

OPTIMIZATION

Method. To find maximum and minimum values of $f(x, y, z)$ subject to the constraint $g(x, y, z) = c$:

- (1) Find all possible solutions to $\nabla f(x, y, z) = \lambda \nabla g(x, y, z)$ and $g(x, y, z) = c$. (This gives you 4 equations in 4 variables; ingenuity might be required).
- (2) Evaluate $f(x, y, z)$ at all the points. The largest value you get is the max and the smallest value is the min.

1. A rectangular box without a top is to be made from 12 m^2 of material. Our goal is to find the largest possible volume of the box.

- a) Find the function to be maximized.
- b) Find the constraint function.
- c) Use the method above.

2. Find the minimum and maximum distances from the sphere $x^2 + y^2 + z^2 = 4$ to the point $(3, 1, -1)$.