

MAT 310

Chapter 2 Study Guide

Euclid:

- How did Euclid show 2 lines are perpendicular? Read Definition 10.
- Illustrate the meaning of Euclid's Fifth Postulate.
- Illustrate the meaning of Playfair's Parallel Postulate.
- State the negations of Euclid's Fifth Postulate and Playfair's Parallel Postulate. Illustrate the meaning of each of these negations.
- How does Euclid begin to establish congruence of segments? Angles?

Hilbert:

- Group I Axioms: Which of the Group I did Euclid use (either explicitly stated or assumed implicitly)? Note especially the two paragraphs following the Group I Axioms.
- The theorem on page 53 says that two distinct lines can't intersect more than once. Where have you proven this before?
- Group II Axioms: Illustrate the meaning of Axiom II-4. This is known as Pasch's Axiom. Why is this necessary?
- Group III Axioms: How does Hilbert begin to establish congruence of segments? Angles?

Birkhoff:

- What allows Birkhoff to accomplish the same thing as Hilbert with only four Postulates?
- What is the role of measurement in Birkhoff's Postulates? How does this differ from Hilbert's Axioms? How does this show up in the SMSG Postulates?
- How does Birkhoff begin to establish congruence of segments? Angles?
- Illustrate the meaning of Birkhoff's Postulate 4. How does this relate to Euclid's and Hilbert's systems?

SMSG:

- Is the SMSG Axiom system independent?
- Where do each of the SMSG Postulates come from (e.g., Euclid, Hilbert, Birkhoff)?
- Read the brief descriptions of each of Euclid's, Hilbert's, Birkhoff's, and the SMSG axiomatic systems for Geometry at the top of p. 71. Give at least two different supporting arguments for each of these descriptions.

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Chapter 3 Study Guide

Theorem 3.2.8

- How do you know the angle bisector intersects \overline{AB} ?
- What do you need to show in order to prove \overline{PT} is a bisector of \overline{AB} ?
- What do you need to show in order to prove \overline{PT} is perpendicular to \overline{AB} ?

Theorem 3.3.1 (ASA)

- What is the meaning of "without loss of generality" here? List all of the assumptions are based on this statement? What makes its use valid?
- What is the basic structure of this proof by contradiction? What is assumed? What contradiction is derived? What is concluded?
- What axiom(s) guarantee the existence of point C' ?
- How does the result contradict Postulate 12?

Theorem 3.3.3 (AAS)

- Why does the construction make $\triangle AB'C$ congruent to $\triangle DEF$?
- Why does the construction make $\angle AB'C$ congruent to $\angle ABC$?
- What axiom or theorem is being used to conclude $\angle AB'C$ is greater than to $\angle ABC$?

Theorem 3.3.8 (SSS)

- Why is $\triangle ACS$ congruent to $\triangle APS$?
- How is the triangle inequality used?
- Why does this imply SSS?
- Compare this proof to the proof of Euclid's Propositions 7 and 8. How does this differ in content and proof strategy?