

MAT1300, FALL 2011. HOMEWORK 6, QUESTION 3

Adapted from Guillemin and Pollack page 63.

- (a) Show that if $a > 0$ then the solid hyperboloid $\{x^2 + y^2 - z^2 \leq a\}$ is a manifold with boundary.
- (b) Determine for which values of $a \in \mathbb{R}$ the intersection of the solid hyperboloid $\{x^2 + y^2 - z^2 \leq a\}$ and the unit sphere $\{x^2 + y^2 + z^2 = 1\}$ is a manifold with boundary. What does this intersection look like?
- (c) For which values of a do the surfaces $\{x^2 + y^2 - z^2 = a\}$ and $\{x^2 + y^2 + z^2 = 1\}$ intersect transversally?
- (d) Explain the relation between your answers to parts (b) and (c).