Transparent Transversals

Angle Pair Relationships: Parallel Lines Cut by a Transversal

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Grade Level	10th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	100 minutes
Course	Geometry		

Essential Question

How can we determine the measures of angles?

Summary

Students will determine the relationships between different pairs of angles formed when parallel lines are cut by a transversal.

Snapshot

Engage

Students engage their prior understanding angles using a Quick Draw activity.

Explore

Students sort cards according to the pairs of angles displayed on the cards.

Explain

Students explain the way in which they sorted their cards and the teacher will provide the proper vocabulary to describe each group formed by the students.

Extend

Students determine the relationship between the measures of angles for each kind of angle pair.

Evaluate

Students determine which lines in a diagram are parallel.

Standards

Oklahoma Academic Standards for Mathematics (Grades 9, 10, 11, 12)

G.2D.1.1: Apply the properties of parallel and perpendicular lines, including properties of angles formed by a transversal, to solve real-world and mathematical problems and determine if two lines are parallel, using algebraic reasoning and proofs.
G.2D.1.2: Apply the properties of angles, including corresponding, exterior, interior, vertical, complementary, and supplementary angles to solve real-world and mathematical problems using algebraic reasoning and proofs.

Attachments

- Angle Pair Cards—Transparent Transversals.docx
- Angle Pair Cards—Transparent Transversals.pdf
- Demonstration Angles—Transparent Transversals - Spanish.docx
- Demonstration Angles—Transparent Transversals - Spanish.pdf
- Demonstration Angles—Transparent Transversals.docx
- Demonstration Angles—Transparent Transversals.pdf
- Quick Draw Image for Parallel Lines—Transparent Transversals.docx
- Quick Draw Image for Parallel Lines—Transparent Transversals.pdf
- Transparent Transversals Evaluate—Transparent Transversals - Spanish.docx
- Transparent Transversals Evaluate—Transparent Transversals - Spanish.pdf
- Transparent Transversals Evaluate—Transparent Transversals.docx
- Transparent Transversals Evaluate—Transparent Transversals.pdf
- Transparent Transversals Lab—Transparent Transversals - Spanish.docx
- Transparent Transversals Lab—Transparent Transversals - Spanish.pdf
- Transparent Transversals Lab—Transparent Transversals.docx
- Transparent Transversals Lab—Transparent Transversals.pdf

Materials

- Angle Pair Cards (attached; printed, cut apart, and placed into decks, one deck per 2 - 3 students)
- Quick Draw Image for Parallel Lines (attached)
- Transparent Transversals Lab handout (attached)
- Transparent Transversals Evaluate (attached)
- Demonstration Angles (attached)
- Patty Paper or Wax Paper cut into 4-inch squares (two squares per group)
- Sticky notes

Engage

Teacher's Note

Before beginning this lesson, print and cut out the angles on the attached Angle Pair Cards for you to use in the Extend portion of the lesson.

For this Engage Quick Draw activity, show students the **Quick Draw Image for Parallel Lines**. Tell students that you are going to show them the image for 3 seconds. During the 3 seconds, they are to observe the image so they can reproduce it after the three seconds are over.

Show the students the image for 3 seconds.

Give students 2 minutes to redraw the image in their notebooks or on paper.

Ask students if they would like to have another look. If students respond positively, display the image for another 3 seconds and give students 2 more minutes to edit their drawings.

Ask students what they saw the first time they looked at the image. Have several students respond. Encourage creativity. Some might say a chessboard or dance floor or offer other interpretations of the drawing. Acknowledge all of the various interpretations.

Ask several students what they did to draw the figure.

If a student mentions parallel lines, ask the student which lines are parallel and how they know. If no students mention parallel lines, ask students to examine the picture to determine which lines are parallel. Facilitate a discussion with the students until they are able to communicate that several lines appear to be parallel, but in actuality, they may or may not be.

Tell students that today they are going to learn how to examine diagrams, like the Quick Draw, and determine if any of the lines are parallel using angle measurements.

Explore

Pair students or put students into groups of three.

Pass out one deck of **Angle Pair Cards** to each pair or group.

Explain that each card shows a set of parallel lines and a transversal, a line that intersects the two parallel lines.

Have students examine one card at random. Ask students to write one sentence describing the relationship between the positions of the two starred angles. Their descriptions should refer to the parallel lines as well as to the transversal. Example descriptions include:

- Both angles are above a parallel line and to the left of the transversal.
- The angles are both inside the parallel lines on opposite sides of the transversal.
- The angles are both outside the parallel lines on the same side of the transversal.

Teacher's Note

You may want to give students one or two examples before having them write their own descriptions.

One at a time, have several pairs or groups hold up the card they examined and read their descriptions. Other groups should check to see if the description makes sense to them.

Once students have an idea of how to write a description of the angle-pair relationship, tell students that their job is to sort the cards into categories so that all of the angle pairs in a category can be described in the same way. There must be at least three cards in each category they make, and they must write a description for the angle pair relationships of each category.

Give students 10-20 minutes to sort their cards and write their descriptions.

Explain

Choose a group and have the group come to the front of the room and display the cards in one of their categories on the document camera or overhead projector.

Teacher's Note

If you do not have a document camera you can enlarge one set of cards so that each card is a half-sheet of paper in size and visible to all students. Groups can pick out the cards in their category from this deck in order to display them to the class.

Have the group read the description they wrote for this category. Ask the other groups if they had a category with the same cards in it (and no others). If so, have that group read their description of the category as well. Ask students to determine if the two descriptions are compatible. Ask if any other groups had an equivalent category until no more groups respond.

Once students understand the description and relationship between the angles shown, tell students the vocabulary word used to describe that relationship (corresponding, alternate interior, vertical, etc.). Have students write the word and one of the descriptions given in their notebooks or journals.

Ask a second group to come to the front of the room and share a different category they created. Repeat the above process, ending with writing the vocabulary term for their category in notebooks. Continue having groups share categories until all groups report that they have no more categories to share.

At this point, students should have all the vocabulary associated with angle pair relations in their notebook.

Extend

Pass out the **Transparent Transversals Lab** handout.

In the diagram box, have students use a ruler to create a diagram of parallel lines cut by a transversal by tracing along both edges of the ruler before re-positioning it to create a transversal. Emphasize that they can draw the parallel lines and transversal in whichever directions they want, as long as the transversal intersects both parallel lines.

Have students label the eight angles formed on their diagrams with the numbers one through eight.

For each angle-pair relationship listed on the lab sheet, have students name as many pairs of angles fitting that description as they can.

Teacher's Note

Since students may hay have labelled their diagrams differently, their answers to this part will differ.

Ask students how many pairs of corresponding angles they were able to identify. They should be able to identify four pairs. If several students were unable to identify all four pairs of corresponding angles, have one student come to the board, redraw their diagram, and point out the pairs that were identified. Ask other students to identify additional pairs. Be sure that students record all four pairs on their lab sheets.

Repeat the above procedure for alternate exterior, same-side exterior, alternate interior, and same-side interior angle pairs. Students should be able to identify two pairs of each of these kinds of angle pairs. Make sure students record these on their lab sheets.

Next, have students trace their diagrams onto a piece of wax paper or tracing paper, including the labels of their angles

Using the angles supplied in the **Demonstration Angles** handout, review the terms congruent, supplementary, and supplementary as follows:

- Hold up angle A and angle B so that both of the sides of angle A fall on the corresponding sides of angle B. Ask students what kind of angles A and B are. Students should be able to say that these angles are congruent. Define the term if needed.
- Hold up angles A and C so that one side of A aligns with one side of C and the two angles do NOT overlap. Ask students to identify this angle relationship. Students should say that A and C are supplementary. Define the term if needed.
- Hold up angles A and D so that one side of A aligns with one side of D and the two angles do NOT overlap. Ask students to identify this angle relationship. Students should say that A and C are complementary. Define the term if needed.

Using the copy of their diagram, have students cut apart the eight labelled angles.

For the angle pairs students identified on the lab sheet, have students determine if the two angles are congruent, supplementary, or complementary, using the same procedure as you did during the demonstration. Students should be able to complete the lab sheet on their own.

After students have completed the lab, review with students which sets of angle pairs are supplementary or congruent for parallel lines cut by a transversal. To check for understanding, ask students of these angles would still be supplementary/congruent if the lines were not parallel.

Evaluate

Display the **Transparent Transversals Evaluate** image (attached) on the Smart board, document camera, or overhead projector.

Pass out a sticky note to each student.

On the sticky note, have students record three sets of lines that they know are parallel or that they know are definitely not parallel. For each set of lines, have students justify how they know the lines are parallel or not parallel using mathematical language and the vocabulary learned in this lesson.

Resources

- K20 Center. (n.d.). Quick draw. Strategies. https://learn.k20center.ou.edu/strategy/51