

AN AUTONOMOUS INSTITUTION COIMBATORE – 641035.



UNIT- 4 FUNCTIONS OF SEVERAL VARIABLES

JACOBIAN

JACOBIAN.
If $V = f(x,y)$, $V = g(x,y)$ value the two
functions in two variables, then the jacobian
functions in two variables, then the jacobian of v and v w.r.t x and y is denoted by J.
$J = \frac{\partial (u,v)}{\partial (x,y)} (function) = \begin{vmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} \end{vmatrix}$ $J = \frac{\partial (u,v,viu)}{\partial (x,y,z)} = \begin{vmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} & \frac{\partial u}{\partial z} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} & \frac{\partial v}{\partial z} \end{vmatrix}$ $\frac{\partial v}{\partial x} = \frac{\partial v}{\partial x} = \frac{\partial v}{\partial y} = \frac{\partial v}{\partial z}$



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THONS OF SEVERAL VARIABLES

| Propurties |
| JJ' = 1 |
| I) If u, v and w one functionally depending that
$$J = 0$$

| $J = e^{x} \cos y$, $V = e^{x} \sin y$, find $J = \frac{\partial (u, v)}{\partial (x, y)}$

| $J = \frac{\partial (u, v)}{\partial (x, y)}$

| $J = \frac{\partial v}{\partial x} = \frac{\partial v}{\partial y}$

| $J = e^{x} \cos y$ | $J = e^{x} \sin y$

| $J = e^{x} \cos y$ | $J = e^{x} \cos y$

| $J = e^{x} \cos y$ | $J = e^{x} \cos y$

$J = e^{x} \cos y$	$J = e^{x} \sin y$
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$J = e^{x} \cos y$	



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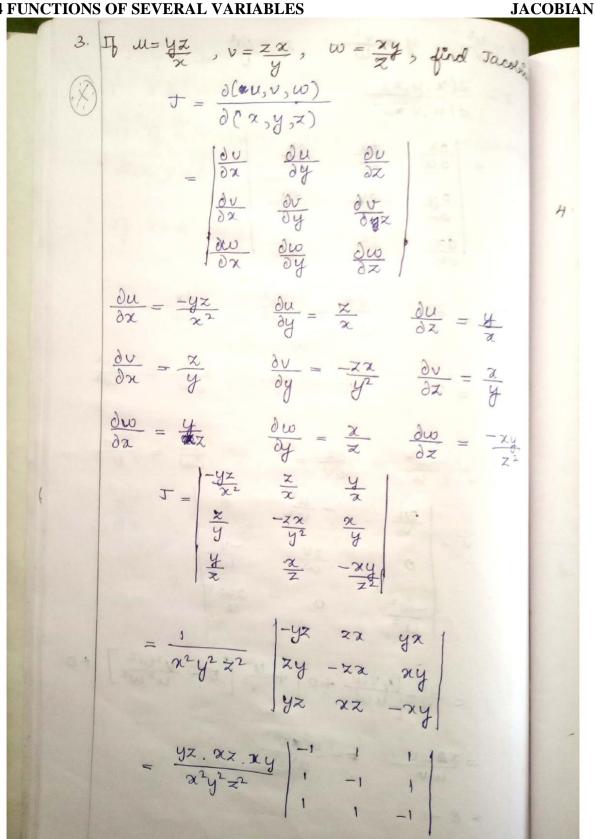
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Thus of several variables
$$= \frac{x^{2}, y^{2}, z^{2}}{x^{2}, y^{2}, z^{2}} \left[-i(0) - i(-2) + i(2) \right]$$

$$= +2+2$$

$$T = 4$$

$$\text{Mose that } u = \frac{x}{y}, v = \frac{x+y}{x-y} \text{ . A ave }$$

$$\text{Jundianally dependent. Find the nelation}$$

$$\text{between them.}$$

$$T = \frac{\partial (U, v)}{\partial (x, y)}$$

$$T = \begin{vmatrix} \frac{\partial V}{\partial x} & \frac{\partial U}{\partial y} \\ \frac{\partial V}{\partial x} & \frac{\partial V}{\partial y} \end{vmatrix}$$

$$\frac{\partial V}{\partial x} = \frac{\partial V}{\partial y} = \frac{\partial V}{\partial x}$$

$$\frac{\partial V}{\partial x} = \frac{\partial V}{\partial y} = \frac{\partial V}{\partial x}$$

$$\frac{\partial V}{\partial x} = \frac{(x-y)(1) - (x+y)(1)}{(x-y)^{2}}$$

$$\frac{\partial V}{\partial y} = \frac{(x-y)(1) - (x+y)(1)}{(x-y)^{2}}$$

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UNS OF SEVERAL VARIABLES

$$J = \begin{bmatrix} \frac{1}{y} & \frac{1}{y} & -\frac{x}{y^2} \\ -\frac{2y}{(x-y)^2} & \frac{2x}{(x-y)^2} \end{bmatrix}$$

$$= \frac{2}{(x-y)^2y^2} \begin{bmatrix} y & -x \\ -y & x \end{bmatrix}$$

$$= \frac{2x}{(x^2-2xy+y^2)y} \begin{bmatrix} 1 & -1 \\ 1 \end{bmatrix}$$

$$= 0$$

$$J = \frac{1}{y} \left(\frac{2x}{(x-y)^2} \right) - \frac{2y}{(x-y)^2} \frac{x}{y^2}$$

$$= \frac{2x}{(x-y)^2y} - \frac{2x}{(x-y)^2y}$$

$$= 0$$

$$\therefore u \text{ and } v \text{ are functionally independent.}$$

$$V = \frac{x+y}{x-y}$$

$$= \frac{y(\frac{x}{y}+1)}{y(\frac{x}{y}-1)} = \frac{y(\frac{x}{y}-1)}{y-1}$$

$$V = \frac{y+1}{y-1}$$



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Solutions of Several variables

$$\int \frac{\partial (x,y)}{\partial u} = \int \frac{\partial x}{\partial u} \frac{\partial x}{\partial v}$$

$$\int \frac{\partial (x,y)}{\partial u} \frac{\partial x}{\partial v} = \int \frac{\partial x}{\partial v} \frac{\partial x}{\partial v}$$

$$\int \frac{\partial x}{\partial u} = (1-v') \frac{\partial x}{\partial v} = \int \frac{\partial x}{\partial v} = u$$

$$\int \frac{\partial x}{\partial u} = v \frac{\partial x}{\partial v} = u$$

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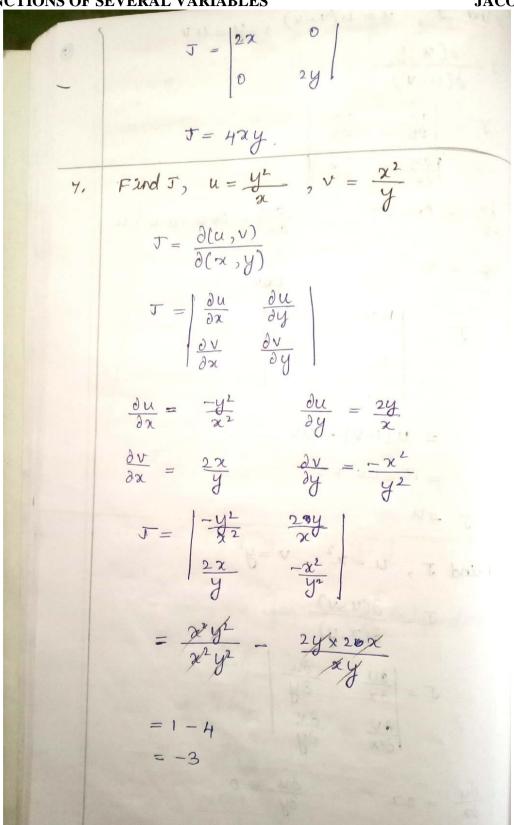


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Find
$$J$$
, $M = x = u(1+v)$, $y = hv(1+u)$

$$J = \frac{\partial(x,y)}{\partial(u,v)}$$

$$Z = u+uv$$

$$y = v + uv$$

$$J = \begin{vmatrix} \frac{\partial x}{\partial u} & \frac{\partial x}{\partial v} \\ \frac{\partial y}{\partial u} & \frac{\partial y}{\partial v} \end{vmatrix}$$

$$\frac{\partial x}{\partial u} = 1+v$$

$$\frac{\partial y}{\partial u} = v$$

$$\frac{\partial y}{\partial v} = 1+u$$

$$J = \begin{vmatrix} 1+v & u \\ v & 1+u \end{vmatrix}$$

$$= (1+v)(1+u) - uv$$

$$= 1+u+v+uv - uv$$

$$= 1+u+v$$