HW 1. (Classical Geometries.) Due Thursday, the last day of March in 2016, i.e.: Next class!

1. Draw two distinct non-parallel lines \( \ell, m \) in the plane and their point of intersection 0. On your figure, indicate the four angles which result. Is it possible that all four angles be distinct, (i.e. mutually non-congruent)? Is it possible that all four angles be equal?

2. Choose one of the four angles from problem 1. Call it \( \alpha \). Construct the angle bisector of \( \alpha \).

NOTE! In this class, up to the midterm construct will always means to complete three tasks:

A) physically construct, either with ruler and compass or Geogebra (or another CAD-type program) the desired object

B) clearly describe the steps of your construction, labelling points and lines made if you need them in the proof

C) prove that you have really constructed what you claim to have constructed.

These tasks may be interwoven, depending on your writing style. You may use a two column-style proof if you like.

You are encouraged to work with classmates on assignments and ESPECIALLY have classmates or the TA proofread your solutions. I ask that you each turn in your own write-up and tell me who you are working with.

HW 2; FOR NEXT TUES, April 5; or perhaps THURS (depending on if I get a sub.)

3. Prove that the points on the angle bisector you constructed in problems 2 are EQUIDISTANT from \( \ell \) and \( m \). (Hint: You will need to be able to DEFINE the distance between a point and a line, and have a means for constructing (give the point and the line) the line segment whose length realizes this distance.)

4. Prove that the perpendicular bisector of segment AB is the locus of points equidistant between A and B. [Hint: this is an if and only if assertion.]

5. Given a circle with center O, construct a 30-30-120 triangle inscribed in the circle.

FOR NEXT THURS: April 7.

6. Return to the first assignment, with the lines \( \ell, m \). Describe the locus of points which are equidistant between \( \ell \) and \( m \).

7. Given a triangle ABC construct its circumscribing circle: the circle which passes through all three vertices. [Hint: Use problem 4. The center of this circle must be equidistant between all three points, and in particular equidistant between A and B.]

8. Given a triangle ABC construct its inscribing circle: the circle which ‘just’ lies inside of ABC and is tangent to all three edges. [HINT: Use problems 3 and 6 relating angle bisectors to equidistants between lines. Also use: a line is tangent at a point P to a circle with center C if and only if \( \ell \) is perpendicular to the “radius vector” \( CP \).]