Homework Assignment 18

Solve and submit your solutions of the following problems. Note also that the late policy is very strict - you will lose 5% for each hour that you are late. In other words, please submit on time!

That's our last assignment! Hurray!

Due date
Friday, April 3, 2026 11:59 pm (Eastern Daylight Time)

Late penalty
5% deducted per hour

Q1 (10 points)

Show that using a ruler and a compass alone, you cannot construct a regular heptagon (7-gon) and a regular nonagon (9-gon).

Q2 (10 points)

A angle trisector (angtri) is a device that given two lines a and b that meet at a point P, allows one to draw a further line c, such that the angle between a and c is one-third the angle between a and b (see notes below). Show that using only a ruler, a compass, and an angtri, one cannot construct a regular hendecagon (11-gon).

Note 1. We don't care that there are two angles between a and b, an acute one and an obtuse one. If you can trisect one you can easily trisect the other.

Note 2. One can make a mechanical angtri rather easily, though of course, using more than a ruler and a compass. In the old times people used to wear mechanical watches. If you brute-force move the minutes hand of a mechanical watch, the hours hand will move 12 times slower. Multiply by 4 and you've made a mechanical angtri.

Q3 (10 points)

1. Show that if a 19° angle is given, you can cut it into 19 equal parts using only a ruler and a compass.
2. Now do the same so elegantly that it will make you smile.
3. Yet show that, unfortunately, a 19° angle cannot be constructed with a ruler and a compass.

Q4 (10 points)

Working over $\mathbb{Q}$, in class we saw that $\mathrm{Gal}(f = 3x^5 - 15x + 5) \simeq S_5$. Find another polynomial with the same property. Multiplying f by a unit is cheap, so please avoid that. Also avoid $f \mapsto f(ax + b)$, $f \mapsto x^5 f(1/x)$, and combinations of all of these operations.

Ready to submit?

- Please ensure all pages are in order and rotated correctly before you submit
- You will not be able to resubmit your work after the due date has passed.

Please wait...