**"QUIZ" for Lecture 11**

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**E-MAIL SCANNED .pdf OF COMPLETED QUIZ to DrZcalc3@gmail.com (Attachment: q11FirstLast.pdf) ASAP BUT NO LATER THAN Oct. 12, 8:00pm Deadline extended to Oct. 17**

**1.** Use Largange multipliers (no credit for other methods) to find the **smallest** value that $x+y+z$ can be, given that $xyz = 125$

$\rightarrow \nabla f = \langle 1,1,1 \rangle$ and $\nabla g = \langle yz, xz, xy \rangle$

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

$\rightarrow 1 = \lambda yz, \quad 1 = \lambda xz, \quad 1 = \lambda xy$

$\rightarrow 1 = \lambda^3 x^2 y^2 z^2$

$\rightarrow \frac{1}{\lambda^3} = (xyz)^2$

$\rightarrow \frac{1}{\lambda^3 x^2} = y^2 z^2 \Rightarrow \frac{1}{\lambda^2} = \frac{1}{\lambda^3 x^2} \Rightarrow \lambda^3 x^2 = \lambda^2 \Rightarrow x^2 = \frac{1}{\lambda} \Rightarrow x = \pm \frac{1}{\sqrt{\lambda}}$

$\rightarrow y = \pm \frac{1}{\sqrt{\lambda}}, \quad z = \pm \frac{1}{\sqrt{\lambda}}$

$\rightarrow \frac{1}{\sqrt{\lambda}} \cdot \frac{1}{\sqrt{\lambda}} \cdot \frac{1}{\sqrt{\lambda}} = 125 \Rightarrow \frac{1}{\lambda^{3/2}} = 125 \Rightarrow \lambda = \frac{1}{25}$

$\rightarrow x = \pm 5, \quad y = \pm 5, \quad z = \pm 5$

$\rightarrow -5-5-5 = -15$

$\rightarrow$ -15 is the smallest value

**2.** Use Largange multipliers (no credit for other methods) to find the **largest** value that $xyz$ can be, given that $x+y+z = 15$

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

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

$\rightarrow yz = \lambda, \quad xz = \lambda, \quad xy = \lambda$

$\rightarrow x^2 y^2 z^2 = \lambda^3$

$\rightarrow x^2 \lambda^2 = \lambda^3 \Rightarrow x^2 = \lambda \Rightarrow x = \pm\sqrt{\lambda}, \quad y = \pm\sqrt{\lambda}, \quad z = \pm\sqrt{\lambda}$

$\rightarrow 3\sqrt{\lambda} = 15 \Rightarrow \sqrt{\lambda} = 5 \Rightarrow \lambda = 25$

$\rightarrow x = \pm 5, \quad y = \pm 5, \quad z = \pm 5$

$\rightarrow 5 \cdot 5 \cdot 5 = 125$

$\rightarrow$ 125 is the largest value