10/21 Quiz solution

Closest point to (0,0,0) on surface

$x + 2y + 4z = 14$

Setup: f is to be minimized,

f is $x^2+y^2+z^2 = (x-0)^2+(y-0)^2+(z-0)^2$

(square of distance to (0,0,0)

g is constraint - limitation of variables!

$x+2y+4z=14$

Lagrange condition:

$\nabla f \parallel \nabla g$,

Here this is

$(2x, 2y, 2z) \parallel (1, 2, 4)$

This simplifies to

$x = \frac{y}{2} = \frac{z}{4}$.

We plug this in constraint:

$$x+2y+4z = x+2(2x)+4(4x) = 14$$

$$7x = 14$$

$$x = 2$$

So $y = 4$, $z = 8$

point is $(2, 4, 8)$