

CUT & GLUE SORT



SCALE DRAWINGS AND SCALE FACTOR

Is It Really a Scale Drawing?

It is one · it is not one · the facts are not enough

FREE

1	2	3	4
The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order.	The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 7 cm by 10.5 cm.	The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 7 cm by 9 cm.	The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order. Each angle matches.

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. Calculators are fine.
2. **Say this once:** *“A scale drawing multiplies every length by the same number and keeps every angle. Divide each pair of matching sides. If the facts on a piece do not settle it, it 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 shows an original and a scale drawing of it, with the factor worked out both ways.
Answers	page 5.

Why this sort. Many students check one pair of sides and stop. Others add the same amount to every side, or call any bigger figure a scale drawing, even one stretched in one direction only. The second row holds those mistakes as facts: every side made 3 cm longer, a stretch one way, two pairs of sides that give 1.5 and 1.33, and four sides in one ratio with an angle that changed.

The last row is the hardest. Its pieces give facts that fit a scale drawing and also fit a figure that is not one: a single pair of sides, four sides with no angles, four right angles with no lengths, and two perimeters. Students often put them in the first row. Ask: *“Can you draw a figure that fits these facts and is not a scale drawing?”* The first row holds a drawing smaller than its original, which is still a scale drawing, and two squares, because any square is a scale drawing of any other square.

The meaning used here. This sheet uses this meaning: a drawing is a scale drawing of an original when every length is multiplied by the same number and every angle stays the same, with matching corners in the order given. Some textbooks use other definitions, so tell the class which ones this sheet uses.



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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Is it a scale drawing?

Three rows

Name _____

Period _____

Date _____

Cut out the twelve pieces on the next page. Each piece gives facts about an original and a drawing.
Decide which row each piece belongs in, and glue it there. Use only the facts on the piece.
Divide the matching sides to test them.

2.4 cm  4 cm <i>original</i>	3.6 cm  6 cm <i>drawing</i>	A scale drawing multiplies every length by the same number. The angles do not change. The scale factor from the original to the drawing is $6 \div 4 = 1.5$. Check with the other pair: $3.6 \div 2.4 = 1.5$. The scale factor from the drawing to the original is $4 \div 6 = 2/3$. A factor more than 1 makes a figure bigger. Less than 1 makes it smaller.
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It is a scale drawing. The facts show it.

It is not a scale drawing. A fact shows it.

Cannot tell. The facts given are not enough.

The twelve pieces

Cut along the dotted lines

1 The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order.	2 The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 7 cm by 10.5 cm.	3 The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 7 cm by 9 cm.	4 The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order. Each angle matches.
5 The original is a square with sides of 3 cm. The drawing is a rectangle 6 cm by 3 cm.	6 The original is a rectangle 4 cm by 6 cm, with a perimeter of 20 cm. The drawing is a rectangle with a perimeter of 30 cm.	7 The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order. One angle is 80° on the original and 65° on the drawing.	8 The original is a rectangle 4 cm by 3 cm. The drawing is a rectangle. Its side that matches the 4 cm side is 10 cm.
9 The original is a square with sides of 3 cm. The drawing is a square with sides of 5 cm. Nothing else is given.	10 Both figures are rectangles. Each angle of the drawing matches the original's angle.	11 The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 6 cm by 8 cm. Both have four right angles.	12 The original is a rectangle 10 cm by 4 cm. The drawing is a rectangle 4 cm by 1.6 cm.



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Cut & Glue Sort — answers

For the teacher

It is a scale drawing. The facts show it.	2 “The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 7 cm by 10.5 cm.” $7 \div 4 = 1.75$ and $10.5 \div 6 = 1.75$. Both sides are multiplied by 1.75, and every angle of a rectangle is 90° .	4 “The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order. Each angle matches.” $6 \div 4$, $9 \div 6$, $10.5 \div 7$ and $13.5 \div 9$ all give 1.5, and the angles match. That is all a scale drawing needs.	9 “The original is a square with sides of 3 cm. The drawing is a square with sides of 5 cm. Nothing else is given.” Every side of a square is the same and every angle is 90° . So $5 \div 3$ multiplies every side. Any square is a scale drawing of any other square.	12 “The original is a rectangle 10 cm by 4 cm. The drawing is a rectangle 4 cm by 1.6 cm.” $4 \div 10 = 0.4$ and $1.6 \div 4 = 0.4$. A scale drawing can be smaller than the original. Its factor is then less than 1.
It is not a scale drawing. A fact shows it.	3 “The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 7 cm by 9 cm.” $7 \div 4 = 1.75$ but $9 \div 6 = 1.5$. Each side is 3 cm longer, and adding is not multiplying.	5 “The original is a square with sides of 3 cm. The drawing is a rectangle 6 cm by 3 cm.” $6 \div 3 = 2$ but $3 \div 3 = 1$. The drawing is stretched one way only. It is bigger, but it is not a scale drawing.	7 “The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order. One angle is 80° on the original and 65° on the drawing.” The sides all give 1.5, but one angle changes from 80° to 65° . A scale drawing keeps every angle.	11 “The original is a rectangle 4 cm by 6 cm. The drawing is a rectangle 6 cm by 8 cm. Both have four right angles.” $6 \div 4 = 1.5$ but $8 \div 6$ is about 1.33. The two pairs of sides give different numbers.
Cannot tell. The facts given are not enough.	1 “The original has sides of 4, 6, 7 and 9 cm. The drawing has sides of 6, 9, 10.5 and 13.5 cm, in the same order.” The sides all give 1.5, but no angle is known. Four sides do not fix the shape. With the same angles it is a scale drawing. With one angle 65° where the original has 80° , it is not.	6 “The original is a rectangle 4 cm by 6 cm, with a perimeter of 20 cm. The drawing is a rectangle with a perimeter of 30 cm.” A drawing 6 by 9 has a perimeter of 30 cm and is a scale drawing (factor 1.5). A drawing 5 by 10 also has a perimeter of 30 cm, and it is not.	8 “The original is a rectangle 4 cm by 3 cm. The drawing is a rectangle. Its side that matches the 4 cm side is 10 cm.” One pair gives $10 \div 4 = 2.5$, but the drawing’s other side is not known. Drawn 10 by 7.5, it is a scale drawing. Drawn 10 by 5, it is not.	10 “Both figures are rectangles. Each angle of the drawing matches the original’s angle.” Every rectangle has four 90° angles, so matching angles are not enough. A 4 by 6 rectangle drawn 6 by 9 is a scale drawing. Drawn 5 by 9, it is not.

Every row holds four pieces. To check a piece with a student, ask first: “Do all the matching sides you know give the same number when you divide?” If no, it goes in the second row. If yes, ask: “Do you know every side and every angle, or is it a square?” If yes, it goes in the first row. If no, it goes in the last row.