## Lesson 2: Transformations as Functions

* Let’s compare transformations to functions.

### 2.1: Math Talk: Transforming a Point

Mentally find the coordinates of the image of $A$ under each transformation.



* Translate $A$ by the directed line segment from $(0,0)$ to $(0,2)$.
* Translate $A$ by the directed line segment from $(0,0)$ to $(-4,0)$.
* Reflect $A$ across the $x$-axis.
* Rotate $A$ 180 degrees clockwise using the origin as a center.

### 2.2: Inputs and Outputs



1. For each point $(x,y)$, find its image under the transformation $(x+12,y−2)$.
	1. $A=(-10,5)$
	2. $B=(-4,9)$
	3. $C=(-2,6)$
2. Next, sketch triangle $ABC$ and its image on the grid. What transformation is $(x,y)\rightarrow (x+12,y−2)$?
3. For each point $(x,y)$ in the table, find $(2x,2y)$.

|  |  |
| --- | --- |
| * $(x,y)$
 | * $(2x,2y)$
 |
| * $(-1,-3)$
 | *
 |
| * $(-1,1)$
 | *
 |
| * $(5,1)$
 | *
 |
| * $(5,-3)$
 | *
 |

1. Next, sketch the original figure (the $(x,y)$ column) and image (the ($2x,2y)$ column). What transformation is $(x,y)\rightarrow (2x,2y)$?

### 2.3: What Does it Do?



1. Here are some transformation rules. Apply each rule to quadrilateral $ABCD$ and graph the resulting image. Then describe the transformation.
	1. Label this transformation $Q$: $(x,y)\rightarrow (2x,y)$
	2. Label this transformation $R$: $(x,y)\rightarrow (x,-y)$
	3. Label this transformation $S$: $(x,y)\rightarrow (y,-x)$

#### Are you ready for more?



1. Plot the quadrilateral with vertices $(4,-2),(8,4),(8,-6),$ and $(-6,-6)$. Label this quadrilateral $A$.
2. Plot the quadrilateral with vertices $(-2,4),(4,8),(-6,8),$ and $(-6,-6)$. Label this quadrilateral $A^{′}$.
3. How are the coordinates of quadrilateral $A$ related to the coordinates of quadrilateral $A^{′}$?
4. What single transformation takes quadrilateral $A$ to quadrilateral $A^{′}$?

### Lesson 2 Summary

Square $ABCD$ has been translated by the directed line segment from $(-1,1)$ to $(4,0)$. The result is square $A^{′}B^{′}C^{′}D^{′}$.



Here is a list of coordinates in the original figure and corresponding coordinates in the image. Do you see the rule for taking points in the original figure to points in the image?

|  |  |
| --- | --- |
| original figure | image |
| $A=(-1,1)$ | $A^{′}=(4,0)$ |
| $B=(1,1)$ | $B^{′}=(6,0)$ |
| $C=(1,-1)$ | $C^{′}=(6,-2)$ |
| $D=(-1,-1)$ | $D^{′}=(4,-2)$ |
| $Q=(-0.5,1)$ | $Q^{′}=(4.5,0)$ |

This table looks like a table that shows corresponding inputs and outputs of a function. A transformation is a special type of function that takes points in the plane as inputs and gives other points as outputs. In this case, the function’s rule is to add 5 to the $x$-coordinate and subtract 1 from the $y$-coordinate.

We write the rule this way: $(x,y)\rightarrow (x+5,y−1)$.



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