

CUT & GLUE SORT



THE TRIANGLE INEQUALITY AND THE HINGE THEOREM

Will These Three Sides Close?

Triangle, gap, or flat · sort the numbers first

FREE

¹ 9 cm, 3 cm, 4 cm	² 10 cm, 6 cm, 8 cm	³ 4 cm, 10 cm, 6 cm	⁴ 5 cm, 13 cm, 9 cm
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Cut & Glue Sort — how to run it

20–25 minutes, including the cutting

1. **Hand out page 3**, one per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“Put the three numbers in order first. Add the two smaller ones. If the sum is more than the biggest, it is a triangle. If it is less, there is a gap. If it is exactly equal, the sides lie flat, and that is not a triangle either.”*
3. **Check a sheet in ten seconds:** every row gets four pieces.

Student sheet	page 3, one per student. The three rows are at the top and the pieces are at the bottom. Three small drawings show a triangle, a gap and a flat set.
Answers	page 4.

The triangle inequality. In any triangle, any two sides add to *more* than the third side. To test three lengths, put them in order and add the two smaller ones. Only this one sum needs checking: the other two sums always include the biggest side, so they are always big enough.

The last row is the most important. In its four pieces the two smaller lengths add to exactly the biggest one, for example 4 cm, 10 cm, 6 cm. The two short sides then lie along the long side, the three corners are on one straight line, and there is no triangle. Tests ask about exactly this case. A student who thinks “equal is enough” puts all four of these pieces in the first row. That student gets eight of the twelve pieces right, and the rows come out uneven. Ask that student to draw the flat set: where would the top corner be?

Why the numbers are not in order on the pieces. Many students add the first two numbers they see. That works only when the biggest number happens to be last. A student who does this gets only four of the twelve pieces right. When a student finishes, ask for one more set of their own for each row.



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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Triangle, gap, or flat?

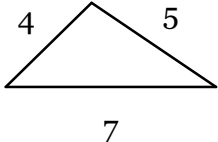
The triangle inequality

Name _____

Period _____

Date _____

Cut out the twelve pieces at the bottom of this page. Each piece gives three side lengths. **First put the three numbers in order. Add the two smaller ones. Compare the sum with the biggest one. Then glue the piece in its row.**

 $4 + 5 = 9$, more than 7. A triangle.	 $3 + 4 = 7$, less than 10. A gap.	 $3 + 7 = 10$, exactly. Flat: no triangle.
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Makes a triangle. The two shorter sides add to **more** than the longest side.

Leaves a gap. No triangle. The two shorter sides add to **less** than the longest side. They cannot meet.

Lies flat. No triangle. The two shorter sides add to **exactly** the longest side. They meet on it, in a straight line.

1 9 cm, 3 cm, 4 cm	2 10 cm, 6 cm, 8 cm	3 4 cm, 10 cm, 6 cm	4 5 cm, 13 cm, 9 cm
5 8 cm, 3 cm, 5 cm	6 4 cm, 12 cm, 7 cm	7 7 cm, 12 cm, 5 cm	8 5 cm, 8 cm, 2 cm
9 9 cm, 2 cm, 9 cm	10 14 cm, 6 cm, 5 cm	11 8 cm, 13 cm, 6 cm	12 2.5 cm, 6 cm, 3.5 cm



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Cut & Glue Sort — answers

For the teacher

Makes a triangle.	2 (10 cm, 6 cm, 8 cm). In order: 6, 8, 10. $6 + 8 = 14$ is more than 10, so the sides meet: a triangle.	4 (5 cm, 13 cm, 9 cm). In order: 5, 9, 13. $5 + 9 = 14$ is more than 13, so the sides meet: a triangle.	9 (9 cm, 2 cm, 9 cm). In order: 2, 9, 9. $2 + 9 = 11$ is more than 9, so the sides meet: a triangle.	11 (8 cm, 13 cm, 6 cm). In order: 6, 8, 13. $6 + 8 = 14$ is more than 13, so the sides meet: a triangle.
Leaves a gap. No triangle.	1 (9 cm, 3 cm, 4 cm). In order: 3, 4, 9. $3 + 4 = 7$ is less than 9, so the two short sides cannot reach each other.	6 (4 cm, 12 cm, 7 cm). In order: 4, 7, 12. $4 + 7 = 11$ is less than 12, so the two short sides cannot reach each other.	8 (5 cm, 8 cm, 2 cm). In order: 2, 5, 8. $2 + 5 = 7$ is less than 8, so the two short sides cannot reach each other.	10 (14 cm, 6 cm, 5 cm). In order: 5, 6, 14. $5 + 6 = 11$ is less than 14, so the two short sides cannot reach each other.
Lies flat. No triangle.	3 (4 cm, 10 cm, 6 cm). In order: 4, 6, 10. $4 + 6 = 10$ is exactly 10, so the sides lie flat in a straight line: no triangle.	5 (8 cm, 3 cm, 5 cm). In order: 3, 5, 8. $3 + 5 = 8$ is exactly 8, so the sides lie flat in a straight line: no triangle.	7 (7 cm, 12 cm, 5 cm). In order: 5, 7, 12. $5 + 7 = 12$ is exactly 12, so the sides lie flat in a straight line: no triangle.	12 (2.5 cm, 6 cm, 3.5 cm). In order: 2.5, 3.5, 6. $2.5 + 3.5 = 6$ is exactly 6, so the sides lie flat in a straight line: no triangle.

Every row holds four pieces. For each piece, put the three lengths in order and add the two smaller ones. More than the biggest: a triangle. Less: a gap. Exactly equal: flat, no triangle.

To check a piece with a student, ask: “Which number is the biggest? What do the other two add to?”