"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

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

$f(x,y,z) = x+y+z$ $\quad g(x,y,z) = xyz$

$f_x = 1$ $\quad g_x = yz$

$f_y = 1$ $\quad g_y = xz$

$f_z = 1$ $\quad g_z = xy$

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

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

$1 = \lambda yz$
$1 = \lambda xz$
$1 = \lambda xy$
$xyz = 125$

$(\lambda xyz)^2 = 1, \quad \lambda xyz = \pm 1$

$\lambda = \pm \frac{1}{125}$

$yz = xz = xy = \frac{1}{\lambda} = 125$

$x = y = z$

$x^2 = 125$

$x = 5\sqrt{5}$

$x+y+z = 3(5\sqrt{5})$

$= 15\sqrt{5}$

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

$f(x,y,z) = xyz$ $\quad g(x,y,z) = x+y+z$

$f_x = yz$ $\quad g_x = 1$

$f_y = xz$ $\quad g_y = 1$

$f_z = xy$ $\quad g_z = 1$

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

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

$\lambda = yz$
$\lambda = xz$
$\lambda = xy$

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

$x = \frac{\lambda}{z}$
$y = \frac{\lambda}{x}$
$z = \frac{\lambda}{y}$

$\frac{\lambda}{x} + \frac{\lambda}{y} + \frac{\lambda}{z} = 15$

$\frac{\lambda yz + \lambda xz + \lambda xy}{xyz} = 15$

$\frac{3\lambda^2}{\sqrt{\lambda^3}} = 15, \quad \sqrt{\lambda} = 5, \quad \lambda = 25$

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

$= 25^{3/2}$

$= 125$