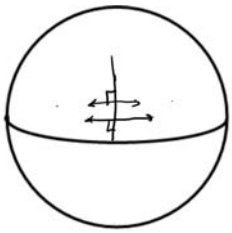
Geometry assignment 2. **Do this assignment on another sheet of paper!**

1. If you have two lines (great circles) on a sphere, and another line (great circle) on the sphere intersects both of them at a right angle, will the two lines be parallel? Why or why not?



2. Please assume that the following facts are true (I'll call them axioms) for spheres, and measurements of angles on spheres:

Ax. 1: Any angle on a sphere can be measured, and it's angle measure is between 0 and 360°
Ax. 2: If an angle is split into (not necessarily equal) two angles (by a line/segment/ray), then the measure of the larger angle is the sum of the two smaller angles.
Ax. 3: The sum of the angles in any (spherical) triangle is greater than 180°.

Prove: Given triangles ΔAB_1C_1 and ΔAB_2C_2 such that

- B_1 lies on the side $\overline{AB_2}$ and C_2 lies on the side $\overline{AB_2}$ of ΔAB_2C_2
- The interior of ΔAB_1C_1 lies inside the interior of ΔAB_2C_2

Then the sum of the angles in ΔAB_2C_2 is greater than the sum of the angles in ΔAB_1C_1

Because this is your first proof of the class, I'm going to give you some tips to start:

- Draw the triangles (it doesn't have to be to scale, the angles don't have to look right. Don't worry that your paper isn't spherical)
- If there are any polygons in your picture that aren't triangles, add in more line segment(s) until everything is split into triangles (because axiom 3 only works for triangles).
- Name and label all of the angles in your picture.
- Write down equations and inequalities using axioms 2 and 3.
- Figure out what your goal is algebraically (what inequality do you have to prove to succeed)
- Do algebra. Keep it organized (a proof isn't just a solution, it's a solution with an explanation).

Transformations on a plane:
You should know intuitively what a translation, a rotation and a reflection are, and your task now is to figure out how to measure things to tell for sure if an isometry is a translation, a rotation, a reflection or something else.

3. If you are given a line ℓ and a triangle ΔABC and the image of the triangle $\Delta A'B'C' = \Delta f(A)f(B)f(C)$ after doing a function to it, what **measurements** could you do to decide if the image was a reflection across the line or not?

3. If you are given a point P and a triangle ΔABC and the image of the triangle $\Delta A'B'C' = \Delta f(A)f(B)f(C)$ after doing a function to it, what **measurements** could you do to decide if the image was a rotation around the point or not?

3. If you are given a triangle ΔABC and the image of the triangle $\Delta A'B'C' = \Delta f(A)f(B)f(C)$ after doing a function to it, what **measurements** could you do to decide if the image was a translation or not?