$	
$= x - 2y \tan^{-1}(\frac{x}{y})$ $\frac{\partial}{\partial x} \left(\frac{\partial z}{\partial y}\right) = \frac{\partial}{\partial x} \left[x - 2y \tan^{-1}(\frac{x}{y})\right]$ $\frac{\partial}{\partial x} \left(\frac{\partial z}{\partial y}\right) = \frac{\partial}{\partial x}$	
$= 1 - 2y - \frac{1}{1 + \left(\frac{x}{y}\right)^2} \cdot \left(\frac{1}{y}\right)$	
$= 1 - 2y^2$	
$= \chi^{2} + y^{2} - 2y^{2}$	
$\frac{\chi^2 + y^2}{\partial^2 z} = \chi^2 - y^2 - 0$ $\frac{\partial^2 z}{\partial x \partial y} = \chi^2 + y^2$	
	2
3 0 & 2 3 0 & 2	y d z
$\frac{\partial^2 z}{\partial x^2} = \frac{\partial^2 z}{\partial y^2} = \frac{y^2 - y^2}{y^2 + y^2}$	
$\frac{1}{2}$	
Hence Proved	



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3.	If $u = f(\frac{x^2}{y})$ , prove that $x(\frac{\partial u}{\partial x}) + 2y(\frac{\partial u}{\partial y}) = 0$
	And $x^2 \left( \frac{\partial^2 u}{\partial x^2} \right) + 3xy \left( \frac{\partial^2 u}{\partial x \partial y} \right) + 2y^2 \left( \frac{\partial^2 u}{\partial y^2} \right) = 0$
Sol	Proof 1:
	$U = f\left(\frac{\chi^2}{V}\right)$
	$\frac{\partial u}{\partial x} = \frac{2x}{2x} \qquad \frac{\partial u}{\partial x} = -x^2$
	Da y y²
	$\frac{x\left(\frac{\partial u}{\partial x}\right) + 2y\left(\frac{\partial u}{\partial y}\right) = x\left(\frac{2x}{y}\right) + \frac{2y'\left(-\frac{x^2}{y^2}\right)}{y^2}}{= 2x^2 - 2x^2}$
	$z(\partial u) + 2y(\partial u) = 0$
	$\left(\frac{\partial x}{\partial x}\right)^{\frac{1}{2}} \left(\frac{\partial y}{\partial y}\right)^{\frac{1}{2}}$
	LHS = RHS Hence Proved
	From Proof O,
	$\frac{\partial}{\partial x} \left( \frac{\partial u}{\partial x} \right) = \frac{\partial}{\partial x} \left( \frac{\partial x}{\partial y} \right) = +\frac{2}{2}$
	$\frac{\partial}{\partial y} \left( \frac{\partial y}{\partial y} \right) = \frac{\partial}{\partial y} \left( \frac{\partial x}{\partial y} \right) = \frac{\partial}{\partial y} \left( \frac{\partial y}{\partial y} \right) = \frac{\partial}$
	$\frac{\partial}{\partial x} \left( \frac{\partial u}{\partial y} \right) = \frac{\partial}{\partial x} \left( \frac{-x^2}{y^2} \right) = -\frac{2x}{y^2}$
	J
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LHS = $\chi^2 \frac{\partial^2 u}{\partial x^2} + 3\chi y \frac{\partial^2 u}{\partial x \partial y} + 2y^2 \frac{\partial^2 u}{\partial y^2} = 0$
LHS = $\chi^{2} \frac{\partial^{2}u + 3\chi y}{\partial \chi^{2}} \frac{\partial^{2}u + 2y^{2}}{\partial \chi^{2}} \frac{\partial^{2}u}{\partial \chi^{2}} = 0$ = $\chi^{2} \frac{(2)}{y} + 3\chi y \frac{(-2\chi)^{2}}{y^{2}} \frac{(2\chi^{2})^{2}}{y^{2}}$ = $2\chi^{2} - 6\chi^{2} + 4\chi^{2}$
LHS = 0  LHS = RHS  Hence Proved



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Ц.	If $u = f(e^{y-2}, e^{z-2}, e^{x-y})$ , prove that $u_x + u_y + u_z = 0$
Sel	$e^{y-2} = \lambda$ $e^{z-2} = m$ $e^{x-y} = n$
	$e^{x-y} = n$
	$\frac{\partial l}{\partial x} = 0 \qquad \frac{\partial l}{\partial y} = e^{y-2} \qquad \frac{\partial l}{\partial z} = -e^{y-2}$
4	$\frac{\partial m = -e^{z-x}}{\partial x} = 0 \qquad \frac{\partial m}{\partial x} = e^{z-x}$
and the second s	J
distribution of the	$\partial n = e^{x-y}$ $\partial n = -e^{x-y}$ $\partial n = 0$
The second secon	ax ay az
and a second sec	u = f(l, m, n)
	20 = 20 21 + 20 2m + 20 2n
	3x 3d 3x 3m 3x 3n 3x
	$= \frac{\partial u}{\partial x} \cdot 0 + \frac{\partial u}{\partial y} \left( -e^{z-x} \right) + \frac{\partial u}{\partial y} \left( e^{x-y} \right)$
	$= 30 (-e_{z-x}) + 30 (e_{x-A})$ $= 90$
1	9w 9v
	$\partial u = \partial u \left( e^{\chi - y} \right) - \partial u \left( e^{\chi - \chi} \right) = 0$
	3x 3n 3m
	$nG \cdot \nu G + mG \cdot \nu G + \lambda G \cdot \nu G = \nu G$
	$\frac{\partial y}{\partial x} = \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left( \frac{\partial y}{\partial y} \right) + 0 + \frac{\partial y}{\partial y} \left($
	JO 16
	$\partial u = \partial u (e^{y-2}) - \partial u (e^{x-y}) - 0$
	gh 97 9u

	24 = 30 31 + 30 3m + 34 3n
	de al dz am dz an dz
	$= \partial u \left(-e^{y-2}\right) + \partial u \left(e^{z-x}\right) + 0$
***	97 9w
	$\partial u = \partial u \left( e^{z-x} \right) - \partial u \left( e^{y-z} \right) - 3$
	1 3z 3m 31
- 14, 11	$\partial u + \partial u + \partial u = \partial u \left( e^{z-y} \right) - \partial u \left( e^{z-x^{\bullet}} \right)$ [from 0, 2 & 3
***	2x 21 22 20 2m
	$+ \frac{\partial x}{\partial y} \frac{\partial y}{\partial z} \frac{\partial z}{\partial y} - \frac{\partial y}{\partial y} \frac{\partial z}{\partial y} \frac{\partial z}{\partial y}$
	$+ \partial u (e^{z-2}) - \partial u (e^{y-2})$
	$\partial m = \partial \Lambda$
	$u_x + u_y + u_z = 0$
	Hence Proved
-	
<u> </u>	TP = - P(x 11) = x = r(0) Q 11 = r s(0) Q
<u> </u>	If $z = f(x,y)$ , $x = r\cos\theta$ , $y = r\sin\theta$ Prove that, $(\partial z)^2 + (\partial z)^2 = (\partial z)^2 + 1 (\partial z)^2$
	$\frac{\partial z}{\partial x} = \frac{\partial z}{\partial y} = \frac{\partial z}{\partial r} = \frac{\partial z}{\partial \theta}$
Sol"	$\chi = r\cos\theta$ , $y = r\sin\theta$
	Differentiating partially wrt 0,
	$\partial x = -r\sin\theta$ , $\partial y = r\cos\theta$
	96 99
	Differentiating partially wrt r,
	$\partial x = \cos \theta$ , $\partial y = \sin \theta$
	dr dr
	$\partial z = \partial z \partial x + \partial z \partial y$
	dr dx dr dy dr
	•



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	$\frac{\partial z}{\partial z} = \cos \theta \frac{\partial z}{\partial z} + \sin \theta \frac{\partial z}{\partial z} - 0$
	dr da dy
1 1	Similarly,
	$\partial z = \partial z \partial x + \partial z \partial y$
	20 2x 20 2y 20
_3, _2 = 1,1 =	$\partial z = -r\sin\theta  \partial z + r\cos\theta  \partial z - \Theta$
	30 2x 2y
	$RHS = \left(\frac{\partial z}{\partial z}\right)^2 + \left(\frac{\partial z}{\partial z}\right)^2$
785	$\left(\frac{\partial r}{\partial r}\right)^{2} \left(\frac{\partial \theta}{\partial r}\right)^{2}$
	$= \frac{(\cos \theta)}{\partial z} + \frac{\sin \theta}{\partial z} + \frac{1}{r^2} \left( -\frac{r\sin \theta}{r^2} + \frac{1}{r\cos \theta} + \frac{1}{r\cos \theta} + \frac{1}{r^2} \right)$
	$\frac{\partial x}{\partial x} \frac{\partial y}{\partial y} + \frac{\partial^2 x}{\partial y} \frac{\partial y}{\partial y}$
	$= (\cos^2\theta \left(\frac{\partial z}{\partial z}\right)^2 + 2\sin\theta \frac{\partial z}{\partial z} \cdot (\cos\theta \frac{\partial z}{\partial z} + \sin^2\theta \left(\frac{\partial z}{\partial z}\right)^2 + \bot$
	$\left(\frac{\partial x}{\partial x}\right) = \frac{\partial y}{\partial y} = \frac{\partial y}{\partial y$
	•
	$\left[r^2\cos^2\theta\left(\partial z\right)^2-2 r\cos\theta\partial z \cdot r\sin\theta\partial z + r^2\sin^2\theta\left(\partial z\right)^2\right]$
	(ay) ay ax (ax)
322 G	
7 24 T	$\frac{\partial x}{\partial x} = \frac{\partial y}{\partial x} = \frac{\partial y}{\partial y} = $
	$\partial y \partial x $ $(\partial x)$
	$= (\partial z)^2 (\cos^2 \theta + \sin^2 \theta) + (\partial z)^2 (\cos^2 \theta + \sin^2 \theta)$
	$\left(\frac{\partial x}{\partial x}\right)$
	$= \left(\frac{\partial z}{\partial z}\right)^2 + \left(\frac{\partial z}{\partial z}\right)^2 \qquad \left[\frac{-1}{2}\sin^2\theta + \cos^2\theta = 1\right]$
	$\frac{\partial x}{\partial y}$
	= LHS
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	LHS = RHS
- 7 3 5 .	Hence Proved