

CUT & GLUE SORT



DILATIONS: CENTER AND SCALE FACTOR

Describe the Dilation Fully

Correct · wrong · not enough

FREE

1 OA = 8 units, OA' = 4 units "Center O. The image is smaller."	2 OA = 2 units, OA' = 6 units "Center O, scale factor 3."	3 OA = 2 units, OA' = 6 units "Center O, scale factor 4."	4 OA = 3 units, OA' = 6 units "Center O. Every point goes twice as far from O."
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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:** *“A full description of a dilation names two things: the center and the scale factor. The scale factor is the image distance divided by the original distance.”*
3. **Students cut out the twelve pieces and glue each one into a row.** Every row gets four.

Rows	page 3, one per student. Three small pictures on it show the center and the scale factor, a factor more than 1, and a factor less than 1.
Pieces	page 4, one per student.
Answers	page 5.

The third row, Not enough, is the one students find hardest. “Dilated by 3” is not a full description, but “dilated by 3 about point O” is. Many students keep leaving out the center, even after a lot of practice. A piece goes in this row only when nothing it says is wrong. So “Scale factor $1/2$ ” on a drawing whose factor is 2 goes in Wrong, even though it also leaves out the center.

The Wrong pieces show three common mistakes. The student divides the wrong way and turns the factor upside down. The student subtracts the two distances instead of dividing them. The student names a point of the figure as the center.

Guessing does not work. Each drawing appears once in every row, so the drawing alone does not decide the row. Every simple guessing rule, such as putting every piece with a center and a number in Correct, 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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Is the Description Right?

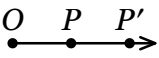
Describing a dilation

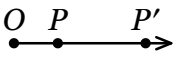
Name _____

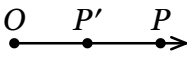
Period _____

Date _____

Cut out the twelve pieces on the next page. Each piece shows a dilation with center O: points A and B, and their images A' and B'. Under the drawing is somebody's description of it. **For each piece, decide: is the description correct, wrong, or not enough?** Glue it into that row. **A full description gives two things: the center and the scale factor.**


center O • scale factor k
 $k = \text{image distance} \div \text{original distance}$


k more than 1
P' is farther from O than P


k less than 1
P' is closer to O than P

Correct: it gives the center and the scale factor, and both are right.

Wrong: the center or the scale factor it gives is wrong.

Not enough: nothing in it is wrong, but it leaves out the center or the scale factor.

The twelve pieces

Cut along the dotted lines

1 OA = 8 units, OA' = 4 units "Center O. The image is smaller."	2 OA = 2 units, OA' = 6 units "Center O, scale factor 3."	3 OA = 2 units, OA' = 6 units "Center O, scale factor 4."	4 OA = 3 units, OA' = 6 units "Center O. Every point goes twice as far from O."
5 OA = 4 units, OA' = 6 units "Center O, and a scale factor more than 1."	6 OA = 4 units, OA' = 6 units "Center A, scale factor 1.5."	7 OA = 8 units, OA' = 4 units "Center O, scale factor 1/2."	8 OA = 2 units, OA' = 6 units "Scale factor 3."
9 OA = 8 units, OA' = 4 units "Center O, scale factor 200%."	10 OA = 3 units, OA' = 6 units "The image is twice as big."	11 OA = 4 units, OA' = 6 units "Scale factor 150%, center O."	12 OA = 3 units, OA' = 6 units "Scale factor 1/2."



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Cut & Glue Sort — answers

For the teacher

Row	Pieces	Why each piece goes in this row
Correct	2, 4, 7, 11	2: The factor is $OA' \div OA = 6 \div 2 = 3$. It gives center O and the right factor. 4: The factor is $OA' \div OA = 6 \div 3 = 2$. “Twice as far from O” means a scale factor of 2, and the center O is right. 7: The factor is $OA' \div OA = 4 \div 8 = 1/2$. It gives center O and the right factor. 11: The factor is $OA' \div OA = 6 \div 4 = 1.5$. 150% is the same as 1.5, and the center O is right.
Wrong	3, 6, 9, 12	3: The factor is $OA' \div OA = 6 \div 2 = 3$. The 4 in the description comes from $6 - 2$. A dilation multiplies distances, so the factor comes from dividing, not subtracting. 6: The factor is $OA' \div OA = 6 \div 4 = 1.5$. A is a point of the figure, not the center. The line through A and A' and the line through B and B' meet at O, so O is the center. 9: The factor is $OA' \div OA = 4 \div 8 = 1/2$. 200% is 2. But A' is closer to O than A, so the factor must be less than 1. The description divided 8 by 4, which turns the factor upside down. 12: The factor is $OA' \div OA = 6 \div 3 = 2$. A' is farther from O than A, so the factor must be more than 1. The factor $1/2$ is upside down, and the center is missing too.
Not enough	1, 5, 8, 10	1: The factor is $OA' \div OA = 4 \div 8 = 1/2$. The center is right and the image is smaller, but the description does not give the factor. 5: The factor is $OA' \div OA = 6 \div 4 = 1.5$. The center is right and the factor is more than 1, but the description does not say what the factor is. 8: The factor is $OA' \div OA = 6 \div 2 = 3$. The factor is right, but the description does not name the center. 10: The factor is $OA' \div OA = 6 \div 3 = 2$. “Twice as big” is right, but the description does not name the center.

How to find the right description from the drawing. The center is the point where the line through A and A' meets the line through B and B'. On every piece that point is O. The scale factor is the image distance divided by the original distance, $OA' \div OA$.