2007 5/18 Hanson Zhao 108

1. Sphere $= x^2+y^2+z^2=1$
find point on sphere that minimizes function $f(x,y,z)=(x-2)^2+(y-2)^2+(z-1)^2$

Check inside $f(x,y,z)$
$f_x = 2(x-2)=0$
$f_y = 2(y-2)=0$
$f_z = 2(z-1)=0$
$x,y,z = (2,2,1)$
not on bounds

So...
$\nabla f = \lambda \nabla g$
a= $2x = \lambda(2x-4)$
b= $2y = \lambda(2y-4)$
c= $2z = \lambda(2z-2)$

$\frac{a}{b} = \frac{2x}{2y} = \frac{2x-4}{2y-4}$
$4xy-8x = 4xy-8y$
$x=y$

$\frac{a}{c} = \frac{2x}{2z} = \frac{2x-4}{2z-2}$
$4xz-4x = 4xz-8z$
$\frac{1}{2}x = z$

$x^2+y^2+z^2=1 \Rightarrow x^2+x^2+(\frac{1}{2}x)^2=1$
$x = \pm\frac{2}{3}$ $y = \pm\frac{2}{3}$, $z = \pm\frac{1}{3}$

Plug into $f(x,y,z)$
minimized at $(\frac{2}{3}, \frac{2}{3}, \frac{1}{3})$