

## Concept: Transformations

Name:

- You should have completed Graphing – Section 4 Part A: Transformations before beginning this handout.

### PART B: COMPUTER COMPONENT

**Instructions:** In UMATH X follow the **Content Menu** path:

**Graphing > Transformations**



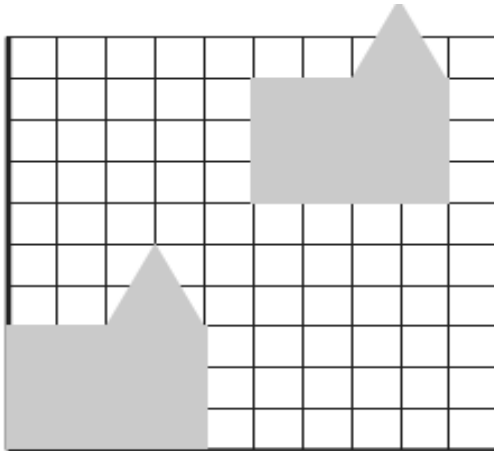
Work through all Sub Lessons of the following Lessons **in order**:

- *Translations*
- *Reflections*
- *Rotations*
- *Dilations*



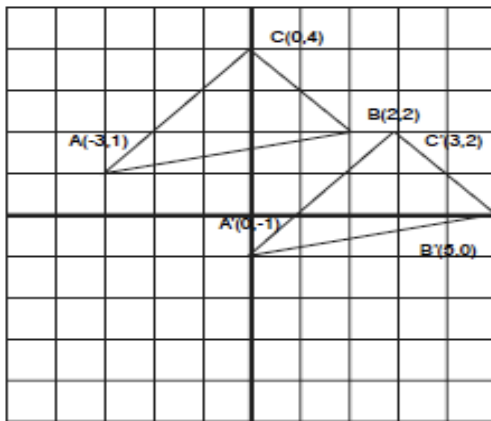
The remainder of your notes will be taken by filling in the blanks and by making sketches of the exercises while you perform the above lessons on the computer.

Use the grids provided for your sketches.

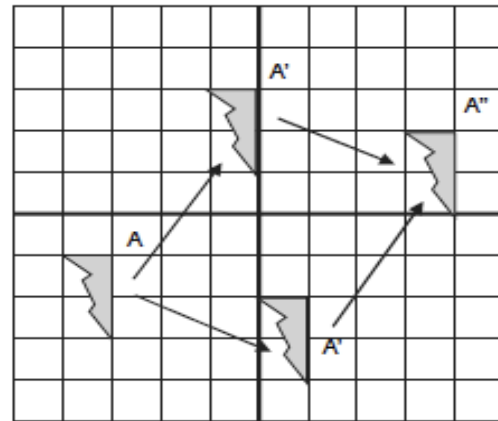
1. *Translation*

 $A(0, 0)$  maps onto  $A'(5, 6)$ 
 $B(4, 0)$  maps onto  $B'(9, 6)$ 
 $C()$  maps onto  $C'(9, 8)$ 

This results in the mapping rule  $(x, y) \rightarrow (x+5, y+6)$   
 Therefore 5 is added to the x-coordinate  
 and 6 is added to the y-coordinate.

From example 1:



From example 2:



Explain how the order of the translations affects the final image produced.

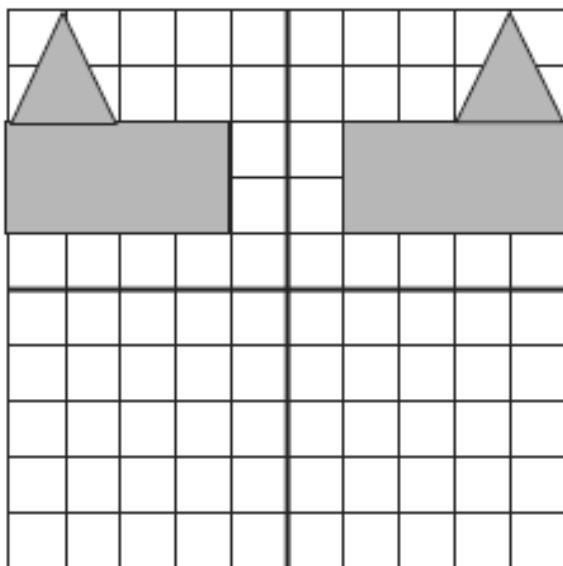
*Regardless of the order in which the translations are processed, the result is the same.*

Explain how two different translations can be combined into one.

*We will need to add the two (or more) translations together and use the results for the movement through x and y space.*

## 2. Reflection (can also be called a “Flip”)

### Sketches



### Reflection Mapping Rules

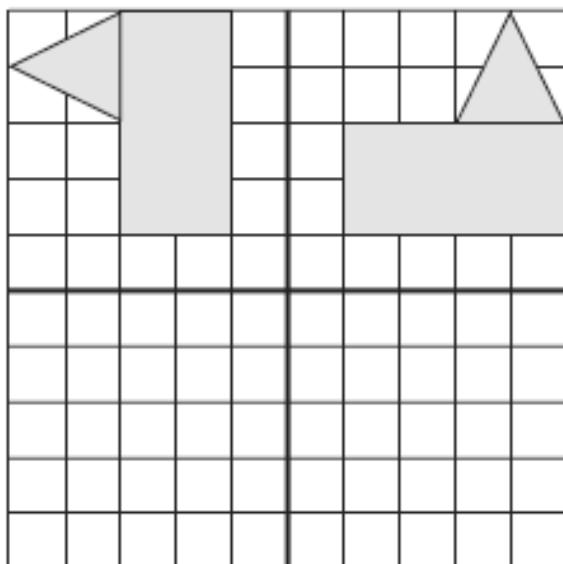
the 1<sup>st</sup> one we used  $(x,y) \rightarrow (-x, y)$

from example 1  $(x,y) \rightarrow (x, -y)$

from example 2  $(x,y) \rightarrow (-x, -y)$

## 3. Rotation

### Sketches



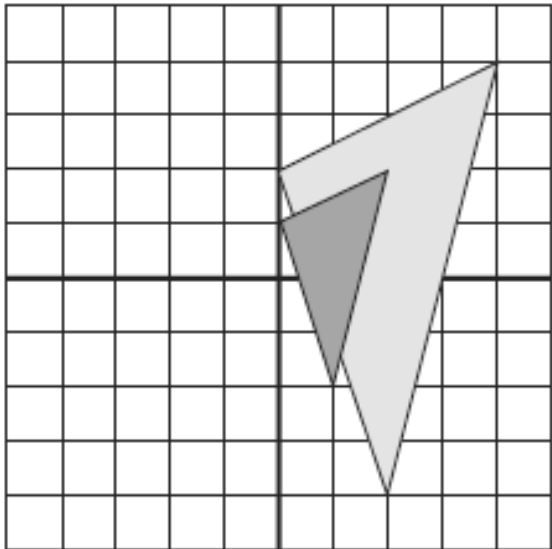
### Rotation Mapping Rules

the 1<sup>st</sup> one we used  $(x,y) \rightarrow (-y, x)$

from example 1  $(x,y) \rightarrow (y, -x)$

from example 2  $(x,y) \rightarrow (-x, -y)$

#### 4. Dilatation

| Sketches  | Dilatation Mapping Rules   |
|---|--|
|  | <p>the 1<sup>st</sup> one we used    <math>(x,y) \rightarrow (2x, 2y)</math></p> <p>from example 1        <math>(x,y) \rightarrow (1/3x, 1/3y)</math></p> <p>from example 2        <math>(x,y) \rightarrow (2x, 2y)</math></p> |

In the first Dilatation that took place, the image was a (n) reduction of the object.

Here, we used the mapping  $(x,y) \rightarrow (1/3x, 1/3y)$

In the second Dilatation that took place, the image was a (n) enlargement of the object.

Here, we used the mapping  $(x,y) \rightarrow (2x, 2y)$

#### OFF COMPUTER EXERCISES

1. (a) Using a piece of graph paper from your notebook, draw the following grid:

- ➔ the x-values must range from -12 to 12
- ➔ the y-values must range from -10 to 10

(b) Draw the object (the original figure) on the grid created in (a) using the following coordinates:

A (-4,0) , B (2,-2) , C (6,4)

- (c) (i) Complete the following transformations using the object in (b).  
 (ii) Identify each transformation as a translation, reflection, rotation or dilatation.

Transformation 1:     $(x-1, y+2)$     translation

Transformation 2:     $(-y, x)$             rotation

Transformation 3:     $(2x, 2y)$             enlargement

Transformation 4:     $(y, -x)$             rotation

Transformation 5:     $(x, -y)$             reflection

Transformation 6:     $(x+5, y-4)$         translation

Transformation 7:  $(-x, -y)$  **rotation**

Transformation 8:  $(\frac{1}{2}x, \frac{1}{2}y)$  **dilatation**

2. Combine transformations 1 and 6 from above. What is the new transformation formed?

**Transformation 1  $(x-1, y+2)$  + Transformation 6  $(x+5, y-4) = T'(x+4, y-2)$  translation**

3. (a) Using a piece of graph paper from your notebook, draw the following grid:

➔ the x-values must range from  $-9$  to  $9$

➔ the y-values must range from  $-12$  to  $12$

(b) Draw the object (the original figure) on the grid created in (a) using the following coordinates:

D  $(-6, 3)$ , E  $(0, 3)$ , F  $(6, -3)$ , G  $(-3, -9)$

(c) (i) Complete the following transformations using the object in (b).

(ii) Identify each transformation as a translation, reflection, rotation or dilatation.

Transformation 1:  $(x, -y)$  **reflection**

Transformation 2:  $(-y, x)$  **rotation**

Transformation 3:  $(x-2, y-3)$  **translation**

Transformation 4:  $(\frac{1}{3}x, \frac{1}{3}y)$  **dilatation**

Transformation 5:  $(y, -x)$  **reflection**

Transformation 6:  $(-x, -y)$  **rotation**