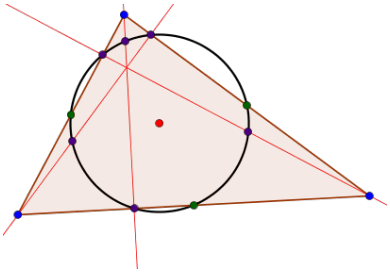
Euclidean Geometry:
An Introduction to Mathematical Work

Math 3600

Spring 2019

Construction Problems



A "step" for our counting purposes happens exactly every time you draw something with either the compass or straightedge. We count steps using the modern "fixable compass." This means that you may copy some segment length for the radius of a circle, but place it at a new point for a center all in one step. If you like, this collapses the content of Euclid Proposition I.2 in to a single step.

The following problems are construction challenges. In each case, you are to

1. find a compass and straightedge construction,
2. enumerate your steps, and
3. prove that your construction works.

You may use any parts of the *Elements* Book I.1-34 or Book III.1-34 as part of your reasoning.

For most challenges, I have included a "par value" indicating the number of steps an experienced constructor would need. Can you meet this or do better?

11.1 Challenge. Given an angle, construct the angle bisector. (par 4)

11.2 Challenge. Given a segment, find the midpoint. (par 3)

11.3 Challenge. Given a line ℓ and a point A not lying on ℓ, construct a line perpendicular to ℓ through A. (par 4, possible in 3)

11.4 Challenge. Given a line ℓ and a point A lying on ℓ, construct a line perpendicular to ℓ through A. (par 4, possible in 3)

11.5 Challenge. Given an angle at a point A and given a ray emanating from a point B, construct an angle at B congruent to the angle at A having the given ray as a side. (par 4)

11.6 Challenge. Given a line ℓ and a point A not lying on ℓ, construct a line parallel to ℓ which passes through A. (par 3)

11.7 Challenge. Given the circumference of a circle, find the center of the circle. (par 5)

11.8 Challenge. Given a circle with center O, and given a point A outside the circle, construct a line ℓ through A which is tangent to the circle. (par 6)