

Grade 8 · Translations, Reflections and Rotations · Lesson

Common Core 8.G.A.1, 8.G.A.3 · mathovore.fr

Translations, reflections and rotations are rigid motions: they move a figure without changing any side length or angle measure. On the coordinate plane a translation adds the same numbers to every point, a reflection changes a sign, and a rotation about the origin swaps the coordinates and changes signs.

Grade 8 Common Core: 8.G.A.1 · 8.G.A.3

Key facts:

- Rigid motions keep segment lengths, angle measures and parallel lines, so the image is congruent to the pre-image.
- Translation: (x, y) becomes $(x + a, y + b)$.
- Reflection across the x-axis: $(x, -y)$. Across the y-axis: $(-x, y)$.
- Rotation about the origin, counterclockwise: 90 degrees $(-y, x)$, 180 degrees $(-x, -y)$, 270 degrees $(y, -x)$.
- The image of point A is written A prime.

What is a rigid motion?

A **rigid motion** moves a figure without changing its size or shape. The three kinds are translations, reflections and rotations. The original figure is the **pre-image**, and the moved figure is the **image**. The image of point A is named A' .

Vocabulary

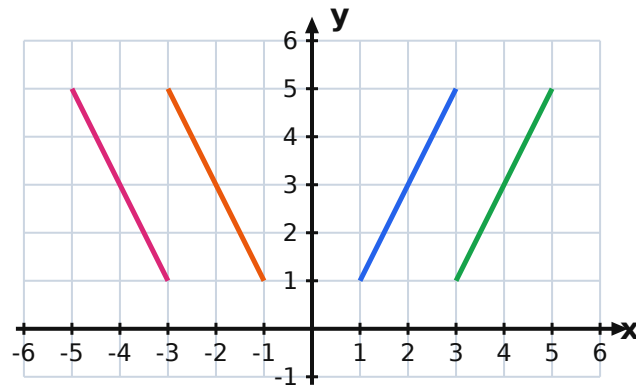
Translation: a slide of every point the same distance in the same direction.

Reflection: a flip across a line, such as an axis.

Rotation: a turn about a point. Here the point is the origin and the turn is counterclockwise.

Every rigid motion keeps lines as lines, keeps the length of every segment, keeps the measure

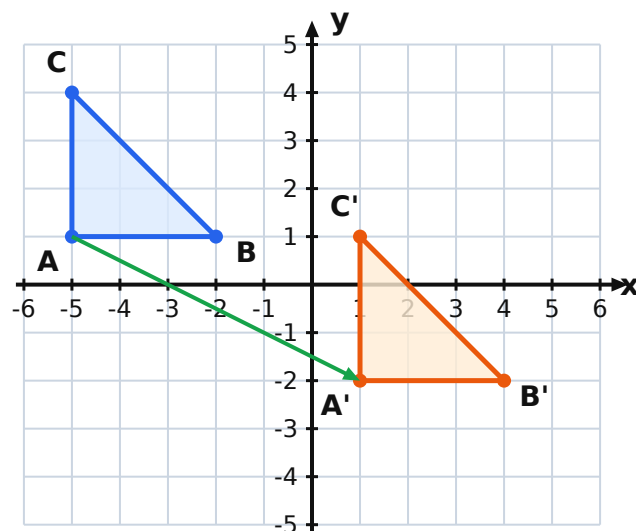
of every angle, and keeps parallel lines parallel. So the image is congruent to the pre-image.



Parallel lines stay parallel after a reflection (slope 2 becomes slope -2 for both).

How do you translate a figure on the coordinate plane?

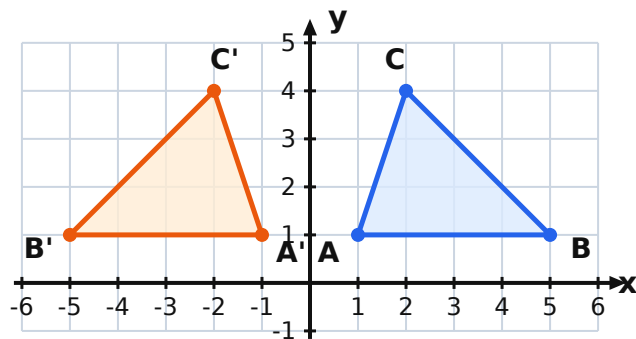
Add the same numbers to every point. Moving 6 right and 3 down changes (x, y) to $(x+6, y-3)$. The point $A(-5, 1)$ lands on $A'(1, -2)$.



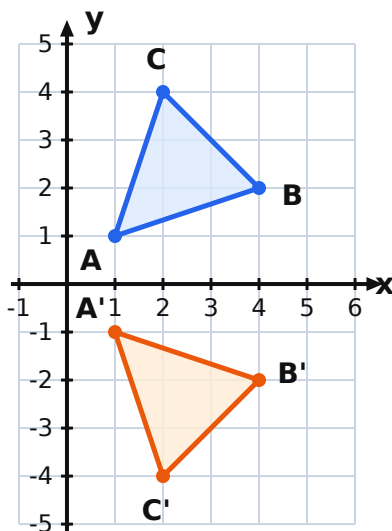
A translation: every point moves 6 units right and 3 units down, $(x, y) \rightarrow (x+6, y-3)$.

How do you reflect a figure across an axis?

A reflection across the x -axis changes the sign of the y -coordinate. A reflection across the y -axis changes the sign of the x -coordinate. Each point and its image are the same distance from the axis.



A reflection across the y -axis: the point (x,y) goes to $(-x,y)$.

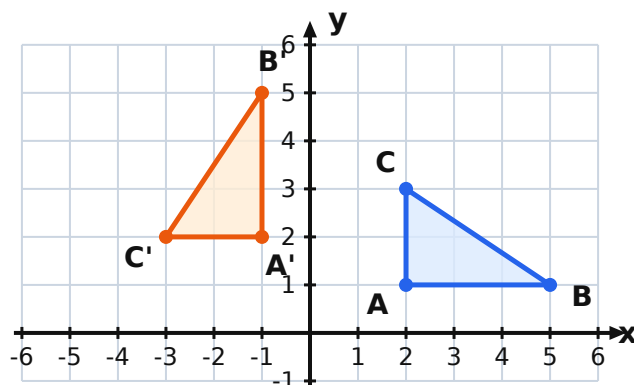


A reflection across the x -axis: $(x,y) \rightarrow (x,-y)$. The two triangles are mirror images.

How do you rotate a figure about the origin?

1. Pick the turn: 90° , 180° or 270° counterclockwise.
2. Apply the matching rule from the table to each vertex.
3. Plot the image points and join them in the same order.

Worked example. Rotate $A(2,1)$ by 90° . The rule $(x,y) \rightarrow (-y,x)$ gives $A'(-1,2)$. Rotating $B(5,1)$ gives $B'(-1,5)$.



A rotation of 90° counterclockwise about the origin: $(x,y) \rightarrow (-y,x)$.

Motion	Rule for (x,y)
Translation by a and b	$(x+a, y+b)$
Reflection across the x -axis	$(x,-y)$
Reflection across the y -axis	$(-x,y)$
Rotation 90°	$(-y,x)$
Rotation 180°	$(-x,-y)$
Rotation 270°	$(y,-x)$

Translations, Reflections and Rotations: frequently asked questions

What stays the same after a translation, reflection or rotation?

Side lengths, angle measures and parallelism stay the same. Only the position, and for reflections and rotations the orientation, can change. That is why the image is congruent to the pre-image.

What is the rule for a reflection across the y -axis?

Change the sign of the x -coordinate: $(x,y) \rightarrow (-x,y)$. For example, $(3,-2)$ becomes $(-3,-2)$. The y -coordinate does not change.

How do you rotate a point 90 degrees counterclockwise about the origin?

Swap the coordinates and negate the new first coordinate: $(x,y) \rightarrow (-y,x)$. For example, $(4,1)$ goes to $(-1,4)$.

What is the difference between a rotation of 180 degrees and a reflection?

A 180° rotation negates both coordinates, $(-x,-y)$. A reflection across one axis negates only one coordinate. Two reflections, one across each axis, equal a 180° rotation.

What does the prime mean in A' prime?

The prime marks the image. If A is a vertex of the pre-image, then A' is the point that A moves to, and B' matches B .