Quiz for lecture 11.

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Section: 8:40-10:00 A.M.

1. Use Largange multipliers to find the smallest value that $x+y+z$ can be, given that $xyz=125$

$$f(x,y,z) = x+y+z$$

$$g(x,y,z) = xyz = 125.$$

$$\nabla f = \langle 1,1,1 \rangle, \quad \nabla g = \langle yz, xz, xy \rangle.$$

$$\langle 1,1,1 \rangle = \lambda \langle yz, xz, xy \rangle.$$

$$\begin{cases} \lambda yz = 1. \\ \lambda xz = 1 \\ \lambda xy = 1. \end{cases}$$

$$\lambda^3 (xyz)^2 = 1$$

$$\lambda^3 = \frac{1}{125^2}$$

$$\lambda = \frac{1}{25}$$

$$x = y = z = \frac{125}{25} = 5$$

$$f(5,5,5) = 15$$

$\therefore$ The minimum of $(x+y+z)$ is 15.

2. Use Largange multipliers to find the largest value that xyz can be, given that $x+y+z=15$.

$$f(x,y,z)=xyz$$

$$g(x,y,z)=x+y+z=15.$$

$$\nabla f=\langle yz, xz, xy\rangle.$$

$$\nabla g=\langle 1,1,1\rangle$$

$$\langle yz, xz, xy\rangle=\lambda\langle 1,1,1\rangle$$

$$\begin{cases} yz=\lambda \\ xz=\lambda \\ xy=\lambda \end{cases}$$

$$(xyz)^2=\lambda^3$$

$$xyz=\lambda^{\frac{3}{2}}$$

$$yz=\frac{\lambda^{\frac{3}{2}}}{x}=\lambda$$

$$x=y=z=\lambda^{\frac{1}{2}}$$

$$3\lambda^{\frac{1}{2}}=15$$

$$\lambda^{\frac{1}{2}}=5.$$

$$x=y=z=5.$$

$$f(5,5,5)=125.$$

$\therefore$ The maximum of xyz is 125.