

GEOMETRY

Exam 9

Based on Chapter 9 (pages 570 - 661) in your textbook.

Student's Name _____ Student Number _____

Street _____ City _____ State _____ Zip Code _____

BE SURE YOU FULLY UNDERSTAND ALL CHECKPOINT PROBLEMS FROM THIS CHAPTER BEFORE YOU COMPLETE THIS EXAM. **SHOW AS MUCH WORK AS POSSIBLE.**

Items 1-4: Use the figure to the right.

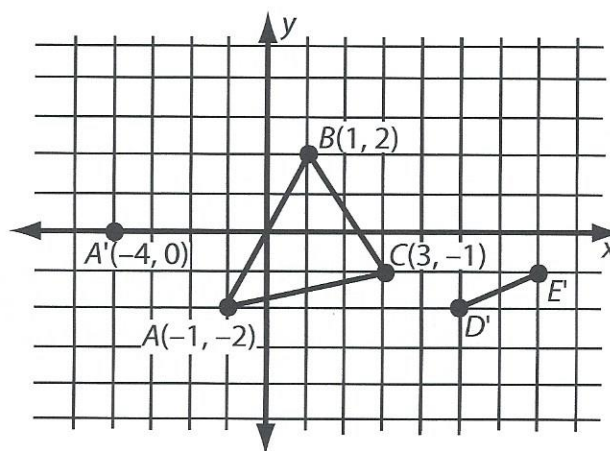
1. Write a rule for the translation of point A to point A' and use that rule to locate points B' and C' .

$(x, y) \rightarrow$ (_____, _____)

$A(-1, -2) \rightarrow A'(-4, 0)$

$B(1, 2) \rightarrow B'(\text{_____, } \text{_____})$

$C(3, -1) \rightarrow C'(\text{_____, } \text{_____})$



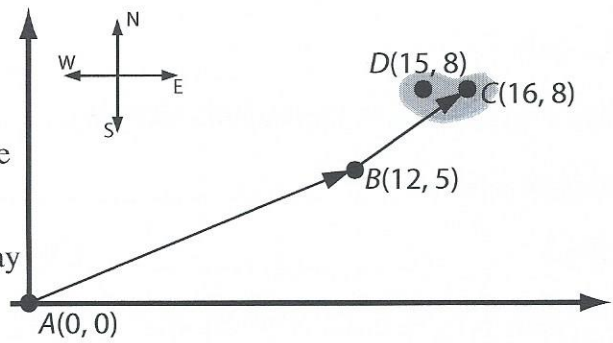
2. Draw $\triangle A'B'C'$ and write a rule to translate $\triangle A'B'C'$ back to $\triangle ABC$.

$(x, y) \rightarrow$ (_____, _____)

3. The image of $(x, y) \rightarrow (x + 1, y - 5)$ is $\overline{D'E'}$ as shown. Draw the preimage.

4. Write the vector that translates $\overline{DE}$ to $\overline{D'E'}$.

5. (A) A golfer, teeing off on an easy par 3 hole from point A , hits the ball to point B . The second stroke moves the ball from point B to C (on the green), ten feet away from the hole (point D). Write the component form for $\overrightarrow{AB}$, $\overrightarrow{BC}$, and $\overrightarrow{AD}$.



$\overrightarrow{AB}$ _____ $\overrightarrow{BC}$ _____ $\overrightarrow{AD}$ _____

- (B) If the golfer makes a ten foot putt from point C into the hole (at point D), then how far did the ball travel en route from A to B to C to D ? *Hint: use the Pythagorean triples 3, 4, 5; 5, 12, 13; and 8, 15, 17 and a scale of 1 unit = 10 feet.*

- (C) How far would the ball travel for a hole in one (A to D)?

(more)

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6. Add, subtract, or multiply the following matrices as indicated.

$$(A) \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix} + \begin{bmatrix} 2 & 0 \\ 3 & -5 \end{bmatrix} =$$

$$(B) \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix} - \begin{bmatrix} 2 & 0 \\ 3 & -5 \end{bmatrix} =$$

$$(C) \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 \\ 3 & -5 \end{bmatrix} =$$

7. Fill in the values to represent the translation from problem 1 using matrices.

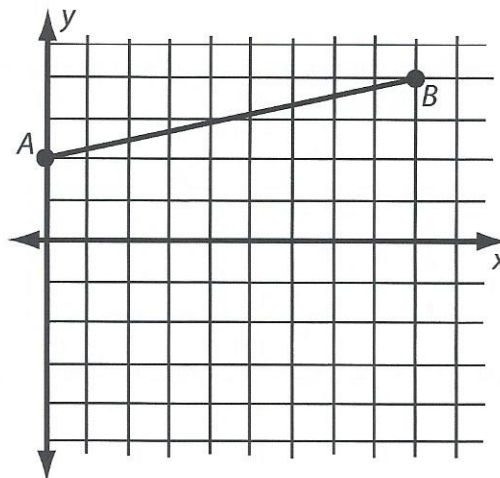
$$\begin{bmatrix} _ & _ & _ \\ _ & _ & _ \end{bmatrix} + \begin{bmatrix} A & B & C \\ _ & _ & _ \end{bmatrix} = \begin{bmatrix} A' & B' & C' \\ _ & _ & _ \end{bmatrix}$$

Items 8-10: Use the figure to the right. The endpoints of $\overline{AB}$ are $A(0, 2)$ and $B(9, 4)$

8. Graph the reflection of $\overline{AB}$ in the x -axis.

9. Locate a point C on the x -axis such that $AC + BC$ is minimized.

$$C = (_, 0)$$



10. Fill in the values to complete item 8 with matrix multiplication.

$$\begin{bmatrix} _ & _ \\ _ & _ \end{bmatrix} \begin{bmatrix} A & B \\ _ & _ \end{bmatrix} = \begin{bmatrix} A' & B' \\ _ & _ \end{bmatrix}$$

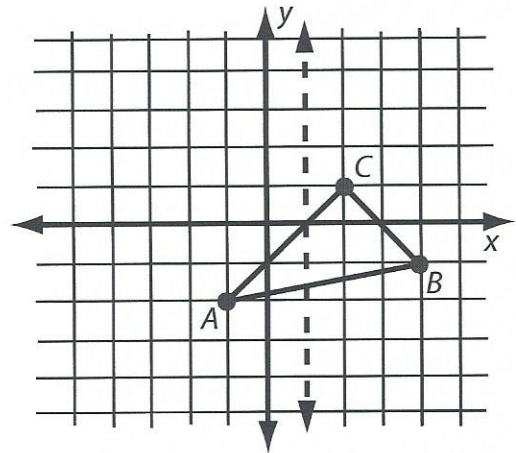
(over)

Items 11-13: Use the figure to the right.

11. Graph the reflection of $\triangle ABC$ in the line $n: x = 1$

12. T F The image can be found by multiplying $\begin{bmatrix} -1 & 0 \\ 0 & 1 \end{bmatrix}$ and $\begin{bmatrix} -1 & 4 & 2 \\ -2 & -1 & 1 \end{bmatrix}$ or using the transformation $(x, y) \rightarrow (-x, y)$.

13. T F y is the perpendicular bisector of $\overline{BB'}$.



Items 14-16: Use the figure to the right.

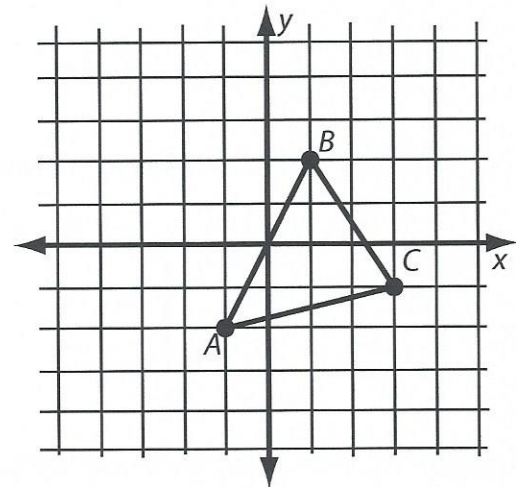
14. Use the coordinate rules to rotate $\triangle ABC$ 90° counterclockwise around the origin. List the coordinates and draw the image of $\triangle A'B'C'$.

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

$$A(-1, -2) \rightarrow A'(_, _)$$

$$B(1, 2) \rightarrow B'(_, _)$$

$$C(3, -1) \rightarrow C'(_, _)$$



15. Find the image matrix that results from a 270° counterclockwise rotation of $\triangle A'B'C'$ from problem 14.

$$\begin{bmatrix} _ & _ \\ _ & _ \end{bmatrix} \begin{bmatrix} A' & B' & C' \\ _ & _ & _ \\ _ & _ & _ \end{bmatrix} = \begin{bmatrix} A'' & B'' & C'' \\ _ & _ & _ \\ _ & _ & _ \end{bmatrix}$$

16. Why you would expect $\triangle A''B''C''$ to have the same vertices as $\triangle ABC$ from problem 14?

(more)

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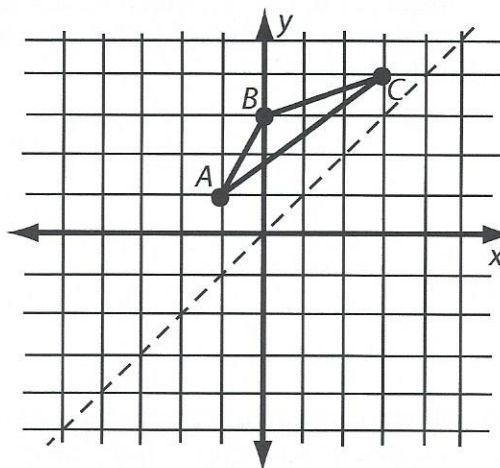
17. The vertices of $\triangle ABC$ are $A(-1, 1)$, $B(0, 3)$, and $C(3, 4)$. Graph the image of $\triangle ABC$ after a composition of the following transformations in the order they are listed.

Translation: $(x, y) \rightarrow (x - 3, y - 3)$

Reflection: in the line $y = x$

Yes No Is the composition a glide reflection?

Yes No Is the image the same if the order of the transformations is switched? (reflection, then glide)



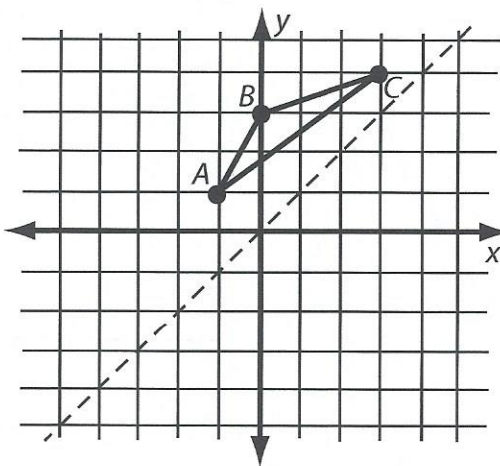
18. The vertices of $\triangle ABC$ are $A(-1, 1)$, $B(0, 3)$, and $C(3, 4)$. Graph the image of $\triangle ABC$ after a composition of the following transformations in the order they are listed.

Rotation: 90° counterclockwise about the origin

Reflection: in the y -axis

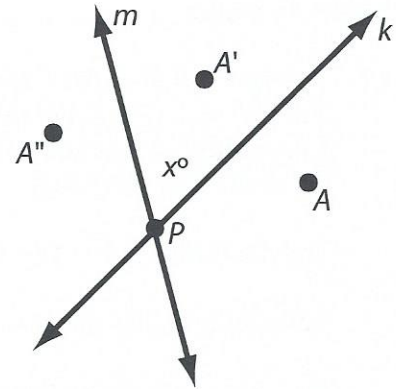
Yes No If the transformations were performed in reverse order (reflection, then rotation), would the final image be the same?

Yes No Would the reflection of $\triangle ABC$ in the line $y = x$ have produced the same final image?



(over)

19. If a reflection in line k followed by a reflection in line m maps point A to A'' , which results in the same image as a 120° rotation about point P , then what is the value of x ?



20. Next to each figure below fill in (a) number of lines of symmetry and (b) all the angles of rotational symmetry. Write "none" where necessary.



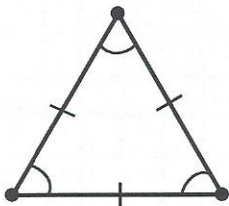
a.

b.



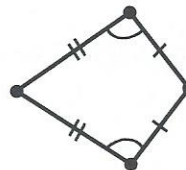
a.

b.



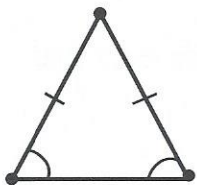
a.

b.



a.

b.



a.

b.



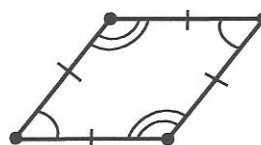
a.

b.



a.

b.



a.

b.

(more)

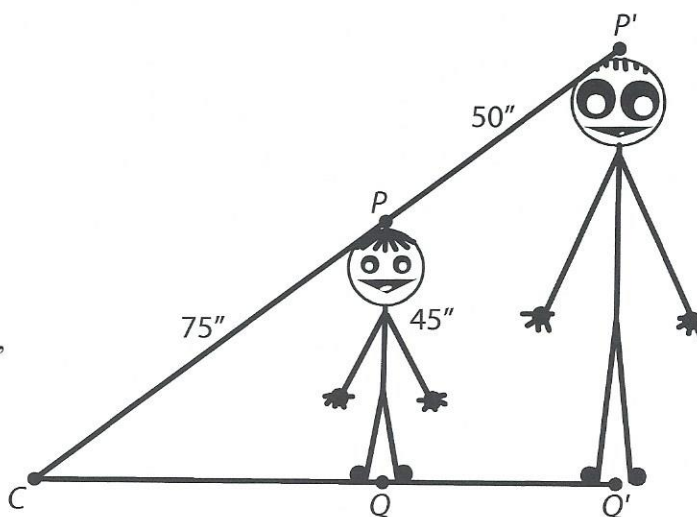
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21. (A) Find the scale factor of dilation for the figure to the right.

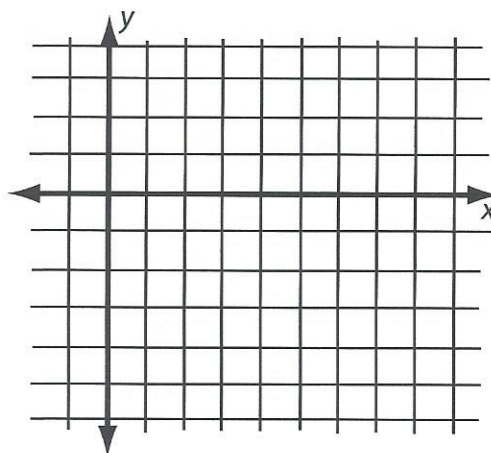
- (B) Is this a reduction or enlargement? (circle one)
reduction *enlargement*

If Jay (PQ) is 3' 9" (or 45 inches) tall, how tall is his dad ($P'Q'$)?



22. The vertices of $\triangle ABC$ are $A(3, -6)$, $B(6, 3)$, $C(9, -3)$. Find the image matrix that represents the dilation of $\triangle ABC$ centered at the origin with a scale factor of $\frac{2}{3}$. Then graph the triangle and its image.

$$\begin{bmatrix} A & B & C \\ \text{---} & \text{---} & \text{---} \\ \text{---} & \text{---} & \text{---} \end{bmatrix} = \begin{bmatrix} A' & B' & C' \\ \text{---} & \text{---} & \text{---} \\ \text{---} & \text{---} & \text{---} \end{bmatrix}$$



23. Which of these is NOT an isometry?

- (A) a translation
 (B) a 30° rotation about the origin followed by a reflection in the x -axis
 (C) a dilation
 (D) a reflection in the line $y = -x$ followed by a 160° rotation about the point $(1, -2)$

FILL IN YOUR NAME AND THE OTHER REQUIRED INFORMATION ON EACH PAGE OF THE EXAM AND MAIL THE EXAM TO AMERICAN SCHOOL.

