

Geometry · Rigid Transformations · Worksheet Answer Key

Common Core G-CO.A.2, G-CO.A.3, G-CO.A.4, G-CO.A.5 · mathovore.fr

This answer key gives a full worked solution for each problem on the rigid transformations worksheet. Use it to compare image coordinates, vectors and symmetry counts, and to check each rule you applied.

GeometryCommon Core: G-CO.A.2 · G-CO.A.3 · G-CO.A.4 · G-CO.A.5

Problem 1: Translate points

- a. Add the components: $(3+(-5), -2+4) = (-2, 2)$.
- b. $(-4+7, 6+(-9)) = (3, -3)$.

Problem 2: Translate a triangle

Add 3 to each x-coordinate and subtract 5 from each y-coordinate.

$A'(4, -4)$, $B'(7, -4)$, $C'(5, -1)$.

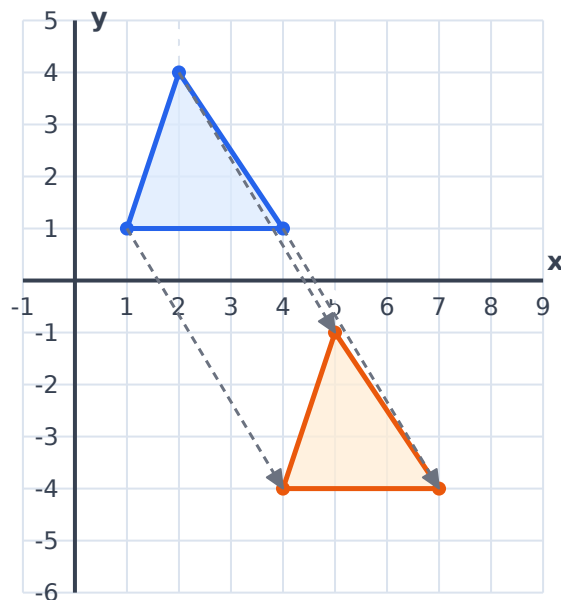


Image after the translation.

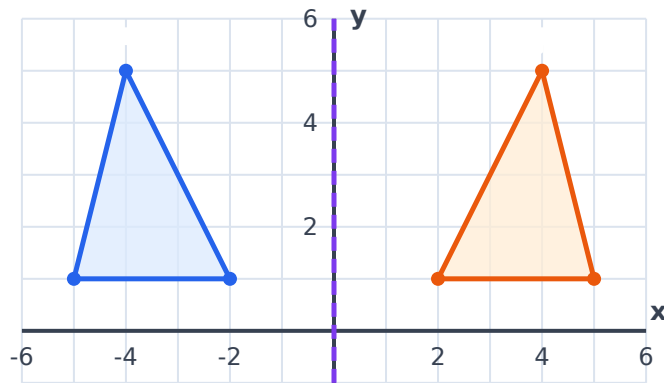
Problem 3: Reflect points over the axes

- a. The x-axis reflection changes the sign of y: $(-3, -5)$.
- b. The y-axis reflection changes the sign of x: $(3, 5)$.
- c. $(4, 7)$.

Problem 4: Reflect a triangle over the y-axis

Change the sign of each x-coordinate.

$D'(5, 1)$, $E'(2, 1)$, $F'(4, 5)$.



The y-axis is the mirror line.

Problem 5: Reflect over $y = x$

Swap the coordinates.

- a. $(-6, 2)$
- b. $(-1, -4)$
- c. $(5, 0)$

Problem 6: Reflect over a vertical line

The y-coordinate stays the same. The new x-coordinate is $2(3) - x$.

- a. $2(3) - (-1) = 7$: $(7, 4)$
- b. $2(3) - 5 = 1$: $(1, -2)$
- c. The point is on the line, so it stays: $(3, 6)$

Problem 7: Rotate points 90 degrees

Use (x, y) becomes $(-y, x)$.

- a. $(-1, 4)$
- b. $(-2, -3)$
- c. $(5, 0)$

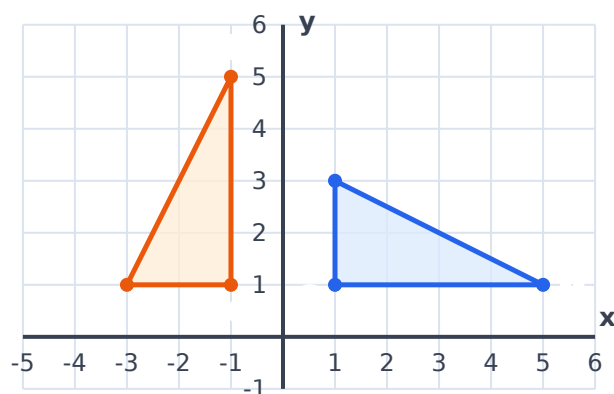
Problem 8: Rotate 180 degrees and clockwise

- a. (x, y) becomes $(-x, -y)$: $(5, -2)$.
- b. A 90° clockwise turn sends (x, y) to $(y, -x)$: $(6, -2)$.

Problem 9: Rotate a triangle

Use (x, y) becomes $(-y, x)$ for each vertex.

$G'(-1, 1)$, $H'(-1, 5)$, $J'(-3, 1)$.



Rotation of 90° counterclockwise about the origin.

Problem 10: Find the translation vector

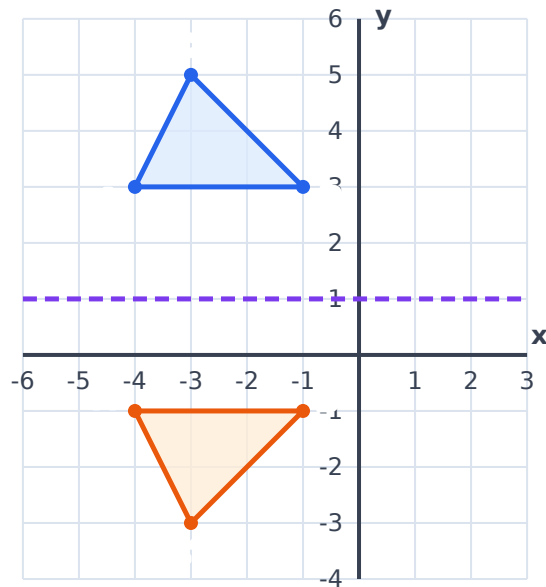
Compare $P(-5, 3)$ with $P'(1, 0)$: $1 - (-5) = 6$ and $0 - 3 = -3$. The other vertices agree.

The vector is $\langle 6, -3 \rangle$.

Problem 11: Find the line of reflection

The line of reflection is the perpendicular bisector of $\overline{AA'}$. $A(-4, 3)$ and $A'(-4, -1)$ have the same x-coordinate, so the line is horizontal, through the midpoint $\left(-4, \frac{3+(-1)}{2}\right) = (-4, 1)$.

The line is $y = 1$.



The mirror line is $y = 1$.

Problem 12: Rigid or not?

- Image endpoints $(4, -1)$ and $(7, 3)$: length $\sqrt{3^2 + 4^2} = 5$. **Rigid** (a translation).
- Image endpoints $(0, 0)$ and $(6, 8)$: length 10. **Not rigid** (a dilation).
- Image endpoints $(0, 0)$ and $(3, -4)$: length 5. **Rigid** (a reflection).
- Image endpoints $(0, 0)$ and $(9, 4)$: length $\sqrt{81 + 16} = \sqrt{97}$, about 9.85. **Not rigid**.
- Image endpoints $(0, 0)$ and $(-4, 3)$: length 5. **Rigid** (a rotation of 90° counterclockwise).

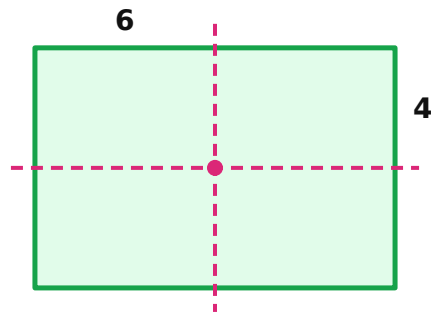
Problem 13: Compare distances

- $AB = \sqrt{(4-1)^2 + (6-2)^2} = \sqrt{9+16} = 5$.
- $A'(-2, 4)$ and $B'(1, 8)$: $A'B' = \sqrt{9+16} = 5$.
- $A'(2, 2)$ and $B'(8, 6)$: $A'B' = \sqrt{36+16} = \sqrt{52}$, about 7.21.

The translation keeps length 5, so it is **rigid**. The stretch changes it, so it is **not rigid**.

Problem 14: Symmetry of a rectangle

- One line joins the midpoints of the long sides and one joins the midpoints of the short sides, so there are **2 lines**. The diagonals are not lines of symmetry because the rectangle is not a square.
- The rectangle maps onto itself after a turn of 180° and a full turn of 360° .



Rectangle with length 6 and width 4; dashed lines are lines of symmetry.

Problem 15: Symmetry of a regular hexagon

A regular polygon with n sides has n lines of symmetry, so a hexagon has **6 lines**.

The smallest turn is $360 \div 6 = 60$ degrees. The rotations are 60° , 120° , 180° , 240° **and** 300° .

Problem 16: Symmetries of other shapes

- 0 lines**. It maps onto itself after a rotation of 180° about its center.
- 1 line** (through the midpoints of the parallel sides). It has **no** rotational symmetry other than a full turn.
- 5 lines**. The smallest rotation is $360 \div 5 = 72$, so 72° , 144° , 216° **and** 288° .

Problem 17: Translate, then reflect

- $(2, 3)$ becomes $(-2, 4)$ after the translation, then $(-2, -4)$ after the reflection.
- $(0, -2)$ becomes $(-4, -1)$, then $(-4, 1)$.

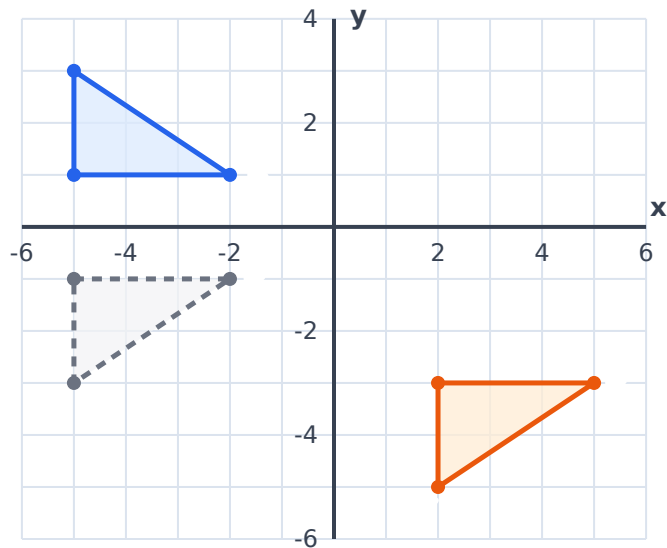
Problem 18: Rotate, then reflect

- After the rotation: $K'(-1, 1)$, $L'(-1, 3)$, $M'(-4, 1)$. After the reflection over the y-axis: $K''(1, 1)$, $L''(1, 3)$, $M''(4, 1)$.
- Each final point is the original with its coordinates swapped, for example $L(3, 1)$ to $L''(1, 3)$. The single transformation is a **reflection over the line $y = x$** .

Problem 19: Describe a sequence

The orientation of the triangle is flipped, so use a reflection. **One answer:** reflect over the x-axis, then translate by $\langle 7, -2 \rangle$.

Reflection: $A'(-5, -1)$, $B'(-2, -1)$, $C'(-5, -3)$. Translation: $A''(2, -3)$, $B''(5, -3)$, $C''(2, -5)$, which matches the final image.



Reflect over the x-axis, then translate.

Problem 20: Video game character

Translation: $(3-7, -4+6) = (-4, 2)$.

Rotation: (x, y) becomes $(-y, x)$, so $(-4, 2)$ becomes $(-2, -4)$.

Problem 21: Park statues

The y-coordinate stays 3. The new x-coordinate is $2(1) - (-6) = 8$.

The second statue is at $(8, 3)$. Check: the walkway $x=1$ is halfway between -6 and 8 .

Problem 22: Logo design

A 180° rotation sends (x, y) to $(-x, -y)$.

$(-2, -1)$, $(-5, -1)$, $(-3, -4)$.

Problem 23: Pinwheel

The blades are equally spaced, so the smallest turn is $360 \div 8 = 45$ degrees.

All rotations are multiples of 45° : 45° , 90° , 135° , 180° , 225° , 270° , 315° , 360° .

Problem 24: Perimeter after a sequence

Translation: $A'(2, -2)$, $B'(5, -2)$, $C'(2, 2)$. Reflection: $A''(2, 2)$, $B''(5, 2)$, $C''(2, -2)$.

Original side lengths: $AB=3$, $AC=4$, $BC=\sqrt{9+16}=5$, perimeter 12. The image sides are 3, 4 and 5 as well, so the perimeter is **12** both times. Rigid transformations preserve length.

Problem 25: Does order matter?

Translate first: $(1, 2)$ becomes $(4, 2)$, then $(-4, 2)$.

Reflect first: $(1, 2)$ becomes $(-1, 2)$, then $(2, 2)$.

The results differ, so Priya is **wrong**: the order of a sequence matters.