

CUT & GLUE SORT

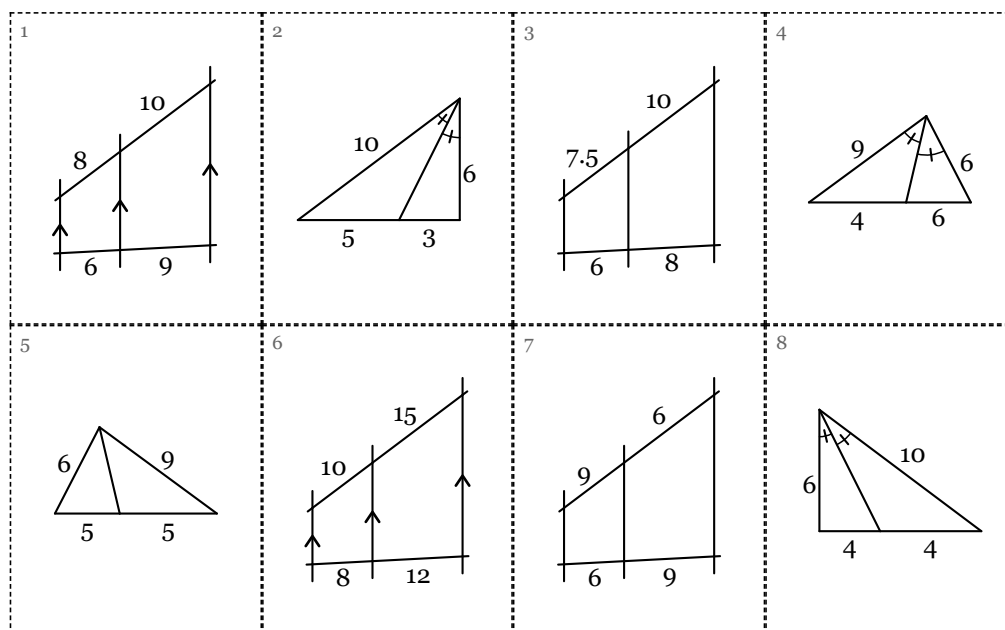


PROPORTIONAL SEGMENTS AND THE ANGLE BISECTOR THEOREM

Can These Numbers Be Right?

Parallel lines and angle bisectors · twelve drawings · read the marks first

FREE



1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue. Nothing else is needed.
2. **Say this once:** *“First look for the marks. No arrowheads and no equal angles means nothing follows. If the marks are there, write the proportion and check the numbers.”*
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 has the two rules and the three rows. Page 4 has the pieces.
Answers	page 5.

Each piece is a drawing with four numbers. Half of them show three lines cut by two transversals, with the three lines standing upright. The other half show a triangle with a segment from the top corner to the bottom side. When the lines are marked parallel, the left piece over the right piece is the same fraction on both transversals. When the angle is marked as two equal angles, each piece of the bottom side goes with the side that meets it at the same corner. On these sheets, an angle bisector of a triangle is the segment from a corner to the opposite side that cuts the angle at that corner into two equal angles. Some textbooks use other definitions, so tell the class which ones this sheet uses.

The last row is the most important. Its drawings look exactly like the others, but nothing marks the lines as parallel or the two angles as equal. Then the rules say nothing, even when the numbers happen to fit. Many students assume lines are parallel because they look parallel.

Row 2 holds the common mistakes, written into the numbers. The bigger piece is next to the shorter side. The left piece is the smaller one on one transversal and the bigger one on the other. The fractions are close but not equal. The two pieces of a bisected side are equal although the sides are not. No real figure has these numbers, so these drawings cannot be to scale, and the sheet tells students not to measure. A student who puts every marked piece in row 1 places only eight pieces correctly. Guessing rules place at most six 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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Cut & Glue Sort — can the numbers be right?

Proportional pieces

Name _____

Period _____

Date _____

Cut out the twelve pieces on the next page. Each piece is a drawing with four numbers. **First look at the marks. Then check the numbers. Glue the piece in its row.** The drawings are not to scale. Do not measure. The two rules, with drawings, are at the top of the next page.

Arrowheads mean the lines are parallel. Then the two pieces of one transversal, in order, make the same fraction as the two pieces of the other transversal. An arc with a small stroke on each half means the angle is cut into two equal angles. Then each piece of the bottom side goes with the side that meets it at the same corner.

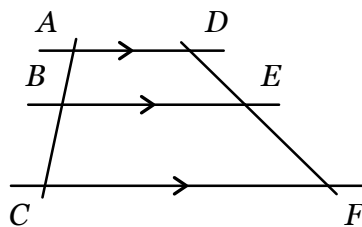
Row 1. Can be right. The marks show parallel lines or a bisector, and the numbers follow the rule.

Row 2. Cannot be right. The marks show parallel lines or a bisector, but the numbers break the rule.

Row 3. Cannot tell. Nothing marks the lines as parallel, or the angle as cut into two equal angles.

Cut & Glue Sort — the pieces

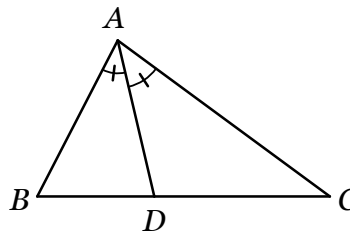
Cut along the dashed lines



Parallel lines

$$\frac{AB}{BC} = \frac{DE}{EF}$$

AB and BC are on one line.
DE and EF are on the other line.



Angle bisector AD

$$\frac{BD}{DC} = \frac{AB}{AC}$$

BD and AB meet at B. DC and AC meet at C.

You may know other facts about angle bisectors. This sheet uses only this one.

Cut out the twelve pieces. Glue each one in its row on the other sheet. Keep the box above. It shows the two rules.

1 	2 	3 	4
5 	6 	7 	8
9 	10 	11 	12



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Each row holds four pieces. On the pieces with three lines, the three lines stand upright and the two transversals run across. The pieces of each transversal are read from left to right.

1 **Can be right. The marks show parallel lines or a bisector, and the numbers follow the rule.**

2. Triangle, angle at the top marked as two equal angles. Sides 10 (left) and 6 (right). Pieces 5 (left) and 3 (right). Each piece goes with the side at its corner: $5/3 = 10/6$.

6. Three lines with arrowheads. Lower transversal: 8 and 12. Upper transversal: 10 and 15. Left piece over right piece: $8/12 = 10/15$. The pieces are in proportion.

10. Three lines with arrowheads. Lower transversal: 6 and 4. Upper transversal: 7.5 and 5. Left piece over right piece: $6/4 = 7.5/5$. The pieces are in proportion.

12. Triangle, angle at the top marked as two equal angles. Sides 6 (left) and 9 (right). Pieces 4 (left) and 6 (right). Each piece goes with the side at its corner: $4/6 = 6/9$.

2 **Cannot be right. The marks show parallel lines or a bisector, but the numbers break the rule.**

1. Three lines with arrowheads. Lower transversal: 6 and 9. Upper transversal: 8 and 10. $6/9$ is two thirds and $8/10$ is four fifths. The two fractions are not equal.

4. Triangle, angle at the top marked as two equal angles. Sides 9 (left) and 6 (right). Pieces 4 (left) and 6 (right). The bigger piece, 6, is next to the shorter side, 6, and the smaller piece is next to the longer side, 9.

8. Triangle, angle at the top marked as two equal angles. Sides 6 (left) and 10 (right). Pieces 4 (left) and 4 (right). The two pieces are equal, but the two sides are not. A bisector cuts the angle in half, not the side.

11. Three lines with arrowheads. Lower transversal: 4 and 6. Upper transversal: 7.5 and 5. On the lower transversal the left piece is the smaller one, and on the upper transversal it is the bigger one. $4/6$ is not $7.5/5$.

3 **Cannot tell. Nothing marks the lines as parallel, or the angle as cut into two equal angles.**

3. Three lines, no arrowheads. Lower transversal: 6 and 8. Upper transversal: 7.5 and 10. The lines have no arrowheads, so nothing says they are parallel. The numbers prove nothing either way.

5. Triangle, no marks. Sides 6 (left) and 9 (right). Pieces 5 (left) and 5 (right). Nothing marks the two angles at the top as equal, so the segment may not be a bisector. The numbers prove nothing either way.

7. Three lines, no arrowheads. Lower transversal: 6 and 9. Upper transversal: 9 and 6. The lines have no arrowheads, so nothing says they are parallel. The numbers prove nothing either way.

9. Triangle, no marks. Sides 8 (left) and 12 (right). Pieces 4 (left) and 6 (right). Nothing marks the two angles at the top as equal, so the segment may not be a bisector. The numbers prove nothing either way.

To check a piece with a student, ask two questions. First: what marks are on it? If there are none, it goes in row 3. If there are, ask: which piece goes with which? Write the proportion and check it with the numbers. If it is true, the piece goes in row 1. If not, row 2.