Spherical Geometry Homework; Part 1

Due Monday November 2.

1. (5 pts) Does every point on a sphere have an antipodal point? How many antipodal points does any given point on the sphere have?

2. (10 pts) a. Why was Escher unhappy with tessellations of the plane as a means to display infinity?
b. Look at Escher's Sphere with Fish, Sphere with Angels and Devils, Sphere with Eight Grotesques, and Sphere with Reptiles (pages 244 and 245 Visions of Symmetry). Do you think these spheres would give a good sense of infinity? Why or why not?

3. (10 pts) a. What might "between" mean for points on a sphere? Write a definition you are happy with.
b. With your definition, is St. Louis between the North Pole and the South Pole? Is the North Pole between the South Pole and St. Louis?

4. (5 pts) Draw a picture of sphere. Draw a triangle on it with three 90° angles.

5. (5 pts) Draw a picture of sphere. Draw a triangle on it with one angle larger than 180°.

6. (5 pts) Draw three straight lines on a sphere so each one is perpendicular to the others.

7. (5 pts) Use your knowledge of spherical triangles to explain why the sum of the angles of a quadrilateral on a sphere is always larger than 360°.

8. (5 pts) The state of Colorado has four 90° corners. However, we know that no spherical quadrilateral can have four right angles. What is going on with Colorado?

(These problems correspond to Spherical Geometry exercises # 1-6, 12, 13)