

Introduction to axiomatic systems and finite geometries covered in the class should have given you basic understanding that will allow you to read more complex texts and discuss the topic. In this reading/writing assignment, you will research two topics and submit a written summary of and reflection on what you read. The assignment has two parts that can be submitted separately.

Formal criteria:

- Choose a topic (see below) that you will research on your own. You can use printed or electronic resources to study from but make sure you clearly state the references.
- I will be happy to discuss any part of the assignment with you. However, please do not ask me to read a draft of your paper. Your submission must be final.
- There is no page limit, neither minimum nor maximum. The paper does not have to be long as long as you address all questions and requirements.
- Use a word processor with proper mathematical symbols and notation.
- You may draw pictures in an image editor and include them in the text. Alternatively, you may leave spaces in the text and hand-draw your pictures.
- Electronic submission your assignment (or assignments, if submitted separately) is preferable. However, if you use hand-drawn pictures, you may submit a hard copy instead.
- If you are submitting an electronic copy of your paper, name the file in the format **YourLastName_R** . For example, a student Samantha Smith would send a file named “Smith_AR” (R stands for Reading project). Feel free to ask any questions you might have about the assignment. In the subject of your message, clearly indicate that it is **Reading assignment submission**.

Part One: Finite Geometries

1. Finite geometries of Fano and Young.

Choose either Fano’s or Young’s finite geometry and provide

- a. Brief background (historical) information
 - b. List all the axioms
 - c. Sketch its model. Is there a different (not isomorphic) model?
 - d. Pick one theorem, state it and prove it.
 - e. If you chose Fano’s geometry, explain how Young’s geometry is different. If you chose Young’s geometry, explain how Fano’s geometry is different.
2. OPTIONAL: Finite geometries of Pappus and Desargues.

If you are interested to study more about finite geometries, instead of submitting #1, you may choose either Pappus’ or Desargues’ finite geometry and provide:

- a. Brief background (historical) information
- b. List all the axioms
- c. Sketch or describe its model.
- d. Pick one theorem, state it and prove it.
- e. If you chose Pappus’ geometry, explain how Desargues’ geometry is different and the other way around.

Part Two: Axioms for Euclidean geometry.

In class, we mentioned different sets of axioms for Euclidean geometry that serve various purposes. In this part of your reading assignment, you are going to study them more carefully. You don't have to copy all the axioms, just make sure you address the following questions.

You must include questions 1-3 and then choose one of the three options provided below.

1. Discuss the flaws of Euclid's axiomatic system.

Possible sources include comments on D. Joyce's website. See for example Euclid's proposition 4, 5, 26, etc.

2. Discuss Hilbert's role in and contribution to the axiomatization of Euclidean geometry.
3. Select 3 Hilbert's axioms (each from a different group) and provide their visual explanation.

Option 1:

- Explain (using pictures if suitable) all Birkhoff's axioms.
- Discuss the significance of Birkhoff's axioms.

Option 2:

- Provide background (historical) information on SMSG axioms.
- Discuss the number and independence of these axioms.
- Select 3 SMSG axioms that refer to different objects and provide their visual explanation.

Option 3:

- Optional: When we discussed completeness of axiomatic systems in class, we briefly mentioned that the efforts to find a system of axioms on which the whole mathematics (not just geometry) could be built failed. Even more, these efforts led to formulation and proving the Incompleteness theorems that have significant implications for the mathematics and its philosophy. Research the topic and provide (1) a brief historical background for these theorems, (2) state the theorems including your commentary/reflection and (3) briefly discuss their significance in mathematics.