

Quadrivium I

Lesson Plans

Week 3: The Foundation of a Science

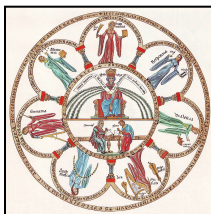
Overview: In the third chapter, the third week, we move from tangible, executable physical procedures to speech. This shift will persist for the remainder of this course and into the Quadrivium II course.

Cultivated Virtue: *Docility (Justice applied to an author or teacher)*. The virtue of *justice* consists in the firm and constant will to give God and neighbor their due. *Docility* is justice applied to a teacher (or anyone with God-given authority over us).

There is relatively little material in Chapter 3. However, students may find it tempting to get frustrated with the material seeming to be too abstract and too arbitrary. Trust your teacher who trusts the author who trusts the larger tradition within which the author is writing. In other words, exercise docility toward your teacher in this wider context. When the temptation to rush or eye-roll becomes too palpable to contain, just be faithful to the work knowing it is assigned with great care, wisdom, and benevolence.

Assessment Preparation: Chapter 3 will be assessed orally. Students should prepare to be able to say the following when prompted: ○ State some undefined terms. ○ Define “right angle.” ○ Define a term using undefined terms. ○ List the postulates exactly from memory.

Looking Ahead: This week we get some important terms and principles, but do not do any proofs. Proofs are the heart of mathematics. Students are encouraged to take some time this week to take a peek at Chapter 4 to see what they look like. By remembering where we are going (proofs) you can remain oriented as we talk about preliminary, foundational elements this week.



Monday

We will be working on the Week 2 Problem and discussing the first section of Chapter 3, *Terms*. If you are not able to attend on Monday in observance of Labor Day, send me an email (kylealbarado@gmail.com) to request the in-class Lesson Plan for Monday.

Day 1 Journal Entry: Add a suitable heading. For example, “Chapter 3 Day 1 Entry.”

- List out the terms given on p. 15.
 - Complete Exercises 1 and 2.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*



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.

The phrase *in medias res* means “in the midst of things.” This phrase originates in the Roman poet Horace. Horace wished to describe one way that good stories can be told. Listeners find themselves immediately, at the outset, in the middle of the tale.

What does this have to do with mathematics? We too must throw ourselves into the middle of the story. Things are already underway. Here is what I mean by that. We could spend a long time explaining exactly what is meant by “definition.” We could spend more time talking about how people prove things, and determining what sorts of things even admit of being proved. Then we could talk about what it means for certain things to be principles of reasoning, exploring what axioms and postulates are. These things are all good. They are all necessary, even. I do not think, though, that they should come first. It is impossible for most people, and especially for younger students, to make any sense of the conversation if they have no examples in mind of what these sorts of things look like concretely, in a specific mathematical situation. [from *Magister*: We will continue reading about this tomorrow. For today, consider how beginning *in medias res* requires the kind of docility described in the cultivated virtue of the week. How do we exercise justice to an author like Homer, an author who tends to throw us in the middle of things? How does this justice extend to a teacher when mathematics is wisely learned *in medias res*?]

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 inspectional reading of Chapter 3. Critically read and annotate the second section, *Postulates*, of the third chapter.
 - ***Repetitio Mater Memoriae*:** Spend time beginning to memorize the five postulates. Read them over repeatedly.
 - ***Recitatio*:** Recite the five postulates aloud repeatedly.
- IV. **Day 2 Journal Entry:** Add a suitable heading. For example, “Chapter 3 Day 2 Entry.”
 - Record the definition of “right angles” in section 3.1 *Terms*.
 - Complete Exercise 3.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- V. **Problem:** If time permits, consider working on the problem described on the last page.
- VI. **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.

[Continued from the previous reading about mathematics and *in medias res*.] What does this have to do with Chapter 3? Here is one example. *A Brief Quadrivium* does not give a substantial account of what a postulate is. There is a brief note, and then there are some postulates. Students will memorize them, and use them. There is no general “theory of postulation” in the book because I believe most people can only fruitfully discuss postulates in general after becoming familiar with them in some specific setting.

Daily plan for Wednesday continued on the next page.

Wednesday (continued)

II. Opening Reading Excerpt (cont.)

We have to keep moving, from the very beginning. This is how language works. Somehow, when we speak, we are confident that our words signify, that they make our thoughts intelligible to others.

There are two ways we could err in our motion. One is an excess, haste. The other is a defect, slowness. As you study and [maybe one day] teach the quadrivium you must continually examine: [am I] learning things deeply enough? And on the other hand, [am I] presuming to grasp things more deeply than our preparation warrants? Superficial learning is a sign of haste, but protracted discussion might also reveal a fault. [from *Magister*: It is prudent and studious to examine one's learning in this way. How is it also a reflection of justice and docility?]

Ponder this excerpt as you complete your work. Compare this excerpt to the cultivated virtue this week: docility. 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 inspectional reading of Chapter 3. Critically read and annotate the third section, *Proof*, of the third chapter.

- ***Repetitio Mater Memoriae***: Spend time continuing to memorize the five postulates. Read them over repeatedly.

- ***Recitatio***: Recite the five postulates aloud repeatedly.

IV. Day 3 Journal Entry: Add a suitable heading. For example, "Chapter 3 Day 3 Entry."

- Complete Exercises 5 & 6.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- Draw a picture illustrating the definition of "right angle." Be prepared to use this illustration to ***explain*** the definition.
- If prudent, complete Exercise 3 again.

V. Problem: If time permits, consider working on the problem described on the last page.

VI. 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. This is the same point requiring patience from last week. It is well worth considering again as we are right in the middle of going from actions to explanations.

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 second one this week.]

- 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.

Daily plan for Thursday continued on the next page.

Thursday (cont.)

Going from actions to explanations: After a couple of weeks of instrumental work, we will make a dramatic shift. Our goal will be not to make but to explain. Doing this is a dramatic advance in human thought. It means that we are concerned not only with what is useful, with what works. Instead, we strive to grasp *what is* and to give a comprehensible account of it in our own words. This is a different sort of mathematical activity than making and computing. Adopting the new perspective demands patience.

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:** Reread the whole chapter. Take the time to pause and identify the questions answered by the reading and those raised by the reading. *Take special note of those things that now stand out to you as being better understood.
- ***Repetitio Mater Memoriae:*** Spend time continuing to memorize the five postulates. Read them over repeatedly.
 - Practice Exercise 4.
- IV. **Day 4 Journal Entry:** Add a suitable heading. For example, "Chapter 3 Day 4 Entry."
- Take notes on your ability to demonstrate Exercise 4. Which postulates are easiest to recall? Which postulates are the most elusive to memorize?
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- 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?
- VI. **Problem:** If time permits, consider working on the problem described on the last page.
- VII. **Close in Prayer:** As with all things, conclude with gratitude in prayer.
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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:** Carefully and critically read the following excerpt from Dr. Peter Ulrickson.
- [Continued from the previous reading about mathematics and *in medias res*.] In the first century AD, the Roman author Quintillian wrote a work called *The Institutes of Oratory*. It influenced the way that people thought about liberal education throughout the Middle Ages. Quintillian considered an objection to the study of grammar, one that might well be transferred to mathematical speculation: will it not lead students to a pedantic, narrow focus on minutiae, weakening the mind and distracting them from more important things? This is a serious objection, and Quintillian grants that the danger indeed exists. His response, though, is not to abandon all study of grammar. Instead, Quintillian says that this kind of study injures only those who linger in it, but not those who pass through it.
- We must consider the foundation of mathematical thought in a similar way. We cannot skip them, and we must pass through them, but we also must not tarry in them. [from *Magister*: How is it imprudent to skip over or tarry in the foundations of mathematical thought? Which temptation is easier for you to fall into: being too hasty or too slow?
- III. **Day 5 Journal Entry:** Add a suitable heading. For example, "Chapter 3 Day 5 Entry."
- Copy the assessment prep section from the first page as a checklist.
 - Quiz yourself orally. Repeat aloud responses for Exercises 1, 4, 5, and 6. Consult the text as needed.
 - ***Repetitio Mater Memoriae:*** keep practicing as prudence and time allow.
- IV. **Problem:** If time permits, consider working on the problem described on the last page.
- V. **Close in Prayer:** As with all things, conclude with gratitude in prayer.
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Week 3 Problem

A few definitions:

Definition 1. A figure is said to be a **polygon** when it is enclosed by straight lines (a rectilinear figure).

Definition 2. A polygon is said to be **regular** when all of its sides are equal to one another.

Use your compass and straightedge to construct a regular six-sided polygon.

See if you are able to write out each step like the procedures from Chapter 2.