MA 501 Homework #2

Due by the end of Monday, January 21

To submit this assignment you should email me two SketchUp files (for problems 1a and 1b) and a pdf document (preferable typed, but can be handwritten and scanned) for problems 2–4.

1. Practice constructions with SketchUp. I recommend watching some of the introductory video tutorials here: `http://www.sketchup.com/training/videos.html`.

   (a) Read pages 9–10 of "Geometry Software for Three-Dimensional Visualization and Modeling", `http://www.ms.uky.edu/~lee/jessieclark/NCTMDenver.pdf`, and then create your own geometry still life according to the instructions on page 11. Email me your SketchUp file.

   (b) Go to YouTube and search for other videos on SketchUp. Some nice ones can be found if you include "3DVinci" as a search term. Construct something interesting and potentially relevant to school mathematics, email me the SketchUp file, and be prepared to discuss and/or demonstrate your construction in class. (I hope everyone chooses something different!)

2. Read the section on High School Geometry in the Common Core State Standards for Mathematics, `http://www.corestandards.org/assets/CCSSI_Math%20Standards.pdf`, pages 74–78. Identify two or three items that you would like us to focus on. Write a paragraph or so to explain why these are important for you—perhaps you would like to expand your own knowledge, perhaps you know from experience that students often struggle these these, or perhaps there are some other reasons. Be prepared to discuss this in class.

3. Practice with GeoGebra or Geometer's Sketchpad to construct the perpendicular bisectors of a general triangle, and then use the point of intersection to contruct the circumcircle of that triangle. You do not have to submit this sketch, but you may wish to use this sketch, or parts of this sketch, to illustrate your solutions to the problems below.

   (a) Using standard triangle congruence theorems, such as SAS, ASA, SSS, HL, etc., prove that if P is a point on the perpendicular bisector of line segment $\overline{AB}$, then the distances PA and PB are equal.

   (b) Using standard triangle congruence theorems, such as SAS, ASA, SSS, HL, etc., prove that if $\overline{AB}$ is a line segment and P is a point such that the distances PA and PB are equal, then P is on the perpendicular bisector of $\overline{AB}$.

(c) Now prove that if ΔABC is a triangle and P is the intersection of the perpendicular bisectors of sides $\overline{AB}$ and $\overline{AC}$, then P is also on the perpendicular bisector of side $\overline{BC}$. (This justifies that all three perpendicular bisectors intersect at a common point, and that this point is equidistant from the three vertices).

4. A Platonic solid is a convex polyhedron with the properties that (1) every face is congruent to a common regular polygon, and (2) the same number of faces meet at each vertex. By examining the possible types of faces and their angles (equilateral triangles, squares, regular pentagons, etc.), explain why there can be no more than five Platonic solids.