

Grade 8 - Translations, Reflections and Rotations

- Lesson

Common Core 8.G.A.1, 8.G.A.2, 8.G.A.3 · maths-pdf.fr/en/

Translations, reflections and rotations are rigid transformations: they move a figure without changing its side lengths or angle measures, so the image is congruent to the original. A translation slides, a reflection flips across a line, and a rotation turns about a point. You can find image coordinates with simple rules on the coordinate plane.

Grade 8 · Common Core State Standards: **8.G.A.1, 8.G.A.2, 8.G.A.3**

Key facts

- Translation by (a,b) : $(x,y) \rightarrow (x+a,y+b)$.
- Reflection across the x-axis: $(x,-y)$; across the y-axis: $(-x,y)$.
- Rotation about the origin: 90° counterclockwise $(-y,x)$; 180° $(-x,-y)$; 90° clockwise $(y,-x)$.
- Rigid motions preserve lengths, angles and parallel lines.
- Two figures are congruent if a sequence of rigid motions maps one to the other.

What is a rigid transformation?

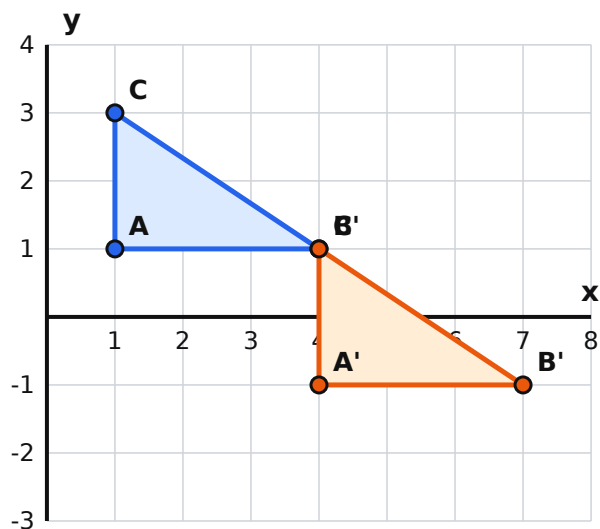
A rigid transformation moves a figure without changing its size or shape. The three kinds are translations, reflections and rotations. The original figure is the **preimage** and the moved figure is the **image**, whose vertices are marked with a prime symbol such as A' .

Properties preserved

Rigid transformations keep **side lengths**, **angle measures** and **parallel lines** the same. The image is always **congruent** to the preimage.

How do you translate a figure?

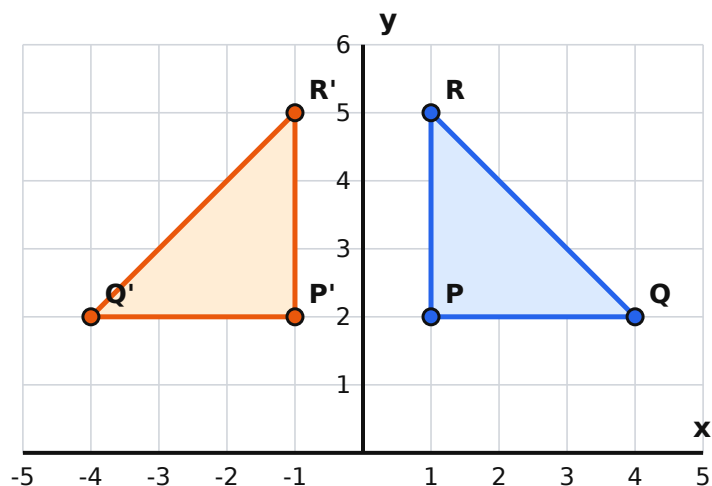
A translation slides every point the same distance in the same direction. To translate right a and up b , add a to every x-coordinate and b to every y-coordinate: $(x,y) \rightarrow (x+a,y+b)$. Moving left or down uses negative numbers.



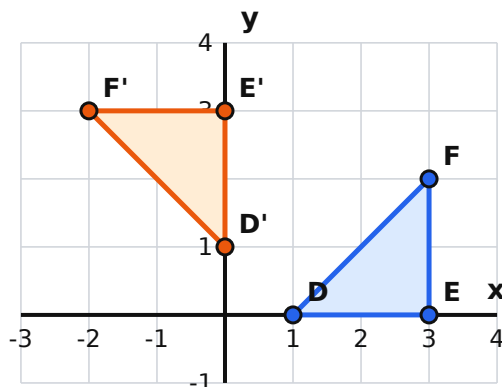
Triangle ABC slides 3 right and 2 down.

How do you reflect and rotate?

A reflection flips a figure across a line, the line of reflection. Across the x-axis, $(x, y) \rightarrow (x, -y)$. Across the y-axis, $(x, y) \rightarrow (-x, y)$. A rotation turns a figure about a point. About the origin, 90° counterclockwise sends (x, y) to $(-y, x)$, 180° sends it to $(-x, -y)$, and 90° clockwise sends it to $(y, -x)$.



Reflection across the y-axis.



Rotation of 90 degrees counterclockwise about the origin.

Move	Rule	Example
Translate (3, -2)	$(x + 3, y - 2)$	(1, 1) to (4, -1)
Reflect, x-axis	$(x, -y)$	(2, 5) to (2, -5)
Reflect, y-axis	$(-x, y)$	(2, 5) to (-2, 5)
Rotate 90 ccw	$(-y, x)$	(2, 5) to (-5, 2)
Rotate 180	$(-x, -y)$	(2, 5) to (-2, -5)

Coordinate rules for rigid motions.

What does congruent mean?

Two figures are **congruent** if a sequence of rotations, reflections and translations maps one onto the other. To describe a sequence, list the moves in order. For example, triangle T with vertices (0,0), (2,0), (0,3) is congruent to the triangle with vertices (5,1), (7,1), (5,4), because a translation 5 right and 1 up maps one to the other.

1. Compare the order of the vertices (a reflection reverses it).
2. Choose a move that sends one vertex to its image.
3. Check that every other vertex lands correctly.

Questions about translations, reflections and rotations

What does the prime symbol mean?

The point A' , read A prime, is the image of point A after a transformation.

Does a reflection change the size of a figure?

No. A reflection flips the figure, but all lengths and angles stay the same. Only the orientation

(the order of the vertices) is reversed.

How do I rotate a point 90 degrees clockwise?

Swap the coordinates and change the sign of the new y-value: $(x,y) \rightarrow (y,-x)$. For $(3,1)$ you get $(1,-3)$.

Which transformations change orientation?

Only reflections reverse the order of the vertices. Translations and rotations keep the same orientation.

How do I show two figures are congruent?

Describe a sequence of translations, reflections and rotations that maps one figure exactly onto the other.