Day 2 Investigation – Translations

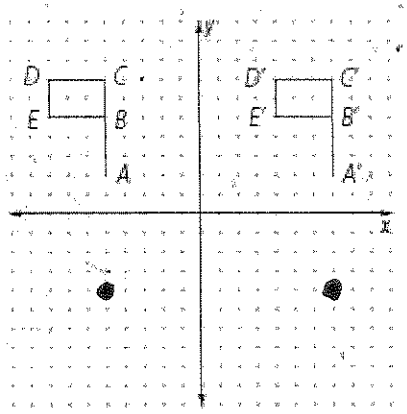
Name: ANSWER KEY

Translating Shapes A **translation**, or sliding motion, is determined by distance and direction. By looking carefully at a simple shape and its translated image, you can discover patterns relating the coordinates of the shape and the coordinates of its image. ← translated figure

(2) On the screen below, a flag *ABCDE* and its translated image *A'B'C'D'E'* are shown.

preimage → original figure

Horizontal Translation



a. Describe the translation as precisely as you can.

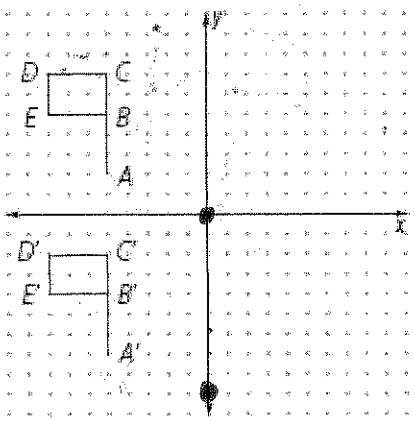
b. Explain how the translated image of the flag could be produced using only the translated images of points *A*, *B*, *C*, *D*, and *E*.

c. Under this translation, what would be the image of (0, 0)? Of (1, −5)? Of (−5, −4)? Of (*a*, *b*)?

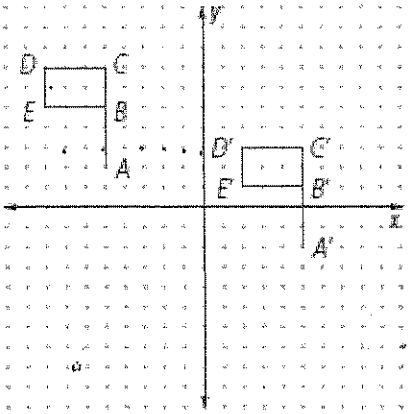
d. Write a rule you can use to obtain the image of any point (*x*, *y*) in the coordinate plane under this translation. State your rule in words and in symbolic form (*x*, *y*) → (__, __).

(3) The screens below show a flag *ABCDE* and its image under two other translations.

Vertical Translation



Oblique Translation



a. Describe the vertical translation as precisely as you can. The diagonal (oblique) translation.

b. Under the vertical translation, what would be the image of (0, 0)? Of (2, 5)? Of (4.1, −2)? Of (*a*, *b*)?

Your answers:

2a. 12 units right

b. omit

c. (0, 0) → (12, 0)
(1, −5) → (13, −6)
(−5, −4) → (7, −4)
(a, b) → (a + 12, b)

*d. (x, y) → (x + 12, y)

3a. Vertical → 9 units down

Oblique → 4 down 10 right

b. • (0, −9)
• (2, −4)
• (4.1, −11)
• (a, b − 9)

$(x,y) \to (x+\_\_, y+\_\_)$ $(x,y) \to (0+a, 0+b)$ $\to (a,b)$

c. Write a rule you can use to obtain the image of any point (x, y) under the vertical translation. State your rule in words and in symbolic form $(x, y) \to (\_\_, \_\_)$.

c. $(x,y) \to (x, y-9)$

d. Under the oblique translation, what would be the image of $(0, 0)$? Of $(2, 5)$? Of $(4.1, -2)$? Of (a, b)?

d. $(0,0) \to (10,-4)$
$(2,5) \to (12,1)$
$(4.1,-2) \to (14.1,-6)$
$(a,b) \to (a+10, b-4)$

e. Write a rule you can use to obtain the image of any point (x, y) under the oblique translation. State your rule in words and in symbolic form.

e. $(x,y) \to (x+10, y-4)$
10 units right
4 units down

(4) Compare the transformation rules you developed for Part d of Problem 2 and for Parts c and e of Problem 3. Write a general rule that tells how to take any point (x, y) and find its translated image if the preimage is moved horizontally h units and vertically k units. Compare your rule with others and resolve any differences.

4. $(x,y) \to (x+h, y+k)$

You now have a rule you can use to find the translated image of any point when you know the **components of the translation**—the horizontal and vertical distances and directions the point is moved (left or right, up or down). This is exactly the information a calculator or computer graphics program needs in order to display a set of points and their translated images.

(5) Use the following questions to help write an algorithm that would guide a programmer in the development of a translation program that displays the original figure (called the **preimage**) and its translated image and connects corresponding vertices of the two figures.

- What information would you need to input?
- What formula or formulas could be used in the processing portion?
- What information should be displayed in the output?

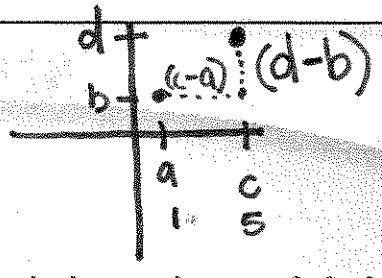
list of steps to solve problem

$(x,y) \to (x+h, y+k)$

5. Hint: Write the steps you would use to translate a figure.

① Enter pre-image coordinates (x,y)] input
② Enter rule $(x,y) \to (x+h, y+k)$]
③ Calculate the new image] processing
④ ⑤ Display image coordinates (x', y')] output

Summarize the Mathematics



In this investigation, you developed coordinate rules relating points and their images under different rigid transformations: translations, rotations about the origin, and line reflections.

(1) A translation is determined by a single point and its image.

i. Suppose a translation slides the point $O(0, 0)$ to the point $A(a, b)$. Write a symbolic rule $(x, y) \to (a, b)$ that describes this translation.

ii. Suppose a translation slides the point $A(a, b)$ to the point $B(c, d)$. Write a symbolic rule $(x, y) \to (\_\_, \_\_)$ that describes this translation.

$(x,y) \to (x+(c-a), y+(d-b))$

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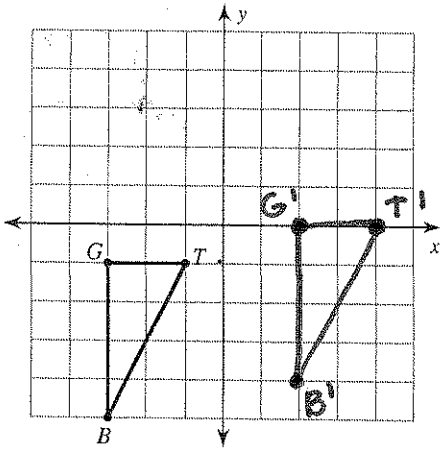
Name_____

Translations DAY 2 HOMEWORK

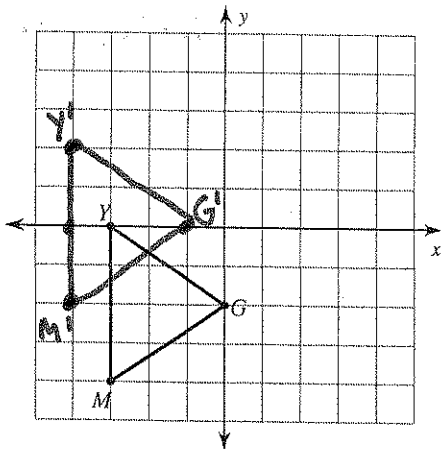
Date_____ Period____

Graph the image of the figure using the transformation given.

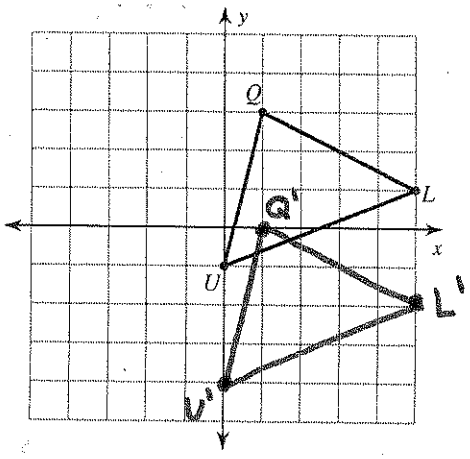
1) translation: 5 units right and 1 unit up



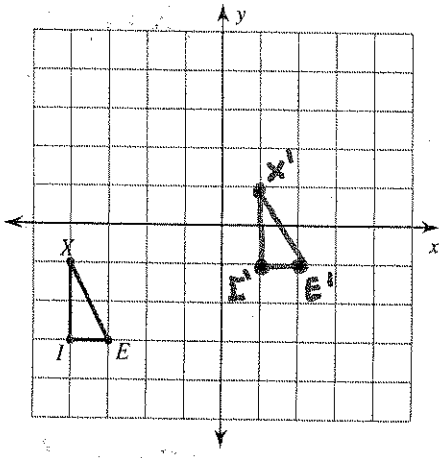
2) translation: 1 unit left and 2 units up



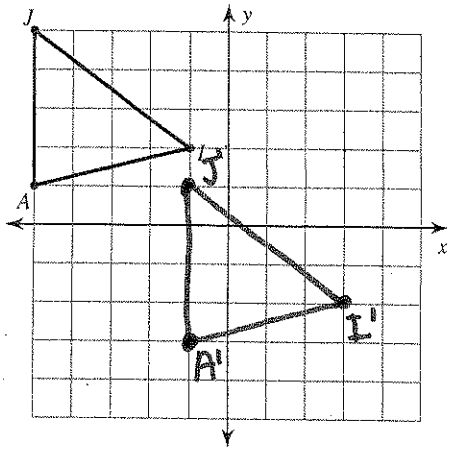
3) translation: 3 units down



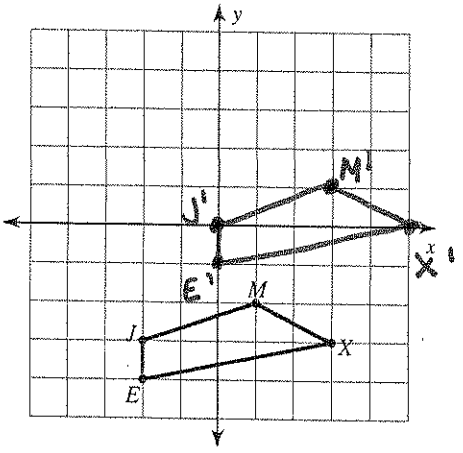
4) translation: 5 units right and 2 units up



5) translation: 4 units right and 4 units down

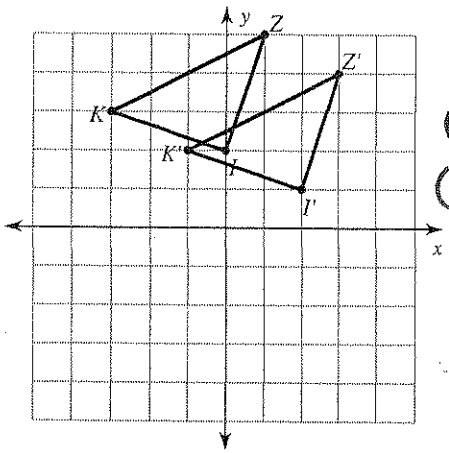


6) translation: 2 units right and 3 units up



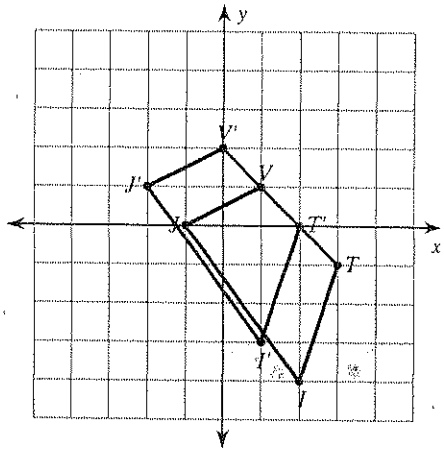
Write a rule to describe each transformation.

7)



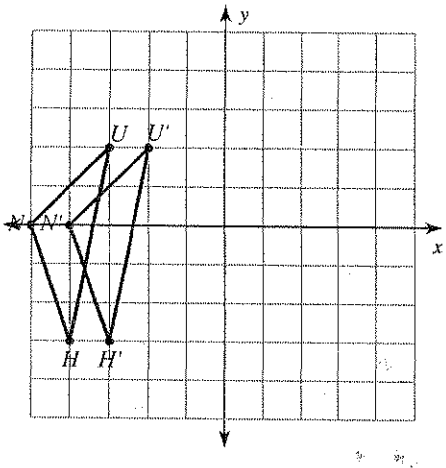
$(x,y) \rightarrow (x+2, y-1)$

8)



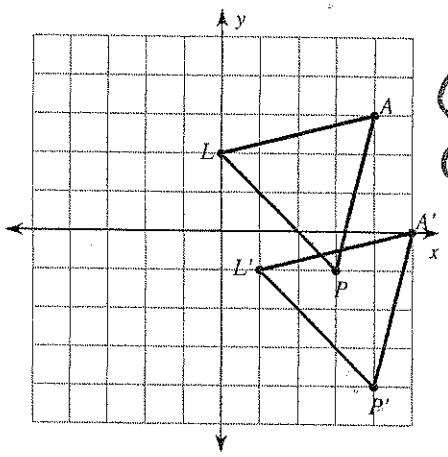
$(x,y) \rightarrow (x-1, y+1)$

9)



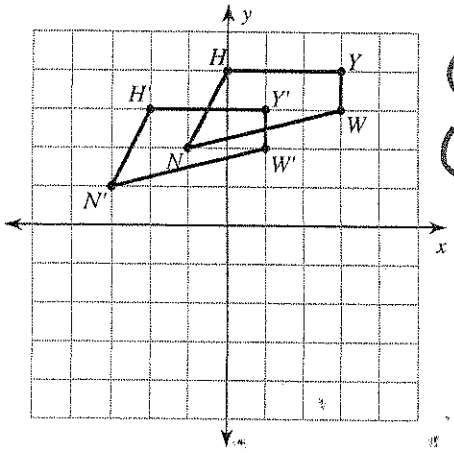
$(x,y) \rightarrow (x+1, y)$

10)



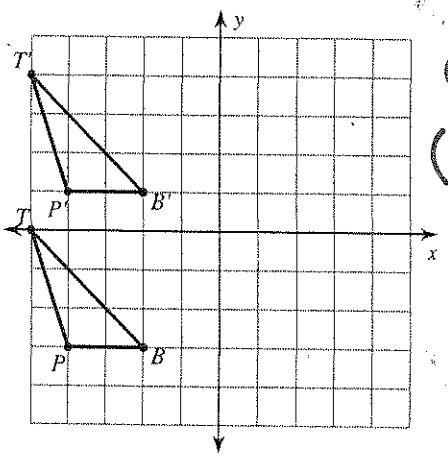
$(x,y) \rightarrow (x+1, y-3)$

11)



$(x,y) \rightarrow (x-2, y-1)$

12)



$(x,y) \rightarrow (x, y+4)$