Congruent Triangles

ID: 8516

Time required
45 minutes

Activity Overview

This activity is intended to provide students with an opportunity to discover three methods of proving triangles congruent: SSS, SAS, and ASA. Students will not formally prove these theorems; rather, they will use the dynamic feature of the Graphs & Geometry application to gather evidence that these theorems are in fact true.

Topic: Triangles & Congruence

- *Investigate the SSS, SAS, and ASA sets of conditions for congruent triangles.*

Teacher Preparation and Notes

- *This activity should be used as an introduction to the triangle congruence theorems. Students should already be familiar with the definition of congruent polygons—Congruent polygons are polygons with all corresponding sides congruent and all corresponding angles congruent.*
- *While this activity will provide sufficient evidence that these theorems are true, it is important to point out that such evidence does not constitute a proof of the theorems.*
- *Problems 4 and 5 can be used as extensions to this activity. In Problem 4, students will study the ambiguous case, SSA. In Problem 5, students will learn that the lengths of the sides of any triangle are such that the sum of the lengths of any two sides must exceed the length of the third side.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "8516" in the quick search box.***

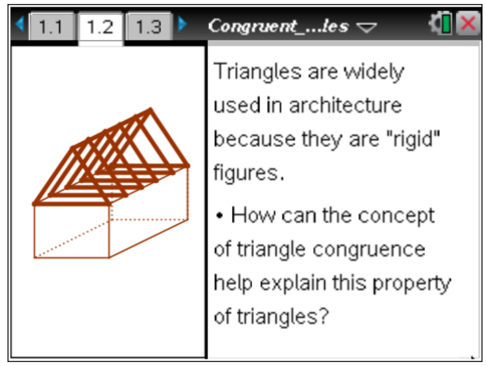
Associated Materials

- *Congruent_Triangles.tns*
- *Congruent_Triangles_Soln.tns*
- *Congruent_Triangles_Student.doc*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Congruent Triangles (TI-84 Plus with TI-Navigator) — 5419*
- *Triangle Congruence with Activity Center (TI-84 Plus family with TI-Navigator) — 8240*
- *Congruent Triangles - Conditions that Prove Congruency (TI-Nspire technology) — 11515*



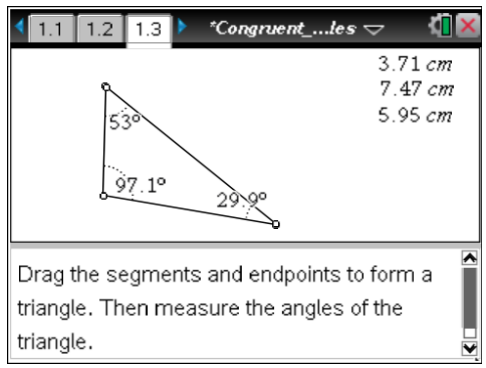
One focus question defines this activity:

How can the concept of triangle congruence help explain the "rigid" property of triangles?

Before answering this question, show students the diagram on page 1.2. Tell them that the roof truss shown is the diagram is formed by a series of congruent triangles. Ask why they think the term "rigid" is used to describe a triangle. Also, ask why this is a desirable property to have in construction and architecture. This conversation should be very informal. However, inform students that the ideas of triangle congruence explored in this activity can help explain the concept of triangle rigidness.

Have students advance to page 1.3, where they will begin investigating several different methods used to demonstrate triangle congruence.

Problem 1 – Investigating the SSS Congruence Theorem



Students should use the segments on page 1.3 to form a triangle. To manipulate the segments, students will need to grab and drag the segment itself, in addition to dragging its endpoints to rotate it. Since the lengths of the segments are locked, each student will obtain the same triangle, shown at the right.

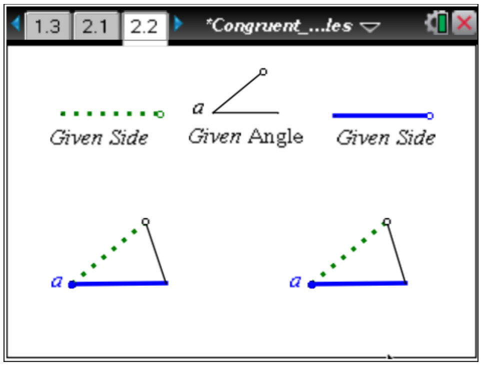
Notice that the angle measurements of the completed triangle are displayed on the screen. By the definition of congruent triangles, students should observe that the triangles they compare with one another are congruent since all corresponding sides and corresponding angles are congruent (Note: The angle measurements might be off slightly if the endpoints are not aligned perfectly.)

Students should be convinced that two triangles with corresponding sides congruent are congruent. Since SSS case ties directly into the focus question of the activity, this might be a good time to discuss how this theorem relates to triangle rigidity.

TI-Nspire Navigator Opportunity: *Screen Capture*

See Note 1 at the end of this lesson.

Problem 2 – Investigating the SAS Congruence Theorem



This problem is slightly different in that students will have two triangles on their screen rather than just one. The attributes have been set so it is easy to identify which sides correspond. The given angle has been denoted *a*.

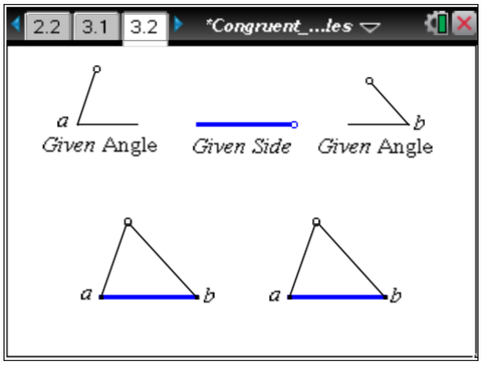
No matter how students manipulate the triangles, they should find that there is only one unique triangle that can be formed, leading them to conclude that triangles with these congruent corresponding parts must be congruent.

Students are asked to write a conjecture about their observations. A sample conjecture might be:

If two pairs of corresponding sides and the included angle of two triangles are congruent, then the two triangles are congruent.

It is important that students understand that the congruent angle must occur "between" the two congruent sides.

Problem 3 – Investigating the ASA Congruence Theorem



This problem allows students to investigate a case with two pairs of congruent corresponding angles and a congruent corresponding side.

No matter how students manipulate the triangles, they will find that there is only one unique triangle that can be formed, leading them to conclude that triangles with these congruent corresponding parts must be congruent.

Students are asked to write a conjecture about their observations. A sample conjecture might be:

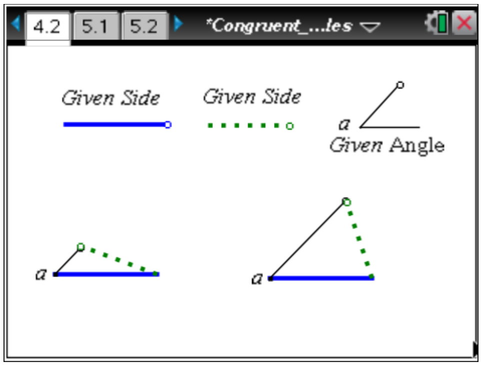
If two pairs of corresponding angles and the included side of two triangles are congruent, then the two triangles are congruent.

It is important that students understand that the congruent side must lie "between" the two congruent angles.

Problem 4 – Investigating the SSA Case

After working through the first three problems, students might be led to believe that any set of three corresponding parts is sufficient to prove two triangles congruent.

The screen at right illustrates that two pairs of corresponding congruent sides and a congruent non-included angle may not produce congruent triangles.

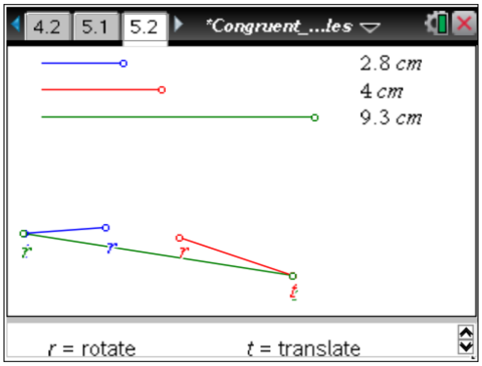


However, if students manipulate the given information, they will find that, under certain conditions, the two triangles are in fact always congruent. For example, the two triangles will be congruent any time the corresponding side adjacent to the given angle has a length that is less than or equal to the length of the other corresponding side.

Problem 5 – The Case of the Missing Triangle

After working through Problem 1, students might assume that any set of three given side lengths will always produce the same triangle. However, it is quite possible that a triangle cannot be made at all.

The diagram at right, with segments of lengths 2.8, 4, and 9.3, gives an example of a situation in which a triangle cannot be formed.



Students are asked to write a conjecture about their observations. Their conjectures should resemble the triangle inequality theorem which states:

In any triangle, the sum of the lengths of any two sides exceeds the length of the third side.

TI-Nspire Navigator Opportunities

Note 1
Throughout entire activity: *Screen Capture*
Use Screen Capture to verify students are following the instructions correctly and able to create the intended triangles.