1. a) Show that the parametrized surface 
   \[ X(u,v) = (v \cos u, v \sin u, au) \], \( a > 0 \) is regular.

   b) Compute its normal vector \( N(u,v) \).

   c) Using eventually b), prove that the angle formed by the tangent plane with the \( z \)-axis along the coordinate line \( u = u_0 \) is proportional to the distance from the corresponding point \( X(u_0, v) \) to the \( z \)-axis.

2. a) Show that \( X : (0, \infty) \times (0,2\pi) \to \mathbb{R}^3 \)
   \[ X(u,v) = (u \sin \alpha \cos v, u \sin \alpha \sin v, u \cos \alpha) \],
   where \( \alpha \) is constant, is a parametrization of the cone with \( 2\alpha \) as the angle at the vertex.

   b) In this coordinate neighborhood, prove that the curve
   \[ \alpha(t) = X(e^t \sin \alpha \cot \beta, t) \]
   where \( c, \beta \) are constant, intersects the generators of the cone \((v = \text{const.})\) under the angle \( \beta \).

3. Let \( S \) be a regular surface covered by two coordinate neighborhoods \( V_1 \) and \( V_2 \), for which \( V_1 \cap V_2 \) has two connected components \( W_1 \) and \( W_2 \).
The Jacobian of the change of coordinates is positive in $W_1$ and negative in $W_2$. Prove that $S$ is unorientable.