Problem Set 13: Planar Geometry

Due 05/04/04

As usual, think about all problems, and come up with some ideas about how to solve them.

The following problems are construction problems. Using just an *unmarked* ruler and compass you have to draw the line, or circle with a given property.

Warm up example: Given a segment MN on a line, find its midpoint. (Your ruler is unmarked so you can not measure your segment.)
Constrution: Fix you compass such that the radius is more then half the length of the segment, but less then the length of the segment. Keep this radius fixed and draw two circles centered at M, and N. They are going to intersect in two points P, Q. Draw the line determined by P and Q. This line is going to cut your segment in half. So you have determined the midpoint.

1. (a) Given a line l and a point A on this line, draw the line through A which is perpendicular on l.
   (b) Given a line l and a point B which is not on the line. Draw the line through B which is perpendicular on l.

2. Let l and m be two lines in the plane that are skew to each other (that is, they intersect at a single point X). Let P be a point (other than X)that is on the line l. Construct the circle that is tangent to both lines and passes through P.

3. Given an arbitrary triangle ABC draw the inscribed circle.(i.e. the circle which is tangent to the three sides of the triangle.)

4. Given an arbitrary triangle ABC draw the circle which is determined by its vertexes. (Hint: Find a property that describes the center.)

5. Using a ruler and compass:
   (a) Draw an equilateral triangle.
   (b) Draw a square.
   (c) Draw a hexagon.

6. The entire plane is colored using two colors. Prove that there are two identically colored points exactly 1 foot apart.