

MA153, Multi-Variable Calculus

Quiz 3 - 30 September 2008

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Section: _____

Show all of your work. An unjustified answer is not correct! You will have 10 minutes.

THIS QUIZ IS WORTH 20 POINTS

1. Find three positive numbers whose sum is 100 and whose product is a maximum.

(a) What is your objective equation - (the equation you are trying to minimize or maximize)?

Ob =? xyz

(b) What is your constraint equation - (your limitations)?

Co =? $x + y + z = 100$

(c) What method are you going to use to solve this, (LaGrange or Optimization)?

both

(d) Input Work and Solution Below:

optimization

1) objective xyz

2) constraint $x + y + z = 100$

3) reduce $z = 100 - x - y$

$xy(100 - x - y)$

$100xy - x^2y - xy^2$

4) $\nabla C_b = \langle 100y - 2xy - y^2, 100x - 2xy - x^2 \rangle$

$\nabla C_b = 0 \Rightarrow 100y - 2xy - y^2 = 0$

$100x - 2xy - x^2 = 0$

$\Rightarrow 2xy = 100y - y^2 = 100x - x^2$

$\Rightarrow x = y$

$\Rightarrow 100x - 2x^2 - x^2 = 0$

$\Rightarrow -3x = -100 \quad x = y = z = \frac{100}{3}$

La Grange

1) objective xyz

2) Co $x + y + z = 100$

3) $\nabla C_b = \lambda \nabla C_o$

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

$\Rightarrow yz = \lambda$

$xz = \lambda \quad x + y + z = 100$

$xy = \lambda$

$\Rightarrow xz = xz \quad \& \quad xz = xy$

$\Rightarrow x = y \quad \& \quad z = y$

$\Rightarrow x = y = z$

$\Rightarrow 3x = 100 \Rightarrow x = \frac{100}{3}$

$x = y = z = \frac{100}{3}$