

# MAT131 Fall 2022 Paper HW 9

**Due the week of November 7 – November 11.** For all problem sets, students are allowed to work together. However, the final answer you turn in must be based on your own understanding and must be in your words. Per university policy, all instances of suspected academic dishonesty will be referred to the academic judiciary.

**Problem 1.** A simple shed consists of half of a right circular cylinder (bisected along the axis, not perpendicular to the axis) forming the “roof”, and the two side walls each consisting of one half of a circular disk with the same radius. There is no “floor”; the shed rests directly on the ground. For fixed surface area for the roof and side walls, what ratio of radius to length of the cylinder maximizes the volume enclosed? Show all work.

**Problem 2.** A hemisphere of fixed radius  $r$  has its (great) circle boundary resting flat on the ground. A second, smaller hemisphere is placed above, with its (great) circle boundary resting horizontally on the first hemisphere. What is the maximum height about the ground for the top of the second hemisphere? Show all work.