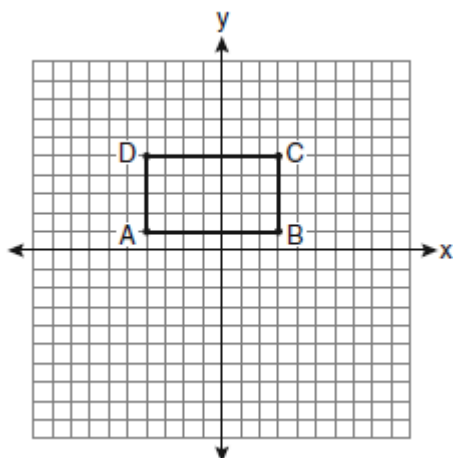


NAME: \_\_\_\_\_

1. 080908ge, P.I. G.G.57

On the set of axes below, Geoff drew rectangle  $ABCD$ . He will transform the rectangle by using the translation  $(x, y) \rightarrow (x + 2, y + 1)$  and then will reflect the translated rectangle over the  $x$ -axis.

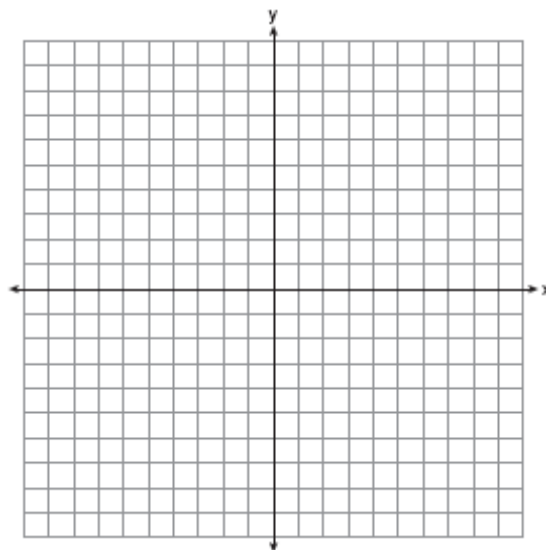


What will be the area of the rectangle after these transformations?

- [A] less than 28 square units
- [B] greater than 28 square units
- [C] It cannot be determined from the information given.
- [D] exactly 28 square units

2. 060937ge, P.I. G.G.58

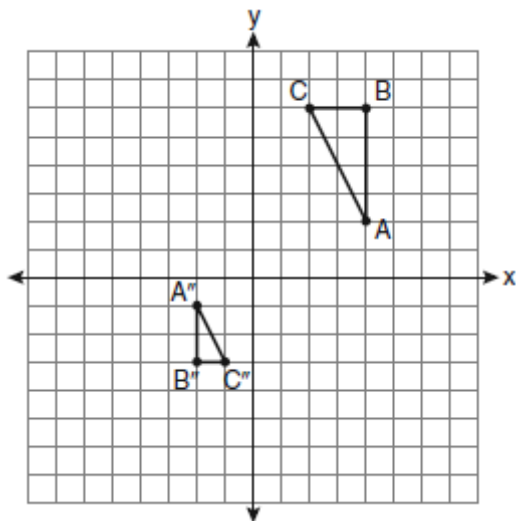
The coordinates of the vertices of parallelogram  $ABCD$  are  $A(-2, 2)$ ,  $B(3, 5)$ ,  $C(4, 2)$ , and  $D(-1, -1)$ . State the coordinates of the vertices of parallelogram  $A''B''C''D''$  that result from the transformation  $r_{y\text{-axis}} \circ T_{2, -3}$ . [The use of the set of axes below is optional.]



NAME: \_\_\_\_\_

3. 060908ge, P.I. G.G.60

After a composition of transformations, the coordinates  $A(4,2)$ ,  $B(4,6)$ , and  $C(2,6)$  become  $A''(-2,-1)$ ,  $B''(-2,-3)$ , and  $C''(-1,-3)$ , as shown on the set of axes below.



Which composition of transformations was used?

[A]  $R_{180^\circ} \circ D_2$

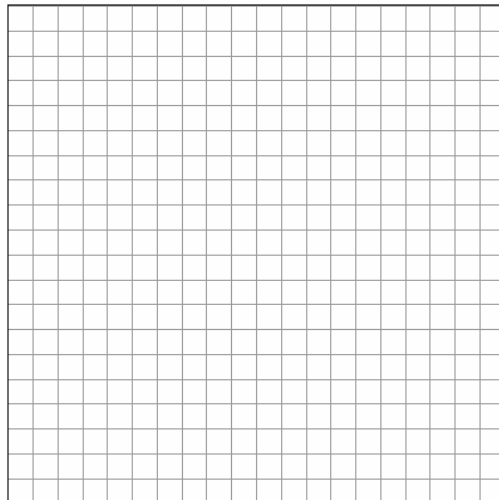
[B]  $D_{\frac{1}{2}} \circ R_{180^\circ}$

[C]  $D_{\frac{1}{2}} \circ R_{90^\circ}$

[D]  $R_{90^\circ} \circ D_2$

4. 060928b, P.I. G.G.58

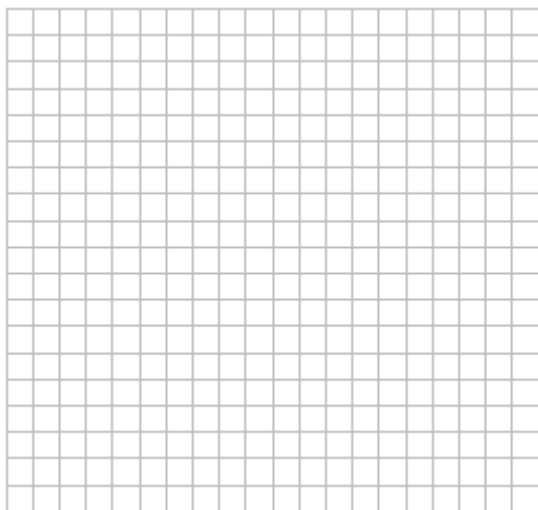
On the accompanying grid, graph and label  $\triangle ABC$  with vertices  $A(3,1)$ ,  $B(0,4)$ , and  $C(-5,3)$ . On the same grid, graph and label  $\triangle A''B''C''$ , the image of  $\triangle ABC$  after the transformation  $r_{x\text{-axis}} \circ r_{y=x}$ .



NAME: \_\_\_\_\_

5. 010930b, P.I. G.G.58

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,  $R_{270} \circ D_2$ . On the grid below, graph and label both the original park  $\triangle ABC$  and its image, the new park  $\triangle A''B''C''$ , following the transformation.



6. fall0823ge, P.I. G.G.58

The endpoints of  $\overline{AB}$  are  $A(3,2)$  and  $B(7,1)$ . If  $\overline{A''B''}$  is the result of the transformation of  $\overline{AB}$  under  $D_2 \circ T_{-4,3}$  what are the coordinates of  $A''$  and  $B''$ ?

- [A]  $A''(2,7)$  and  $B''(10,5)$   
 [B]  $A''(14,-2)$  and  $B''(22,-4)$   
 [C]  $A''(-2,10)$  and  $B''(6,8)$   
 [D]  $A''(-1,5)$  and  $B''(3,4)$

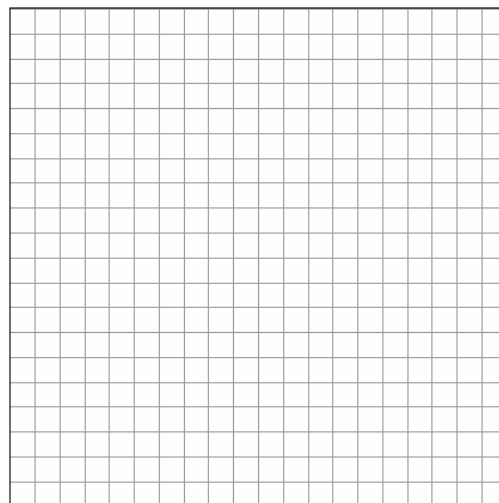
7. 080715b, P.I. G.G.58

The coordinates of  $\triangle JRB$  are  $J(1,-2)$ ,  $R(-3,6)$ , and  $B(4,5)$ . What are the coordinates of the vertices of its image after the transformation  $T_{2,-1} \circ r_{y\text{-axis}}$ ?

- [A]  $(3,-3)$ ,  $(-1,5)$ ,  $(6,4)$   
 [B]  $(1,-3)$ ,  $(5,5)$ ,  $(-2,4)$   
 [C]  $(3,1)$ ,  $(-1,-7)$ ,  $(6,-6)$   
 [D]  $(-1,-2)$ ,  $(3,6)$ ,  $(-4,5)$

8. 080626b, P.I. G.G.58

Given point  $A(-2,3)$ . State the coordinates of the image of  $A$  under the composition  $T_{-3,-4} \circ r_{x\text{-axis}}$ . [The use of the grid is optional.]



9. 010618b, P.I. G.G.58

What are the coordinates of point  $A'$ , the image of point  $A(-4,1)$  after the composite transformation  $R_{90^\circ} \circ r_{y=x}$  where the origin is the center of rotation?

- [A]  $(-4,-1)$  [B]  $(4,1)$   
 [C]  $(1,4)$  [D]  $(-1,-4)$

NAME: \_\_\_\_\_

10. 010520b, P.I. G.G.58

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

- [A]  $(5,6)$  [B]  $(-6,-9)$   
 [C]  $(9,-6)$  [D]  $(6,9)$

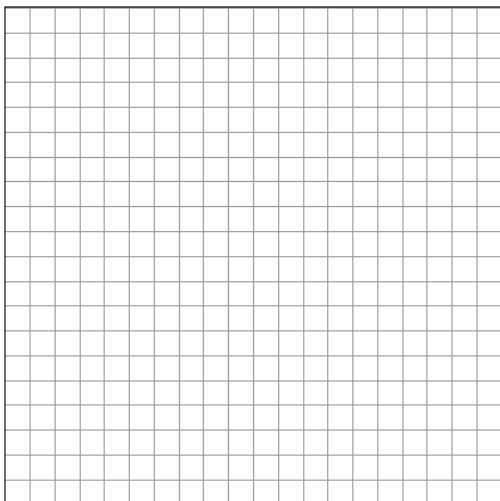
11. 080413b, P.I. G.G.58

What is the image of point  $(1,1)$  under  $r_{x\text{-axis}} \circ R_{0,90^\circ}$ ?

- [A]  $(-1,-1)$  [B]  $(1,1)$   
 [C]  $(1,-1)$  [D]  $(-1,1)$

12. 080327b, P.I. G.G.58

On the accompanying grid, graph and label  $\overline{AB}$ , where  $A$  is  $(0,5)$  and  $B$  is  $(2,0)$ . Under the transformation  $r_{x\text{-axis}} \circ r_{y\text{-axis}}(\overline{AB})$ ,  $A$  maps to  $A''$  and  $B$  maps to  $B''$ . Graph and label  $\overline{A''B''}$ . What single transformation would map  $\overline{AB}$  to  $\overline{A''B''}$ ?



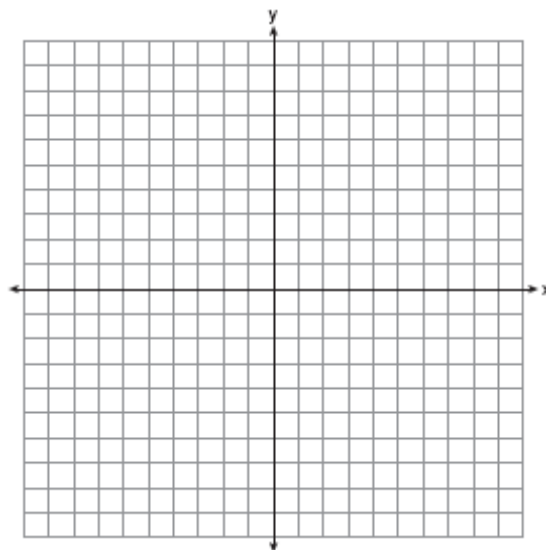
13. 080231b, P.I. G.G.58

Graph and label the following equations,  $a$  and  $b$ , on the accompanying set of coordinate axes.

$$a: y = x^2$$

$$b: y = -(x - 4)^2 + 3$$

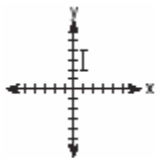
Describe the composition of transformations performed on  $a$  to get  $b$ .



NAME: \_\_\_\_\_

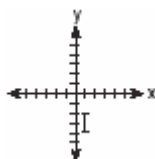
14. 080219b, P.I. G.G.58

The accompanying graph represents the figure  $\Gamma$ .

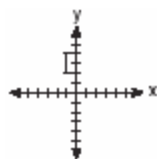


Which graph represents  $\Gamma$  after a transformation defined by  $r_{y=x} \circ R_{90^\circ}$ ?

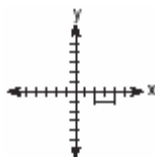
[A]



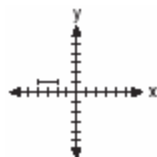
[B]



[C]



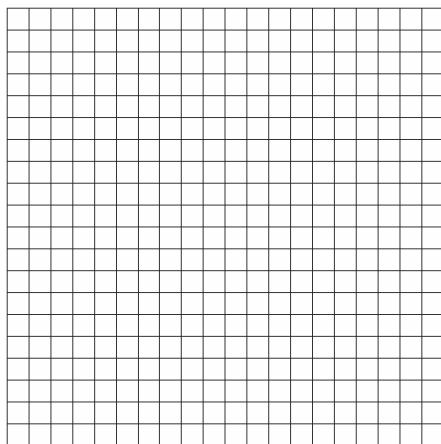
[D]



15. 010232b, P.I. G.G.58

a On the accompanying grid, graph the equation  $2y = 2x^2 - 4$  in the interval  $-3 \leq x \leq 3$  and label it  $a$ .

b On the same grid, sketch the image of  $a$  under  $T_{5,-2} \circ r_{x\text{-axis}}$  and label it  $b$ .

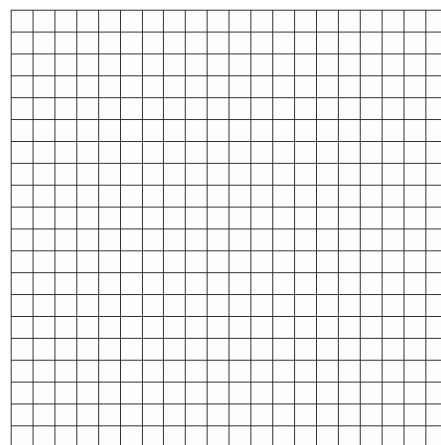


16. 080028a, P.I. G.G.58

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.



[1] D

[4]  $A''(0,-1)$ ,  $B''(-5,2)$ ,  $C''(-6,-1)$ , and  $D''(-1,-4)$ , and appropriate work is shown.

[3] The composite transformation is graphed and labeled correctly, but the coordinates are not stated or are stated incorrectly.

or [3] Appropriate work is shown, but one computational or graphing error is made.

[2] Appropriate work is shown, but two or more computational or graphing errors are made.

or [2] Appropriate work is shown, but one conceptual error is made, such as performing the reflection before the translation.

[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.

or [1]  $A''(0,-1)$ ,  $B''(-5,2)$ ,  $C''(-6,-1)$ , and  $D''(-1,-4)$ , but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[2] incorrect procedure.

[3] B

[4] Both  $\triangle ABC$  and  $\triangle A''B''C''$  are graphed and labeled correctly.

[3] Appropriate work is shown, but one graphing or labeling error is made.

or [3] Appropriate work is shown, but only  $\triangle A''B''C''$  is graphed and labeled correctly.

[2] Appropriate work is shown, but two or more graphing or labeling errors are made.

or [2] Appropriate work is shown, but one conceptual error is made, such as reflecting over the  $x$ -axis before reflecting over the line  $y = x$ .

[1] Appropriate work is shown, but one conceptual error and one graphing or labeling error are made.

or [1]  $A''(1,-3)$ ,  $B''(4,0)$ , and  $C''(3,5)$  are stated, but no work is shown.

or [1]  $\triangle ABC$  is graphed and labeled correctly, but only  $r_{y=x}$  or  $r_{x\text{-axis}}$  is graphed correctly.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[4] incorrect procedure.

[4] Triangles  $ABC$  and  $A''B''C''$  are graphed and labeled correctly. [Students are not required to state the coordinates  $A''(6,-6)$ ,  $B''(-4,-10)$ , and  $C''(-2,6)$ .]

[3] Appropriate work is shown, but one computational or graphing error is made.

or [3] Only triangle  $A''B''C''$  is graphed and labeled correctly.

[2] Appropriate work is shown, but two or more computational or graphing errors are made.

or [2] Appropriate work is shown, but one conceptual error is made.

or [2] Triangle  $ABC$  is graphed and labeled correctly, and either the rotation or dilation is graphed and labeled correctly.

or [2] The coordinates  $A''(6,-6)$ ,  $B''(-4,-10)$ , and  $C''(-2,6)$  are stated, but no further correct work is shown.

[1] Appropriate work is shown, but one conceptual error and one computational or graphing error are made.

or [1] Triangle  $ABC$  is graphed and labeled correctly, but no further correct work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[5] incorrect procedure.

[6] C

[7] B

[2]  $(-5,-7)$ , and appropriate work is shown, such as stating the coordinates of each transformation or graphing each transformation.

[1] Appropriate work is shown, but one computational or graphing error is made.

or [1] Appropriate work is shown, but one conceptual error is made, such as performing the translation before the reflection.

or [1] Only one of the transformations is performed correctly.

or [1]  $(-5,-7)$ , but no work is shown.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[8] incorrect procedure.

[9] B

[10] D

[11] A

- [4]  $\overline{AB}$  and  $\overline{A''B''}$  are graphed and labeled correctly,  $A''(0,-5)$  and  $B''(-2,0)$ , and a correct transformation is identified, such as  $R_{180^\circ}$ ,  $R_{-180^\circ}$ , or  $r_{(0,0)}$ .
- [3] One error is made in graphing  $\overline{AB}$ , but  $\overline{A''B''}$  is graphed and labeled appropriately, and an appropriate transformation is identified.
- [2]  $\overline{AB}$  is graphed and labeled correctly but one mistake is made in finding  $\overline{A''B''}$ , but an appropriate transformation is identified.
- or [2] Both  $\overline{AB}$  and  $\overline{A''B''}$  are graphed and labeled correctly, but the transformation is missing or is incorrect.
- [1]  $\overline{AB}$  is graphed and labeled correctly, but one mistake is made in finding  $\overline{A''B''}$ , and the transformation is missing or is incorrect.
- or [1] One error is made in graphing  $\overline{AB}$ , but  $\overline{A''B''}$  is graphed and labeled appropriately, but the transformation is missing or is incorrect.
- or [1]  $R_{180^\circ}$ ,  $R_{-180^\circ}$ , or  $r_{(0,0)}$ , but no graph is drawn.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [12] \_\_\_\_\_

- [4] Both equations are graphed correctly and the description of the transformation  $a \rightarrow b$  is correct, such as  $T_{(4,3)} \circ r_{x\text{-axis}}$  or  $r_{y=3} \circ T_{(4,3)}$  or  $T_{(4,3)} \circ R_{180^\circ}$  or an equivalent explanation, such as a shift right of 4 followed by a reflection over the  $x$ -axis followed by a shift up of 3.
- [3] Both equations are graphed correctly, but only one transformation is shown or described correctly.
- [2] Both equations are graphed correctly, but no further correct work is shown.
- [1] Only one equation is graphed correctly, and no composition formula or explanation is shown.
- or [1] The correct composition formula or explanation is shown, but no graphs or incorrect graphs are drawn.
- or [1] Both equations are graphed incorrectly, but an appropriate composition formula or explanation is shown.
- [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [13] \_\_\_\_\_
- [14] A \_\_\_\_\_
- a [2] The equation  $2y = 2x^2 - 4$  is graphed correctly over the required interval and labeled.
- [1] An appropriate graph is shown, but less than the required interval is drawn.
- or [1] An appropriate graph is shown, but one coordinate is calculated incorrectly.
- b [2] A correct composition of transformations of the graph drawn in part a is sketched and labeled.
- [1] Only one of the transformations is correct.
- or [1] The composition of transformations is correct, but done in reverse order.
- a and b [0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously incorrect procedure.
- [15] \_\_\_\_\_



[3] Yes,  $A''$  is  $(1,-3)$  and  $B''$  is  $(2,-1)$  and appropriate work is shown, algebraically or graphically.

[2] Correct coordinates for  $A''$  and  $B''$  are found, but no conclusion is shown.

or [2] Either  $A''$  or  $B''$  is correct, and an appropriate conclusion is shown.

or [2] One transformation is correct and one is incorrect, such as the reflection in  $y$ , but an appropriate conclusion is shown.

[1] Neither transformation is correct, but an appropriate conclusion is shown.

or [1] One transformation is correct.

[0] A zero response is completely incorrect, irrelevant, or incoherent or is a correct response that was obtained by an obviously

[16] incorrect procedure.

---