

CUT & GLUE SORT



DILATING LINES, SEGMENTS AND ANGLES

Dilations: Always, Sometimes or Never?

Lines · segments · angles · the center

FREE

1	2	3	4
A dilation with scale factor 3 takes a line to itself.	A dilation with scale factor 3 takes an angle to an angle with the same measure.	A dilation with scale factor 2 takes a segment 5 cm long to a segment of the same length.	A dilation with scale factor 3 takes a line through the center to itself.

Cut & Glue Sort — how to run it

25 minutes, including 5–8 minutes of cutting

1. **Hand out pages 3 and 4**, one of each per student, with scissors and glue.
2. **Say this once:** *“Before you decide, check if the center is on the line. In this lesson, a line is not parallel to itself.”*
3. **Students cut out the twelve pieces and glue each one into a row.** Every row gets four.

Rows	page 3, one per student. Five small pictures on it show what a dilation is and the four results of this lesson.
Pieces	page 4, one per student.
Answers	page 5.

Each piece is a sentence about a dilation that is always, sometimes or never true. For example, *“A dilation takes a line to a parallel line”* is only sometimes true, because a line through the center goes to itself.

The Sometimes row is the heart of the lesson. Every sentence there is true when the center is on the line and false when it is not, or the other way around.

One piece depends on a definition. The sheet uses the rule that a line is not parallel to itself. Some books say that a line is parallel to itself. A student who learned that rule will put “a dilation takes a line to a parallel line” under Always. That is the right answer in those books, not a mistake in the mathematics. Say so if it comes up.

The Never row shows common mistakes. Students multiply an angle by the scale factor, keep a segment the same length, think the center moves, or think the image of a line can cross it.

Guessing does not work. Each row holds more than one kind of object, so the kind does not decide the row. Every simple guessing rule, such as putting every sentence with a measure in Never, sorts 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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Always, Sometimes or Never?

Dilating lines, segments and angles

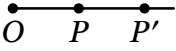
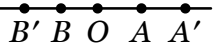
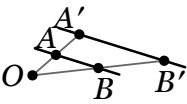
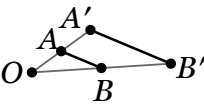
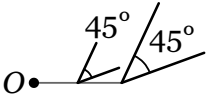
Name _____

Period _____

Date _____

Cut out the twelve pieces on the next page. Each piece says what a dilation does. **For each piece, decide: is it always true, sometimes true, or never true?** Glue it into that row.

In this course, a line is not parallel to itself. Parallel lines are two different lines that never meet.

 center O • scale factor k P' is on ray OP, k times as far from O	 a line through O its image is the same line	 a line not through O its image is a new line, parallel to it	 a segment AB A'B' is k times as long as AB	 an angle its image has the same measure
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Always true: *it is true every time.*

Sometimes true: *it is true for some and false for others. It depends on where the center is.*

Never true: *it is false every time.*

The twelve pieces

Cut along the dotted lines

1 A dilation with scale factor 3 takes a line to itself.	2 A dilation with scale factor 3 takes an angle to an angle with the same measure.	3 A dilation with scale factor 2 takes a segment 5 cm long to a segment of the same length.	4 A dilation with scale factor 3 takes a line through the center to itself.
5 A dilation with scale factor 2 takes a segment 4 cm long to a segment 8 cm long on the same line.	6 A dilation with scale factor 3 takes a line to a line that crosses it at one point.	7 A dilation with scale factor $\frac{1}{2}$ takes a segment to a segment half as long.	8 A dilation with scale factor 3 takes an angle of 40° to an angle of 120° .
9 A dilation with scale factor 2 takes a line to a line that is parallel to it.	10 A dilation with scale factor 2 takes a segment 5 cm long to a segment 10 cm long.	11 A dilation with scale factor 2 moves the center to a new point.	12 A dilation with scale factor 2 leaves a point where it is.



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Cut & Glue Sort — answers

For the teacher

Row	Pieces	Why each piece goes in this row
Always true	2, 4, 7, 10	2: A dilation never changes an angle measure. Only the arms get longer. 4: A line through the center goes to itself for any scale factor. The sentence says the line goes through the center, so it is always true. 7: Every segment becomes $\frac{1}{2}$ times as long, so the image is always half as long. 10: Every segment becomes 2 times as long, whatever its direction, so 5 cm becomes 10 cm.
Sometimes true	1, 5, 9, 12	1: It is true only when the line passes through the center. Any other line goes to a different, parallel line. 5: The image is always 8 cm long. But it is on the same line only when the segment's line passes through the center. 9: It is true when the line misses the center. A line through the center goes to itself, and a line is not parallel to itself. 12: It is true only when the point is the center. Every other point moves.
Never true	3, 6, 8, 11	3: With scale factor 2, the image is always 10 cm long, never 5 cm. Some students think “parallel” means “the same length”. 6: The image of a line is the same line or a parallel line. It never crosses the line at one point. 8: A dilation never changes an angle measure, so the image is still 40° . The arms get longer, but the angle does not. 11: The center is the one point that never moves.

How to decide Sometimes. A sentence is sometimes true when it is true for some lines, segments or points and false for others. On this sheet, that always depends on where the center is.