

"QUIZ" for Lecture 11

NAME: (print!) Prathik Lolla Section: _____

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

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

$$f_x = 1, f_y = 1, f_z = 1, \quad g_x = yz, g_y = xz, g_z = xy$$

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

$$\nabla f = \lambda \nabla g$$

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

$$yz = \frac{1}{\lambda}, \quad xz = \frac{1}{\lambda}, \quad xy = \frac{1}{\lambda}$$

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

$$(yz)^2 = \frac{1}{x^2 \lambda^3} \quad (xz)^2 = \frac{1}{y^2 \lambda^3} \quad (xy)^2 = \frac{1}{z^2 \lambda^3}$$

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

$$xyz = 125$$

$$\left(\frac{1}{\sqrt{\lambda}}\right)^3 = 5^3$$

$$\frac{1}{\sqrt{\lambda}} = 5$$

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

$$x = 5, y = 5, z = 5$$

$$x + y + z = 15$$

15

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

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

$$f_x = yz, f_y = xz, f_z = xy$$

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

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

$$g_x = 1, g_y = 1, g_z = 1$$

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

$$\nabla f = \lambda \nabla g$$

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

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

$$(xyz)^2 = \lambda^3, \quad x + y + z = 15$$

$$x = \sqrt[3]{\lambda}, \quad y = \sqrt[3]{\lambda}, \quad z = \sqrt[3]{\lambda}$$

$$x + y + z = 15$$

$$3\sqrt[3]{\lambda} = 15$$

$$\sqrt[3]{\lambda} = 5$$

$$\lambda = 125$$

$$xyz = 125$$

125