

**Test 1**  
MAT 310 / MTE 585  
September 25, 2001  
50 points

Calculators allowed.  
No notes allowed.

DO NOT WRITE ANSWERS ON THIS PAGE  
Write your answers on the blank pages provided.

Note: When answering a question that says “name”, “list” or “state” then you need only do that without further elaboration. When answering a question that says “describe”, “explain” or “prove” then a more detailed response is expected.

1. (2 points) Describe one way to check whether something is a straight line that will work on both the plane and the sphere.  
(4 points) Name two other properties that straight lines in the plane and straight lines on a sphere have in common.  
(4 points) List two ways in which straight lines in the plane and straight lines on a sphere are different from each other.
  
2. (10 points) List all the symmetries of each of the two figures below ignoring any slight imperfections in the drawing. For b. assume that the strip extends infinitely in both directions. In each case, be specific about the location of any points or lines and amounts that may be relevant for that symmetry. For example, for a rotation symmetry you need to say what point(s) is(are) the center of a symmetry rotation and what angle(s), in degrees or radians, will make the rotation transformation a symmetry.
  
  
  
  
  
  
  
  
  
  
3. (5 points) Explain a way to determine the measure of an angle in degrees without using a protractor (i.e. measuring only lengths of arcs and/or line segments).
  
4. (10 points) **State** and **prove** the vertical angle theorem using any proof except the (measurement) proof where angle sums are compared. Make sure it is clear what definition of angle and of angle congruence you are using.
  
5. (5 point) Explain the central (or point) symmetry transformation.

6. (5 points) Give a definition for a triangle on the plane. Sketch and/or carefully describe a triangle on a sphere that fits this definition but is different from what we normally picture as a triangle on a plane. Estimate the sum of the interior angles of your triangle.
7. (5 points, credit for any relevant geometric argument for each side) Should the vertices of a triangle on a sphere be allowed to be collinear (i.e. on the same great circle)? Argue both sides.