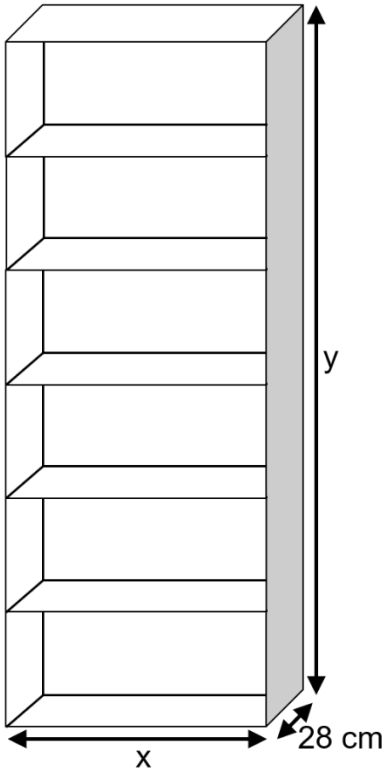
Assignment 1: The BILLY bookcase
CAL1 2025

A BILLY bookcase, pictured below, is apparently sold every 5 seconds somewhere in the world. We model the bookcase as sketched to the right: a top plate, a bottom plate, five shelves, two side plates and a back plate. The bookcase is 28 cm deep, and we denote its width and height by x and y, respectively.



Ignoring the thickness of the plates, we want to determine the values of x and y that will use the least material given that the total volume of the bookcase is $0.45\ \text{m}^3 = 450000\ \text{cm}^3$.

a. First, determine these optimal values of x and y analytically (*i.e.*, not numerically).
b. Then determine the optimal values using Newton's method for optimization (*i.e.*, numerically) and compare.