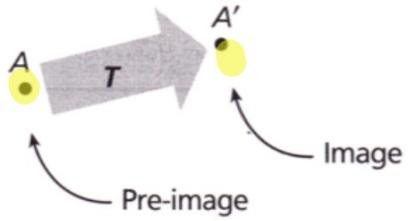
Transformations
Day 1

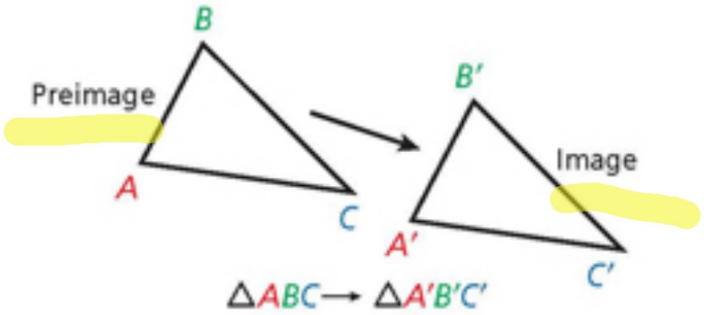
Section 1-7

CC.9–12.G.CO.2

1 ENGAGE Introducing Transformations

A **transformation** is a function that changes the position, shape, and/or size of a figure. The inputs for the function are points in the plane; the outputs are other points in the plane. A figure that is used as the input of a transformation is the **pre-image**. The output is the **image**.

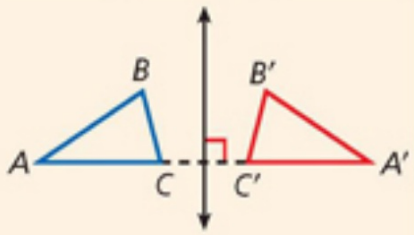




For example, the transformation T moves point A to point A'. Point A is the pre-image, and A' is the image. You can use function notation to write $T(A) = A'$. Note that a transformation is sometimes called a *mapping*. Transformation T maps point A to point A'.

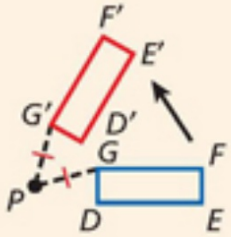
Transformations

REFLECTION



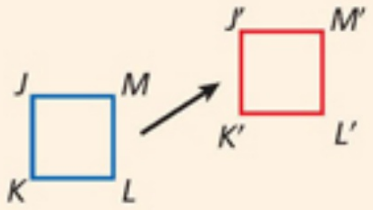
A **reflection** (or *flip*) is a transformation across a line, called the line of reflection. Each point and its image are the same distance from the line of reflection.

ROTATION



A **rotation** (or *turn*) is a transformation about a point *P*, called the center of rotation. Each point and its image are the same distance from *P*.

TRANSLATION



A **translation** (or *slide*) is a transformation in which all the points of a figure move the same distance in the same direction.

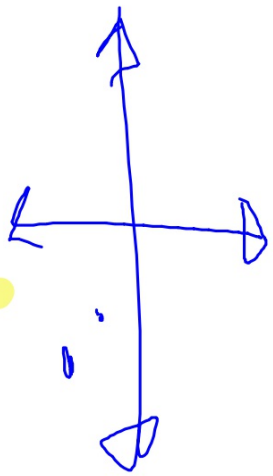
Coordinate notation is one way to write a rule for a transformation on a coordinate plane. The notation uses an arrow to show how the transformation changes the coordinates of a general point, (x, y).

For example, the notation $(x, y) \rightarrow (x + 2, y - 3)$ means that the transformation adds 2 to the x-coordinate of a point and subtracts 3 from its y-coordinate. Thus, this transformation maps the point $(6, 5)$ to the point $(8, 2)$.

1b. Consider the transformation given by the rule $(x, y) \rightarrow (x + 1, y + 1)$. What is the domain of this function? What is the range? Describe the transformation.

x

y



1 unit → Right

1 unit ↑ up

In the following slides, identify the transformation:

If the transformation is a reflection, draw the line of reflection

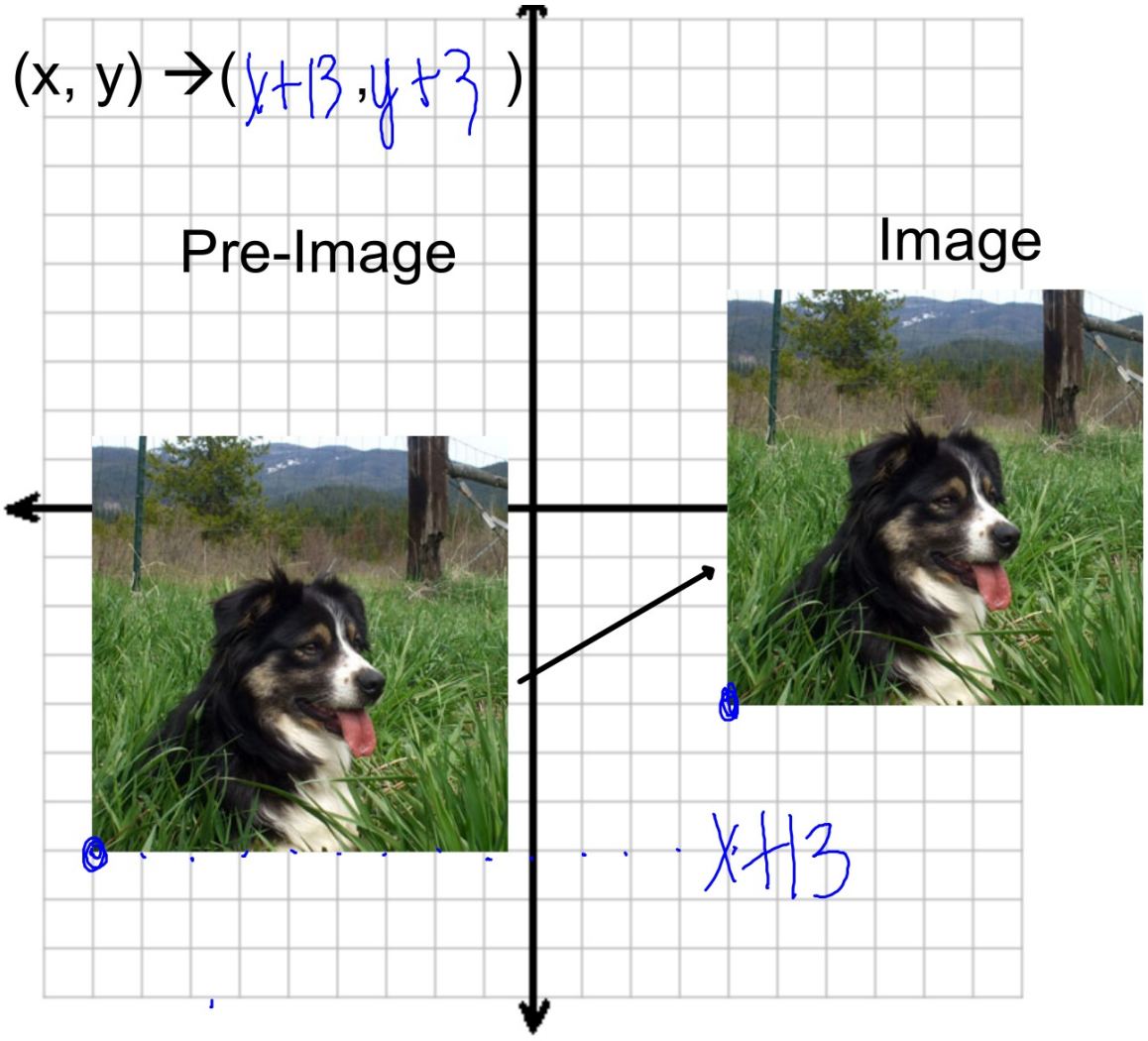
If the transformation is a rotation, draw the point of rotation and identify the degrees of rotation.

If the transformation is a translation, identify the translation using the coordinate plane (on the following slide)

Which transformation is shown below?

Pre-Image

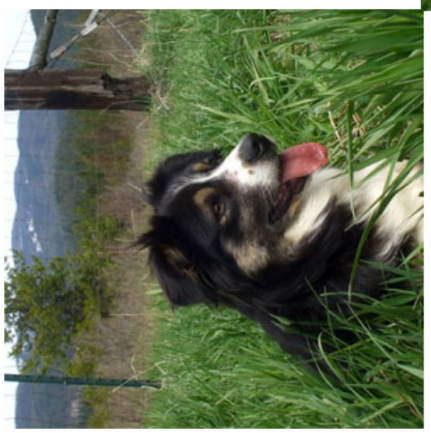
Image


(x, y) → (x+13, y+3)
Pre-Image
Image
x+13

Which transformation is shown below?

Image

Pre-Image

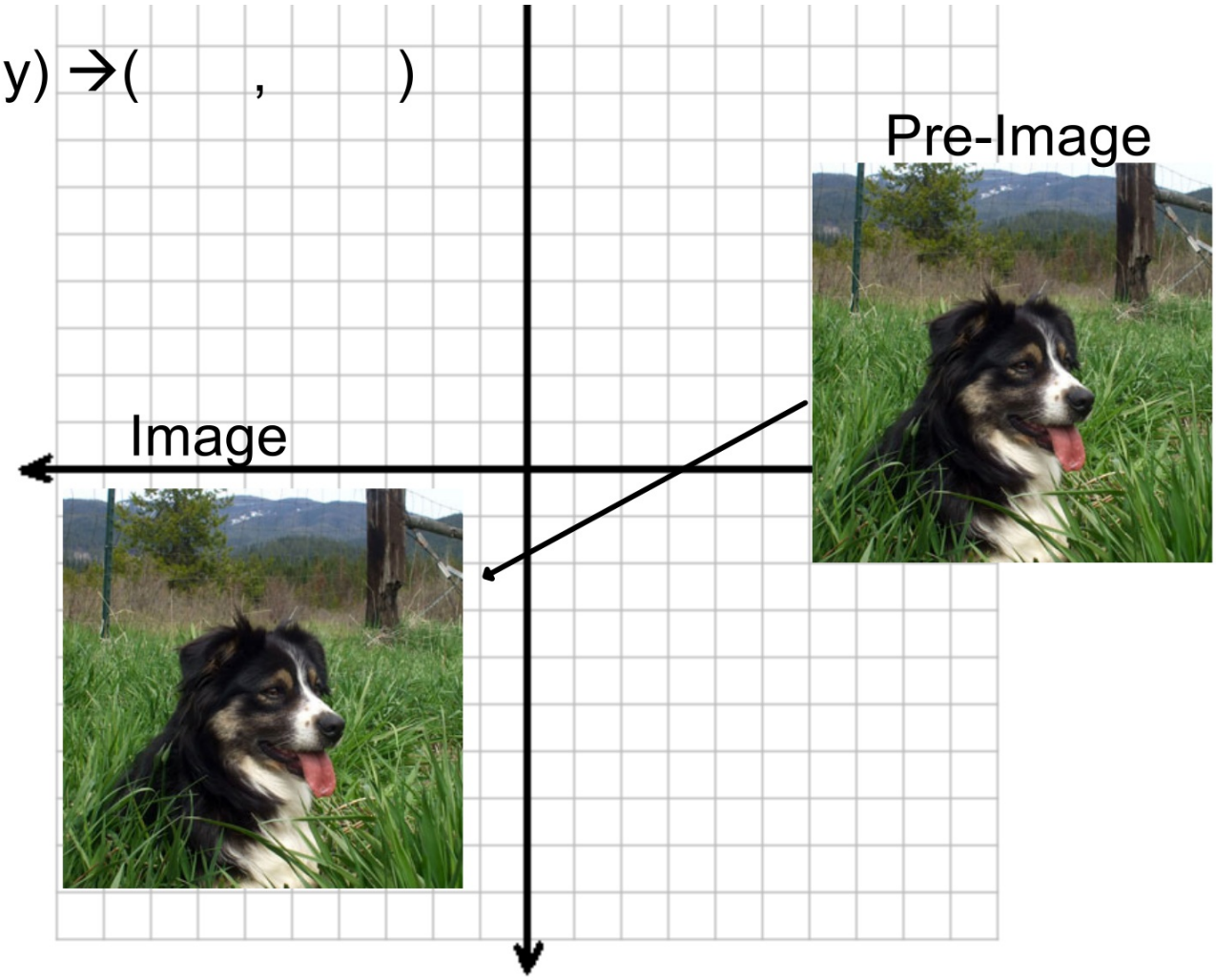


Which transformation is shown below?

Pre-Image

Image

(x, y) → (,)



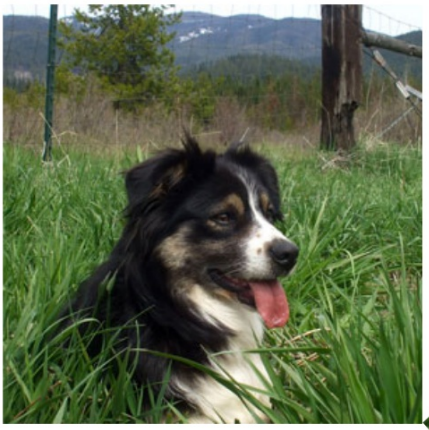
Which transformation is shown below?

Pre-Image

Image

Which transformation is shown below?

Pre-Image



Image

Which transformation is shown below?

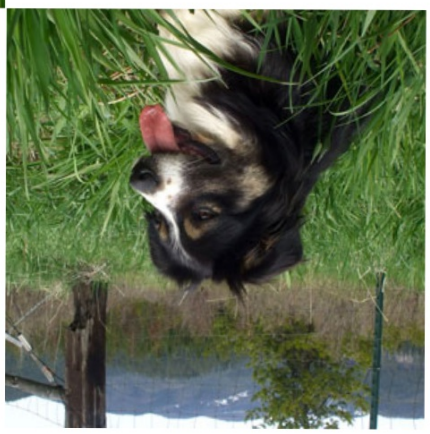
Pre-Image

Image

Which transformation is shown below?

Pre-Image

Image

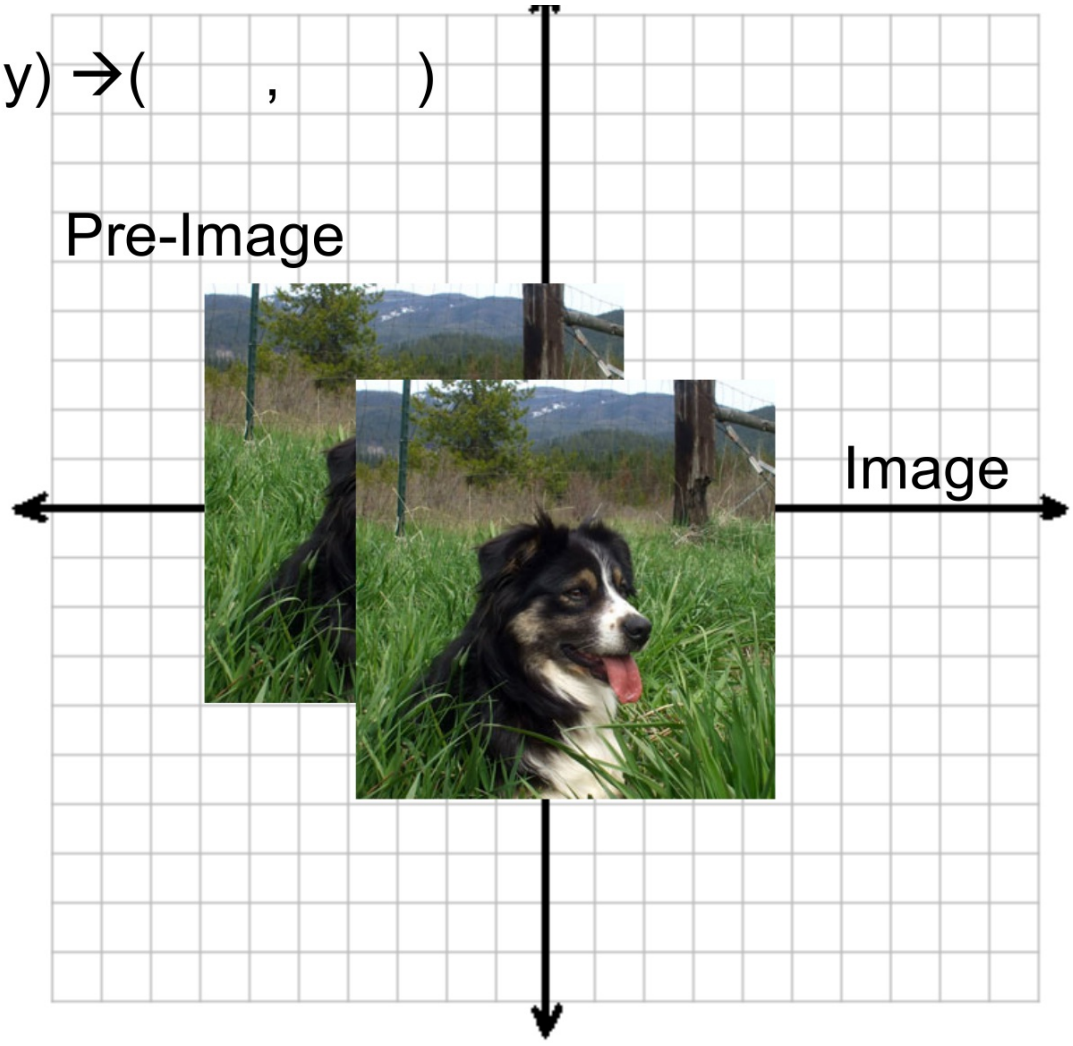


Which transformation is shown below?

Pre-Image

Image

(x, y) →(,)



Challenge

Which transformation is shown below?

Pre-Image

Image

REFLECT

1a. Explain how to identify the pre-image and image in $T(E) = F$.

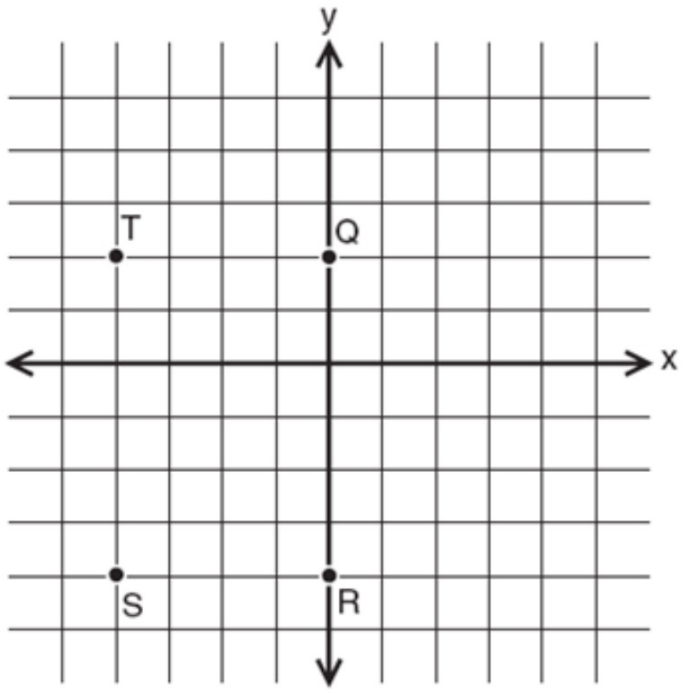
1b. Consider the transformation given by the rule $(x, y) \rightarrow (x + 1, y + 1)$. What is the domain of this function? What is the range? Describe the transformation.

1c. Transformation T maps points in the coordinate plane by moving them vertically up or down onto the x-axis. (Points on the x-axis are unchanged by the transformation.) Explain how to use coordinate notation to write a rule for transformation T.

What is the image of (x,y)
after a translation of
3 units right
and 7 units down?

(1) $(x + 3, y - 7)$
(2) $(x + 3, y + 7)$
(3) $(x - 3, y - 7)$
(4) $(x - 3, y + 7)$

If
$x = -2$
and $y = -1$,
which point
on the accompanying set of axes
represents the translation
$(x,y) \rightarrow (x + 2, y - 3)$?



(1) Q
(2) R
(3) S
(4) T

What is the image of point (2,5)
under the translation
that shifts
(x,y)
to
$(x+3, y-2)$?

(1) (0,3)
(2) (0,8)
(3) (5,3)
(4) (5,8)

1) If $T:(3,4)\rightarrow(\underline{4},\underline{8})$, then $T:(-5,4)\rightarrow(\_\_,\_\_)$ 	2) If $T:(6,2)\rightarrow(\underline{5},\underline{1})$, then $T:(-3,-1)\rightarrow(\_\_,\_\_)$ 

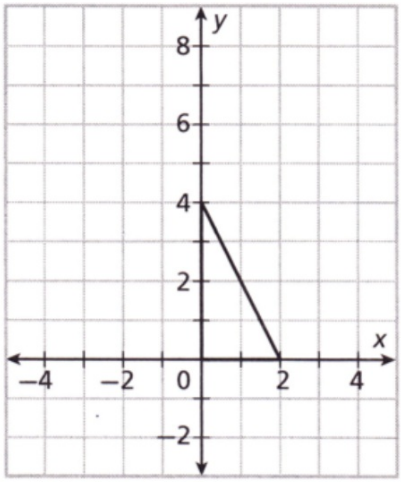
CC.9–12.G.CO.5

2 EXPLORE Classifying Transformations

Investigate the effects of various transformations on the given right triangle.

- Use coordinate notation to help you find the image of each vertex of the triangle.
- Plot the images of the vertices.
- Connect the images of the vertices to draw the image of the triangle.

A $(x, y) \rightarrow (x - 4, y + 3)$

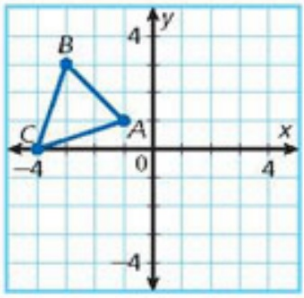


EXAMPLE 3 Translations in the Coordinate Plane

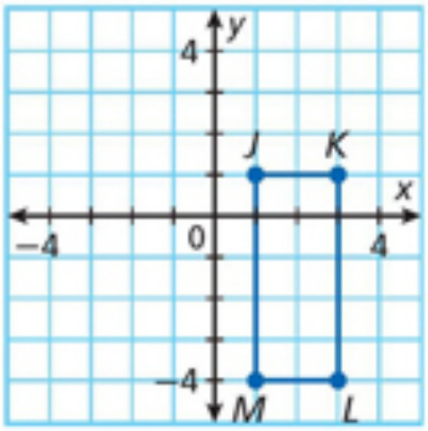
Find the coordinates for the image of $\triangle ABC$ after the translation $(x, y) \rightarrow (x + 3, y - 4)$. Draw the image.

Step 1 Find the coordinates of $\triangle ABC$.

The vertices of $\triangle ABC$ are $A(-1, 1)$, $B(-3, 3)$, and $C(-4, 0)$.



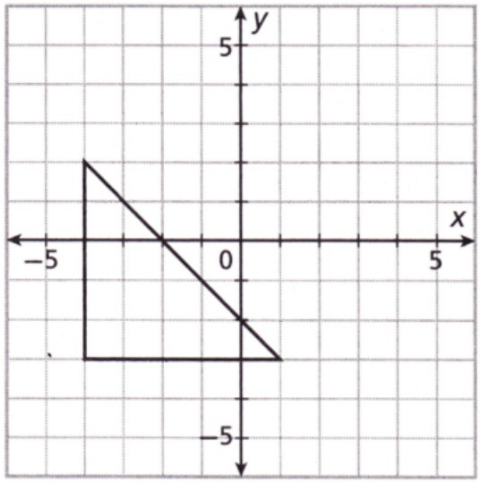
3. Find the coordinates for the image of *JKLM* after the translation $(x, y) \rightarrow (x - 2, y + 4)$. Draw the image.



PRACTICE

Draw the image of the triangle under the given transformation. Then tell whether the transformation appears to be a rigid motion.

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



Draw the image of the triangle under the given transformation. Then tell whether the transformation appears to be a rigid motion.

6. $(x, y) \rightarrow (x - 4, y - 4)$