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COIMBATORE-641 035. TAMIL NADU

DEPARTMENT OF MATHEMATICS

UNIT IV

MAXIMA AND MINIMA EX = ET

WORKING RULE TO FIND MAXIMUM OR MINIMUM VALUES [EXTREMUM VALUES] OF F(X,Y).

Find
$$\frac{\partial f}{\partial x}$$
 and $\frac{\partial f}{\partial y}$ $(x + y + y + y) = y + y$

* Set
$$\frac{\partial F}{\partial x} = 0$$
 and $\frac{\partial F}{\partial y} = 0$

Solve it Simultaneously

The Solution point of these equations called Stationary points.

Find the values of
$$r = \frac{\partial^2 f}{\partial x^2}$$
, $s = \frac{\partial^2 f}{\partial x \partial y}$, $t = \frac{\partial^2 f}{\partial y^2}$ at these points.

$$t = \frac{\partial F}{\partial y^2}$$
 at these points



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- # @ If $rt-s^2 > 0$ and r < 0, then the function is maximum at that point.
 - (b) If $rt s^2 > 0$ and $r \neq 0$, then the function is minimum at that point.
 - © If $\gamma t s^2 \angle 0$, then the function is neither maximum nor minimum at that point. This Point is called as saddle point.
 - d If $rt s^2 = 0$, then the case is inconclusive. Hence further investigation is genuired.

NECESSARY CONDITION:

The necessary condition for the function f(x,y) to have a maxima minima at a point (a,b) is $\frac{\partial f}{\partial x} = 0$, $\frac{\partial f}{\partial y} = 0$ at (a,b).

SUFFICIENT CONDITION:

Write 3 and 4 Step in working rule.

This is the Sufficient Condition for the function to be maxima or minima.

Critical 7 & t 76.8 Conclusions

Points 54

(411) 13 > 0 0 6 42 > 0 Minimum p

(2,-1) 13 > 0 0 -6 -42 < 0 Neither and

(-3,1) -12 < 0 6 -13 < 0 5 Society points

(-3,1) -12 < 0 6 -13 < 0





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PROBLET	Ms :	ral B	1-5	12 11			
its extreme values.							
Soln: heise Latt La managin of acissaut							
$f(x,y) = x^3 + y^3 - 12x - 3y + 20$							
5	N. S.				•/1		
9F = 3x	3(1) 3(1) 5	delena	дy	- and the	9		
orizhan of	= 0	.11	34 2	f = 0			
$\frac{\partial x}{\partial x} = 0$ $\frac{\partial f}{\partial x} = 0$ $\frac{\partial f}{\partial y} = 0$							
$3x^{2} - 12 = 0$ $x^{2} = 4$ $3y^{2} - 3 = 0$							
				y= 1			
Hence the state of restation for the state of the state o							
Hence the stationary points are $(2,1)$, $(2,-1)$, $(-2,1)$, $(-2,-1)$.							
10 10 10 10 10							
$\Upsilon = \frac{\partial^2 f}{\partial x^2} = 6x$							
$-2 \approx \frac{2^{3} + 6^{3}}{2} = 10 \text{ gast. } \text{μ box e sairly}$							
This is the sufficient condition for $\frac{\partial x}{\partial y}$ of moision to sufficient $\frac{\partial x}{\partial y}$							
$t = \frac{\partial^2 f}{\partial y^2} = 6y$ same to ampean ad ot.							
	∂y²		· Yattir at	11 40 1914100	TO BE INT.		
Critical	r	15	t	rt-s2	Conclusion		
Points	= 621	4			201121407012		
(2,1)	12 >0	0	6	72 > 0	Minimum point		
(a,-i)	12 > 0	0	-6	70	Neither max		
	1219		-6	-72 < 0	nor min points		
(-2,1)	-1220	0	6	-7a < 0	- Sad dre point		
(-a, -1)	-12/2	6			"		
	-1220	0	-6	72 >0	Maximum point		



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	Min value = $[f(x,y)]_{(211)}$	
	Max value = $\left[f(x,y)\right]_{(-2,-1)} = 38$	(0)
2	Find the maximum and minimum valu	es of
	$x^{2} - xy + y^{2} - 2x + y$.	Critical Polat
300	$\frac{Soln:}{\partial x} = 0 , \frac{\partial f}{\partial y} = 0$	(0,0)
	2x - y - 2 = 0, $-x + 2y + 1 = 0$	(a,a)
11111	$\Rightarrow \chi = 1, y = 0$	
30	(1,0) is the stationary point.	
	$\gamma = \frac{\partial^2 f}{\partial x^2} = a > 0$	
	$S = \frac{\partial^2 F}{\partial x^2} = -3 \times 0$	
	dx dy	
	$t = \frac{\partial^2 f}{\partial y^2} = 2 \sqrt{3} \int_{0}^{\infty} proposition = 0$)
	8t-82 = 4-41 = 3 >0 thing this	aicher)
150	$\delta t - \delta^2 = 4 - 41 = 3 > 0$ $(1,0) \text{ is a minimum point.}$	+ ,x
	Min. value = $[f(x,y)]_{(1,0)} = -1$.	