

If at First You're Not the Same, Try Triangles! (Part 2)

Triangle Congruence Theorems

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Grade Level	10th Grade	**Time Frame**	180 minutes
Subject	Mathematics	**Duration**	3-4 class periods
Course	Geometry		

Essential Question

How can we tell when two triangles are congruent?

Summary

Students determine the triangle congruence theorems.

Snapshot

Engage

Students complete a Think-Pair-Share activity to activate their prior knowledge about what it means to be congruent.

Explore

Students play "Guess What Triangle?" (based on the board game, "Guess Who?").

Explain

Students explain what questions are "good" or "bad" in helping them determine what information is needed to find congruent triangles.

Extend

Students consider a real-life application of congruent triangles to see how they are used.

Evaluate

Students complete proof puzzles which prove that two triangles are congruent.

Standards

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

G603: Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles

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

G.2D.1.7: Apply the properties of congruent or similar polygons to solve real-world and mathematical problems using algebraic and logical reasoning.

Attachments

- Defining Congruence and Congruence Statements Day 2.pdf
- Defining Congruence and Congruence Statements Day 2.pptx
- Guess What Triangle Edition - Spanish.docx
- Guess What Triangle Edition - Spanish.pdf
- Guess What Triangle Edition.docx
- Guess What Triangle Edition.pdf
- Proof Puzzles - Spanish.docx
- Proof Puzzles - Spanish.pdf
- Proof Puzzles.docx
- Proof Puzzles.pdf
- Scissor Lift Proof Solution.docx
- Scissor Lift Proof Solution.pdf

Materials

- Guess What Triangle Edition (attached)
- Scissor Lift Proof (attached)
- Proof Puzzles (attached)
- Defining Congruence and Congruence Statements Day 2 (attached)

Engage

Teacher's Note

You will need to at least complete the Explore and Explain portions of "If at First You're Not the Same, Try Triangles! (Part 1)" before beginning this lesson.

Open the attached slide deck and display **slide 1**. Place students in pairs to complete a Think-Pair-Share activity for the Engage portion of the lesson.

Explore

Go to **slide 2**. Explain to the class that they will be playing a game similar to "Guess Who?" Their job is to determine which of the 36 triangles pictured you (the teacher) have chosen each round. In order to do so, they have to ask yes or no questions about your triangle. You will either respond "yes," "no," or "I don't know," if they ask about a side or angle that is unknown for your triangle. If the class is able to determine which triangle you are referring to in four questions or fewer, they get a point.

Variations

You can choose to make copies of the game board for each students. The students can use two-sided counters to keep track of which triangles have been eliminated. Alternatively, you can place one board under the document camera to track which triangles have been eliminated as a whole class.

Pick one triangle to begin Round 1. As students ask questions, respond by indicating what the question is about (a side length, angle measurement, or where a side or angle is) before indicating if the answer is "yes," "no," or "I don't know." If students ask about positions of sides or angles, guide them to describe the position in relation to other parts of the triangle. For example, an appropriate question would be: "Is the 30 degree angle between the side that measures four and the unknown side?" However, it would not be appropriate to ask: "Is the side that measures four on the bottom?" since the triangle could be held a different way to change this answer.

Be sure to have at least two rounds where the students do not earn points: one round because only angle measurements are given (A1, B5, C5, F1) or because two sides and the non-included angle are given, and one round where two sides and the non-included angles are given (A5, A6, B2, C6, D5, F3, F5, F6). This will ensure that students see that not all sets of information will lead to congruent triangles.

Explain

After several rounds, ask students what questions have been proven to be necessary, good questions and which ones have not.

Teacher's Note

Students should talk about asking about side and angle lengths and the placement of those sides and angles.

Go to **slide 3**. Ask students how many sides and angles they think they need to know in order to identify congruent triangles. They should respond with "three."

Go to **slide 4**. Have students to review the posters made in part one of this lesson. Note that, for each poster, three pieces of information were given. Ask if that information was always enough to ensure the triangles were congruent. They should respond that it was not.

Direct students to consider posters two and six. Have students note that, for both posters, two sides and an angle measurement were given. Ask students why this information resulted in all congruent triangles for poster two but in two different possibilities for poster six. The goal is to get students to understand that the relative position of the sides and the angle matter: Two sides and an angle only result in congruent triangles if the angle is between the two given sides.

Go to **slide 5**. Have students match each statement to one of the posters, and determine if the statement is enough to determine that two triangles are congruent. Statements five and six should be ruled out. Click the slide again to reveal "shortcut" ways to write these statements. Have students copy the four ways of determining congruent triangles into their notes (SSS, SAS, ASA, AAS), and draw a diagram of two triangles fitting each description.

Extend

Go to **slide 6**. Explain that this slide shows what is called a "scissor lift" in multiple positions. In every position, the platform at the top of the scissor lift is parallel to the ground. Tell students that it is congruent triangles that ensure the platform is always parallel. Ask students to brainstorm how congruent triangles might ensure this. If students get stuck, give them a hint: The intersecting legs are always bolted together at their midpoints.

After several minutes, have students share out their thoughts and ideas. Go to **slide 7** and guide students through this proof. A solution to the proof is attached to this lesson (the "Scissor Lift Parallel Proof Solution").

Evaluate

Have students complete the attached "Proof Puzzles," a variation of the Card Sort instructional strategy.

Resources

- K20 Center. (n.d.). Think-pair-share. Instructional Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5064b49
- K20 Center. (n.d.). Card sort. Instructional Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f506976b