What You Will Learn

- Perform similarity transformations.
- Describe similarity transformations.

Performing Similarity Transformations

A dilation is a transformation that preserves shape but not size. So, a dilation is a nonrigid motion. A **similarity transformation** is a dilation or a composition of rigid motions and dilations. Two geometric figures are **similar figures** if and only if there is a similarity transformation that maps one of the figures onto the other. Similar figures have the same shape but not necessarily the same size.

Congruence transformations preserve length and angle measure. When the scale factor of the dilation(s) is not equal to 1 or −1, similarity transformations preserve angle measure only.

$(3,2) \to (3\cdot3, 2\cdot3) = (9,6)$

$k=3$

$(3,2) \to (3\cdot1, 2\cdot1) = (3,2)$

$k=1$

$(3,2) \to (3\cdot{-1}, 2\cdot{-1}) = (-3,-2)$

$k=-1$

$(a,b) \to (-a,-b)$

$(a,b) \to (-a,b)$

Graph $\overline{AB}$ with endpoints $A(12, -6)$ and $B(0, -3)$ and its image after the similarity transformation.

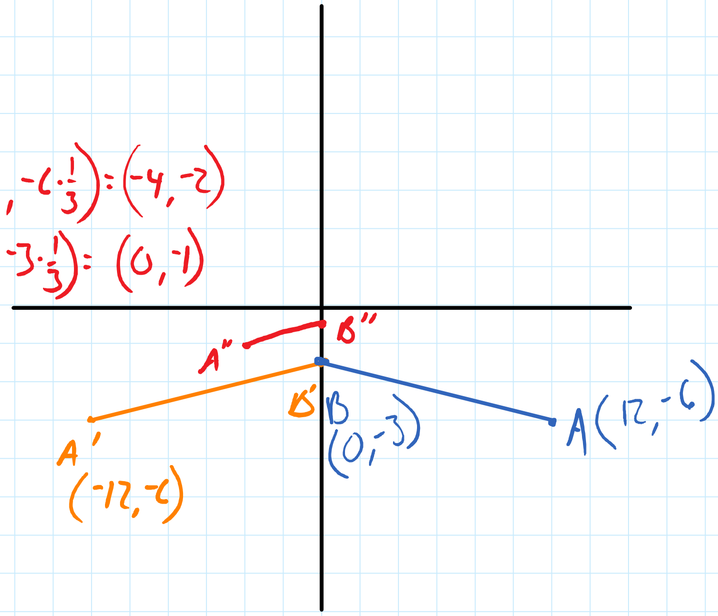
$B(0, -3)$ and its image after the similarity transformation.

Reflection: in the y-axis

Dilation: $(x, y) \rightarrow \left(\frac{1}{3}x, \frac{1}{3}y\right)$

$A(12, -6) \rightarrow A'(-12, -6) \rightarrow A''\left(-12 \cdot \frac{1}{3}, -6 \cdot \frac{1}{3}\right) = (-4, -2)$

$B(0, -3) \rightarrow B'(0, -3) \rightarrow B''\left(0 \cdot \frac{1}{3}, -3 \cdot \frac{1}{3}\right) = (0, -1)$



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1. Graph $\overline{CD}$ with endpoints $C(-2, 2)$ and $D(2, 2)$ and its image after the similarity transformation.

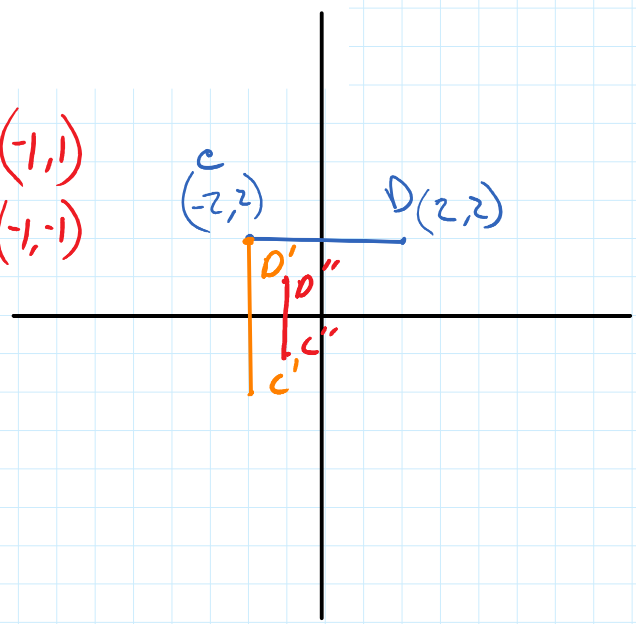
Rotation: 90° about the origin

Dilation: $(x, y) \rightarrow \left(\frac{1}{2}x, \frac{1}{2}y\right)$

$(a, b) \rightarrow (-b, a)$

$D(2, 2) \rightarrow (-2, 2) \rightarrow \left(-2 \cdot \frac{1}{2}, 2 \cdot \frac{1}{2}\right) = (-1, 1)$

$C(-2, 2) \rightarrow (-2, -2) \rightarrow \left(-2 \cdot \frac{1}{2}, -2 \cdot \frac{1}{2}\right) = (-1, -1)$

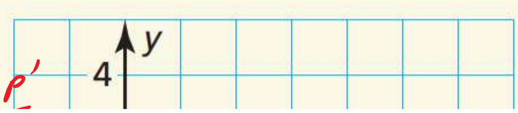


Describe a similarity transformation that maps trapezoid *WXYZ* to trapezoid *PQRS*.

$(a, b) \rightarrow (a, -b)$

$W(2, 1) \rightarrow W'(2, -1) \rightarrow W''(2 \cdot 2, -1 \cdot 2) = (4, -2)$

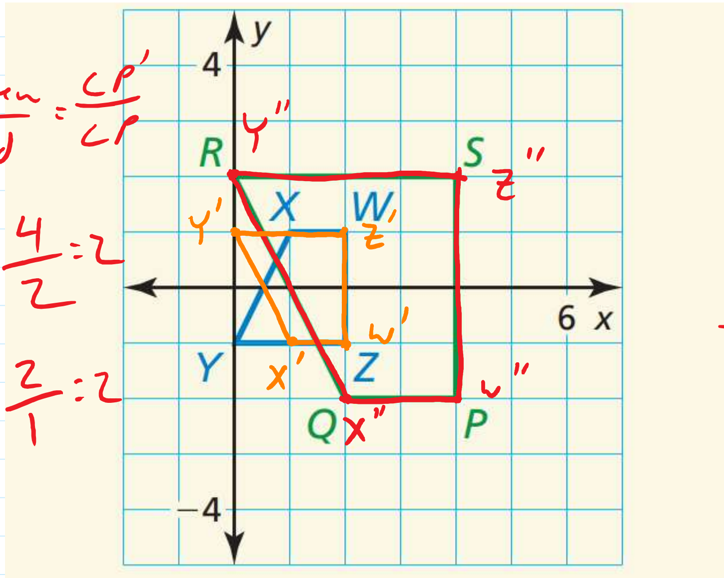
$X(1, 1) \rightarrow X'(1, -1) \rightarrow X''(1 \cdot 2, -1 \cdot 2) = (2, -2)$



$\frac{New}{old} = \frac{CP'}{CP}$

$\frac{4}{2} = 2$

$\frac{2}{1} = 2$



$X(1,1) \rightarrow X'(1,-1) \rightarrow X''(1\cdot 2, -1\cdot 2) = (2,-2)$

$Y(0,-1) \rightarrow Y'(0,1) \rightarrow Y''(0\cdot 2, 1\cdot 2) = (0,2)$

$Z(2,-1) \rightarrow Z'(2,1) \rightarrow Z''(2\cdot 2, 1\cdot 2) = (4,2)$

reflection in x-axis
dilation $k=2$

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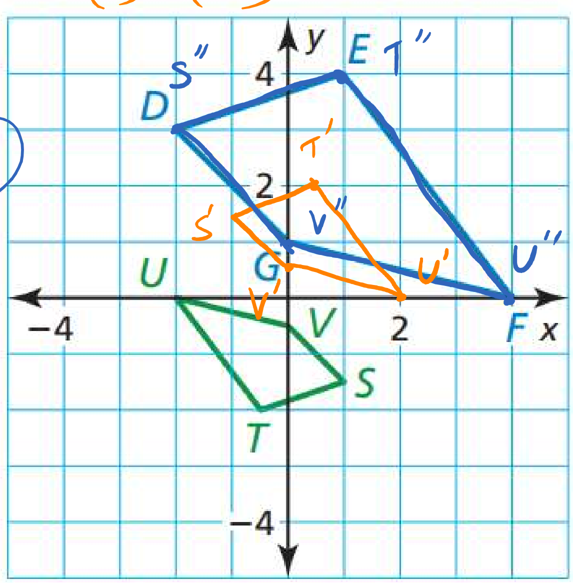
3. In Example 2, describe another similarity transformation that maps trapezoid *PQRS* to trapezoid *WXYZ*.

$(a,b) \rightarrow (-a,-b)$

$\frac{4}{2} = 2$



$S(1,-1\frac{1}{2}) \rightarrow S'(-1,1\frac{1}{2}) \rightarrow S''(-1\cdot 2, 1\frac{1}{2}\cdot 2) = (-2,3)$

$T(-\frac{1}{2},-2) \rightarrow T'(\frac{1}{2},2) \rightarrow T''(\frac{1}{2}\cdot 2, 2\cdot 2) = (1,4)$

$U(-2,0) \rightarrow U'(2,0) \rightarrow U''(2\cdot 2, 0\cdot 2) = (4,0)$

$V(0,-\frac{1}{2}) \rightarrow V'(0,\frac{1}{2}) \rightarrow V''(0\cdot 2, \frac{1}{2}\cdot 2) = (0,1)$

$\frac{1}{\frac{1}{2}} = \frac{1}{1} \div \frac{1}{2} = \frac{1}{1}\cdot\frac{2}{1} = \frac{2}{1} = 2$

Practice sec 4.6 **pg. 219: 1-11EO**