



7th
Basic

8th
Advanced

USA
GRADES

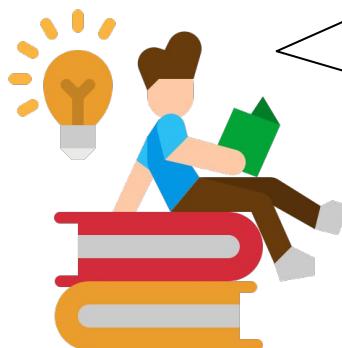
Helping With Math

Shape Transformations

Suitable for students
aged 11-13



This pack is suitable for learners aged 11 to 13 years old or 7th and 8th graders (USA). The content covers fact files and relevant basic and advanced activities involving transformations.



Reading is as important as understanding the different shape transformations. Let's learn it together!



What is Transformation?

- This is the process of manipulating or changing a polygon or any other 2D object on a plane.
- We have to know important terms like "preimage" and "image".
- Preimage, also called as inverse image, is the 2D shape before any transformation.
- Image is the figure made after transformation.



TYPES OF TRANSFORMATION

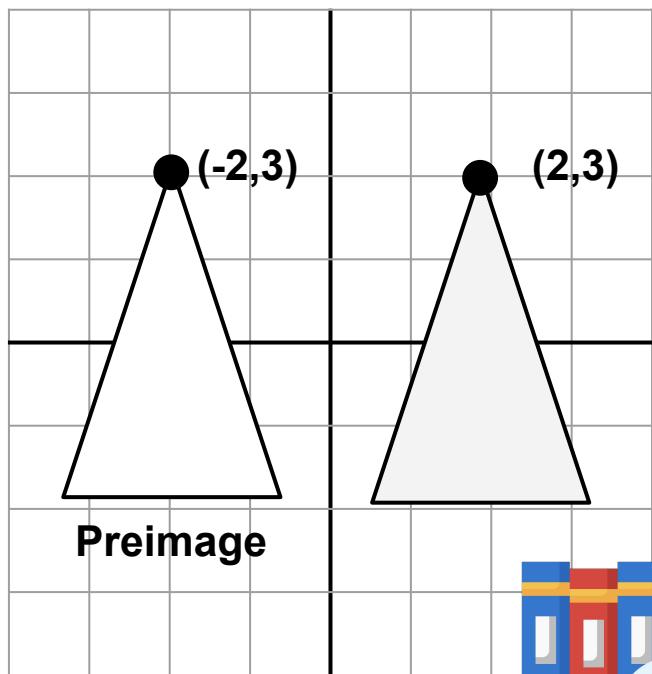
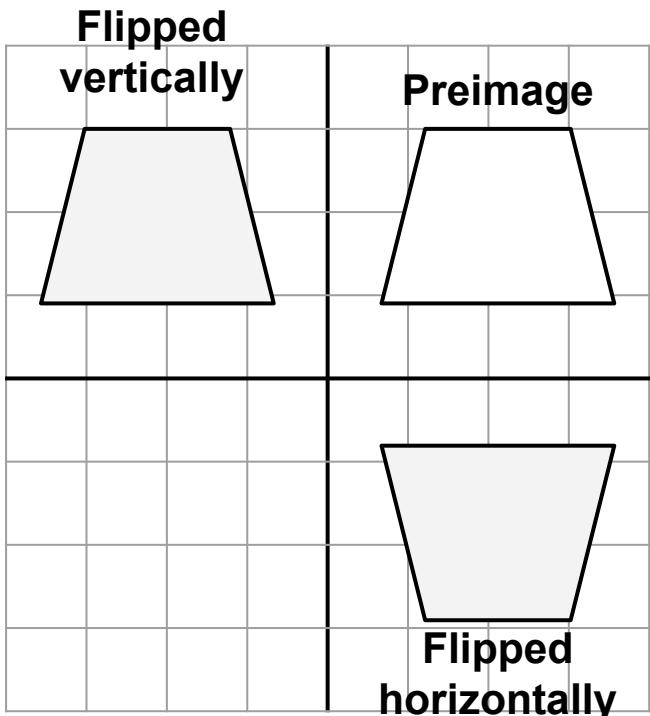
RIGID TRANSFORMATION

The images from these transformations does not change its sizes and shapes.



REFLECTION

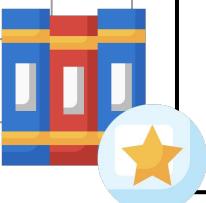
This is the mirrored image of the preimage. This is done by flipping the preimage.



To use reflection in a coordinate plane, you need to identify the coordinate of the vertex, and count the distance of the line away from the vertex to the other direction.

Reflection across the x-axis: $(x, -y)$

Reflection across the y-axis: $(-x, y)$

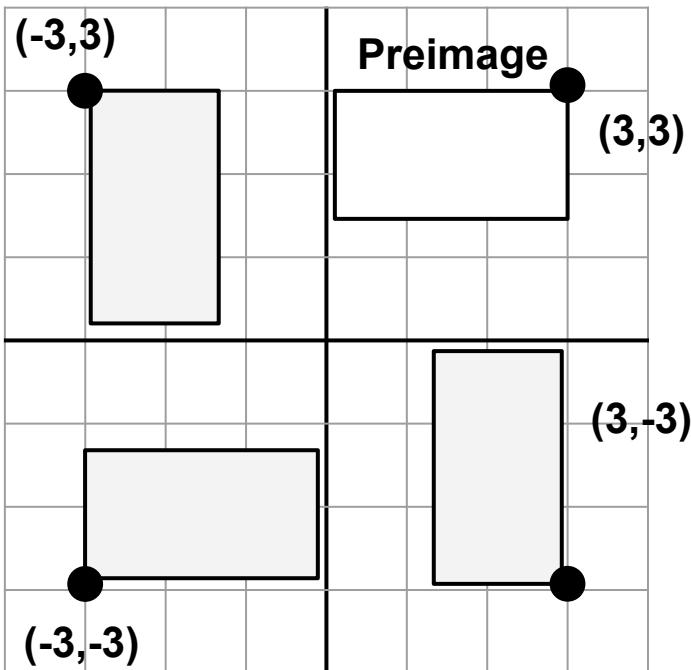
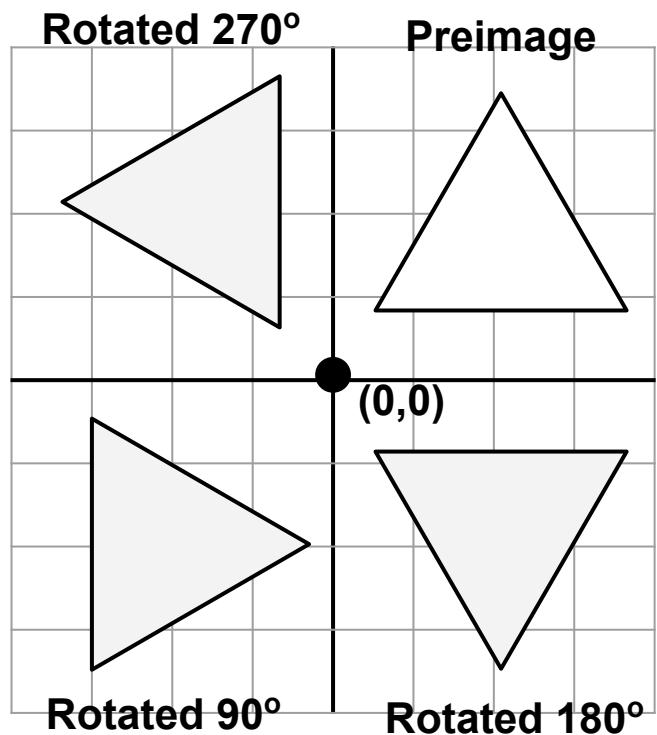


TYPES OF TRANSFORMATION



ROTATION

It takes each point in a figure and rotates it in a certain number of degrees.



In using the coordinate plane,

To rotate 90°, switch the x and y values and multiply the y-value with -1.

To rotate 180°, multiply both x and y values with -1.

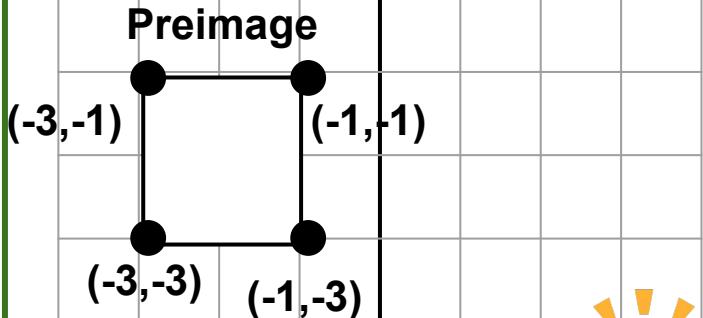
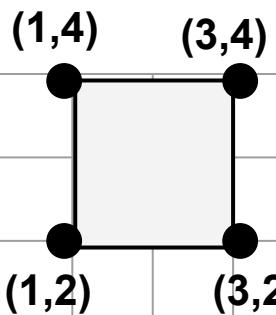
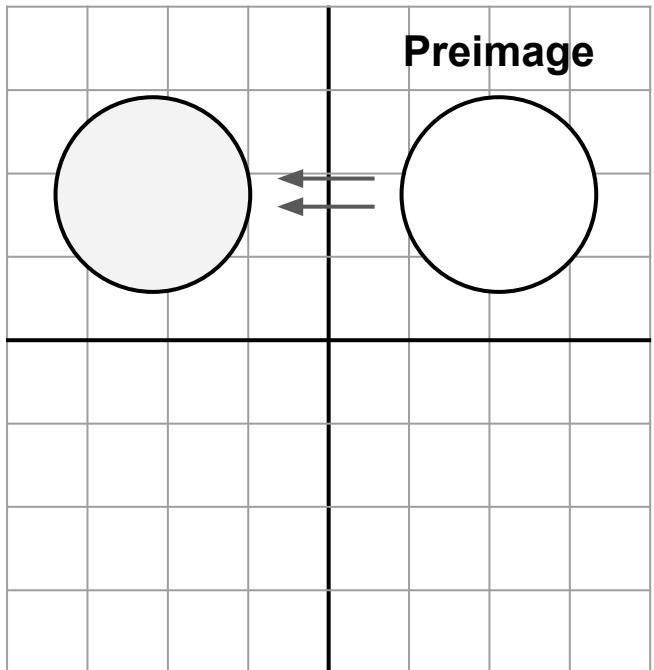
To rotate 270°, switch the x and y values and multiply the x-value with -1.



TYPES OF TRANSFORMATION

TRANSLATION

This is done by changing the position of the preimage without changing its orientation.



For translation, you need to solve for the new coordinates of each point in a shape, depending on the given movement.

For example:

$$(x,y) - (x + 4, y + 5)$$

$$(-3, -1) = (-3 + 4, -1 + 5) = (1,4)$$

$$(-1, -1) = (-1 + 4, -1 + 5) = (3,4)$$

$$(-1, -3) = (-1 + 4, -3 + 5) = (3,2)$$

$$(-3, -3) = (-3 + 4, -3 + 5) = (1,2)$$

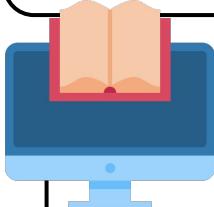
Plot the new coordinates in the plane, and connect the points to create the shape.



TYPES OF TRANSFORMATION

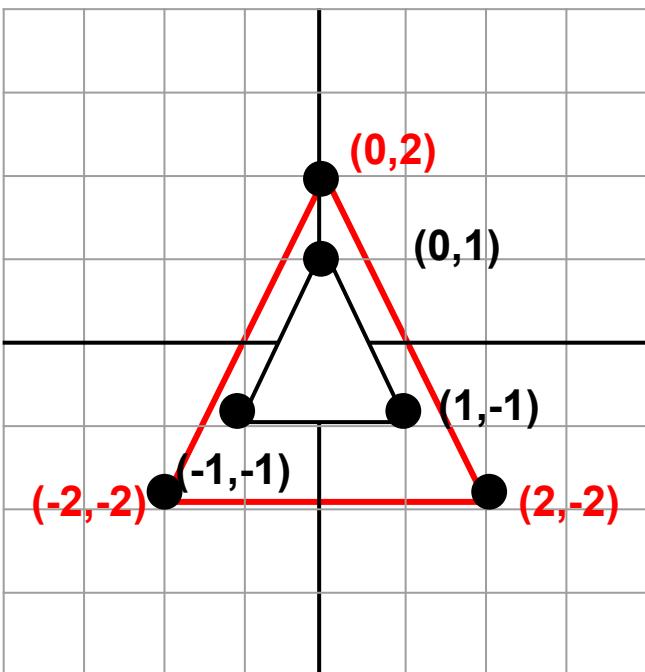
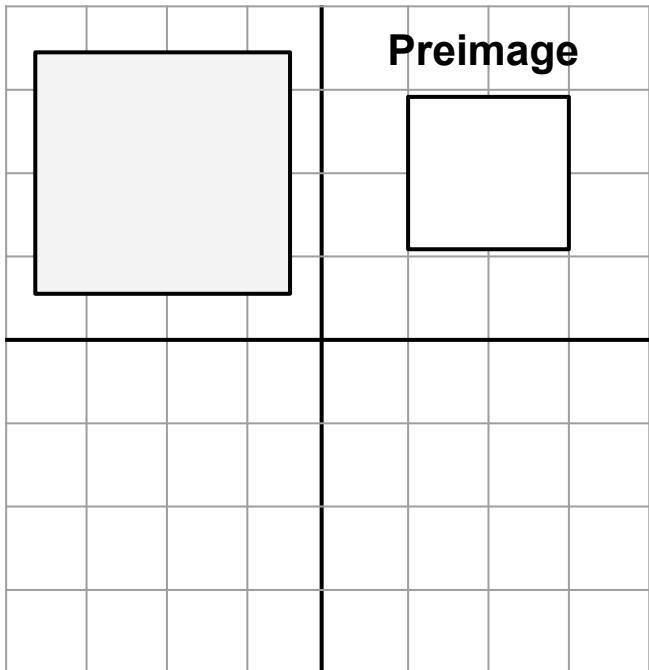
NON-RIGID TRANSFORMATION

The images from these transformations has changes in terms of the size or shape of the preimage or both size and shape.



DILATION

Dilation is done by keeping the interior angles of the preimage, while increasing its sides proportionally.



To use dilation in a coordinate plane, you need to multiply the scale factor (k) to the given points of the preimage.

For example:
 $k = 2; (kx, ky)$

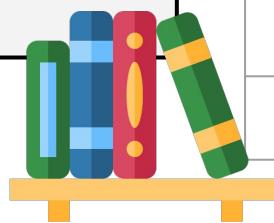
$$(2 \times 0, 2 \times 1) = (0, 2)$$
$$(2 \times 1, 2 \times -1) = (2, -2)$$
$$(2 \times -1, 2 \times -1) = (-2, -2)$$



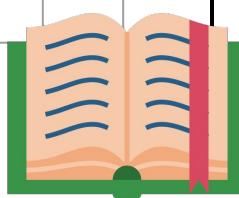
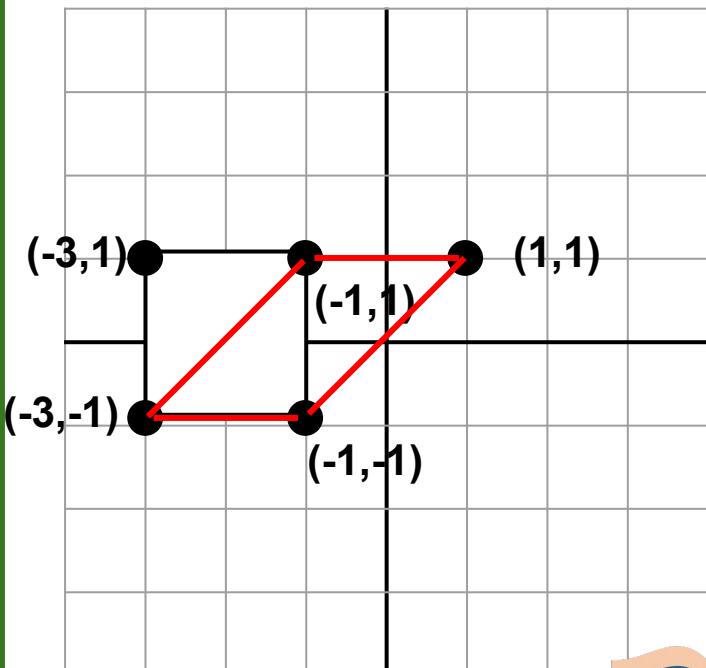
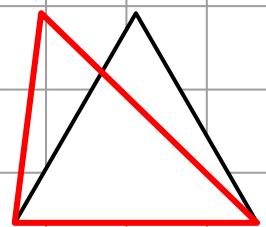
TYPES OF TRANSFORMATION

SHEAR

Shear is done by keeping the size of the preimage, while changing its interior angles.



Preimage



To shear in a coordinate plane, you need to add a shear factor (m).

To shear horizontally,
 $(x + my, y)$

To shear vertically,
 $(x, y + mx)$

For example,
 $m = 2$

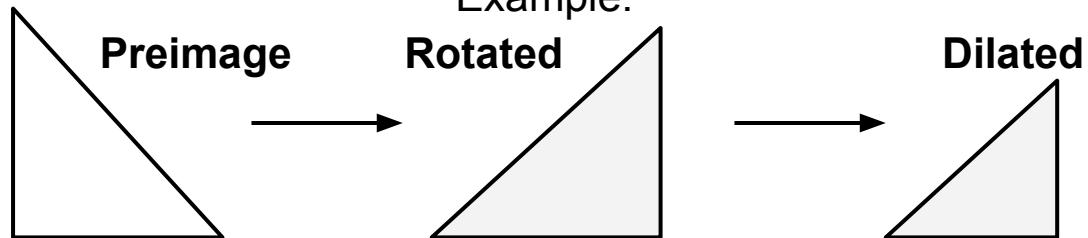
Horizontal Shear:
 $(-3 + [2 \times 1], 1) = (-1, 1)$
 $(-1 + [2 \times 1], 1) = (1, 1)$



PRACTICE TIME!

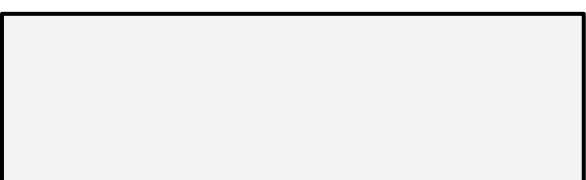
TAKE NOTE:

Transformations can be combined, whether rigid or non-rigid transformations.



Provide the different transformations based on its type.

RIGID TRANSFORMATION



NON-RIGID TRANSFORMATION

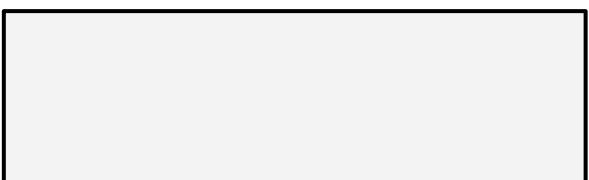


TABLE OF ACTIVITIES

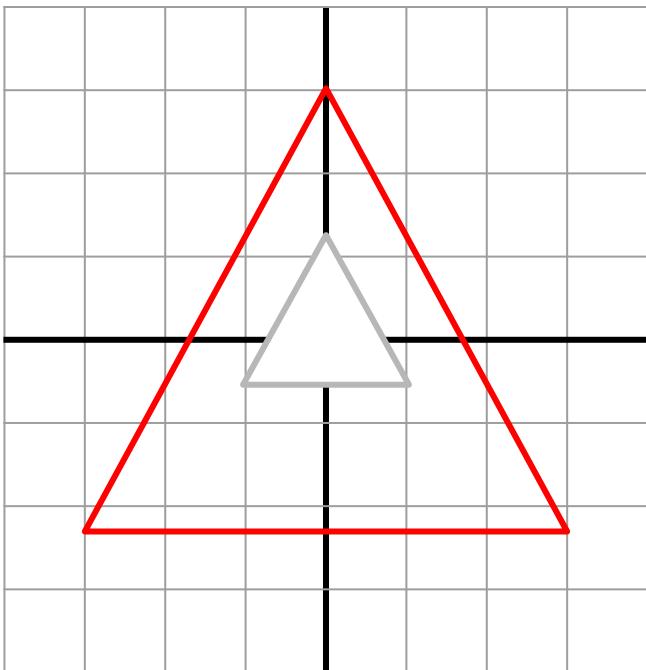
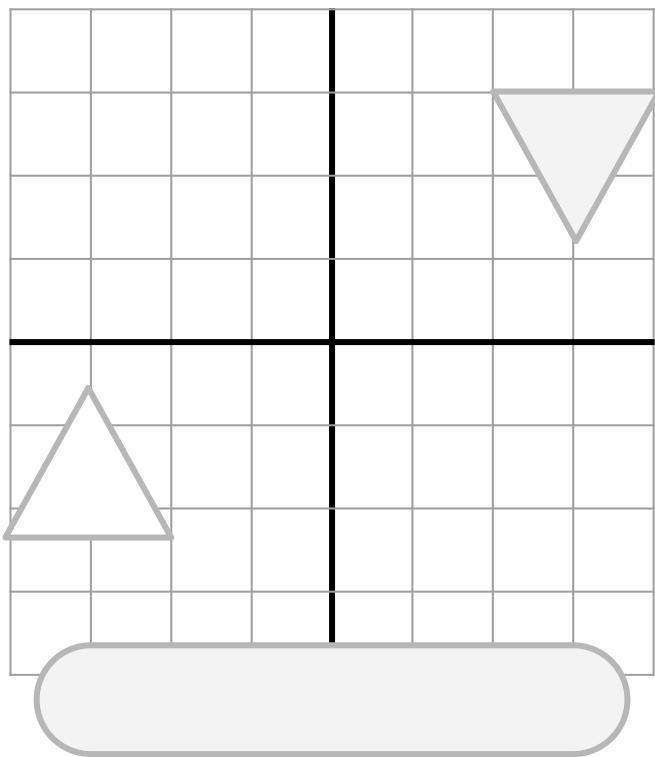
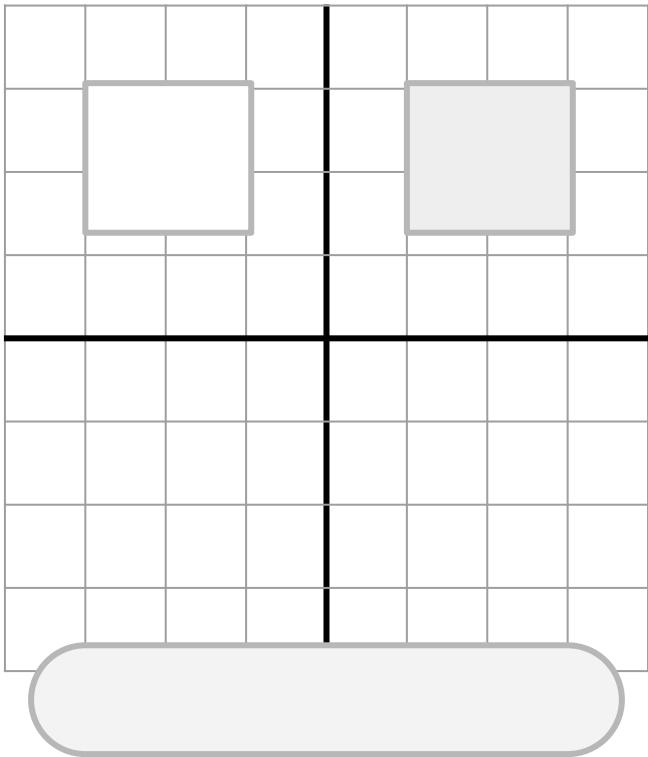
Ages 11-12 (Basic)		7th Grade
1	Different Types	
2	Good Communication	
3	Show Your Drawing	
4	New Knowledge	
5	Not All True	
Ages 12-13 (Advanced)		8th Grade
6	The Changes	
7	Follow the Instructions	
8	I Love Books	
9	Imaginative Mind	
10	Everyday Transformation	



DIFFERENT TYPES

G7
Basic

There are different types of books that can be read. There are also different types of transformation. Identify the transformations done for each image.



GOOD COMMUNICATION

G7
Basic

Being literate is very important to communicate well with other people. Let's check how well you understood the different shape transformations by showing illustrations of each type below.

REFLECTION

ROTATION

TRANSLATION

DILATION



SHEAR

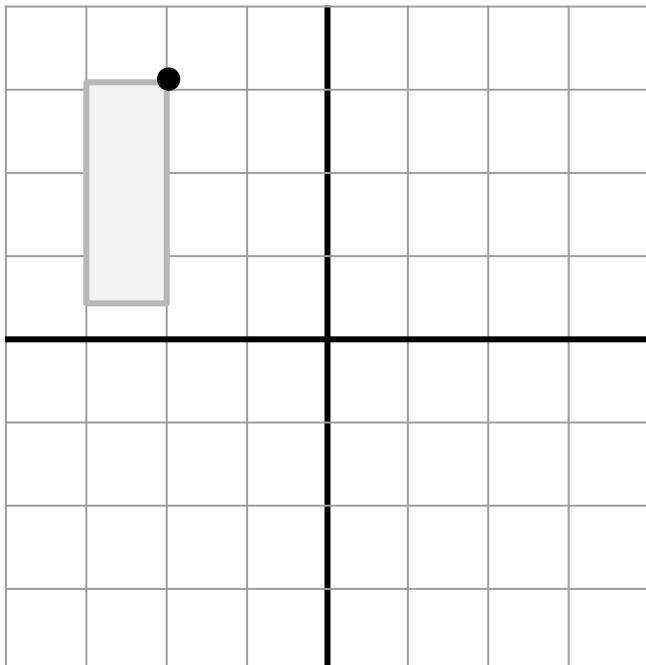


SHOW YOUR DRAWING

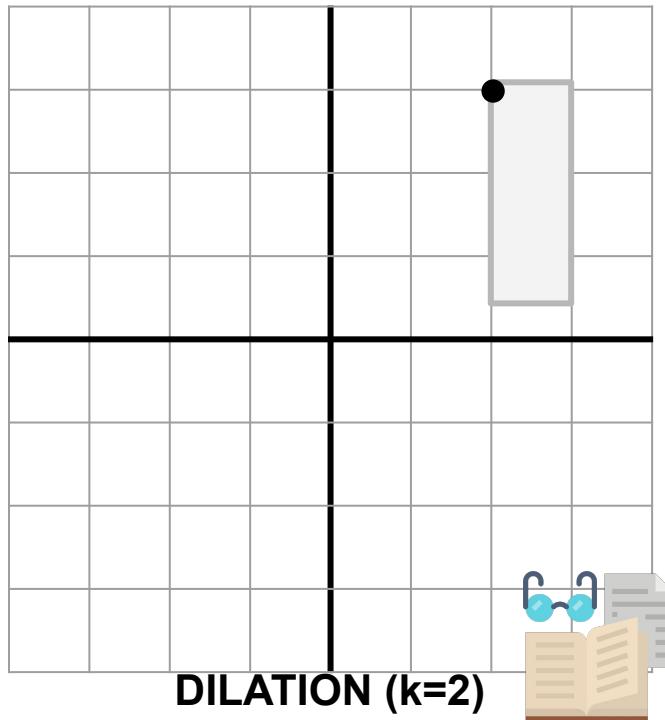
G7
Basic

Literacy also involves art. Draw the transformation of the shapes below based on what is being asked.

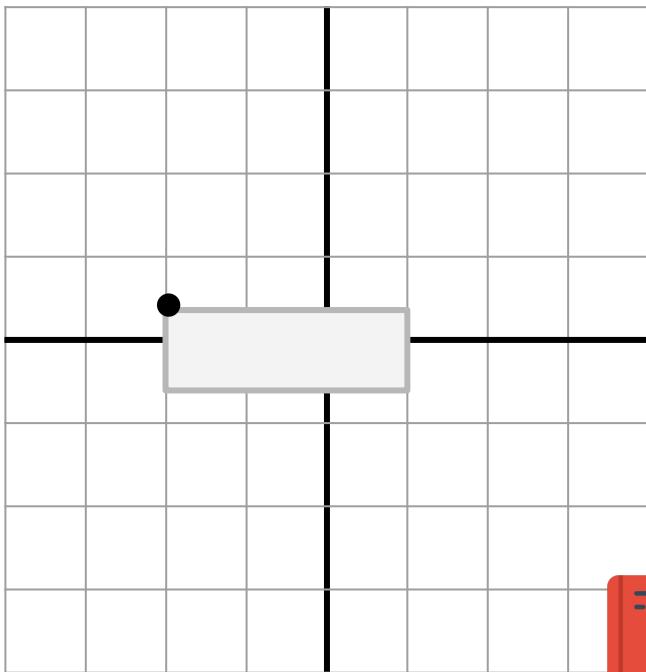
ROTATION (180°)



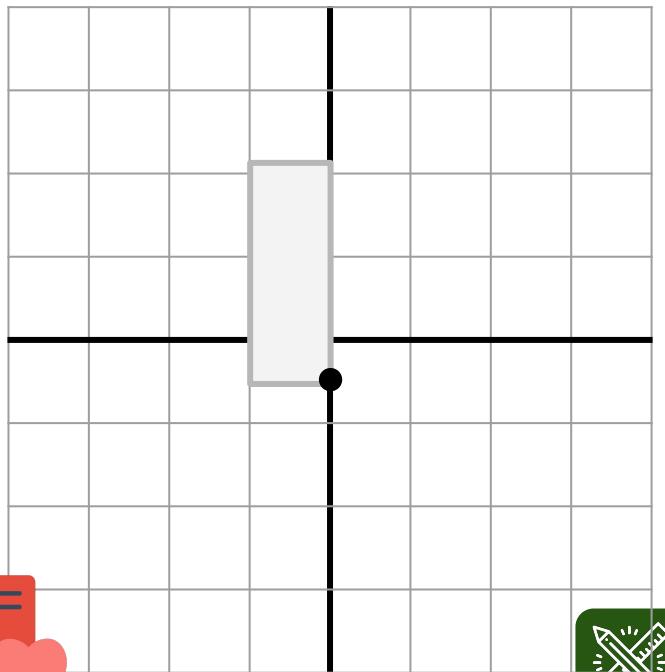
REFLECTION (X-AXIS)



TRANSLATION ($x+2, y+1$)



DILATION ($k=2$)



NEW KNOWLEDGE

G7
Basic

Literacy opens up new knowledge. You have read about shape transformations which will help you provide the answers below.

This is the transformation that shows the mirrored image of a preimage.



This is the kind of transformation that changes the size and shape of a preimage.

This is done by keeping the size of the preimage while changing its interior angles.



This is the process of manipulating a 2D object.

This is the formula used to shear an object vertically.



This is done by changing the position of the preimage.

This is the formula used to dilate an object.



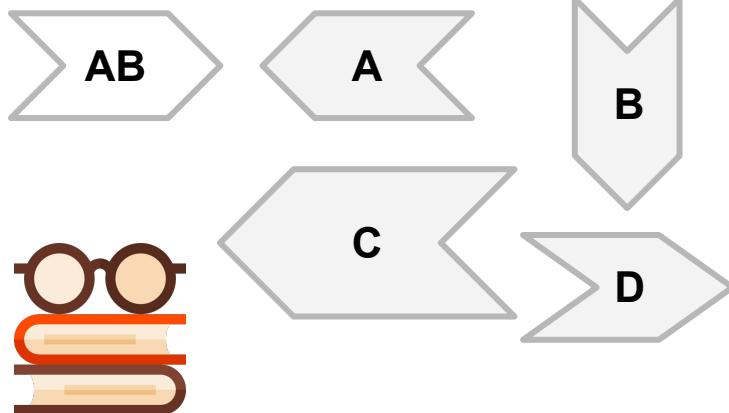
This should be done to rotate the preimage by 180° .



NOT ALL TRUE

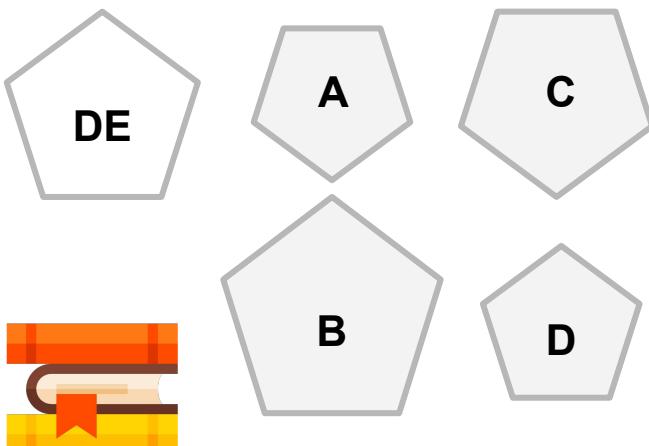
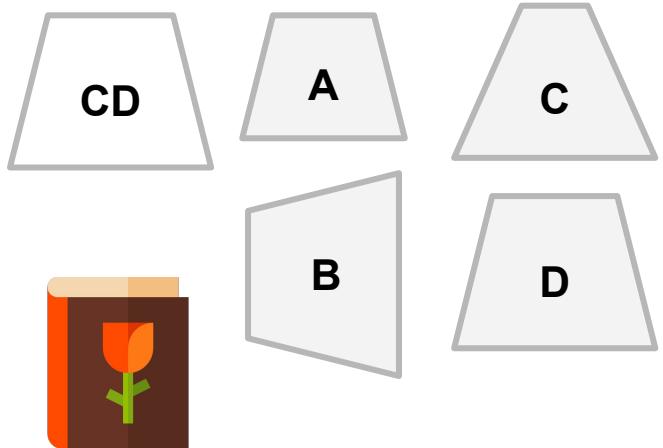
G7
Basic

Not all that you can see in the internet is true. You need to do lots of research. The statements below are also not all true. Choose which statement below is false.



- I. A is the reflection of AB.
- II. B is the rotation of AB by 180° .
- III. C is a combination of dilation and reflection.
- IV. D is the sheared transformation of AB.

- I. A is the reflection of CD.
- II. B is the rotation of CD by 270° .
- III. C is a sheared transformation of CD.
- IV. D is the reflection and translation of CD.



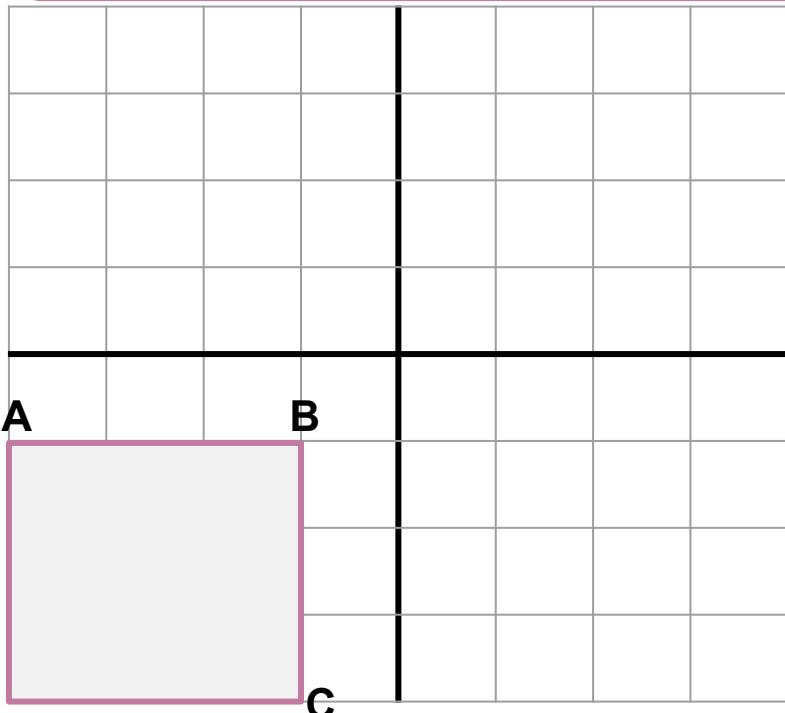
- I. A rotation and dilation of DE.
- II. B is the dilation of DE.
- III. C is the rotation of DE.
- IV. D is the translation of DE.



THE CHANGES

G8
Advanced

Researches and studies changes as years goes by. When you transform a shape, it also changes its coordinates. Plot the image and write down the new coordinates of each points.



D

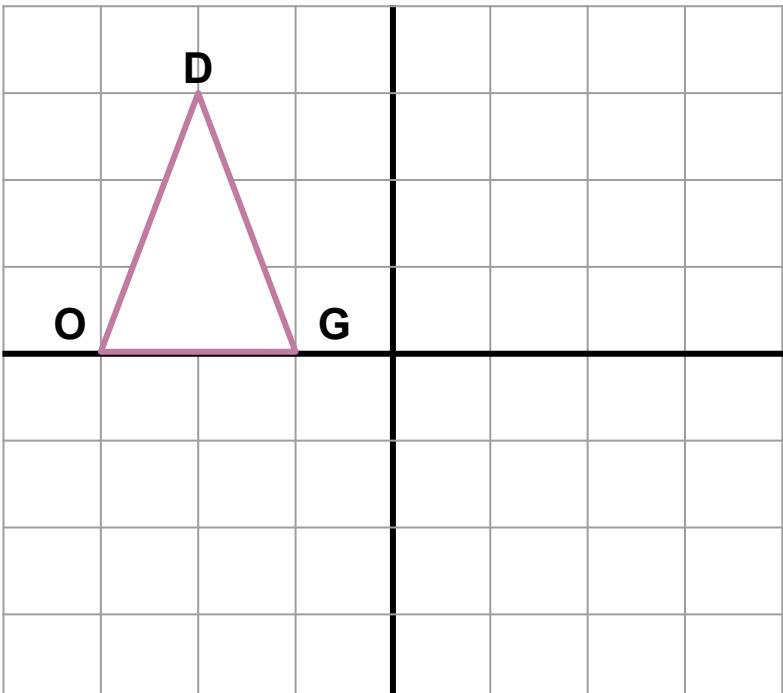
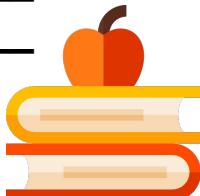
Rotate the triangle in the coordinate plane by 270° .

$$\begin{aligned}D &= \underline{\hspace{2cm}} \\O &= \underline{\hspace{2cm}} \\G &= \underline{\hspace{2cm}}\end{aligned}$$



Translate the square in the coordinate plane using the rule $(x + 4, y + 3)$

$$\begin{aligned}A &= \underline{\hspace{2cm}} \\B &= \underline{\hspace{2cm}} \\C &= \underline{\hspace{2cm}} \\D &= \underline{\hspace{2cm}}\end{aligned}$$



FOLLOW THE INSTRUCTIONS

G8
Advanced

Writing is an art formed through words. Plot down the preimage and follow the specific instructions given below. Provide the new coordinates for the final image and plot it.

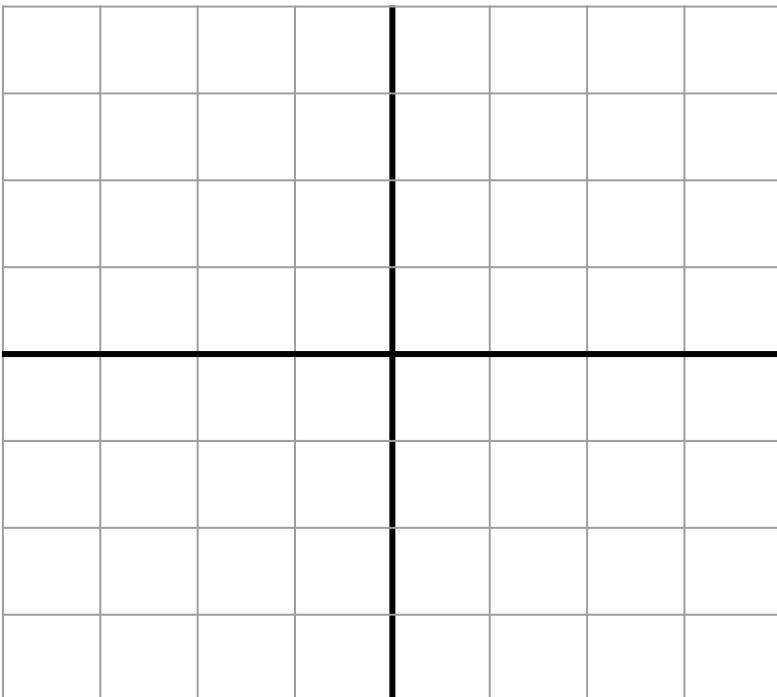
$\triangle DEF$ has coordinates of:

$$\begin{aligned}D &= (-1, -3) \\E &= (-3, -3) \\F &= (-3, -1)\end{aligned}$$



$\triangle KLM$ has coordinates of:

$$\begin{aligned}K &= (2, 1) \\L &= (1, -1) \\M &= (3, -1)\end{aligned}$$

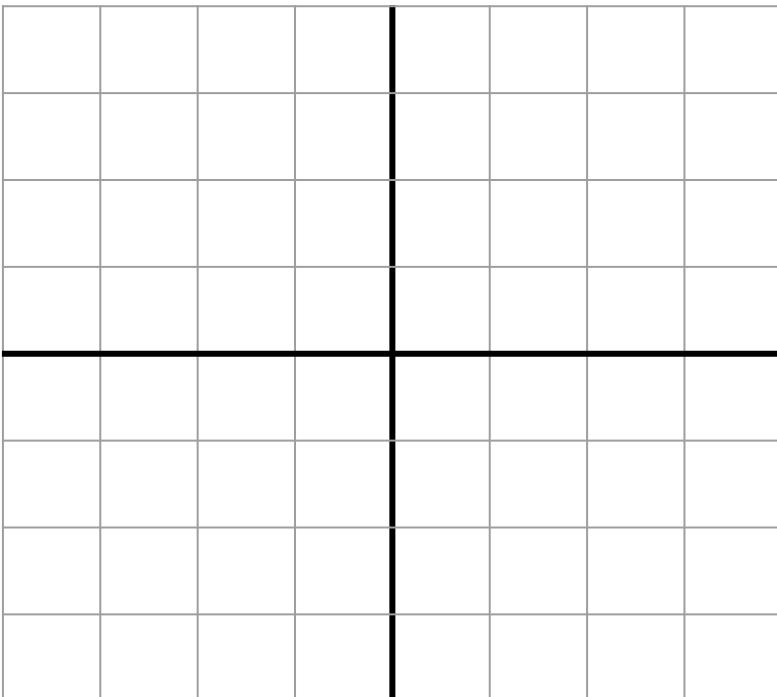


Dilate $\triangle DEF$ with a scale factor of 2.
Reflect it across the x axis.

$$\begin{aligned}D &= \underline{\hspace{2cm}} \\E &= \underline{\hspace{2cm}} \\F &= \underline{\hspace{2cm}}\end{aligned}$$

Translate $\triangle KLM$ with the rule $(x-3, y-2)$.
Rotate it 90° .

$$\begin{aligned}K &= \underline{\hspace{2cm}} \\L &= \underline{\hspace{2cm}} \\M &= \underline{\hspace{2cm}}\end{aligned}$$

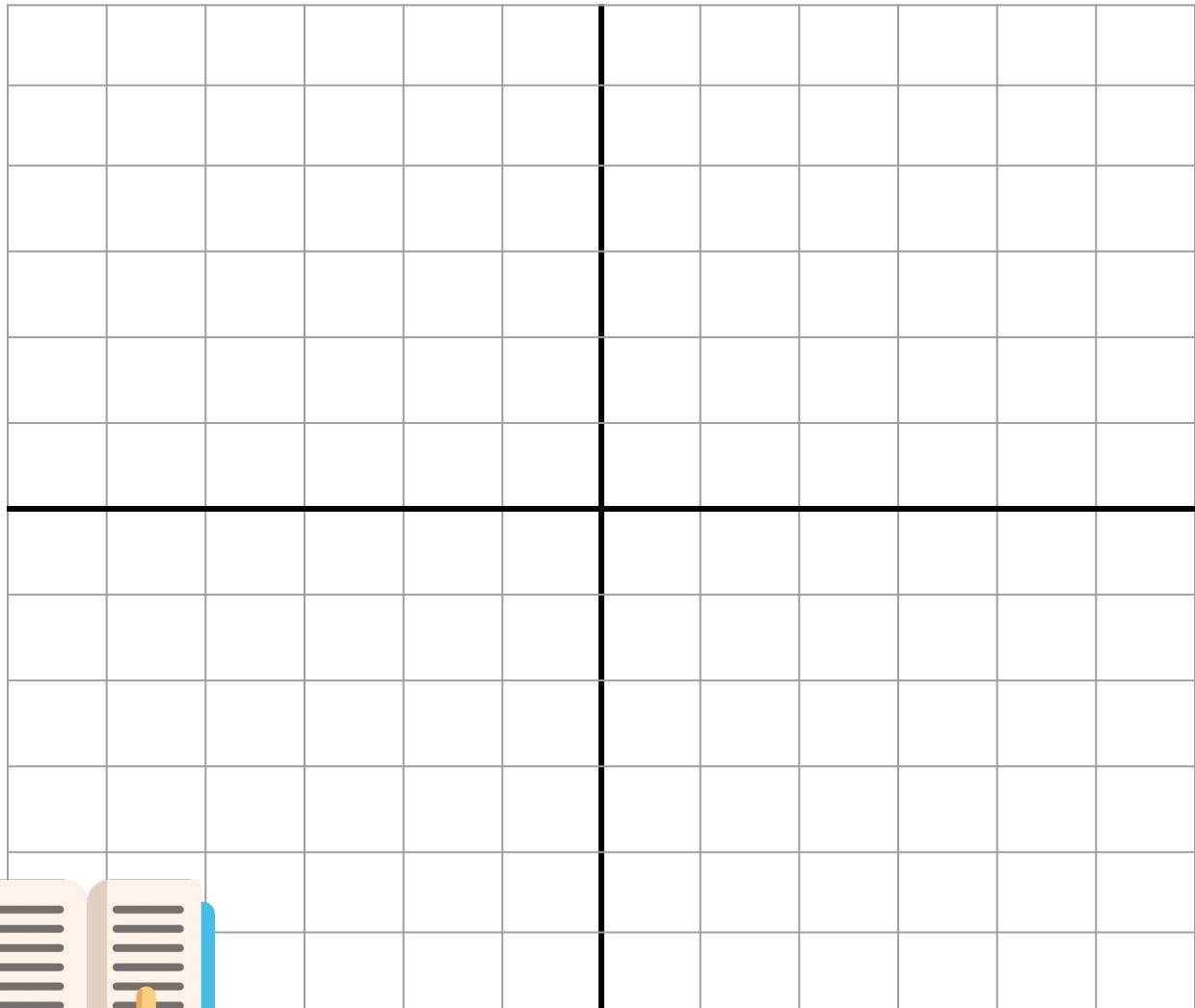


I LOVE BOOKS

G8
Advanced

Dan loves to read books and would always spend his time in bookstores. He bought a new book and excitedly went home to read it. Read the statement below and plot the preimage and images formed.

You bought a new book, $\square ABCD$, and placed it on the floor with the following coordinates: $A = (-5, 5)$; $B = (-2, 5)$; $C = (-2, 1)$; $D = (-5, 1)$. To make it fit your shelf, you need to translate it with the rule $(x+5, y-4)$. After translation, rotate it at 180° .



IMAGINATIVE MIND

G8
Advanced

Imaginative minds are needed to fully appreciate reading books.
Give the new coordinates for the new transformations.



REFLECTION (Across the x-axis)

1. PREIMAGE

$$F = (5, -7); A = (5, -8); N = (5, -2)$$

$$F =$$

$$A =$$

$$N =$$

DILATION ($k = 4$)

2. PREIMAGE

$$A = (4, 5); R = (3, 6); M = (3, 4)$$

$$A =$$

$$R =$$

$$M =$$

TRANSLATION ($x+5, y-2$)



ROTATION (270°)

3. PREIMAGE

$$C = (-7, 8); A = (-2, 10); T = (-2, 3)$$

$$C =$$

$$A =$$

$$T =$$

4. PREIMAGE

$$T = (2, 2); A = (5, 6); N = (5, 0)$$

$$T =$$

$$A =$$

$$N =$$



EVERYDAY TRANSFORMATION

G8
Advanced

Being literate is useful in our everyday lives, as well as shape transformations. List down 3 application of the following transformations in our daily lives.

REFLECTION



ROTATION



TRANSLATION



DILATION



ANSWER GUIDE

Activity 1

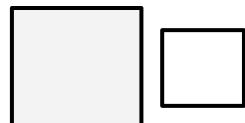
1. Reflection
2. Rotation
3. Dilation

Activity 2

REFLECTION



DILATION



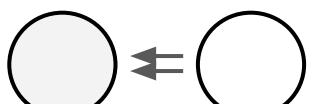
ROTATION



SHEAR



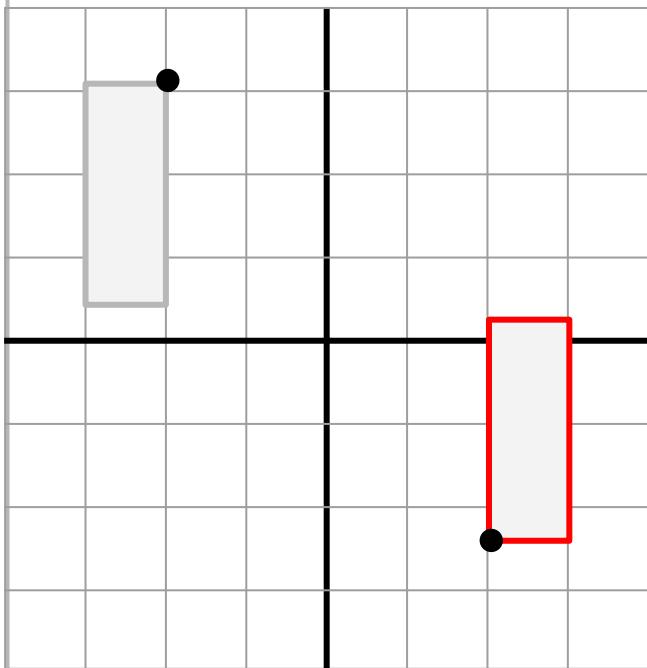
TRANSLATION



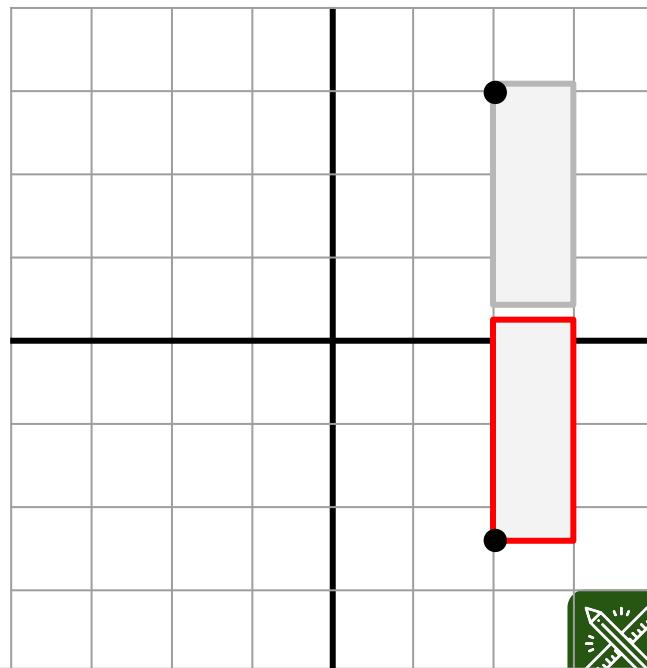
*Answers may vary.

Activity 3

ROTATION (180°)



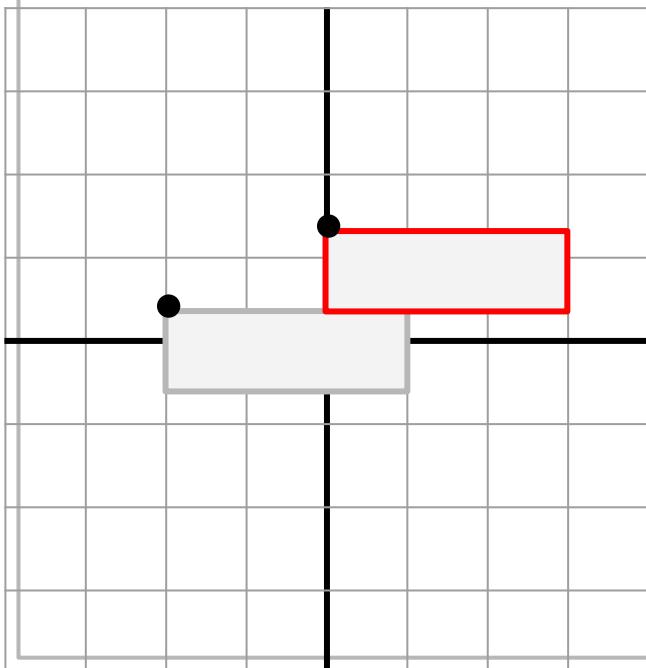
REFLECTION (X-AXIS)



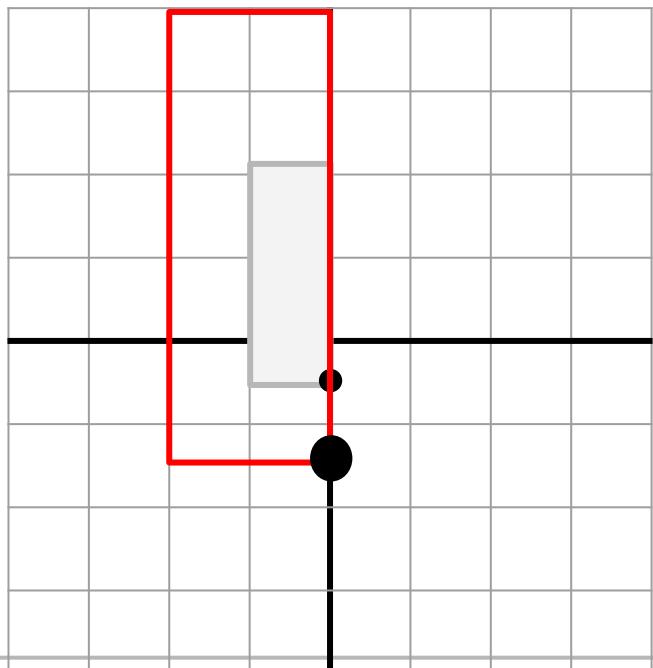
ANSWER GUIDE

Activity 3

TRANSLATION ($x+2, y+1$)



DILATION ($k=2$)



Activity 4

- | | |
|-------------------|-----------------------------|
| 1. Reflection | 5. $(x, y + mx)$ |
| 2. Dilation | 6. Translation |
| 3. Shear | 7. (kx, ky) |
| 4. Transformation | 8. Multiply x and y with -1 |

Activity 5

1. II

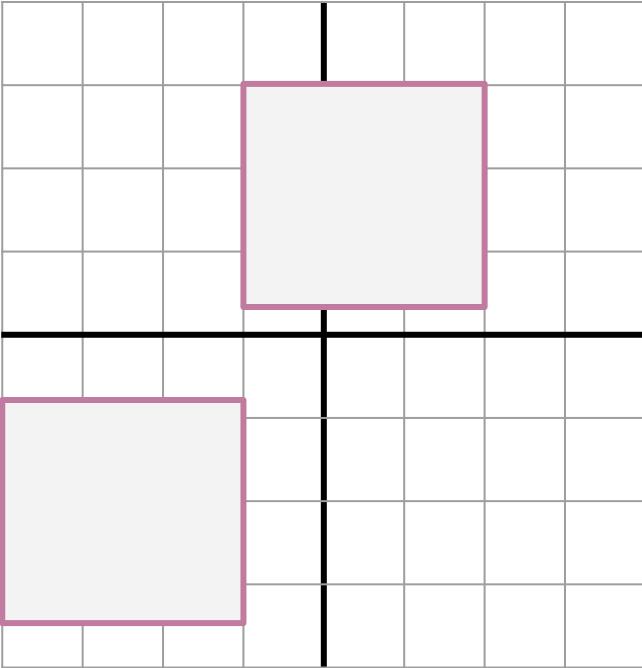
2. I

3. IV



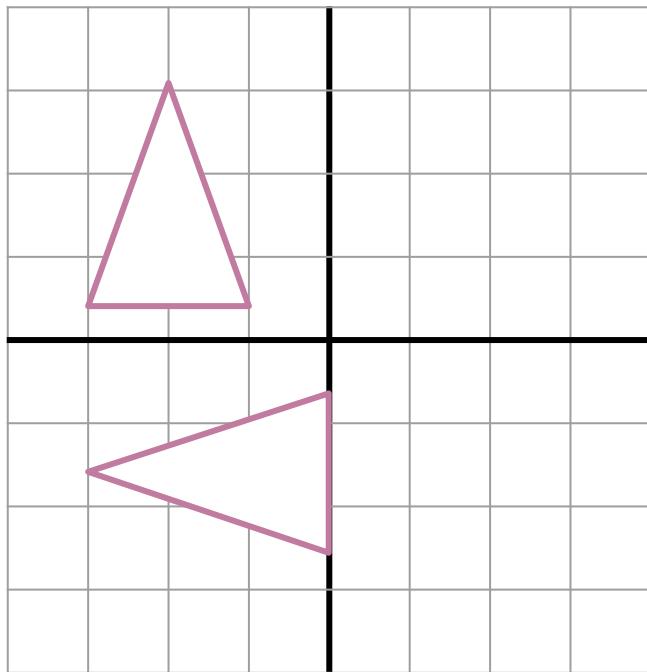
ANSWER GUIDE

Activity 6



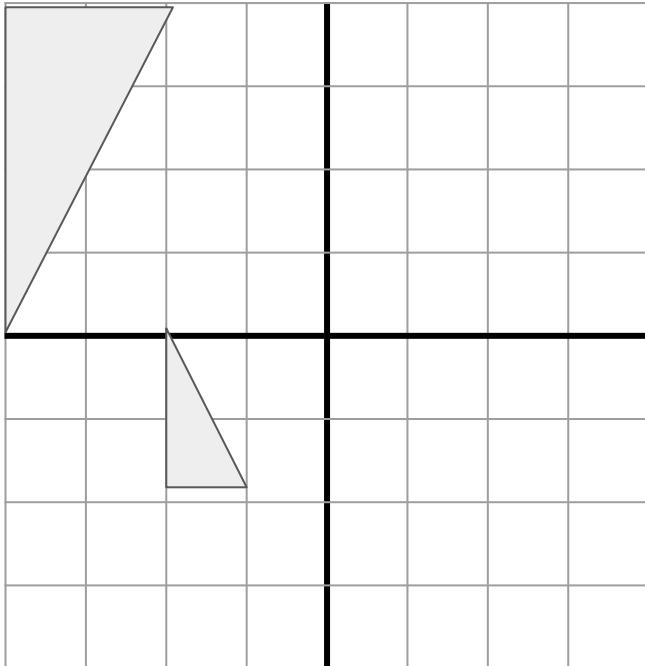
$$\begin{aligned} A &= (-1, -4) (-1+4) (-4+3) = (3, -1) \\ B &= (-1, -1) (-1+4) (-1+3) = (3, 2) \\ C &= (-4, -1) (-4+4) (-1+3) = (0, 2) \\ D &= (-4, -4) (-4+4) (-4+3) = (0, -1) \end{aligned}$$

$$\begin{aligned} D &= (-2, 3) (3x-1, -2) (-3, -2) \\ O &= (-3, 0) (0x-1, -3) (0, -3) \\ G &= (-1, 0) (0x-1, -1) (0, -1) \end{aligned}$$



ANSWER GUIDE

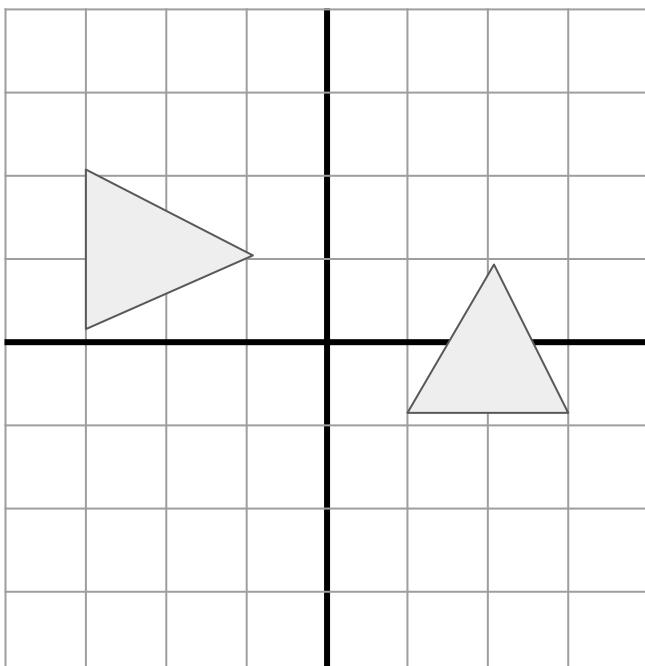
Activity 7



$$D = (-1, -2) (-1 \times 2) (-2 \times 2) = \\ (-2, -4) = \mathbf{(-2, 4)}$$

$$E = (-2, -2) (-2 \times 2) (-2 \times 2) = \\ (-4, -4) = \mathbf{(-4, 4)}$$

$$F = (-2, 0) (-2 \times 2) (0 \times 2) = \\ (-4, 0) = \mathbf{(-4, 0)}$$

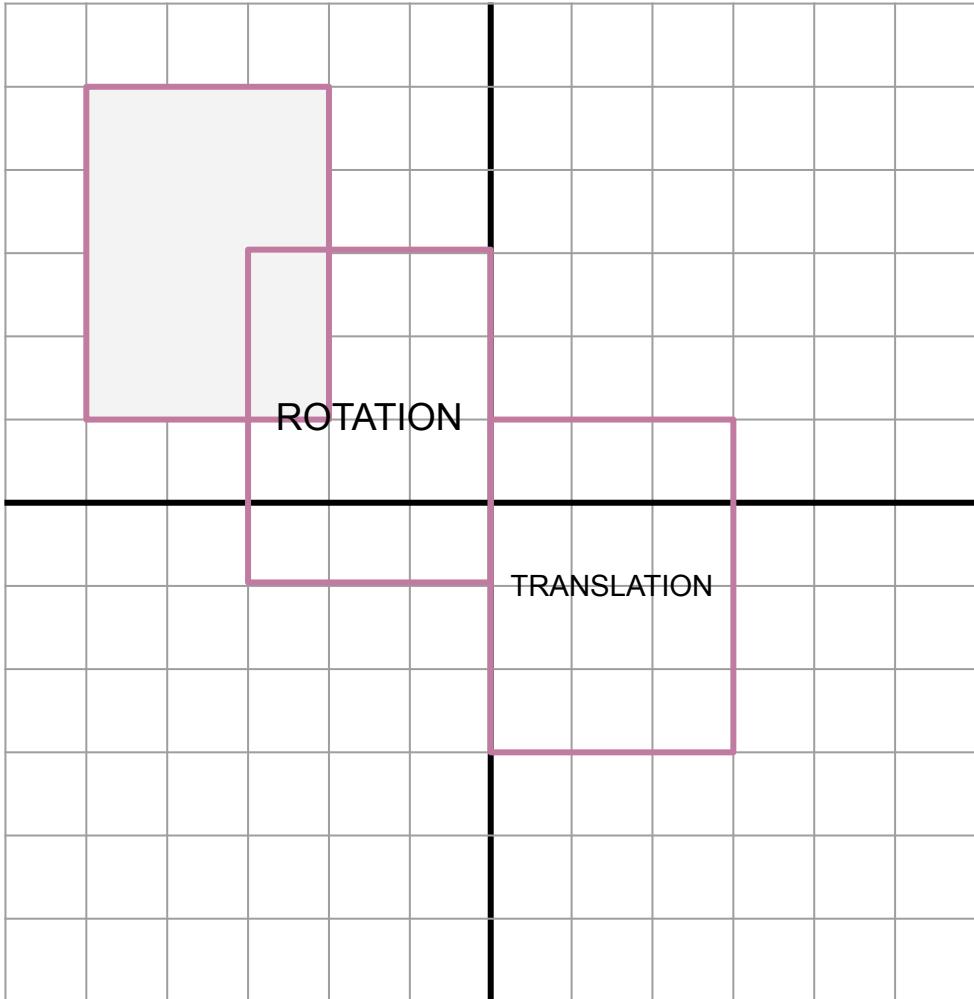


$$K = (2-3, 1-2) = (-1, -1) = \mathbf{(-1, 1)} \\ L = (1-3, -1-2) = (-2, -3) = \mathbf{(-3, 2)} \\ M = (3-3, -1-2) = (0, -3) = \mathbf{(-3, 0)}$$



ANSWER GUIDE

Activity 8



TRANSLATION

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

ROTATION

$$\begin{aligned}(0, 1) (-1) &= (0, -1) \\ (3, 1) (-1) &= (-3, -1) \\ (3, -3) (-1) &= (-3, 3) \\ (0, -3) (-1) &= (0, 3)\end{aligned}$$



ANSWER GUIDE

Activity 9

1. $F = (5, -7x-1) = (5, 7)$

$A = (5, -8x-1) = (5, 8)$

$N = (5, -2x-1) = (5, 2)$

2. $A = (4 \times 4, 4 \times 5) = (16, 20)$

$R = (4 \times 3, 4 \times 6) = (12, 24)$

$M = (4 \times 3, 4 \times 4) = (12, 16)$

3. $C = (-7+5, 8-2) = (-2, 6)$

$A = (-2+5, 10-2) = (3, 8)$

$T = (-2+5, 3-2) = (3, 1)$

4. $T = (2x-1, 2) = (-2, 2)$

$A = (5x-1, 6) = (-5, 6)$

$N = (5x-1, 0) = (-5, 0)$

Activity 10

Reflection

1. Symmetry of the face
2. Mass production of shoes
3. Flipping images on a computer

Rotation

1. Turning of ferris wheel
2. Turning of car wheel
3. Spinning of washing machine

Translation

1. Movement of aircraft
2. Movement of car
3. Flying of birds

Dilation

1. Enlarging photos
2. House plans
3. Design of machineries

*These are just examples. Answers may vary.



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