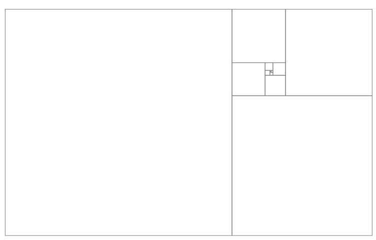
MA495 Midterm Guide - February 21, 2020

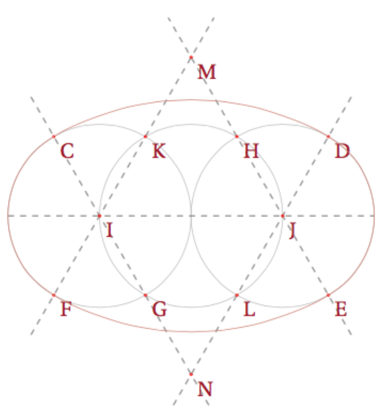
I the axiomatic method & computations

1. What is the axiomatic method?
2. Define *parallel*.
3. State Euclid's five postulates.
4. What is an RAA-proof, or proof by contradiction?
5. Define: right angle, supplelmentary angle, angle bisector
6. In the golden rectangle below, assume the large square shown has side length ϕ. What are the dimensions of the 4th largest golden rectangle?



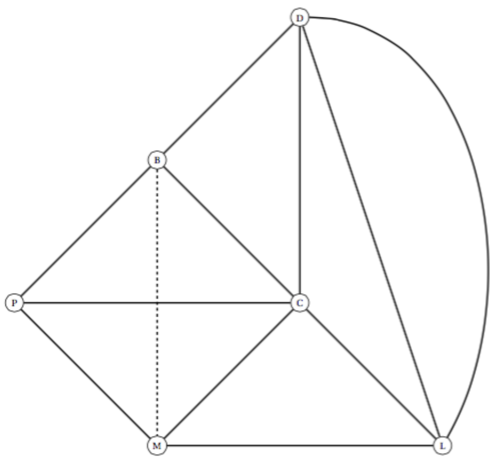
II basic constructions

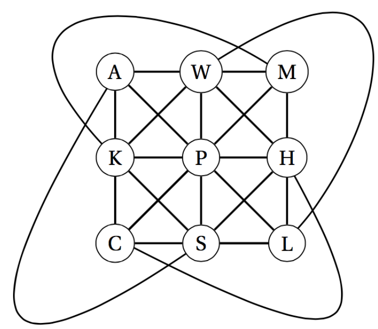
1. Let segment AB be given. Construct the perpendicular bisector of AB and prove your result.
2. Let $\angle ABC$ be given. Show how to bisect this angle and prove your result.
3. Show how to trisect a given segment. You may use similar triangles to prove your result.
4. Use the figure below to describe how to construct an ellipse using straightedge & compass.



III logic & incidence geometry

1. Define: contrapositive, converse, inverse,
2. State the three Incidence Axioms.
3. finite projective & affine planes
4. Let "points" be the letters and "lines" be segments and arcs shown in the graph below. Is this an affine plane? Is this a model of incidence geometry? Indicate which axioms are not satisfied. Modify the figure as necessary to produce an affine plane





5. Show that the figure to the right is a model of the affine plane of order 3.

IV Hilbert's axioms

1. Define the *same side of a line* and *opposide sides of a line.*
2. State the Betweenness Axioms in your own words.
3. In $\triangle ABC$, show that $AB \cong AC \iff \angle B \cong \angle C$. Do not cite the propositions in the text, prove them.
4. Prove the SSS Congruence theorem. You may use the result from Chapter 4 that the perpendicular bisector of a segment is unique.

5. Given $B * A * C$. Prove that $\overrightarrow{AB} = \overrightarrow{AC}$. Use this to show that a given ray has a unique opposite ray.

6. Show that vertical angles are congruent to each other. You may use the fact that supplements of congruent angles are congruent.

7. Show that an equiangular triangle (all angles congruent to one another) is equilateral.