Quiz 7
Math 202 F01

Name: Solutions
3/12/15

1. Use Lagrange multipliers to give a system of equations that could be solved to find the point on $xy^2z^3 = 2$ that is closest to the origin. *DO NOT* solve the equations.

minimize $f(x,y,z) = x^2+y^2+z^2 \quad \left(= \text{dist}((x,y,z),(0,0,0))^2\right)$

constraint $g(x,y,z) = xy^2z^3 = 2$

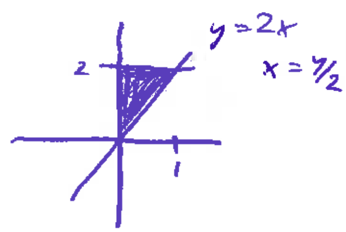
$\nabla f = \lambda \nabla g$: $\langle 2x, 2y, 2z \rangle = \lambda \langle y^2z^3, 2xyz^3, 3xy^2z^2 \rangle$

$$\boxed{\begin{aligned} 2x &= \lambda y^2 z^3 \\ 2y &= 2\lambda x y z^3 \\ 2z &= 3\lambda x y^2 z^2 \\ xy^2z^3 &= 2 \end{aligned}}$$

2. Sketch the region of integration for the integral

$$\int_0^1 \int_{2x}^2 e^{(y^2)}\, dy\, dx,$$

then reverse the order of integration, and evaluate it.



$$\int_0^2 \int_0^{y/2} e^{y^2}\, dx\, dy = \int_0^2 e^{y^2} x \Big|_{x=0}^{y/2} dy$$

$$= \int_0^2 \frac{y}{2} e^{y^2}\, dy = \frac{e^{y^2}}{4}\Big|_0^2 = \frac{e^4-1}{4}$$