

Quadrivium I

Lesson Plans

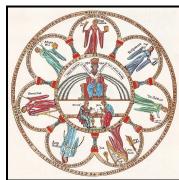
Week 7: Ratio

Overview: This chapter introduces a key concept, ratio. Ratio is the thing that ties together all four disciplines of the quadrivium. Our approach is to think about ratio first through geometry, but we will also use it in arithmetic.

Cultivated Virtue: *Perseverance (Fortitude)*. The virtues of *patience*, *perseverance*, and *constancy* can all sound very similar because they all fall under the domain of *fortitude*. In the thought of St. Thomas, fortitude ensures firmness of mind and constancy in doing the good. The principal act of fortitude is endurance. We are in the seventh week of our studies. It can be tempting at this point, if it hasn't already been a temptation, to become tired of the hard work and just try to coast along. *Perseverance* is the courage to endure in pursuit of the good in our studies even when we grow tired or when success becomes harder to see. Develop deep inner strength this week through cultivating *perseverance* in your efforts to overcome mediocrity and pursue excellence, even in the small things. Each day, focus on the task at hand. Build on last week's virtue, solitude, to devote yourself to the assigned tasks.

Assessment Preparation: Chapter 7 will be assessed by means of demonstrating proofs. Students should be prepared to prove Proposition 42 (VI.1) from memory. Students will have the option to select one of the following to prove: Proposition 43 (VI.2) or Proposition 45 (VI.8).

Looking Ahead: Next week, Chapter 8 on the golden ratio, concludes the study of geometry. Next week's material will probably seem easy in comparison to the work done this week. For now, persevere, knowing that the effort will pay off.



Monday

Day 1 Journal Entry: Add a suitable heading. For example, "Chapter 7 Day 1—Repetition and Comparison."

- Add entries for Definition 38, Definition 39, Definition 40 and Definition 41 [see example below for all such entries]

Definition 38. *A ratio is a relationship of size between two things of the same kind.*

- Complete Exercises 1, 2, 3, and 4.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*

Tuesday

- II. **Recitation/ Prayer:** Begin by reciting the “Rules of a Virtuous Classroom” and praying “A Prayer Before Study” of St. Thomas Aquinas
- III. **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. Yes. Yes. Again. These are the same as last week...and the previous two weeks before. They are verily, 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.

- IV. **Reading Excerpt from the Chapter:** Reread section 7.1
- Critically read and annotate section 7.2: Ratio and Proportion in Plane Figures
 - Recall that there were two ways to talk about equality of triangles, a strict way and a loose way. The comparison of triangles in Proposition 42 (VI.1) involves the looser sense. In other words, if the bases are the same, the triangles are the same *under some decomposition into smaller pieces*. They might not have the same angles.
 - Proposition 43 (VI.2) is phrased tersely. It is important to read the statement, look at the diagram, and skim over the proof, then go back to the diagram to nail down exactly what is being discussed. Do not simply wrestle with the statement of the proposition.
- V. **Day 2 Journal Entry:** Add a suitable heading. For example, “Chapter 7 Day 2—Ratio and Proportion in Plane Figures.”
- **Cultivated Virtue: Solitude.** Seek solitude while working on your journal entry.
 - Add an entry for Proposition 42 (VI.1) and Proposition 43 (VI.2).
 - Complete Exercises 5, 6, 7, and 8.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- 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.

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 and the two before. Seriously, this point is 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:** Review section 7.2
- Critically read and annotate section 7.3: Similarity and Right Triangles through the proof of Proposition 46 (VI.19).
 - Be sure to read things like $AC : AB$ as “the ratio of AC to AB ” when reading the proof of Proposition 46. Do not fall into passive absorption of the symbols, or sloppy use of language. Practice reading aloud.
- IV. **Day 3 Journal Entry:** Add a suitable heading. For example, “Chapter 7 Day 3—Similarity and Right Triangles (1)”
- **Cultivated Virtue: Solitude.** Seek solitude while working on your journal entry.
 - Add an entry for Proposition 44 (VI.4), Proposition 45 (VI.8), and Proposition 46 (VI.19 Porism)
 - Make a diagram illustrating Proposition 46.
 - Complete Exercise 9.
 - *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.

Forgetfulness

Plato’s dialogue *Meno* reminds us that we might already have all that we need, for mathematics and for virtue, although we will need to do some searching within. There is another side of knowing well and doing well, though; we have all acquired habits worth losing. The Greek word for truth is *aletheia*. The initial letter functions just as it does in our words *agnostic* and *amoral*, indicating that *aletheia* is being without *lethe*, forgetfulness. The river Lethe, a river of oblivion, was a feature of ancient mythology. While its classical valence is ambiguous, Dante gave the stream of forgetfulness a decidedly positive place, setting it atop the mountain of Purgatory. That the newly purified might rise to the heavenly spheres, they must first bathe in its waters and forget their sins.

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 7.

- Critically read and annotate all of section 7.3: Similarity and Right Triangles.

IV. **Day 4 Journal Entry:** Add a suitable heading. For example, “Chapter 7 Day 4—Similarity and Right Angles (2).”

- **Cultivated Virtue: Solitude.** Seek solitude while working on your journal entry.
- Add an entry for Theorem 47 (VI.31)
- Complete Exercises 10 and 11.
 - *Be sure to write the prompt for each exercise.*
 - *Use impeccable grammar: Be clear, concise, accurate, and eloquent.*
- (Optional) Attempt Exercises 13-17.

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 perseverance.
 - III. **Reading Excerpt from the Chapter:** Reread the whole chapter
 - Reflect on how the exercises this week contribute to understanding the chapter.
 - IV. **Day 5 Journal Entry:** Add a suitable heading. For example, “Chapter 7 Day 5—The Pythagorean Theorem (3).”
 - **Cultivated Virtue: Solitude.** Seek solitude while working on your journal entry.
 - Complete Exercises 2-7. (These responses for Friday will be closely assessed.)
 - V. **Optional Enrichment:** Try out any remaining exercises that are of interest to you from Chapter 7.
 - VI. **Assessment Preparation:** Practice for the Week 7 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 7 Assessment

- Complete Friday’s Exercises with great diligence. (They will be carefully reviewed with an eye toward demonstrations of your learning)
- Demonstrate a proof for Proposition 42 (VI.1). Justify statements in the proof with reference to definitions, postulates, and/or other propositions.
- Prove Proposition 43 (VI.2) or Proposition 45 (VI.8) (select one).

