

High School Geometry Lesson Plan: Parallel Lines and Transversals

Introduction

Each lesson in the Adolescent Literacy Toolkit is designed to support students through the reading/learning process by providing instruction before, during, and after reading/learning.

Note that lessons incorporate the *gradual release of responsibility* model. When this model is used within a single lesson and over several lessons, students are provided with enough instruction and guidance to use the literacy strategies on their own. The following lesson includes some examples of explicit instruction and modeling, guided practice, and independent practice, but students need more practice and feedback than is possible within the context of a single lesson.

Bold print indicates a direct link to the *Content Area Literacy Guide* where readers will find descriptions of literacy strategies, step-by-step directions for how to use each strategy, and quadrant charts illustrating applications across the four core content disciplines.

The following lesson plan and lesson narrative show geometry teachers how they can incorporate the use of literacy strategies to support high school students to learn geometry content and concepts. The lesson is designed for one block period (80–90 minutes) or two traditional classes (50 minutes).

Instructional Outcomes

NCTM standards: 1.2 Solve problems that arise in mathematics and those involving mathematics in other contexts; 3.2 Use the language of mathematics to express ideas precisely; 11.3 Analyze characteristics and relationships of geometric shapes and structures.

Content Learning Outcome: Students will more easily learn and recall geometric terms, thus improving their understanding of geometric concepts and the precision of their use of terms when discussing how they solve problems and when they ask questions.

Literacy Support Strategies and Instruction

Before reading/learning: **Triple-Entry Vocabulary Journal** (teacher modeling)

- Materials: Template for **Triple-Entry Vocabulary Journal** with example for *parallel lines*

During reading/learning: **Triple-Entry Vocabulary Journal** (guided practice)

- Materials: Text chapter explaining *types of lines, transversals, and angles*

After reading/learning: **Quick Write** (individual practice)

- Materials: Student-generated brainstorming list of real-life situations aligned to *parallel lines and transversals*

Before Reading/Learning (10 minutes)


Literacy outcome: Students will be introduced to a strategy for building their mathematical vocabulary, the **Triple-Entry Vocabulary Journal**.

Teacher preparation: Review the chapter in the textbook related to types of lines, transversals and angles. Prepare a list of related key vocabulary terms that are important for students to understand (e.g., *parallel lines, right angle, perpendicular lines, skew lines, transversals, interior angle, exterior angle, consecutive interior angle, alternate exterior angle, alternate interior angle, and corresponding angle*).

Teacher facilitation:

- 1) Introduce the **Triple-Entry Vocabulary Journal** by giving students a template with the page split into three columns labeled *Word in Context*, *Definition in My Own Words*, and *Picture, Memory Aid, Phrase*.
- 2) Consider whether there might be a necessary order for learning the words, e.g., *right angle* before *perpendicular*. In other words, consider if there are definitions that might be dependent on one of the preceding vocabulary words.
- 3) Draw three columns on the board and label as in the template distributed to students. Look at the page in the chapter where parallel lines are introduced. In the first column jot down the sentence in which the term “parallel lines” appears and the page number.
- 4) Explain what clues you see in the text explanation of the term that help you write a definition in your own words. Stress that “in my own words” means in words that I can understand, but, in mathematics, these words should be used precisely and accurately.
- 5) Draw a memory aid that will help you recall the definition. For example, explain that *parallel* lines are the same distance apart, such as the railings in the escalator clip art below.
- 6) Stress that while the mall escalator image shows parallel lines, everyone may have different memory aids. Brainstorm or suggest others (e.g., swimmers staying in their lanes, chair legs being parallel for a sturdy seat, or driving lanes on the highway).

Sample of a Triple-Entry Vocabulary Journal Template

Word in Context	Definition in My Own Words	Picture, Memory Aid, Phrase
<p>Parallel: Two lines in a plane that never meet are called parallel lines. The term parallel and the notation (\parallel) are used for lines, segments, rays, and planes.</p>	<p>Lines that are continuously the same distance apart, such as the railings on stairs.</p>	

- 7) Together with the class, complete an entry for *right angles* and *perpendicular lines*.
- 8) Remind students to begin by locating where the term is explained in the text and recording it in the left column.
- 9) Emphasize that “writing a definition in one’s own words” means it must be paraphrased while still retaining the same meaning as the text definition.
- 10) Have students *Turn and Talk* about how they would define the word before asking for suggestions for each sample entry.
- 11) Encourage students to create and draw their own memory aid and to share these in small groups or with the whole class.

During Reading/Learning (45 minutes)

Literacy outcome: Students will discuss and synthesize textbook definitions using visualization and personal connections to deepen understanding of how to define and retain new vocabulary.

Teacher facilitation:

- 1) Pass out a **Triple-Entry Vocabulary Journal** page with the following terms written in the left column, along with page numbers where they can be found (e.g., *skew lines*, *transversals*, *interior angle*, *exterior angle*, *consecutive interior angle*, *alternate exterior angle*, *alternate interior angle*, and *corresponding angle*).
- 2) Ask students to read along as you read aloud the text pages that describe the above terms. As the words are introduced in the text, pause to allow students to write the term in context, their own (but still precise) definitions, and to draw a memory aid. Continue for a few terms. Then ask students to continue to read the chapter in pairs and complete their journals.
 - Have students discuss the words and explain their memory aids with a partner.
 - Encourage students to use precise drawings, graphic visualizations, or descriptive phrases rather than rote copying of the angle graphics from the text.
 - Help students picture how the angle would look in real-life applications and generate examples like pizza slices, road traffic patterns, fruit orchard layouts, and so on.
 - Tell students they are to add new terms to their **Triple-Entry Vocabulary Journal** throughout the unit.
 - Ask student volunteers to come up to the board and share one journal entry with the class by writing their entries for one term in each of the three columns.

After Reading/Learning (25 minutes)

Literacy outcome: Students will use writing to summarize.

Teacher facilitation:

- 1) Ask students to do a **Quick Write** to show their understanding of the mathematical terms discussed in the chapter.
 - Explain they should write about the real-world application for two of the terms from the journal. Refer them back to the list brainstormed by the class for ideas.
 - Explain the **Quick Write** should be about one half to one page long.
 - Clarify that a **Quick Write** is focused on quickly conveying content and ideas rather than writing conventions, grammar, or spelling.

Like all student-completed literacy strategy templates, these completed **Triple-Entry Vocabulary Journals** and **Quick Writes** provide valuable data for teacher reflection. The **Triple-Entry Vocabulary Journals** should not be graded. The student responses are used to assess student learning and make decisions about next lessons.

Suggested Subsequent Lessons

Continue to use the **Triple-Entry Vocabulary Journal**, consistently modeling at least one vocabulary term and having students practice a few together before assigning other terms. Establish the habit that students will continue to add words to the journal throughout the semester during class and when doing homework. After students have had sufficient practice

with this strategy, you may also want to ask them to provide their own definitions for key terms on mathematics exams throughout the year.

High School Geometry Lesson Narrative: Parallel Lines and Transversals

Teachers: As you read the lesson narrative, think about the following questions. You may want to discuss them with fellow mathematics teachers.

- *What does the teacher do to support students' literacy development and content learning before, during, and after reading/learning?*
- *What challenges do you anticipate if you were to implement this lesson in your own classroom? How would you prepare to meet these challenges?*
- *How would you make improvements to this lesson?*

Ms. Taylor knew her students were having a difficult time learning, remembering, and using correct mathematics terminology. They tuned out when she repeated definitions for terms or asked them to write definitions in their notes. What would be a more engaging strategy for teaching new mathematics terms? How could she help them organize their terminology notes so they could use them as a reference? She decided to try using the literacy strategy of the **Triple-Entry Vocabulary Journal**. She began to think about how to introduce the strategy to the students.

Before Reading/Learning

Students were surprised when Ms. Taylor had a large photo of herself, taken on the stairway of the local shopping mall, projected on the board. Students were clearly curious why the photo was being shown. She began the class by explaining she was going to share a strategy to help them learn and remember mathematics terms and concepts related to lines, angles, and transversals. She distributed a template for the **Triple-Entry Vocabulary Journal** which had three columns labeled *Word in Context*; *Definition in My Own Words*; and *Picture, Memory Aid, Phrase*. She told them they'd be using the new journal format to record and learn new vocabulary related to lines, angles, and transversals. "Let's start with a simple example: parallel lines. Look on page 48 in your text. A cornfield is pictured with rows and the text says, *two lines in a plane that never meet are called parallel lines*. The term parallel and the notation \parallel are used for lines, segments, rays, and planes. From these context clues, like the picture and especially the \parallel graphic, and my prior knowledge about the parallel bars in gymnastics, for instance, I can figure out that parallel lines are lines which are continuously the same distance apart, such as the railings on stairs. Are you with me?"

A few of the students nodded as she continued, "Now comes the part where I use visualization and my imagination. How can I create a drawing or short phrase to help me remember my definition? Here's what made sense to me." Ms. Taylor walked close to the projected photo on the front wall. "What do you see here that relates to the concept of *parallel*?" Bethany offered "The railings are sorta like the notation \parallel but going the opposite direction." "Yes, that's it! And when I go to the mall, I see people hanging onto those railings like their lives depend on it. So if I shut my eyes and let a visual image come to my mind about parallel lines, I envision those railings. The **Triple-Entry Vocabulary Journal** helps you make a connection to the word, what it means, and a picture in your head of something familiar." Ms. Taylor asked for a volunteer to explain why she might have them do this. Peter said, "Well, you, I mean, well, you see those escalator walls in your head, and it seems a bit crazy to me, but when it happens to you, you make a connection so you can remember what parallel lines are." "Exactly," said Ms. Taylor.

"In a few minutes, each of you will practice in a small group using the **Triple-Entry Vocabulary Journals** as we read and review the properties of *parallel lines*, *angles*, and *transversals*. For

each term you come to, you'll discuss with your group what you think the word means and what clues you found in the text to determine the meaning. Then you can either start by writing the definition in your own words or you can come up with a visual to represent the meaning of your word. I would like each person to complete his or her own **Triple-Entry Vocabulary Journal** so you can use it later when we add words or if you want to study from it. But I encourage group members to talk, think out loud, help each other, and brainstorm visual representations. Let's finish this one for *parallel lines*." She led them in a step-by-step process to analyze the contextual clues in the text, write a definition, and draw a memory aid. "Do you understand what to do?" Several students responded, "Not really..." So Ms. Taylor walked them through another term, *perpendicular lines*, still thinking aloud, but this time eliciting thinking from students as much as possible to get them ready to work in groups. First, she asked students to find the word in context and explain what clues on the page could be used to find the meaning. She helped students to identify clues in the text, had them turn and talk to try to use those clues together, and then asked for contributions when she began to write on the overhead, creating a definition using their words. Finally, Ms. Taylor asked for suggestions for a visual representation of *perpendicular lines* in order to illustrate the concept. She sketched one example on the overhead.

During Reading/Learning

Ms. Taylor continued the lesson, "As you can see from the remaining terms in the left column, I've given you a variety of words and page numbers so you and your partner can read them in context in your geometry text." Ms. Taylor put students into pairs. She asked them to first read over the section of the text pertaining to this topic. The terms in the **Triple-Entry Vocabulary Journal** were in bold print: *parallel lines*, *perpendicular lines*, *skew lines*, *transversals*, *interior angle*, *exterior angle*, *consecutive interior angle*, *alternate exterior angle*, *alternate interior angle*, *corresponding angle*.

"Let me summarize again what you'll do." She explained they would look for context clues in the surrounding sentence, use their knowledge about prefixes/roots/suffixes to analyze the term, and decide whether to use the glossary or index to find more information. "Once you have a pretty clear idea about the word's meaning, you will discuss a definition in your words, not the book's, to enter into column two. Then in column three you will draw an illustration, cartoon, graphic, or a phrase if you need some words. The goal is to create a memory aid to help you recall the meaning of the term and to connect the word to something you know about already to try to deepen your understanding." Noticing a few students still looking a bit confused, she went to the whiteboard and drew a rough sketch of a pepperoni pizza. "And if I drew this pizza with one slice this big and another slice this small, what term might this illustration represent?" "Some kind of angle," said Martha. "Which kind?" replied Ms. Taylor. "Well, they are both *acute*," said Walter. "Good!" said Ms. Taylor.

"Now let's work through the chapter together. As we read, we'll stop when we encounter new words. You will add those to the **Triple-Entry Vocabulary Journal** so you can create your definitions and draw your memory aids." A fair number of students were attentive as they read about the types of angles and transversals, spontaneously sharing their drawings with nearby students. As the class neared the end, she noted with surprise that two students who usually hated any writing tasks were busily drawing although neither had written any definitions. She acknowledged the quality of the drawing and asked each to explain one of their drawings. When each student did so, Ms. Taylor pointed out that was exactly what they needed to write for their definitions.

As the class ended, Ms. Taylor reiterated they would be defining terms during the next few classes, then they'd practice completing the **Triple-Entry Vocabulary Journals** on their own as part of their homework. She encouraged the students to be creative and have fun with the memory aids. "You can use stick figures, graphic visualizations, descriptive phrases, humor, real-life applications—but you can't simply copy the graphic in the text."

After Reading/Learning

Once the students had completed the chapter on parallel lines, transversals, and angle theorems, Ms. Taylor decided to ask them to make connections between the concepts they had discussed and real-life applications by having them do a **Quick Write**. One student inquired, "What do you mean by real-life application?" Ms. Taylor began to brainstorm ideas on the board and students added their own ideas: road traffic patterns, sports, architecture, airplane routes/collisions, and several others. "Show your understanding of the mathematical terms used in this chapter. For each of three terms, write down two real-life applications." She explained to the students that they should focus on the content and ideas, not grammar or spelling, as they do not "count" in a **Quick Write**. She explained students should limit their writing to one page. To stimulate their thinking, she also had posted a painting, a photograph, and a magazine ad that used *transversals*. She watched as students, who normally grumbled if she gave any writing during mathematics class, settled down to begin writing.