## Math 411: Advanced Euclidean Geometry

**Contact Information**

Office hours or T: 4-5 or Th at 3-5,after class if desired or by appointment in 327 SEO. (Subject to change)

Feel free to e-mail me at jbaldwin@uic.edu or phone to make an appointment to discuss any difficulties that arise.

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### Unit 2

In the third and 4th weeks we will study Chapter 7.26 to end and 8.1 -8.36 (Pasch's Theorem) pages 153-183.

**Due Tuesday Feb 5**

7.27 and 7.35 are straightforward. We will do some of the other parts of them in class and you should look at those problems before Tuesday Jan. 29.

1. 7.27 6-8
2. 7.35: 4-6 and 12-14.
3. 7.43 (remember $\ell \cdot {}^{o}\overline{AB}^{o}$ means $\ell \cdot {}^{o}\overline{AB}^{o} \neg \emptyset$)
4. 7.45.2 (remember to use Axiom IV)
5. 7.47. Give an example to show Axiom IV was needed.
6. 7.49.ii, 7.49.iii
7. 7.60,7.61 and 7.62 together prove one result.
   (a) Explain in one short paragraph the connection between these theorems.
   (b) Prove 7.62.

**Due Tuesday Feb 12**

8.7 and 8.16 are again pretty easy.

1. 8.7.1, 8.7.2
2. 8.16.2, 8.16.3

3. 8.22, 8.25.5, 8.31.1,
4. 8.35 Rewrite the proof in your own words, using the statements of the theorems; do not refer to Theorem numbers.
5. 7.47. 8.40

**Definition 1** *The binary relation* $<$ *is a* linear order *of the set* $S$ *if*

*irreflexive* *For every* $x \in S$, $x \not< x$

*antisymmetry* *For every* $x, y \in S$, $x < y$ *implies* $y \not< x$.

*transitivity* *For every* $x, y, z \in S$, $x < y$ *and* $y < z$ *implies* $x < z$.

*trichotomy* *For every* $x, y, z \in S$, $x < y$ *or* $y < x$ *or* $x = y$.

If it is more convenient, a group (1 or more) students may submit the following assignment jointly. I accept the groups judgement that everyone who signs the paper contributed and will give all students the same score for the assignment.

Problem 6. Let $\langle \Pi, \mathcal{L}, \Psi \rangle$ be a geometry satisfying axioms I to IV and $\ell$ a non-empty line. Define a linear order on $\ell$. That is define a binary relation on $\ell$ and prove it satisfies the axioms above.

Hint: One way to approach the problem is to fix point $A, B, C \in \ell$ such that $A - B - C$ (why do such exist) and define separately a linear order on ${}^{o}\overrightarrow{BA}$ and ${}^{o}\overrightarrow{BC}$ and then combine them. I have in mind that for $X, Y \in^{o} \overrightarrow{BC}$:

$$X < Y \equiv \overrightarrow{YA} \supset^{o} \overrightarrow{XA}.$$

It is important that $\supset$ means *proper* superset. I have to use a slightly different definition on ${}^{o}\overrightarrow{BA}$. Don't forget to include $B$ in the ordering. Considering Example 8.20 will so why one has to be careful about the cases.

Note that there have several major mistakes in editing the book.

The top 4 inches of page 158 just repeats the bottom of page 157.

The proof of Theorem 7.46 (which is non-trivial) has been omitted. I will present it in class.

Line -4 on page 164 the reference should be to example 7.38. Again in Remark 7.59, the references to 7.37 should be to 7.38.