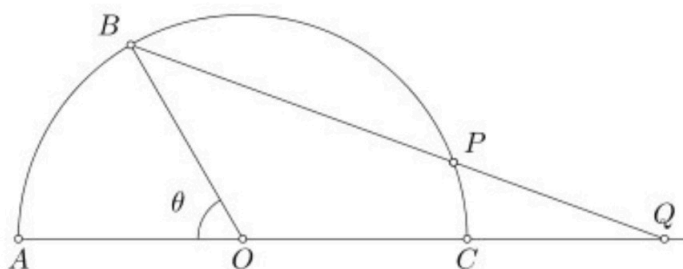


Math 130  
Homework 2 – Due September 13, 2016  
Jamie Conway

1. (Archimedes trisection of the angle using *ruler* and compass)

Prove that you can trisect an angle using ruler (*ie.* a straight-edge that can measure) and compass, using the following strategy (you need to hand in a complete proof): Given angle  $\theta$  and a unit-length marking on your ruler, first construct a unit-radius semi-circle. Then slide your ruler until you find a segment of length 1 ( $PQ$  in the picture) between the base and circumference of the semi-circle. Show that  $\angle PQC = \theta/3$ .



2. Look at some of the proofs of the Pythagorean theorem at this site:

<http://www.cut-the-knot.org/pythagoras/index.shtml>.

Pick one proof that looks interesting to you (that we didn't do in class), and give a clear, step-by-step exposition of the proof. The proofs on the site aren't always good/complete, so choose something that you can explain better than the site.

3. Do the following problems from Stillwell's *The Four Pillars of Geometry*:

2.3.2, 2.3.3 (don't give a proof, just an illustration and an explanation of why it works)

2.5.2, 2.5.5 (you may find it helpful to try 2.5.4 first)

2.7.5, 2.8.1-3

4. In class, we showed that the angle-sum of a triangle is  $180^\circ$ .

- (a) Use this to find the angle-sum of a convex  $n$ -gon. Is your formula true for non-convex polygons?
- (b) Using (a), prove that the only convex regular (all angles equal, all sides equal) polygons that tile the plane are the triangle, square, and hexagon.
- (c) (\*\*Challenge problem: not to hand in!) Show that no convex 7-gon (not necessarily regular) can tile the plane.