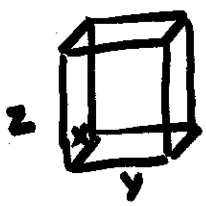
MATH 21-259 Quiz 7 03/24/11

Name: Solution key Lab Section: ____________________

Allowed time: 10 mins

1. A package is in the shape of a rectangular box can be mailed by the USPS carrier if the sum of its length and girth (the perimeter of a cross section perpendicular to the length) is at most 108 cm^2. Suppose we want to determine the dimensions of the package that will maximize the volume of the package.

   (a) (3 points) Set up the problem in the form to use the method of Lagrange multipliers, i.e., to maximize F subject to the constraint G = c.



Maximize $F(x,y,z) = xyz$ subject to the constraint $G(x,y,z) = x + 2(y+z) = 108 = c$

   (b) (5 points) Determine the system of equations that has to be solved in order to solve the problem. DO NOT SOLVE THE EQUATIONS, JUST FIND THEM.

Lagrange Condition: $\nabla F = \lambda \nabla G$

$$\boxed{\begin{aligned} yz &= \lambda \\ xz &= 2\lambda \\ xy &= 2\lambda \\ x + 2y + 2z &= 108 \end{aligned}}$$ – system of equations.

2. Classify the critical points (1, 2) and (2, 1) for a function $f(x, y)$ given the following conditions.

   (a) (1 point) If $f_{xy}(1,2) \neq 0$, $f_{yy}(1,2) = 0$, and $f_{xx}(1,2) > 0$ then the point (1, 2) can be classified as a Saddle point ~~minimum~~. [$D < 0$]

   (b) (1 point)If $[f_{xy}(2,1)]^2 - f_{xx}(2,1)f_{yy}(2,1) < 0$ and $f_{xx}(2,1) > 0$ then the point (2, 1) can be classified as a ~~saddle point~~. local minimum [$D > 0, A > 0$]