9.1 Properties of Translations

8.G.1
Verify experimentally the properties of rotations, reflections, and translations.

8.G.3
Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates

Vocabulary

transformation - function that describes a change in the position, size, or shape of a figure

preimage - the input (beginning) transformation

↳ A, B, C 

image - the output (result) transformation

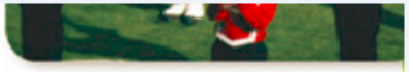
↳ A', B', C' 

(A-prime)

translation - a transformation that slides a figure along a straight line

P279

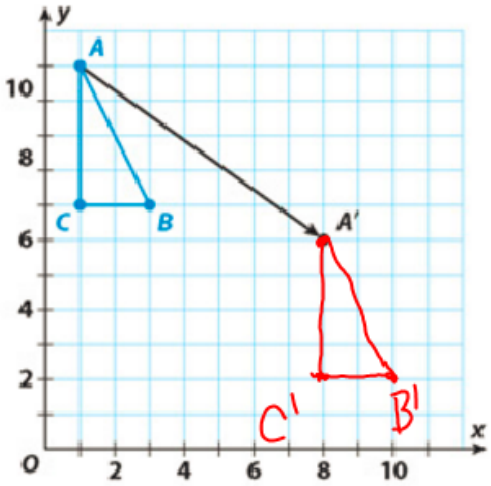
The triangle shown on the grid is the preimage (input). The arrow shows the motion of a translation and how point A is translated to point A'.



A Trace triangle ABC onto a piece of paper. Cut out your traced triangle.

B Slide your triangle along the arrow to model the translation that maps point A to point A'.

C The image of the translation is the triangle produced by the translation. Sketch the image of the translation.

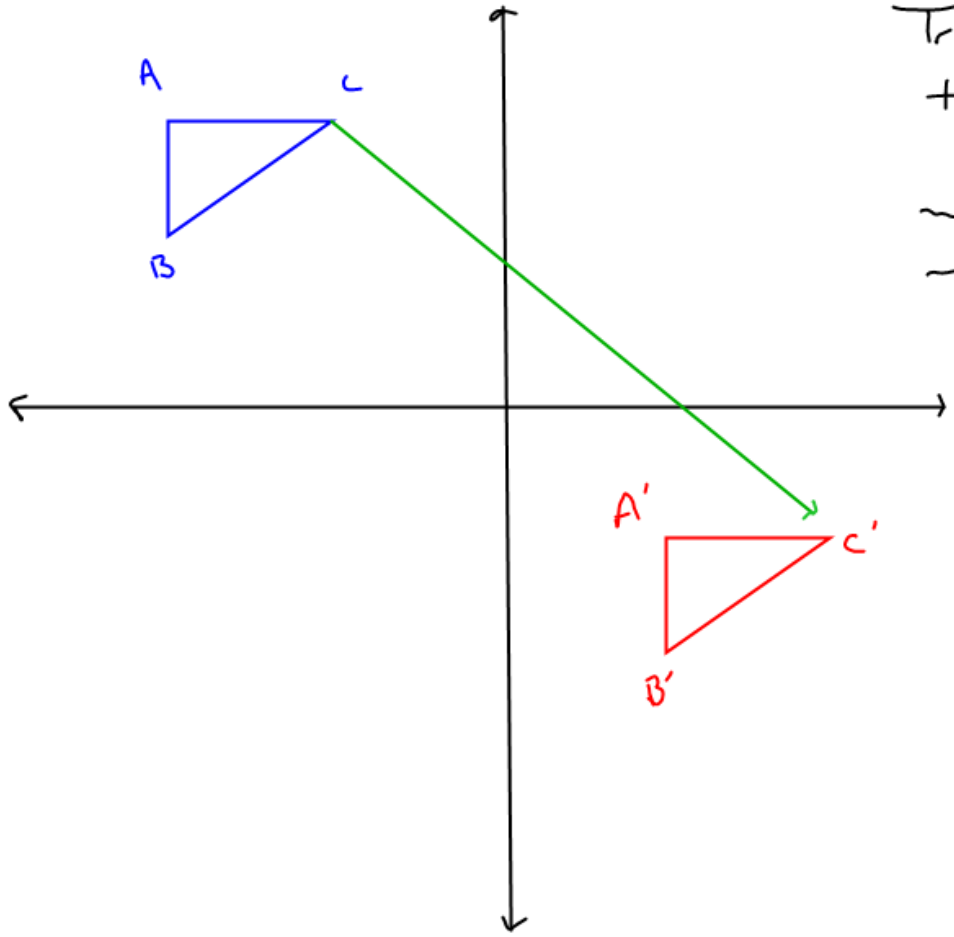


D The vertices of the image are labeled using prime notation. For example, the image of A is A'. Label the images of points B and C.

E Describe the motion modeled by the translation.

Move 7 units right and 5 units down.

F Check that the motion you described in part **E** is the same motion that maps point A onto A', point B onto B', and point C onto C'.



Translation from △ABC to △A'B'C'

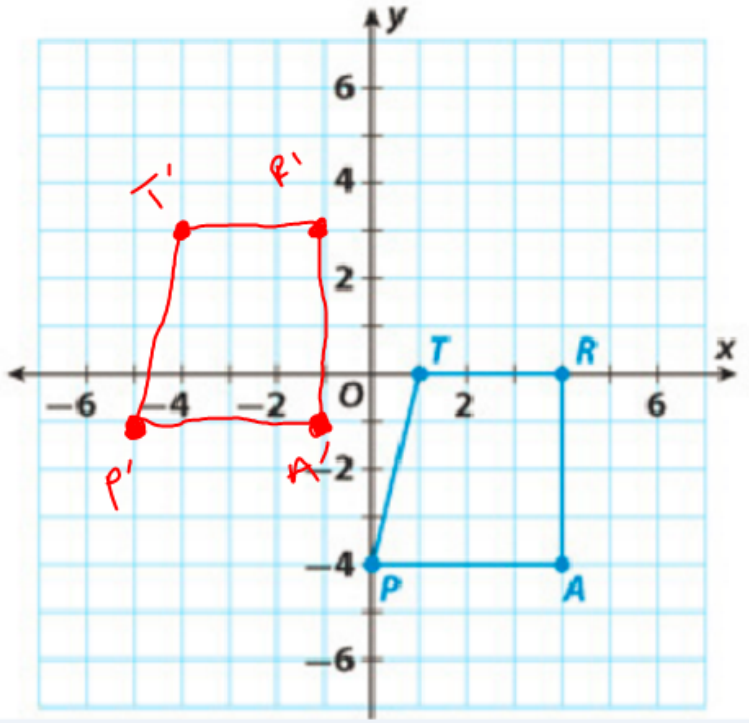
___ # of units right and
___ # of units down

p 280

Use trapezoid *TRAP* to investigate the properties of translations.

A Trace the trapezoid onto a piece of paper. Cut out your traced trapezoid.

B Place your trapezoid on top of the trapezoid in the figure. Then translate your trapezoid 5 units to the left and 3 units up. Sketch the image of the translation by tracing your trapezoid in this new location. Label the vertices of the image T', R', A', and P'.



C: TR 1.3cm RA 1.7cm AP 1.7cm TP 1.75

D: T'R' 1.3cm R'A' 1.7cm A'P' 1.7cm T'P' 1.75cm

E: Sides are the same for image & preimage

F: $m\angle T = 104°$ $m\angle R = 90°$ $m\angle A = 90°$ $m\angle P = 76°$

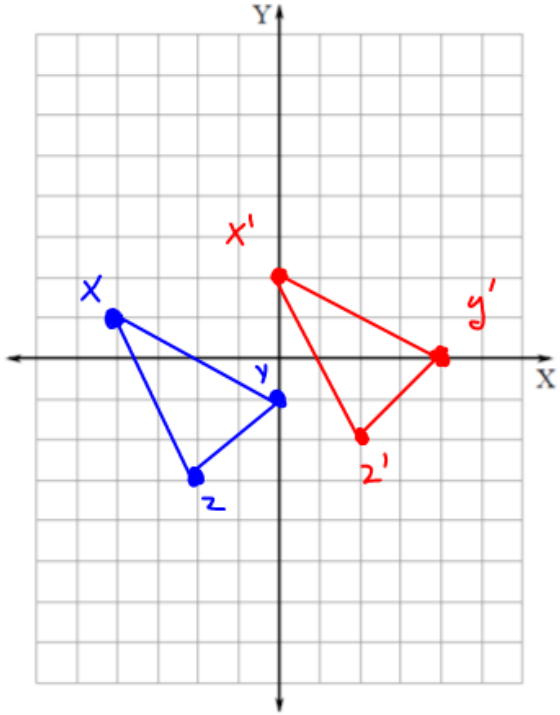
$$\begin{array}{r} 90 \\ +90 \\ +104 \\ +74 \\ \hline 360° \end{array}$$

G: $m\angle T' = 104°$ $m\angle R' = 90°$ $m\angle A' = 90°$ $m\angle P' = 76°$

H: angles are same for image & preimage

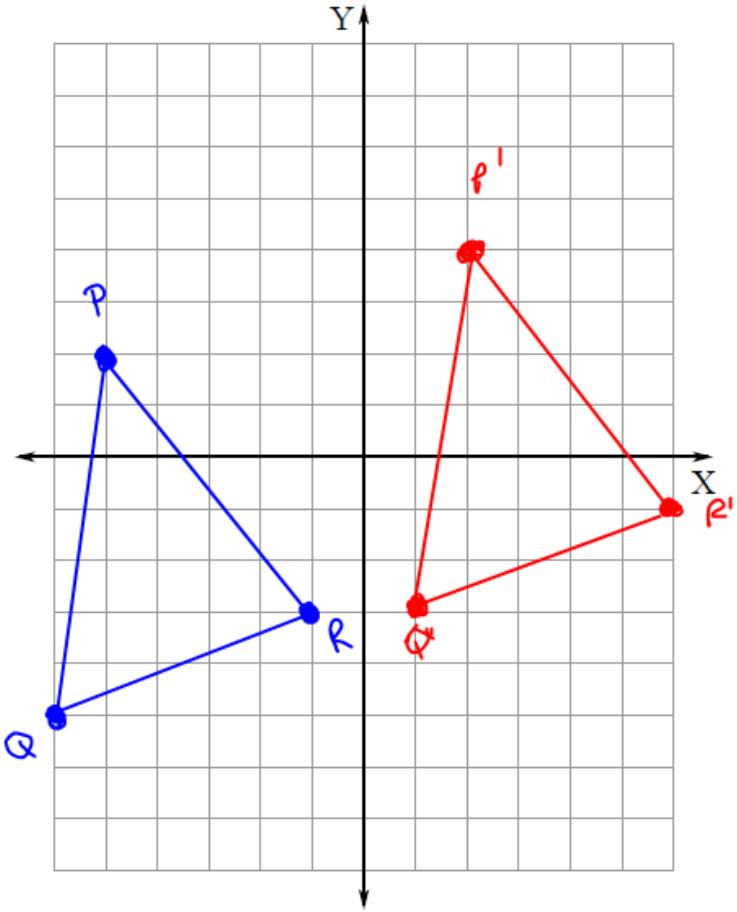
EXAMPLE 1

The figure shows triangle *XYZ*. Graph the image of the triangle after a translation of 4 units to the right and 1 unit up.



ADDITIONAL EXAMPLE 1

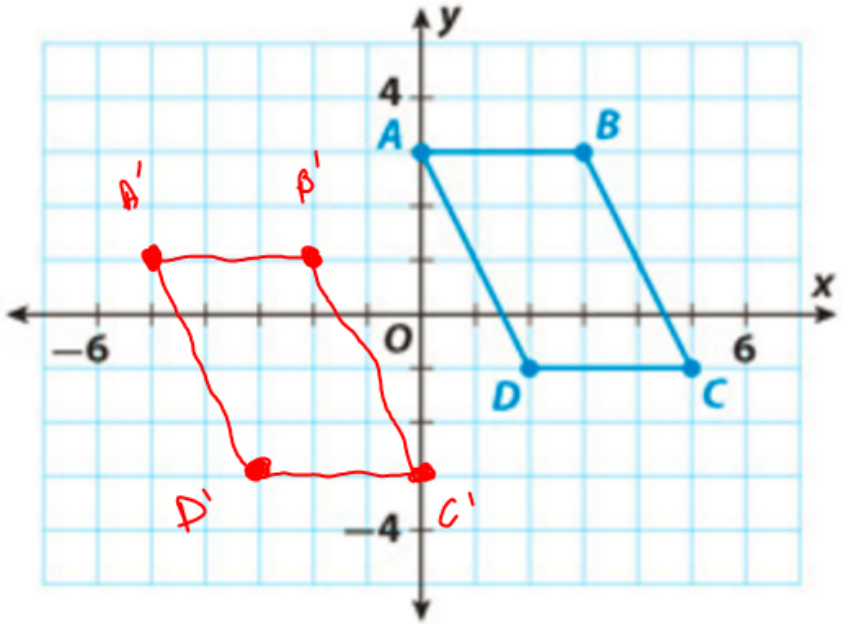
The figure shows triangle *PQR*. Graph the image of the triangle after a translation of 7 units to the right and 2 units up.



P 282

YOUR TURN

4. The figure shows parallelogram *ABCD*. Graph the image of the parallelogram after a translation of 5 units to the left and 2 units down.



a = some number
b = some number

Translations

Right a units	Add a to the x-coordinate $(x+a, y)$
Left a units	Subtract a from the x-coordinate $(x-a, y)$
Up b units	Add b to the y-coordinate $(x, y+b)$
Down b units	Subtract b from the y-coordinate $(x, y-b)$

EXAMPLE 1

P291

Triangle *XYZ* has vertices *X*(0, 0), *Y*(2, 3), and *Z*(4, −1). Find the vertices of triangle *X′Y′Z′* after a translation of 3 units to the right and 1 unit down. Then graph the triangle and its image.

$X(0,0) \rightarrow X'(0+3, 0-1) \rightarrow X'(3,-1)$

$Y(2,3) \rightarrow Y'(2+3, 3-1) \rightarrow Y'(5,2)$

$Z(4,-1) \rightarrow Z'(4+3, -1-1) \rightarrow Z'(7,-2)$

ADDITIONAL EXAMPLE 1

Triangle *PQR* has vertices *P* (3, 3), *Q* (5, −1), and *R* (1, −2). Find the vertices of triangle *P'Q'R'* after a translation of 3 units to the left and 1 unit up. Then graph the triangle and its image.

$P(3,3) \rightarrow P'(3-3, 3+1) \rightarrow P'(0,4)$

$Q(5,-1) \rightarrow Q'(5-3, -1+1) \rightarrow Q'(2,0)$

$R(1,-2) \rightarrow R'(1-3, -2+1) \rightarrow R'(-2,-1)$

P298

YOUR TURN

1. A rectangle has vertices at (0, −2), (0, 3), (3, −2), and (3, 3). What are the coordinates of the vertices of the image after the translation $(x, y) \rightarrow (x - 6, y - 3)$? Describe the translation.

(-6,-5)(-6,0)(-3,-5)(-3,0)

(0-6, -2-3)
(0-6, 3-3)
(3-6, -2-3)
(3-6, 3-3)