

# Homework 7

Due: Wednesday Dec 11th

Geometry for Teachers, MTH 623, Fall 2019

Instructor: Abhijit Champanerkar



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**Reading** Notes and slides on Spherical Geometry

**Problems** Solve and submit the following problems.

- Using the spherical distance formula prove that the antipodal map is a spherical isometry.
- Find the great circle containing the following pairs of points.
  - $P = (0, 0, -1)$  and  $Q = (0, 1, 0)$ .
  - $P = (1/2, -1/2, 1/\sqrt{2})$  and  $Q = (2/3, 1/3, -2/3)$ .
- Are the points  $P = (0, 0, -1)$ ,  $Q = (0, 1, 0)$  and  $R = (0, 0, 1)$  collinear ?
- Find the spherical distance between the following pairs of points.
  - $P = (0, 0, -1)$ ,  $Q = (0, 1, 0)$ .
  - $P = (1/2, -1/2, 1/\sqrt{2})$ ,  $Q = (2/3, 1/3, -2/3)$ .
  - $P = (0, 1/2, \sqrt{3}/2)$  and  $-P = (0, -1/2, -\sqrt{3}/2)$ .
- Find angle between the following great circles:
  - $L_{\vec{j}}$  and  $L_{\vec{k}}$
  - $L_{\langle 1/3, 2/3, 2/3 \rangle}$  and  $L_{\langle -3/5, 4/5, 0 \rangle}$
- Find the area of the triangle with the following vertices:
  - $P = (1, 0, 0)$ ,  $Q = (0, -1, 0)$  and  $R = (0, 0, -1)$ .
  - $P = (1/2, -1/2, 1/\sqrt{2})$ ,  $Q = (2/3, 1/3, -2/3)$ , and  $R = (1, 0, 0)$ .
- Can we have a polyhedron consisting of 12 hexagonal faces and every vertex of degree 4 ?

**Write up** (Please type your write-up, figures can be hand-drawn if needed)

Write a one page summary of the article *Think Globally* by Steven Strogatz (get article from class homepage).