A problem based overview of the first half of the course.

Lecture 1.

1.1 Construct the perpindicular bisector of a given line segment. (Book I.Prop. 10)

1.2. Construct the angle bisector of a given angle (I.9)

1.3. Prove Thales theorem about right triangles inscribed in a circle. (III.31, III.31)

1.4 Prove 'Thales 2. " If AB is a chord of a circle with center C and X is any point on the larger of the two arcs of the circle then the angle AXB is half the angle ACB. (III.20; III.21)

lecture 2.

2.2. Construct angles of 45, 30, 15, and 22.5 degrees.

2.3. Given a circle and point on that circle, construct an isosceles triangle that is insribed in the circle has P as vertex, and has angles as per problem 2.1 at P.

2.4 Prove: the sum of the interior angles of a triangle is 180 degrees. (I.32)

Lecture 3.

3.1. *Prove* that the tangent to a circle is perpindicular to the radius. [*Define* tangent.] (I.16, I.17)

3.2 Given a triangle, *construct* the circumsribing circle and the inscribed circle. (IV.4; 15)

3.3. On the sphere, draw a 90-90-90 triangle, and a 90-30-90 triangle.

3.4. *Construct* a regular hexagon. (IV.15). [How did you use Post. V?]

3.5. *Construct* a regular N-gon inscribed in a given circle, $N = 3, 4, 6, 8$ (IV.8,9,15)

3.6. Given a segment AB *construct* a division of AB into 3 equal parts; 7 equal parts; a point C on AB so that $AC/AB = 4/7$. [Pillars: p. 8-10; esp. p. 8]

lecture 4. Area and Similarity.

4.1. Given a triangle, construct the midpoints of each side. Connect them to divide the triangle into 4 subtriangles. Prove that these 4 small triangles are congruent to one another similar to the bigger one. Conclude that if we halve all sides of a triangle we obtain one with 1/4 the area.

Generalize to scalings of a triangle's sides by an integer length. By a rational length. By any real length.

4.2. Prove that the area of a triangle is one-half the product of any edge length times the altitude to that edge. (I.41)

4.3 Prove Pythagoras' theorem. (I.47)

4.4 What does it mean for two triangles to be similar?

lecture 5 ...?

More circles... ? Def. tangent. (See Euc. III.16; III.19)

Given a point A, a line ℓ with $A \notin \ell$ and another point $X \in \ell$, construct the circle passing through A and X and tangent to ℓ at X.

Given a circle $\mathcal{C}$ and a point X *exterior* to the circle, construct the two tangents to $\mathcal{C}$ through X.

lecture 6. Arithmetic algebra. (Euclid, book II)

6.1. Given segment a construct segment b with $a : b = \sqrt{2}$

6.2. Given segment AB construct point C on line A so that $AC : AB = 1/3$.

6.3. Given a unit, and segments of length a, b construct a segment with length $\sqrt{ab}$. (Euclid: II.14)

6.4. Given segment a construct segment b with $a : b = \sqrt{5}$; b with $a : b = \sqrt{5}+1$; b with $b = (1/2)(\sqrt{5}+1)$

Lecture 7. Construct the regular pentagon. (IV.11; also see IV.12-14)

Lecture 8. Mon of week 3 (?)

8.1. Levi 38: The base of an equilateral triangle is the diameter of a circle. Thus the edges of the triangle cuts the half-circle into three circular arcs. Find the angular measure of each of these arcs.

And: make the construction: the 'given' being the diameter.

8.2: Levi 34 and 17. Two of a triangle's sides have length 3 inches and 4 inches. What are the possibilities for the triangle's area?

8.3. Show, by drawing a counterexample that an "ASS" (Angle-Side-Side) congruence law is false.