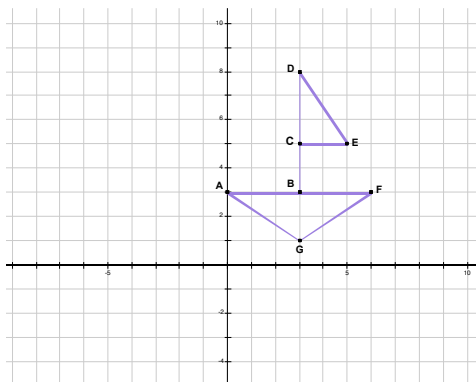


TASK 1.1.1: PATTY PAPER TRANSFORMATIONS**Solutions**

In the table below, write the coordinates of each point in the figure.

Point	x-coordinate	y-coordinate
A	0	3
B	3	3
C	3	5
D	3	8
E	5	5
F	6	3
G	3	1

- On patty paper, trace the figure from the previous graph (include the axes for reference). Using the patty paper, do each of the transformations listed in a-f on the original figure. After each transformation, record (in the table provided) the coordinates of the images of the labeled points from the preimage. Describe in words and symbols any patterns you see.

a. Translate the preimage down 2 units

b. Translate the preimage to the left 3 units.

Point	x-coordinate	y-coordinate
A'	0	1
B'	3	1
C'	3	3
D'	3	6
E'	5	3
F'	6	1
G'	3	-1
Change in words	Same values	Decreased by 2
Symbols	x	$y - 2$

Point	x-coordinate	y-coordinate
A'	-3	3
B'	0	3
C'	0	5
D'	0	8
E'	2	5
F'	3	3
G'	0	1
Change in words	Decreased by 3	Same values
Symbols	$x - 3$	y

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c. Translate the preimage right 1 unit and up 2 units

Point	x-coordinate	y-coordinate
A'	1	5
B'	4	5
C'	4	7
D'	4	10
E'	6	7
F'	7	5
G'	4	3
Change in words	Increases by 1	Increases by 2
Symbols	$x+1$	$y+2$

d. Translate the preimage left 4 units and down 1 unit.

Point	x-coordinate	y-coordinate
A'	-4	2
B'	-1	2
C'	-1	4
D'	-1	7
E'	1	4
F'	2	2
G'	-1	0
Change in words	Decreases by 4	Decreases by 1
Symbols	$x-4$	$y-1$

e. Reflect the preimage about the x-axis.

Point	x-coordinate	y-coordinate
A'	0	-3
B'	3	-3
C'	3	-5
D'	3	-8
E'	5	-5
F'	6	-3
G'	3	-1
Change in words	No change	Opposite signs
Symbols	x	$-y$

f. Reflect the preimage about the y-axis.

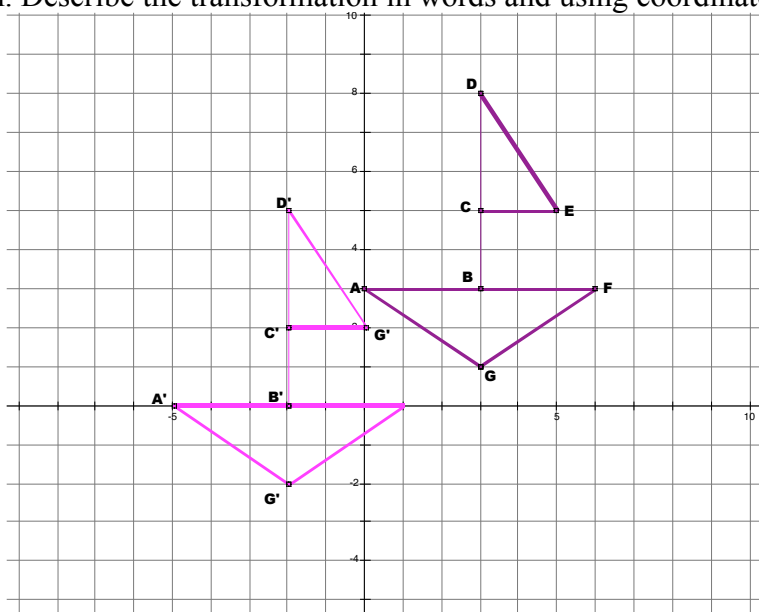
Point	x-coordinate	y-coordinate
A'	0	3
B'	-3	3
C'	-3	5
D'	-3	8
E'	-5	5
F'	-6	3
G'	-3	1
Change in words	Opposite signs	No change
Symbols	$-x$	y

2. In geometry, each of the transformations can be generalized by using coordinate notation. For example, when the preimage point (4, 2) is translated to the left and up to produce the image point (2, 4), the corresponding coordinate notation would be

$T:(x, y) \rightarrow (x - 2, y + 2)$. Using the information from the tables in part 1 and coordinate notation, complete the table below.

Transformation	Generalization
a. Translated down 2 units – the x-coordinates stayed the same – y’s decreased by 2 $\rightarrow y - 2$	$T:(x, y) \rightarrow (x, y - 2)$
b. Translated left 3 units- x-coordinates decreased by 3 $\rightarrow x - 3$ and the y coordinates are the same	$T:(x, y) \rightarrow (x - 3, y)$
c. Translated right 1 and up 2 – the x’s increased by 1 $\rightarrow x + 1$ and y’s increased by 2 $\rightarrow y + 2$	$T:(x, y) \rightarrow (x + 1, y + 2)$
d. Translated left 4 and down 1- x’s decreased by 4 $\rightarrow x - 4$ and y’s decreased by 1 $\rightarrow y - 1$	$T:(x, y) \rightarrow (x - 4, y - 1)$
e. Reflected over the x-axis- x’s stayed the same the y-coordinates were the opposite signs.	$R:(x, y) \rightarrow (x, -y)$
f. Reflected over the y-axis- x –coordinates had the opposite signs and y stayed the same.	$R:(x, y) \rightarrow (-x, y)$

3. The graph below shows both the original preimage and its image under a transformation. Describe the transformation in words and using coordinate notation.



The image is translated 5 to the left and 3 down. Using coordinate notation,

$$T:(x, y) \rightarrow (x - 5, y - 3)$$

Math notes

Transformations are taught both in geometry and algebra, but the context and the notation is different. Algebra II teachers who have not taught geometry may be unfamiliar with the notation and pedagogical approach for teaching students to write transformations in geometry. However, as the Algebra II students are asked to write transformations using function notation, it is important for Algebra II teachers to understand the prior mathematical exposure that may be causing some student misunderstandings about transformations.

Teaching notes

It is very important that teachers experience using the patty paper to do the translations that are in this task. Patty paper is a common tool used when exploring transformations in geometry.

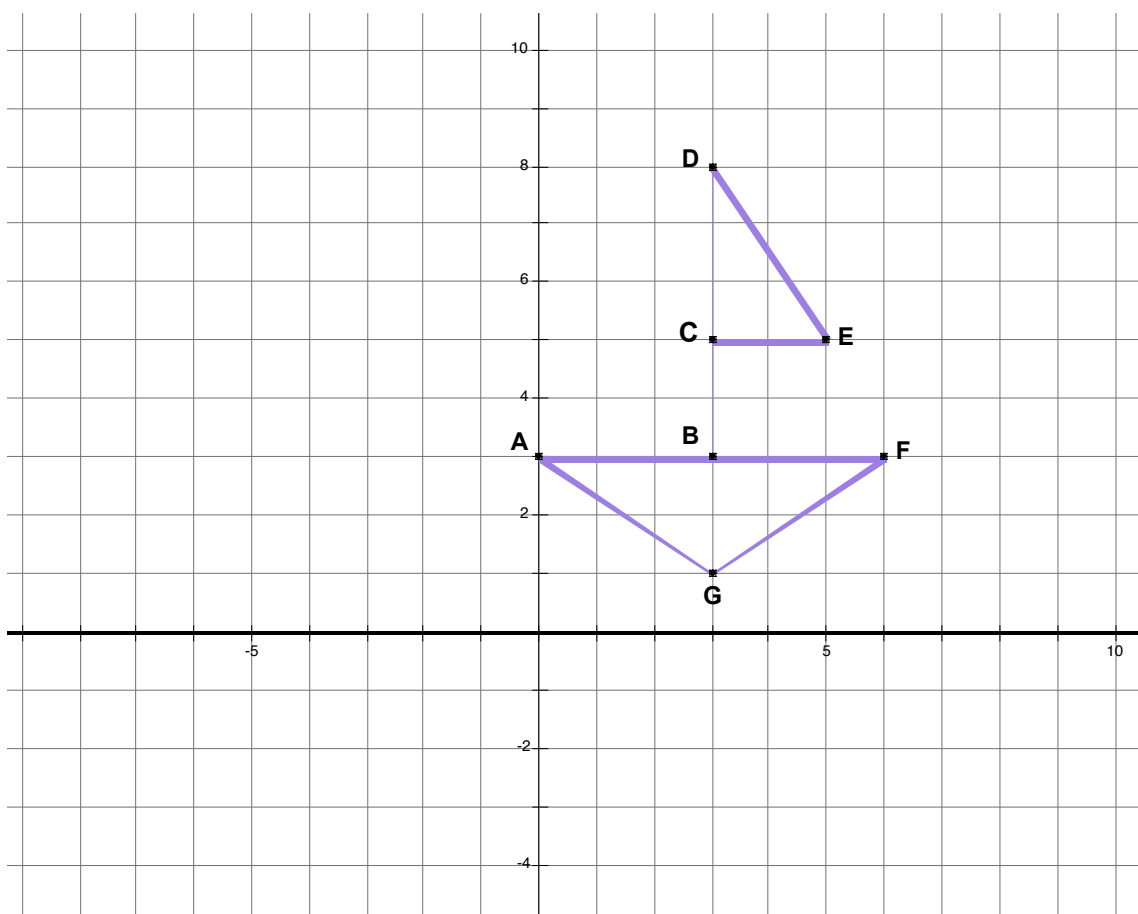
**** Note:** Patty paper is square, lightly waxed paper that is used as a manipulative for doing constructions and other explorations in geometry classrooms. It is actually the paper that is used to separate hamburger patties and can be purchased at most restaurant suppliers.

The instructor may want to model the tracing of the figure on the overhead. (You can use a square piece of transparency film to model for participants.) When tracing the figure participants need to also copy the x- and y- axes to assist in aligning their copy when they do the transformations described in Exercise 1.

As a class (so that students understand how to use the patty paper and the manner in which they need to record their observations of what happens after each transformation), work through Exercise 1a. After Exercise 1a is modeled, have participants work in pairs to complete the other tables. After participants have completed the tables in Exercise 1, have them compare their answers with another pair.

For Exercise 2, complete the first entry in the table as a class. Under the transformation column participants are expected to give a written description of the translation and its representation in coordinate notation in the generalization column. Have representatives from the groups present their findings to the class.

Exercise 3 is included as a brief assessment to see if participants have grasped the use of coordinate notation to describe transformations.

TASK 1.1.1 PATTY PAPER TRANSFORMATIONS

In the table below, write the coordinates of each point in the figure.

Point	x-coordinate	y-coordinate

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1. On patty paper, trace the figure from the previous graph (include the axes for reference). Using the patty paper, do each of the transformations listed in a-f on the original figure. After each transformation, record (in the table provided) the coordinates of the images of the labeled points from the preimage. Describe in words and symbols any patterns you see.

a. Translate the preimage down 2 units.

Point	x-coordinate	y-coordinate
Change in words		
Symbols		

b. Translate the preimage to the left 3 units.

Point	x-coordinate	y-coordinate
Change in words		
Symbols		

c. Translate the preimage right 1 unit and up 2 units.

Point	x-coordinate	y-coordinate
Change in words		
Symbols		

d. Translate the preimage left 4 units and down 1 unit.

Point	x-coordinate	y-coordinate
Change in words		
Symbols		

Algebra II: Strand 1. Foundations of Functions; Topic 1. Linking Foundations; Task 1.1.1

e. Reflect the preimage about the x-axis.

Point	x-coordinate	y-coordinate
Change in words		
Symbols		

f. Reflect the preimage about the y-axis.

Point	x-coordinate	y-coordinate
Change in words		
Symbols		

2. In geometry, each of the transformations can be generalized by using coordinate notation. For example, when the preimage point $(4, 2)$ is translated to the left and up to produce the image point $(2, 4)$, the corresponding coordinate notation would be $T : (x, y) \rightarrow (x - 2, y + 2)$.

Using the information from the tables in part 1 and coordinate notation, complete the table below.

Transformation (Descriptions from tables)	Generalization (Using coordinate notation)
a.	
b.	
c.	
d.	
e.	
f.	

3. The graph below shows both the preimage and its image under a transformation. Describe the transformation both in words and using coordinate notation.

