"QUIZ" for Lecture 11

NAME: (print!) Rachel Balji **Section:** 23

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 largest value that $x + y + z$ can be, given that $xyz = 125$

$f(x,y,z) = x+y+z$ $xyz=125$

$f_x = 1$ $\nabla f = \langle 1,1,1 \rangle$

$f_y = 1$

$f_z = 1$

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

$g_y = xz$

$g_z = xy$

$\nabla f = \lambda \nabla g$

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

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

$1 = xz\lambda \Rightarrow$ $1 = xyz\sqrt{\lambda^3}$

$1 = xy\lambda \Rightarrow$ $yz = \frac{1}{x\sqrt{y^3}}$

$yz = \frac{1}{\lambda}$ $\frac{1}{\lambda} = \frac{1}{x\sqrt{y^3}} \Rightarrow x = \pm\frac{\lambda}{\sqrt{\lambda^3}} = \lambda\lambda^{-3/2} = \lambda^{-\frac{1}{2}}$

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

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

$\rightarrow x = \sqrt{\lambda}$

$y = \sqrt{y}$

$z = \sqrt{\lambda}$

$\frac{1}{\sqrt{\lambda}} \cdot \frac{1}{\sqrt{\lambda}} \cdot \frac{1}{\sqrt{\lambda}} = 125$

$= \lambda\left(\frac{1}{\sqrt{\lambda}}\right) = 125$

$\lambda = 0.04$

$x = \frac{1}{\sqrt{0.04}} = 5$

$y = 5$

$z = 5$

point $\Rightarrow (5,5,5)$ and $(-5,-5,-5)$ $\hookrightarrow f(x,y,z) = -15$

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

$\frac{1}{2}$

$1 - \frac{3}{2} = -0.5$ $1 - 1.5$

$\therefore$ The maximum value is 15.

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

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

$f_y = xz$

$f_z = xy$ $\nabla f = \lambda(\nabla g)$

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

$g_y = 1$

$g_z = 1$

$yz = \lambda$, $xz = \lambda$, $xy = \lambda$ $\rightarrow$ $(xyz)^2 = \lambda^3$

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

$xy = \lambda^{3/2}/z$

$\lambda = \lambda^{3/2}/z$

$z = \pm\sqrt{\lambda}$

$\sqrt{\lambda} + \sqrt{\lambda} + \sqrt{\lambda} = 15$

$3\sqrt{\lambda} = 15$

$\sqrt{\lambda} = 5$

$\lambda = 25$

$x = \pm\sqrt{25} = \pm 5$

$y = 5$

$z = 5$

Point $= (5,5,5)$ and $(-5,-5,-5)$

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

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

$\frac{3}{2} - 1 = 0.5$

$\therefore$ The largest value that xyz can be is 125.