

Looking Between the Lines

Parallel Lines, Transversal Lines, and Angles

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Grade Level	10th Grade	**Time Frame**	180 Minutes
Subject	Mathematics	**Duration**	3 Class Periods
Course	Geometry		

Essential Question

How do the angles formed by two parallel lines and a transversal relate to one another?

Summary

This lesson focuses on an extension of parallel lines by exploring what happens when a transversal line passes through them. The goal is for students to understand the different angles that form due to the intersection and to apply that knowledge to real-world situations. Students will be able to identify special angle pairs and then solve problems in real-world scenarios using those properties.

Snapshot

Engage

Students brainstorm places where they have seen parallel lines in real life.

Explore

Students use a protractor to measure different angles and compare their findings.

Explain

Students review the definitions of different types of angles and determine how they apply to real-world situations.

Extend

Students design a blueprint of their dream town, complete with at least one transversal street and all four types of special angle pairs that are covered in this lesson.

Evaluate

Students analyze their peers' blueprints, provide feedback, and work through practice problems.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

G401: Use properties of parallel lines to find the measure of an angle

Oklahoma Academic Standards Mathematics (Geometry)

G.2D.1.1: Use properties of parallel lines cut by a transversal to determine angle relationships and solve problems.
G.2D.1.3: Apply the properties of angles (corresponding, exterior, interior, vertical, complementary, supplementary) to solve problems using mathematical models, algebraic reasoning, and proofs.

Attachments

- City Design Rubric—Looking Between the Lines.docx
- City Design Rubric—Looking Between the Lines.pdf
- Diving into the Vocab—Looking Between the Lines.docx
- Diving into the Vocab—Looking Between the Lines.pdf
- Exit Ticket—Looking Between the Lines.docx
- Exit Ticket—Looking Between the Lines.pdf
- I Notice, I Wonder—Looking Between the Lines.docx
- I Notice, I Wonder—Looking Between the Lines.pdf
- Lesson Slides—Looking Between the Lines.pptx
- Lines and a Protractor—Looking Between the Lines.docx
- Lines and a Protractor—Looking Between the Lines.pdf

Materials

- Lesson Slides (attached)
- Lines and a Protractor handout (attached; one per student)
- Diving into the Vocab handout (attached; one per student)
- I Notice, I Wonder handout (attached; one per student)
- Exit Ticket handout (attached; one per student)
- City Design Rubric (attached; one per student)
- Protractor
- Markers or Colored pencils
- Ruler
- Butcher Paper or Chart Paper

30 minutes

Engage

Introduce the lesson using the attached **Lesson Slides**. Use **slides 2–4** to introduce the lesson title, essential question, and the lesson objective.

Display **slide 5** and introduce students to the Collective Brain Dump strategy. Instruct students to answer the question on the slide. As they respond, write down their answers on the board or on a piece of chart paper. After all students have shared out, review their responses and facilitate a brief class discussion. Highlight any particular comments about city or street designs.

30 minutes

Explore

Teacher's Note: Expected Prior Knowledge and Skills

In this section, students will use protractors to measure angles. Prior to this section, make sure that students know how to read and use a protractor. Or provide them with a demonstration at the beginning of this section.

Display **slide 6**. Pass out one copy of the attached **Lines and a Protractor** handout to each student. Place students in groups of two (or three) and pass out a protractor to each group. Within each group, have students investigate the relationships among different angles by drawing lines on their own worksheets and then measuring the angles. Instruct each person in the group to draw a line through the two parallel lines that is *not* perpendicular under the “Trial #1” section. Ask each student to shade the acute angles with one color and shade the obtuse angles with another color.

Display **slide 7**. After shading the angles, group members should take turns determining the exact measurements of each angle and writing the measurement in the shaded region. Have students talk about their measurements and the relationships among them.

After they discuss their findings, have students repeat the process with “Trial #2.” Inform students that they should try to make a line that is different from their first line. Have them try going in a different direction or changing how steep their line is. Advise them to shade, measure, and discuss as they did in Trial #1.

30 minutes

Explain

Display **slide 8** and introduce the students to the Think-Pair-Share strategy.

With a partner, students should write a statement at the bottom of their worksheets based on their findings during the Explore activity. Explain to students that the line they drew through the parallel lines is called a transversal. Ask students to be as specific as they can with their claim about how the angles were created when a transversal crossed parallel lines related to each other. Once each student pair creates a statement, have them join another pair to share their statements in groups of four. After students discuss in their small groups, bring all students back together and then discuss the following questions as a class:

- Did your findings differ or were they similar to others?
- What do we now know about parallel lines when a transversal cuts through them?

Display **slide 9** and ask them to reflect on the activity.

Display **slide 10**. Pass out the **Diving into the Vocab** handout to each student. Instruct them to create definitions for parallel lines, transversal lines, corresponding angles, consecutive interior angles, alternate interior angles, and alternate exterior angles as a class.

Instruct students to turn to the back of the Diving into the Vocab handout. Move to **slide 11**. Have them as a class, go over how to solve for x using alternate interior angles. Show students they may have to set the equations equal to each other. Have students work through the problems as you work through them. Go over how to solve for x using consecutive interior angles. Explain that the equations add up to 180°. Allow students to make notes as they are following along on their paper. Have them check their work by plugging the answer back into x and seeing what their values are for those angles. Add more examples as needed.

30 minutes

Extend

Display **slide 12**. Remind students of the activity they completed at the beginning of the lesson when they looked at pictures and had to write captions for what they saw. Ask them what they see now in the picture on the slide after knowing more about angles in relation to parallel lines.

After having a brief class discussion, set up a scenario where each student is the mayor of a new town and gets to help design its layout. Pose the following question to the class: *What needs to be in a town for people to survive and thrive?* Let them talk with their peers and then have a few students share their ideas with the class.

Display **slide 13**. Pass out butcher paper or chart paper to each student and a copy of the **City Design Rubric**. By now, students should be able to envision what components make up a town, including a grocery store, a school, etc. Display **slide 14** and explain to students they will create their own blueprint of their dream town. The town can be designed any way they would like, but it must have these components:

- Name of the town
- Streets that are parallel, with at least one street that is transversal to them
- Buildings or landmarks located at corresponding angles
- Buildings or landmarks located at consecutive interior angles
- Buildings or landmarks located at alternate interior angles
- Buildings or landmarks located at alternate exterior angles
- Two algebraic problems involving the angles that require students to solve for x

Encourage students to be creative and have fun with it! Let them know their blueprints will be displayed around the room and will be used to wrap up the lesson.

30 minutes

Evaluate

Display **slide 15** and pass out the **I Notice, I Wonder** handout to each student. Have each student hang up their city design around the room. Introduce students to the I Notice, I Wonder instructional strategy. Explain that students will move to different posters and write down one thing they notice (observations) and one thing they wonder (questions). Inform students that they should write the name of the cities so that they remember the feedback. They should go to at least three different city designs.

Once students have visited three cities, move to **slide 16** and pass out one copy of the **Exit Ticket** handout to each student. Have students complete the Exit Ticket.

Resources

- K20 Center. (n.d.). Bell ringers and exit tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Collective brain dump. Strategies. https://learn.k20center.ou.edu/strategy/111
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.). Think-pair-share. Strategies. https://learn.k20center.ou.edu/strategy/139