

CUT & GLUE SORT

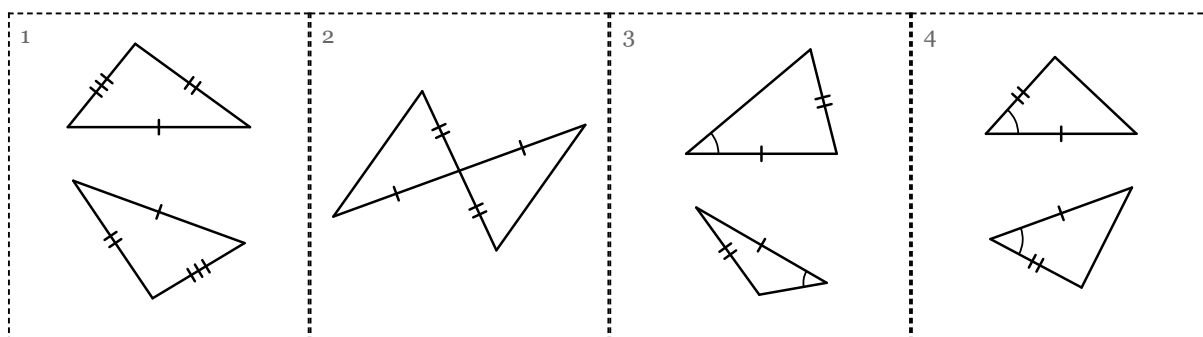


THE SAS TRIANGLE CONGRUENCE CRITERION

SSS, Included-Angle SAS, or Neither?

Marked triangles · crossing segments · is the angle between the sides?

FREE



Cut & Glue Sort — how to run it

25 minutes, including the cutting

1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“For included-angle SAS, the equal angle must be between the two pairs of equal sides. Where two segments cross, the vertical angles are equal. Check where they are before you use them.”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

Student sheets	pages 3 and 4, one of each per student. Page 3 shows SSS, included-angle SAS and vertical angles as small pictures.
Answers	page 5.

The last row is the hardest. Every piece in it has two pairs of equal sides and a pair of equal angles, but the angles are not between the sides. Many students think “two sides and an angle” is enough. A student who thinks so glues these pieces into the middle row, and that row then holds too many. Pieces 3 and 6 in the last row show triangles that are clearly not the same size, so the mistake is plain to see.

Crossing segments are in two rows. Two crossings belong in the middle row. Both segments are cut in half, so the vertical angles at the crossing are between the ticked sides. Two crossings belong in the last row. The vertical angles are still equal, but the ticked sides are not their arms. The first row is SSS, which the class learned before this. One piece there has a side shared by both triangles, which counts as a pair of equal sides with no ticks.

The order of the lines in a words piece does not matter. The piece that lists the angle first is still included-angle SAS.

Guessing does not work. Every simple guessing rule, such as sorting by the kind of picture, places at most six of the twelve pieces correctly.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
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SSS, Included-Angle SAS, or Neither?

Two triangles and their marks

Name _____

Period _____

Date _____

Cut out the twelve pieces on the next page. Each piece shows two triangles and what is equal in them. **Decide which row the piece belongs in, and glue it there.** Where two segments cross, the vertical angles are equal even with no arc drawn.



SSS: three pairs of sides.



Included-angle SAS: two pairs of sides, and the angle **between** them.



Vertical angles face each other where two segments cross. They are always equal.

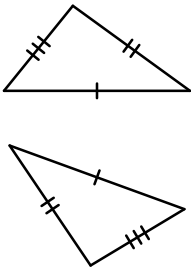
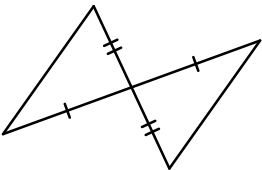
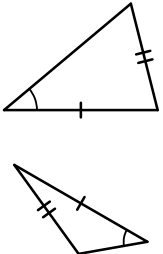
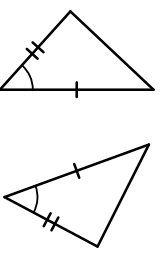
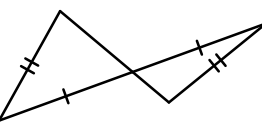
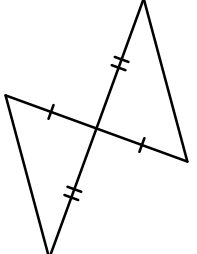
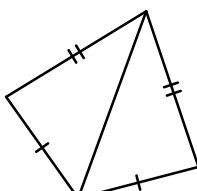
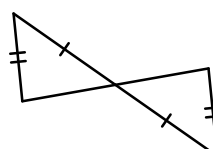
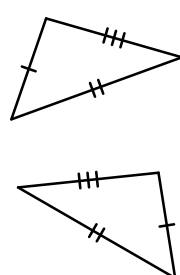
SSS. Three pairs of sides are equal.

Included-angle SAS. Two pairs of sides are equal, and so are the angles between them.

Neither. The equal angles are not between the two pairs of equal sides.

The twelve pieces

Cut along the dotted lines

1 	2 	3 	4 
5 In $\triangle ABC$ and $\triangle DEF$: $\overline{AB} \cong \overline{DE}$ $\overline{CA} \cong \overline{FD}$ $\overline{BC} \cong \overline{EF}$	6 	7 	8 In $\triangle ABC$ and $\triangle DEF$: $\overline{AB} \cong \overline{DE}$ $\overline{BC} \cong \overline{EF}$ $\angle A \cong \angle D$
9 	10 	11 	12 In $\triangle ABC$ and $\triangle DEF$: $\angle B \cong \angle E$ $\overline{AB} \cong \overline{DE}$ $\overline{BC} \cong \overline{EF}$



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Cut & Glue Sort — answers

For the teacher

	SSS	1 — Each side of one triangle has a side of the other with the same number of ticks. No angle is marked.	5 — All three pairs of sides are equal, and no angle is given.	9 — Two pairs of sides are ticked, and the side in the middle belongs to both triangles, so it is the third pair.	11 — The ticks pair all three sides. One triangle is flipped over, which does not matter.
	Included-angle SAS	2 — The ticks cut both segments in half. The two angles at the crossing are vertical angles, so they are equal, and each is between two ticked sides.	4 — The arc is at the corner where the side with one tick and the side with two ticks meet.	7 — Both segments are cut in half. The vertical angles at the crossing are equal and are between the ticked sides.	12 — Sides AB and BC share the letter B, and $\angle B$ is given. The order of the lines does not matter.
	Neither	3 — The arc is at a corner where only one ticked side ends. The triangles are not even the same size.	6 — The vertical angles at the crossing are equal, but each one is not between the two ticked sides of its triangle. The triangles are not even the same size.	8 — Sides AB and BC share the letter B, so the angle between them is $\angle B$, not $\angle A$.	10 — The angles at the crossing are equal, but in each triangle the angle between the two ticked sides is at another corner. These triangles happen to be the same size, but the marks do not show it.

Every row holds four pieces. To place a piece, find the two pairs of equal sides in each triangle. The corner where those two sides meet is where the angle must be for included-angle SAS. If all three pairs of sides are equal, the piece is SSS. A side that belongs to both triangles counts as a pair of equal sides. Two angles facing each other where segments cross count as a pair of equal angles.