

Lagrange Multipliers:

$$f(x,y,z) = x^2 + 4y^2 + 6 \quad ; \quad 2x - 8y = 20$$

① Get constant = 0:

$$2x - 8y - 20 = 0$$

② Set up F: $F = f - \lambda(\text{constraint})$

$$F = x^2 + 4y^2 + 6 - \lambda(2x - 8y - 20)$$

③ Take all first derivatives of F:

$$F_x = 2x - 2\lambda$$

$$F_\lambda = -(2x - 8y - 20)$$

$$F_y = 8y + 8\lambda$$

④ Solve (usually easiest to solve for x, y, z).

$$0 = 2x - 2\lambda$$

$$2x = 2\lambda$$

$$x = \lambda$$

$$0 = 8y + 8\lambda$$

$$8y = -8\lambda$$

$$y = -\lambda$$

$$0 = 2x - 8y - 20$$

$$0 = 2\lambda + 8\lambda - 20$$

$$20 = 10\lambda$$

$$\lambda = 2$$

⑤ Give answer as (x,y) or (x,y,z):

$$x = \lambda = 2$$

$$y = -\lambda = -2$$

$$\Rightarrow (x,y) = (2, -2)$$