Subject: Business Economics Course: B.A., 2nd Semester, Undergraduate.

Paper No: 202 Paper Title: Mathematics for Business Economics

Unit No.: 5 (Five) Title: Functions of two variables

Lecture No: 2 (Two) Title: Some More Aspects of Partial Differentiation

FAQs

Q-1 Give an example of a function which is discontinuous at some point in its domain and all its partial derivatives of first order exist at that point. Solution:

Consider a function defined as Consider the limit of this function at

along a $f(x,y)=\begin{cases} \dfrac{\quad}{x^2+y^2}, & (x,y)\neq(0,0) \\ 0, & (x,y)=(0,0) \end{cases}$

straight

line path

written as

Here the limit depends on the path taken to evaluate it. So the

function is not continuous at

$$\therefore \frac{\quad}{\partial x} = \frac{\quad}{\left(x^2+y^2\right)^2} = \frac{\quad}{\left(x^2+y^2\right)^2}$$ and

It is partially differentiable at every because at it is a well-defined rational function.

Now we will check its partial derivatives at by the definitional approach.

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

then $\sum_{i=1} x_i \frac{\partial}{\partial x_i} = n f(x_1, x_2, \ldots, x_k)$. This result is known as Euler's theorem.

At ,

$$\therefore x\frac{\partial f}{\partial x} + y\frac{\partial f}{\partial y} = x(2y) + y(2x-2y) = 4xy - 2y^2 \neq n\left(5 + 2xy - y^2\right)$$

for any n.

So the partial derivatives of first order for the function exist at , it can be checked that these partial derivatives are not continuous at .

1. If both the first order partial derivatives of a function of two independent variables and are zero at some point in the domain of then what can be said about the nature of point ? Solution:

then no conclusion can be drawn from this test and further investigation is required to find the nature of point .

2. Is Euler's theorem true for a non-homogenous function also? Solution:

No. The condition of homogeneity is a must. Look at a counter example for this.

Take

Q-2 Is Euler's theorem true for homogenous functions of more than two variables also?
Solution:

Yes. The final expression of the result will be Suppose is a homogeneous function of degree and if has continuous partial derivatives,

Q-3 Can the Lagrange's method of undetermined multipliers be used to find extreme points of given function subject to two or more constraints also?

Solution:

Yes. The number of undetermined multipliers to be taken is actually equal to the number of constraints.