G.G.58: Compositions of Transformations: Define, investigate, justify, and apply similarities (dilations and the composition of dilations and isometries)

1 If the coordinates of point A are $(-2, 3)$, what is the image of A under $r_{y-\text{axis}} \circ D_3$?

1) $(-6, -9)$
2) $(9, -6)$
3) $(5, 6)$
4) $(6, 9)$

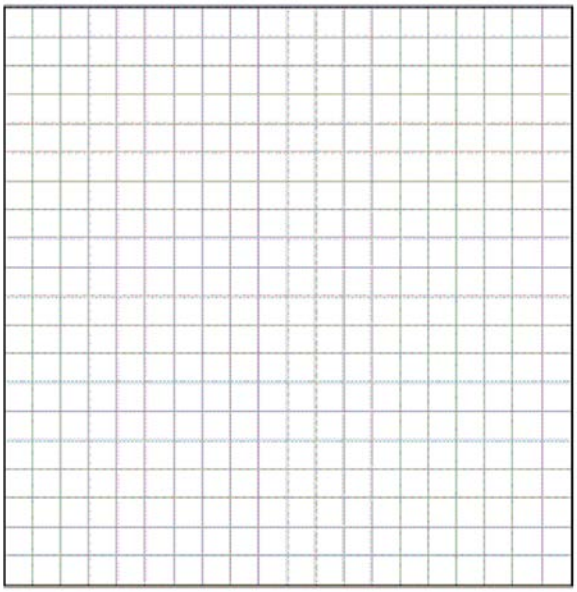
2 If the coordinates of P are $(-2, 7)$, what are the coordinates of $(D_2 \circ r_{y=x})(P)$?

1) $(4, -14)$
2) $(-14, 4)$
3) $(-4, 14)$
4) $(14, -4)$

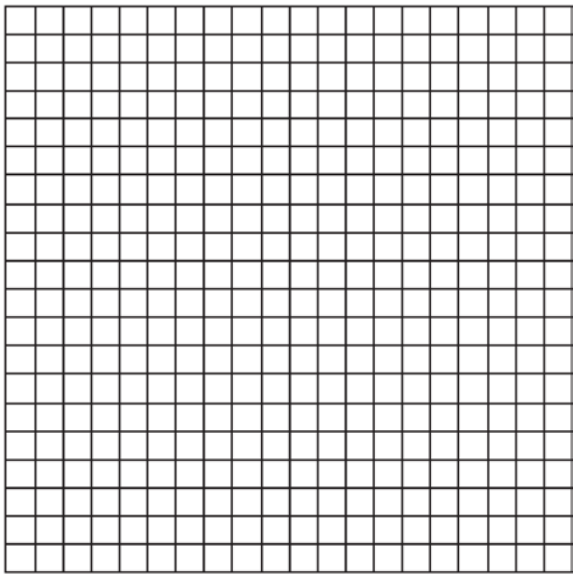
3 Find the coordinates of the image of $(-3, -4)$ under the transformation $D_2 \circ R_{90°}$.

4 If point A has coordinates $(-3, 4)$, what are the coordinates of A', the image of A under $r_{y=\text{axis}} \circ D_2$?

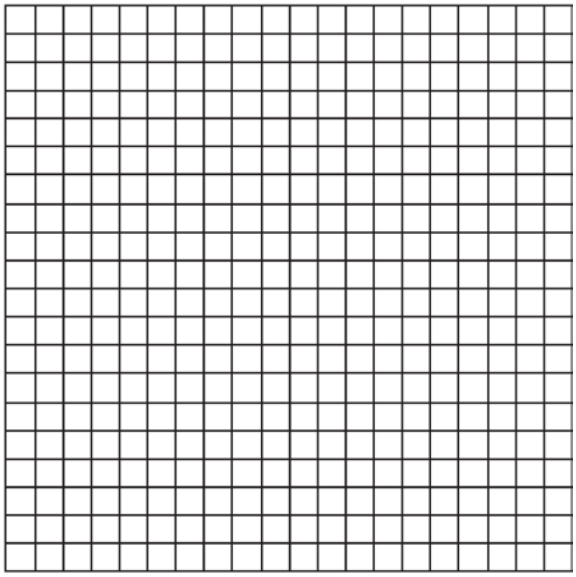
5 The coordinates of the endpoints of $\overline{AB}$ are $A(2, 6)$ and $B(4, 2)$. Is the image $\overline{A''B''}$ the same if it is reflected in the x-axis, then dilated by $\frac{1}{2}$ as the image is if it is dilated by $\frac{1}{2}$, then reflected in the x-axis? Justify your answer. (The use of the accompanying grid is optional.)



6 Triangle ABC has vertices $A(1,0)$, $B(6,3)$, and $C(4,5)$. On the accompanying grid, draw and label ΔABC. Graph and state the coordinates of $\Delta A'B'C'$, the image of ΔABC after the composition $D_2 \circ r_{(0,0)}$.



7 Farmington, New York, has plans for a new triangular park. If plotted on a coordinate grid, the vertices would be $A(3,3)$, $B(5,-2)$, and $C(-3,-1)$. However, a tract of land has become available that would enable the planners to increase the size of the park, which is based on the following transformation of the original triangular park, $R_{270^\circ} \circ D_2$. On the grid below, graph and label both the original park ΔABC and its image, the new park $\Delta A''B''C''$, following the transformation.



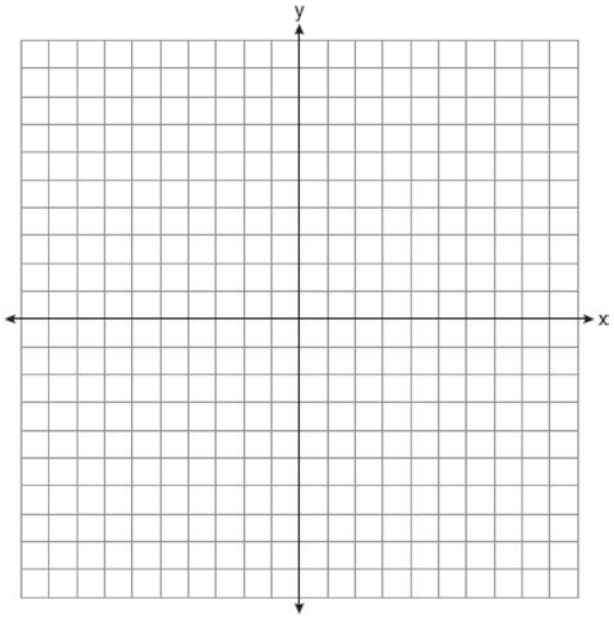
8 Given: F is the transformation $(x,y) \rightarrow (-y,-x)$
U is the transformation
$(x,y) \rightarrow (x-2, y+4)$
N is the transformation $(x,y) \rightarrow (2x, 2y)$
The coordinates of ΔABC are $A(1,2)$, $B(4,0)$, and $C(3,-2)$.

a. Sketch ΔABC and its image $\Delta A'B'C'$ after the transformation F.

b. Sketch $\Delta A''B''C''$, the image of $\Delta A'B'C'$ after the transformation U.

c. Sketch $\Delta A'''B'''C'''$, the image of $\Delta A''B''C''$ after the transformation N.

d. Which transformation, F, U, or N, is a dilation?



9 *a* Triangle ABC has coordinates $A(0,9)$, $B(-3,0)$, and $C(-6,9)$. On the graph below, draw and label triangle ABC.

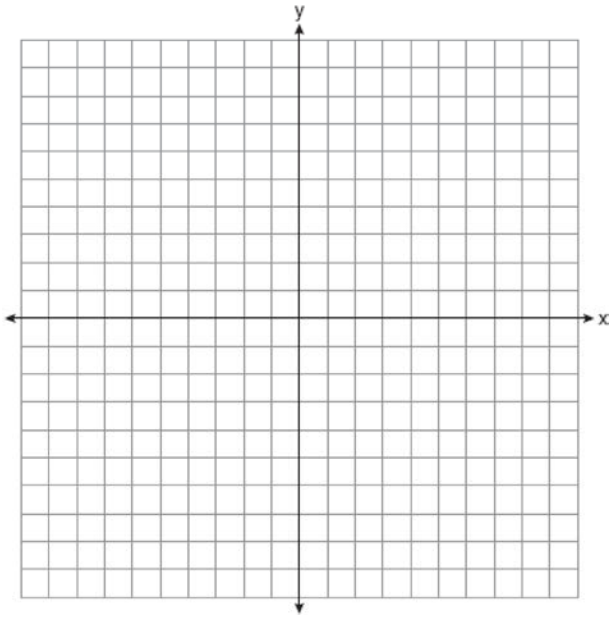
b Reflect the graph drawn in part *a* in the origin. State the coordinates of A', B', and C', the images of A, B, and C.

c Dilate the graph drawn in part *b* using $D_{\frac{1}{3}}$.

State the coordinates of A'', B'', C'', the images of A', B', and C'.

d Translate the graph drawn in part *c* using $T_{(5,4)}$.

State the coordinates of A''', B''', and C''', the images of A'', B'', and C''.



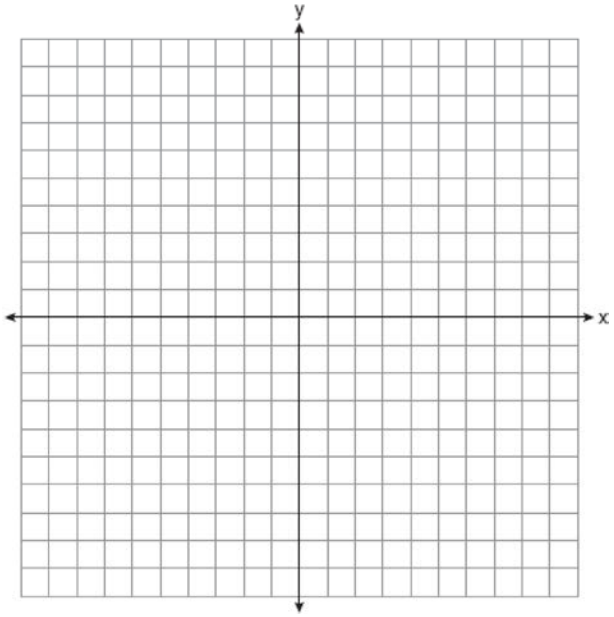
10 Triangle ABC has coordinates $A(3,-2)$, $B(8,2)$, and $C(5,10)$.

a On the grid below, graph and label ΔABC.

b Graph and state the coordinates of $\Delta A'B'C'$, the image of ΔABC after a half-turn $\left(R_{180°}\right)$.

c Graph and state the coordinates of $\Delta A''B''C''$, the image of ΔABC after $\left(D_2 \circ T_{-5,-2}\right)$.

d What is the ratio of the area of ΔABC to the area of $\Delta A''B''C''$?



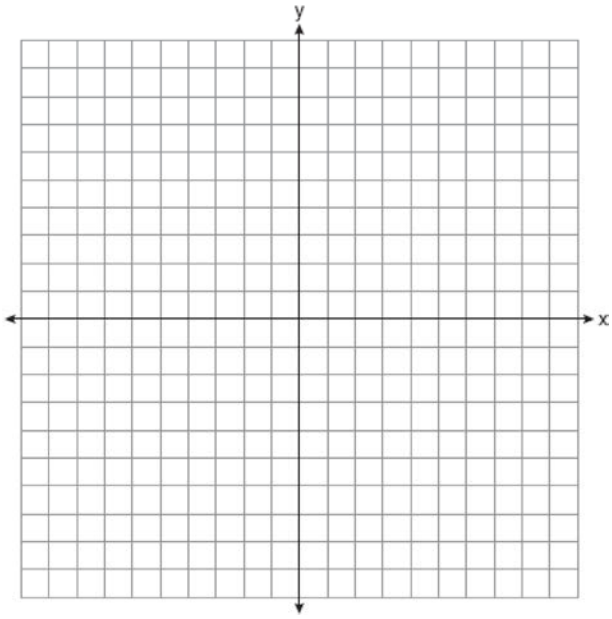
11 On the graph below, sketch the triangle formed by points $A(3,-3)$, $B(-1,-5)$, and $C(5,-4)$. On the same set of axes, graph and state the coordinates of

a $\Delta A'B'C'$, the image of ΔABC after the rotation $R_{90°}$.

b $\Delta A''B''C''$, the image of $\Delta A'B'C'$ after the translation $T_{-4,-1}$.

c $\Delta A'''B'''C'''$, the image of $\Delta A''B''C''$ after the dilation D_3.

Is the composite transformation $\Delta ABC \rightarrow \Delta A'''B'''C'''$ an isometry? Explain your answer.



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Answer Section

1 ANS: 4
After the dilation, the coordinates are (–6,9). After the reflection, the coordinates are (6,9).

REF: 010520b

2 ANS: 4 REF: 019723siii

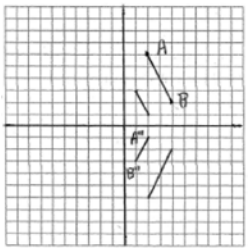
3 ANS:
$(8,-6)$

REF: 089340siii

4 ANS:
$(6,8)$

REF: 080010siii

5 ANS:



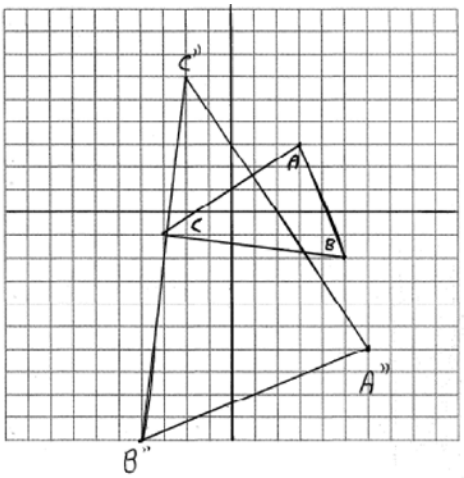
If $\overline{AB}$ is reflected first, the coordinates of the endpoints of $\overline{A'B'}$ are $A'(2,-6)$ and $B'(4,-2)$. When the reflection is dilated, the coordinates of the endpoints of $\overline{A''B''}$ are $A''(1,-3)$ and $B''(2,-1)$. If $\overline{AB}$ is dilated first, the coordinates of the endpoints of $\overline{A'B'}$ are $A'(1,3)$ and $B'(2,1)$. When the dilation is reflected, the coordinates of the endpoints of $\overline{A''B''}$ are $A''(1,-3)$ and $B''(2,-1)$. The images are the same.

REF: 080028a

6 ANS:
$A'(-2,0), B'(-12,-6), C'(-8,-10)$

REF: 068941siii

7 ANS:



REF: 010930b

8 ANS:
N

REF: 068041siii

9 ANS:
$A'(0,-9), B'(3,0), C'(6,-9)$; $A''(0,-3), B''(1,0), C''(2,-3)$; $A'''(5,1), B'''(6,4), C'''(7,1)$

REF: 069038siii

10 ANS:
$A'(-3,-2), B'(-8,-2), C'(-5,-10)$; $A''(-4,0), B''(6,0), C''(0,16)$; $1:4$

REF: 089437siii

11 ANS:
$A'(3,3), B'(5,-1), C'(4,5)$; $A''(-1,2), B''(1,-2), C''(0,4)$; $A'''(-3,6), B'''(3,-6), C'''(0,12)$; No, length is not preserved.

REF: 069938siii