# Rotations

# Special Orthogonal Matrices

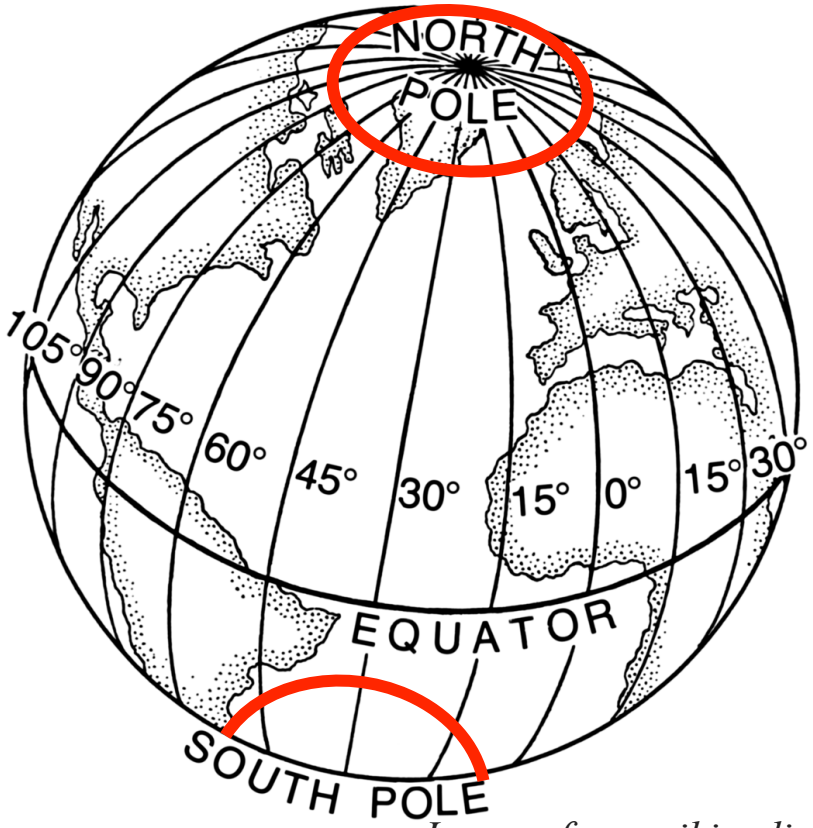
$$\left\{ R \in \mathbb{R}^{3\times 3} \mid R^T R = R R^T = I,\ \det R = 1 \right\}$$

*Special Orthogonal group*
*in 3 dimensions*

- The group of rotations is called $SO(3)$
- Coordinates for $SO(3)$
  1. Rotation matrices
  2. Euler angles
  3. Axis angle parameterization
  4. Exponential coordinates
  5. Quaternions

# Coordinates for a Sphere

- Parameterize using a set of local coordinate charts (latitude and longitude)
- We want a collection of charts to describe the Earth's surface




*Images from wikipedia*

# What is the minimum number of charts you need to cover the Earth's surface?

*Images from wikipedia*

# What is the minimum number of charts you need to cover $SO(3)$?

$$SO(3) = \left\{ R \in \mathbb{R}^{3\times 3} \mid R^T R = R R^T = I,\ \det R = 1 \right\}$$