

CUT & GLUE SORT

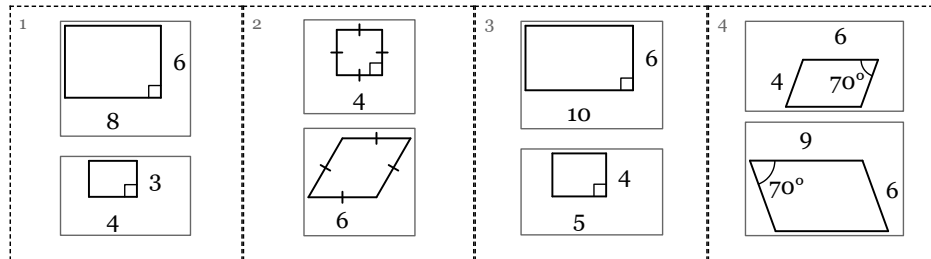


SIMILARITY TRANSFORMATIONS AND SIMILAR FIGURES

Similar, or Which Part Fails?

Similar · the sides fail · every side fits but an angle fails

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:** *“Check the angles. Then check that one number multiplies every side. Shapes of the same size are similar too. If one number works for every side but an angle does not match, the piece goes in the last row.”*
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 prints the meaning of similar and shows a dilation, a slide, a turn and a flip as small pictures.
Answers	page 5.

The last row is the hardest. Many students believe that if every side is doubled, the shapes must be similar. Every piece in the last row has one number that multiplies every side, and the shapes are still not similar, because an angle is different. A student who checks only the sides glues all four of these pieces into the first row. That row then holds eight pieces, and you see the mistake at once.

The second row is the other half. In two of its pieces every angle matches: two rectangles, 10 by 6 and 5 by 4, and two parallelograms with the same 60° angle. A student who checks only the angles puts them in the first row. The other two are a triangle with every side made 2 longer and a triangle stretched sideways only. A student who thinks adding 2 to every side, or stretching one way, keeps the shape puts these in the first row too.

The first row holds two pairs students often reject. One is a triangle and its mirror image of the same size. Congruent shapes are similar, with scale factor 1, and many students think “similar” must mean a different size. The other has the smaller shape second, with scale factor 0.5. Every row has a pair in which one shape is flipped, so a flip never tells a student which row to use.

Which definition of similar these sheets use. Your class may have learned either one. One says a dilation followed by slides, turns or flips moves one shape exactly onto the other. The other says every pair of matching angles is equal and every pair of matching sides is in the same ratio. The student sheet prints both, and both give the same answer on every item. Some textbooks use other definitions, so tell the class which ones this sheet uses.

Guessing does not work. Every simple guessing rule, such as sorting by whether a degree sign is printed, places at most six of the twelve pieces correctly. Checking only the sides places eight.



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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Similar, or which part fails?

Angles and sides

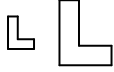
Name _____

Period _____

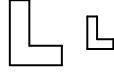
Date _____

Cut out the twelve pieces on the next page. Each piece shows two shapes with their numbers. **Decide which row the piece belongs in, and glue it there.**

Two shapes are **similar** when every angle of one matches an angle of the other, and every side is multiplied by the same number, the **scale factor**. That is the same as saying a dilation, and then slides, turns or flips, can move one shape exactly onto the other. Congruent shapes are similar too: their scale factor is 1.



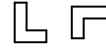
dilation, scale factor 2



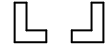
dilation, scale factor $\frac{1}{2}$



slide



turn



flip (turn over)

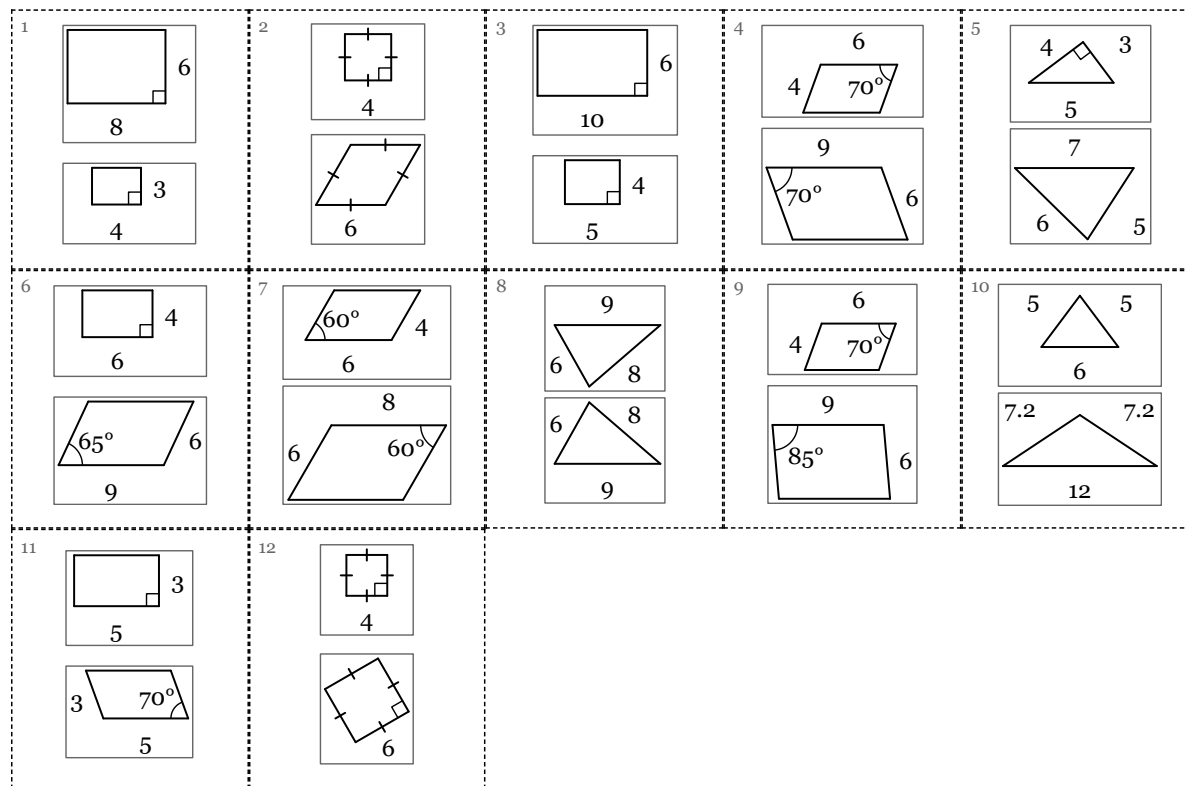
Similar. Every angle matches, and every side is multiplied by the same number.

Not similar. The sides are not all multiplied by the same number.

Not similar. Every side is multiplied by the same number, but an angle does not match.

The twelve pieces

Cut along the dotted lines



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Similar. Every angle matches, and every side is multiplied by the same number.	1 — Every angle is a right angle on both. Each side is multiplied by 0.5: $8 \times 0.5 = 4$ and $6 \times 0.5 = 3$. The second shape is smaller, and that is allowed.	4 — The angle is 70° on both. Each side is multiplied by 1.5: $6 \times 1.5 = 9$ and $4 \times 1.5 = 6$. The second shape is flipped, and that is allowed.	8 — Both triangles have sides 6, 8 and 9, so they are congruent. Congruent shapes are similar, with scale factor 1.	12 — Both are squares, so every angle is 90°. Every side is multiplied by 1.5, because $4 \times 1.5 = 6$.
Not similar. The sides are not all multiplied by the same number.	3 — Every angle is a right angle, but $10 \times 0.5 = 5$ while $6 \times 0.5 = 3$, not 4. The sides are not all multiplied by one number.	5 — Every side is 2 longer, but adding is not multiplying. $4 \times 1.5 = 6$, but $3 \times 1.5 = 4.5$, not 5. No one number works.	7 — The angle is 60° on both, but $4 \times 1.5 = 6$ while $6 \times 1.5 = 9$, not 8. The sides are not all multiplied by one number.	10 — The base is multiplied by 2, but $5 \times 2 = 10$, not 7.2. The triangle was stretched in one direction only.
Not similar. Every side is multiplied by the same number, but an angle does not match.	2 — Every side is multiplied by 1.5, but the square has right angles and the rhombus has none.	6 — Every side is multiplied by 1.5, but the rectangle has a 90° angle where the parallelogram has 65°.	9 — Every side is multiplied by 1.5, but one angle is 70° and the matching angle is 85°.	11 — The sides are the same (multiplied by 1), but the rectangle has 90° angles and the parallelogram has a 70° angle.

Every row holds four pieces. To place a piece, match each side of one shape with a side of the other, going around in order. A piece goes in the first row when one number multiplies every side and every angle matches. It goes in the second row when no single number multiplies every side. It goes in the last row when one number multiplies every side, but an angle still does not match.