



# SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai  
Accredited by NAAC-UGC with 'A++' Grade (Cycle III) &  
Accredited by NBA (B.E - CSE, EEE, ECE, Mech & B.Tech.IT)  
COIMBATORE-641 035, TAMIL NADU

## DEPARTMENT OF MATHEMATICS

### UNIT 4 Lagrange's of Undetermined Multipliers

CONSTRAINED MAXIMIZATION MINIMIZATION

PROCEDURE :

STEP-1: Write  $f(x, y, z)$  and  $g(x, y, z)$  condition:  $\uparrow$

STEP-2: Find  $F = f + \lambda g$  → variable

STEP-3: Find  $\frac{\partial F}{\partial x} = 0$   
 $\frac{\partial F}{\partial y} = 0$   
 $\frac{\partial F}{\partial z} = 0$  } Find relation b/w  $x, y, z$   $\xrightarrow{\text{substituted}}$   $\frac{\partial F}{\partial \lambda} = 0$  Find value of  $x, y, z$

STEP-4: sub the value of  $x, y, z$  in  $f(x, y, z)$

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1. Find the maximum value of  $xyz$  subject to the condition  $x+y+z=a$ . (2 eqn.)

$f(x, y, z) = xyz$   
 $g(x, y, z) = x+y+z-a$   
 $F = f + \lambda g$   
 $F = xyz + \lambda(x+y+z-a)$  — (1)

$F = xyz + \lambda x + \lambda y + \lambda z - \lambda a$

$\frac{\partial F}{\partial x} = yz + \lambda$   
 $\frac{\partial F}{\partial y} = xz + \lambda$   
 $\frac{\partial F}{\partial z} = xy + \lambda$   
 $\frac{\partial F}{\partial \lambda} = x+y+z-a$



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## DEPARTMENT OF MATHEMATICS

$$\frac{\partial F}{\partial x} = 0 \Rightarrow yz + \lambda = 0$$

$$-\lambda = yz \quad \text{--- (2)}$$

$$\frac{\partial F}{\partial y} = 0 \Rightarrow xz + \lambda = 0$$

$$-\lambda = xz \quad \text{--- (3)}$$

$$\frac{\partial F}{\partial z} = 0 \Rightarrow xy + \lambda = 0$$

$$-\lambda = xy \quad \text{--- (4)}$$

$$\frac{\partial F}{\partial \lambda} = 0 \Rightarrow x + y + z - a = 0$$

$$x + y + z = a \quad \text{--- (5)}$$

(2) & (3)  $\Rightarrow yz = xz$   
 $y = x$

(3) & (4)  $\Rightarrow xz = xy$   
 $z = y$

(2), (3) & (4)  $\Rightarrow x = y = z$

(5)  $\Rightarrow x + x + x = a$   
 $3x = a$   
 $x = a/3$

$y = a/3$   
 $z = a/3$

maximum value is

(c)  $f = xyz$   
 $= \left(\frac{a}{3}\right)\left(\frac{a}{3}\right)\left(\frac{a}{3}\right)$   
 $= \frac{a^3}{27}$