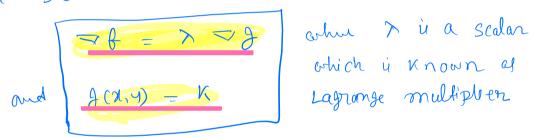
Lagrange multiplier method

Let f: 12 -) R be a function. Lagrange multiplion method is used for maximizing on minimizing a general objective function subject to a constraint of the form $\beta(x,y) = K$.

The following steps consitutes the method at Lagrange multiplier.

1. Find If and Ig in terms of x and y. Then set up the equations



This ail sive you a system of equations based on the components of the gradients.

- 2. Solve this system at equations to get Q,4, >.
- 3. For each of this solutions, find f(x14) and Compare the valued. Every solution that give a maximum values à a maximum point and every salm that gives a minimum value é a moumem point.

Prob1 Use Lagrange multiplier method to find the maximum and minimum value of the function f(x,y) = 3x + y subject to the Jinen constraints x2 + y2 = 10.

Now $\nabla f = \lambda \nabla g$ and g(x,y) = 10 gry y

$$=) \quad \chi = \left(\frac{3}{2\lambda}\right) \quad \text{and} \quad \chi = \left(\frac{1}{2\lambda}\right)$$

now substituting this in 712+42=10, we sol

$$\frac{9}{24 \times 2} + \frac{1}{4 \times 2} = 10$$

$$\frac{\lambda - \frac{1}{2}}{2}, \quad \chi = 3 \quad \text{and} \quad y = 1$$

$$\frac{\lambda = -\frac{1}{2}}{2}, \quad \chi = -3, \quad y = -1$$

me get the Juliang extreme points (3,1) and (-3,-1) of the given optionization problem.

we can classify them by simply finding this valus. f(3.1) = 10

$$(-3, -1) = -10$$

f(-3, -1) = -10-: (3,1) is a maximum point and (-3,-1) is onthing point

prob2 Use Lagrange multiplien method to find the maximum and minimum of $f(\alpha, y) = \alpha y$ subject to $\alpha^2 + y^2 = 8$.

sur maximum valus 4 and it is occurring at (2,2) and (-2,-2).

monimum valus is -4 and it is occarry at (-2, 2) and (2, -2).

For functions of three variables $f(x_1,y_1,z)$ Subject to two constraints $g(x_1,y_1,z) = k$ and $h(x_1,y_1,z) = C$.

Then me can consider

マチェカマタナルマト

1. Find If, Ig and Ih. Then set up the equations

 $\nabla f(x,y,z) = \pi \nabla (g(x,y,z) + h \nabla h (x,y,z)$

g(x,4,2) = K

and h(x,y,z) = C

Note that me have now fine unknows, It me break the figured equation, me will get three equation and hence me will have fine equations.

prob3 Use Lagrange multiplier method to find the maximum and minimum value of the function $f(x_1,y_1,z_2) = 3x - y - 3z$ Subject to $x_1 + y - z_2 = 0$ and $x_1 + z_2 + z_2 = 1$.

Solf Heru, f(x, y, z) = 3x - y - 3z f(x, y, z) = k = 0 $h(x, y, z) = c \Rightarrow x^2 + 2z^2 = 1$ $\Rightarrow f = (3, -1, -3)$

Then the set of equations

$$\begin{aligned}
&= (1,1,-1) & \text{ and } & \nabla h = (2x,0,42) \\
&= h & \Rightarrow g + h & \Rightarrow h \\
&= h(x,y,2) = K \\
&= d & h(x,y,2) = C
\end{aligned}$$
This implies that
$$\begin{aligned}
&(3,-1,-3) = \lambda(1,1,-1) + h(2x,0,42) \\
&= \lambda(2x,0,42) \\
&= \lambda(2$$

$$\frac{4}{m^2} + \frac{2}{m^2} = 1$$

$$\mathcal{X} = \frac{2}{\sqrt{6}} \quad \text{and} \quad \mathcal{Z} = -\frac{1}{\sqrt{6}}$$
and
$$\mathcal{Y} = \mathcal{Z} - \mathcal{H} = -\frac{3}{\sqrt{6}}$$

$$\mathcal{L} = -\sqrt{6}$$

$$\chi = -\frac{2}{\sqrt{6}} \text{ and } Z = \frac{1}{\sqrt{6}}$$

and
$$y = \frac{3}{\sqrt{6}}$$

... The two extreme points to the original optimitation problem are

$$\left(\frac{2}{\sqrt{\epsilon}}, -\frac{3}{\sqrt{\epsilon}}, -\frac{1}{\sqrt{\epsilon}}\right)$$
 and

$$\left(-\frac{2}{\sqrt{6}},\frac{3}{\sqrt{6}},\frac{1}{\sqrt{6}}\right)$$

Eusz A rectangular box without a lid is to be made brom 12 m2 at cardboard. Find the maximum volume of such a box.

Sul Let 21, y and 2 ze the length, a width and height, at the box in meters.

Then we have to max xy2

Subject to ny+242+22x=12

The maximum volume is 4 with n=2, y=2 and z=1.