

Quadrivium I

Lesson Plans

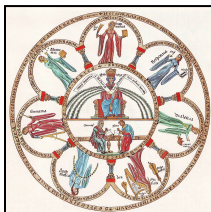
Week 5: Parallels

Overview: This short chapter introduces the use of the Fifth Postulate, which lets us conclude that two lines intersect based on their relationship to a third.

Cultivated Virtue: *Diligence (Temperance)*. In the thought of St. Thomas Aquinas, diligence can be seen as a quality of focused attention that breathes life into all of our moral intentions. It is rooted in love (*diligo*). It is also connected to the fruit of temperance, to unite duty and desire. We may not love what we are doing, but we can love the reason for doing it. If even that is a struggle, we can love the good Lord who wills the work for us. The diligent pupil is wholehearted in their efforts because they recognize their life as a student as a calling from God, a lowercase “v” vocation. Throughout your work this week, reflect on the quality of your attention. If the quality is lacking, it is a call to grow in temperance. Acts of fasting to grow in temperance will produce twofold fruit: it will free us from the attachments that rob us of our attention (distraction) while also adding clarity and focus to our work (what we desire for our attention; as Simone Weil would say, attention as prayer).

Assessment Preparation: Chapter 5 will be assessed by means of demonstrating proofs. Students should be prepared to prove Proposition 20 (I.16). Students will have the option to select one of the following to prove: Proposition 21 (I.27) or Proposition 22 (I.29).

Looking Ahead: Next week covers parallelograms, and culminates in the Pythagorean theorem (which talks about the equality of regions made from squares). It is important to observe that numbers (i.e., what we call “area”) are not used in the classical, Euclidean, purely geometrical formulation of the Pythagorean theorem. What is done right now, with parallel lines, is the key to the next chapter’s non-numerical approach to “area.”



Monday

Day 1 Journal Entry: Add a suitable heading. For example, “Chapter 5 Day 1—Parallels.”

- Add entries for Proposition 21 (I.27) and Proposition 22 (I.29) [see examples below for all such entries]

Proposition 21 (I.27). *Let a line intersect two others so that the alternate interior angles are equal. Then the lines are parallel.*

Proposition 22 (I.29). *A line intersecting two parallel lines makes the alternate interior angles equal.*

- Copy the two proofs (I.27 and I.29). Use your instruments and chapter 2 exercises to add diagrams for each proposition.

Tuesday

- I. **Recitation/ Prayer:** Begin by reciting the “Rules of a Virtuous Classroom” and praying “A Prayer Before Study” of St. Thomas Aquinas
- II. **Opening Reading Excerpt:** Carefully and critically read the following excerpt from Dr. Peter Ulrickson.

To study *A Brief Quadrivium* in its entirety is a challenging task, one that will take some time. Things that take a long time require us to be patient. It is good to know in advance some of the points requiring patience. [from *Magister*: We will look at just the third one today and the fourth one tomorrow. These are the same as last week. They are indeed that important!]

- Practicing the actions.
- Going from actions to explanations.
- **Understanding the statement given.**
- Understanding the proof of a statement.
- Understanding how the various statements form a single, structured body of thought.
- Understanding how the various disciplines—geometry, arithmetic, music, astronomy—themselves amount to one single thing, one way composed of four ways.

Understanding the statement given: The early propositions that we prove will be fairly straightforward and clear. Later assertions are more obscure. How do we shed light? Consider these questions when reading a statement. Do we understand all of the terms? Do we distinguish between the hypothesis and the conclusion? Do we have some grasp of a relation between the things given and the things sought? After patient work, reviewing, rereading, reconsidering, we eventually grasp the statement considered alone. The task of understanding is not complete, as clarified by the next couple of items in tomorrow’s reading.

Ponder this excerpt as you complete your work. Be sure to jot down any interesting questions or thoughts you’d like to share during the next class meeting.

- III. **Reading Excerpt from the Chapter:** Revisit your outline and inspectional reading of Chapter 5.
- Review the propositions from yesterday: Proposition 21 (I.27) and Proposition 22 (I.29). Be sure to apply the directions given in the opening readings from today and tomorrow.
 - Carefully and critically read Proposition 23 (I.30) and the preceding discussions about the term “transitive.”
 - **On scratch paper**, attempt Exercises 4 and 5. (You will use these attempts to refine your work later this week.)
- IV. **Day 2 Journal Entry:** Add a suitable heading. For example, “Chapter 5 Day 2—Properties of Parallels (1).”
- Add an entry for Proposition 23 (I.30).
 - Complete Exercises 6 and 7.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- V. **Close in Prayer:** As with all things, conclude with gratitude in prayer.

Wednesday (*Virtual Office Hours Day)

- I. **Recitation/ Prayer:** Begin by reciting the “Rules of a Virtuous Classroom” and praying “A Prayer Before Study” of St. Thomas Aquinas
- II. **Opening Reading Excerpt:** Carefully and critically read the following excerpt from Dr. Peter Ulrickson.

To study *A Brief Quadrivium* in its entirety is a challenging task, one that will take some time. Things that take a long time require us to be patient. It is good to know in advance some of the points requiring patience. [from *Magister*: We will look at just the fourth one today. Again, same as last week. They are indeed that important.]

- Practicing the actions.
- Going from actions to explanations.
- Understanding the statement given.
- **Understanding the proof of a statement.**
- Understanding how the various statements form a single, structured body of thought.
- Understanding how the various disciplines—geometry, arithmetic, music, astronomy—themselves amount to one single thing, one way composed of four ways.

Understanding the proof of a statement: Understanding a mathematical statement is just the beginning. The heart of mathematics is in the proof, the explanation of why a statement follows from others that have been accepted. It takes time to understand a proof. How does this one thing follow from a previous one? Am I forgetting something important? How can I keep all the details in mind? Is this account really persuasive, compelling, complete? These questions will come to mind as you wrestle with mathematical proofs.

- III. **Reading Excerpt from the Chapter:** Revisit your inspectional reading of Chapter 5.
- Read over the final proofs of the chapter.
 - Exercise **heroic patience** to critically and carefully study Proposition 24 (I.32).
- IV. **Day 3 Journal Entry:** Add a suitable heading. For example, “Chapter 5 Day 3—Properties of Parallels (2).”
- Add an entry for Proposition 24 (I.32)
 - Complete Exercises 1 and 2 (add 8 if you have time).
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- V. **Close in Prayer:** As with all things, conclude with gratitude in prayer.

Thursday

- I. **Recitation/ Prayer:** Begin by reciting the “Rules of a Virtuous Classroom” and praying “A Prayer Before Study” of St. Thomas Aquinas
- II. **Opening Reading Excerpt:** Carefully and critically read the following excerpt from Dr. Peter Ulrickson.
- Why Proofs?*
- Ordinary life acquaints us with the difference between the destination and the road taken. There are many ways to travel from Georgia to Maine. One is to fill up your gas tank and head north. Another is to buy a plane ticket. There is the Appalachian Trail though, too. The journey by foot is hardly straightforward. It is not “obvious.” Why do people—many, every year—bother taking the trail, and not the plane? To ponder this is to gain some appreciation for why we prove in mathematics.
- Ponder this excerpt as you complete your work. Be sure to jot down any interesting questions or thoughts you’d like to share during the next class meeting.
- III. **Reading Excerpt from the Chapter:** Review Proposition 24 (I.32) with heroic fortitude (patience).
- Exercise **heroic patience** to critically and carefully study Proposition 25 (III.31).
- IV. **Day 4 Journal Entry:** Add a suitable heading. For example, “Chapter 5 Day 4—Properties of Parallels (3).”
- Add an entry for Proposition 25 (III.31).
 - Copy the proof for Proposition 25 (III.31). Use your instruments and Chapter 2 exercises to add a diagram for the proposition.
- V. **Assessment Prep:** Review the assessment preparation on the first page. What do you need to do before Monday to prepare to excellently demonstrate excellent work? What are you willing to do? **Make a plan. Execute plan.**
- **Practice demonstrating with a partner.** Make this an essential part of your plan.
- VI. **Close in Prayer:** As with all things, conclude with gratitude in prayer.

Friday

- I. **Recitation/ Prayer:** Begin by reciting the “Rules of a Virtuous Classroom” and praying “A Prayer Before Study” of St. Thomas Aquinas
 - II. **Opening Reading Excerpt:** Reread the cultivated virtue of the week on the first page. Reflect on how you can grow in diligence.
 - III. **Reading Excerpt from the Chapter:** Revisit your inspectional readings of Chapters 4 & 5.
 - Review all of Chapters 4 and 5.
 - Review specifically the proof of Proposition 20 (I.16) in preparation for assessment.
 - IV. **Day 5 Journal Entry:** Add a suitable heading. For example, “Chapter 5 Day 5—Properties of Parallels (4).”
 - Copy the proof for Proposition 20 (I.16) from Chapter 4. Use your instruments and Chapter 2 exercises to add a diagram for the proposition.
 - V. **Optional Enrichment:** Try out any remaining exercises that are of interest to you from Chapter 4.
 - VI. **Assessment Preparation:** Practice for the Week 4 Assessment. Prompts for the assessment are given below.
 - Work on executing your plan.
 - **Practice demonstrating with a partner.**
 - VII. **Close in Prayer:** As with all things, conclude with gratitude in prayer.
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Week 5 Assessment

- State the two propositions about parallel lines and interior angles determined by a transversal. (i.e., I.27 and I.29)
 - Distinguish between the two propositions: which one requires the Fifth Postulate?
- Demonstrate a proof for Proposition 20 (I.16). Justify statements in the proof with reference to definitions, postulates, and/or other propositions.
- Prove Proposition 21 (I.27) or Proposition 22 (I.29) (select one).

