

Transformations and Congruence: practice solutions, Grade 8 – download the PDF

Written solutions to the chapter problems. Check each step, then correct yourself.

1 Translate a point



Add -5 to the x -coordinate and 6 to the y -coordinate: $3 + (-5) = -2$ and $-4 + 6 = 2$.

Answer: $P'(-2, 2)$.

2 Reflect across the axes



(a) Across the x -axis the sign of y changes: $(5, -2)$.

(b) Across the y -axis the sign of x changes: $(-5, 2)$.

3 Half turn about the origin



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

Answer: $S'(-6, 1)$.

4 True or false?



- a. False. A translation is rigid, so size does not change.
- b. True. Reflections preserve lengths.
- c. False. Congruent figures can be in different positions; only size and shape must match.
- d. False. Rotations preserve angle measures.

5 Find the translation



- (a) Horizontal change: $-1 - 2 = -3$. Vertical change: $1 - 5 = -4$. The vector is $\langle -3, -4 \rangle$.
- (b) $B' = (4 - 3, -2 - 4) = (1, -6)$.

6 A reflected rectangle



A reflection is rigid, so the image is a rectangle 8 m by 5 m.

Perimeter: $2(8 + 5) = 26$ m. Area: $8 \times 5 = 40 \text{ m}^2$. Both are the same as for the original.

7 Angles after a rotation



The angles of a triangle add to 180° : $\angle C = 180 - 52 - 67 = 61^\circ$.

A rotation preserves angles, so $\angle C' = 61^\circ$.

8 Translate a triangle



Add 6 to each x and subtract 3 from each y : $A'(3, -2)$, $B'(5, -2)$, $C'(3, 1)$.

$AC = 4 - 1 = 3$ (same x , so vertical distance) and $A'C' = 1 - (-2) = 3$. The lengths are equal.

9

A reflected parallelogram

★★★

(a) Change the sign of each x : $P'(-1, 1)$, $Q'(-4, 1)$, $R'(-5, 3)$, $S'(-2, 3)$.

(b) Yes. PQ and SR are horizontal and both have length 3, so $PQRS$ is a parallelogram. Reflections preserve parallelism and lengths, so $P'Q' \parallel S'R'$ with $P'Q' = S'R' = 3$ and the image is a parallelogram too.

10

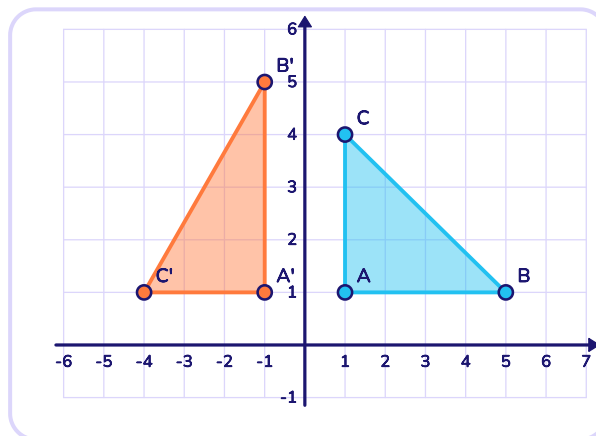
Rotate a triangle

★★★

Use $(x, y) \rightarrow (-y, x)$: $A'(-1, 1)$, $B'(-1, 5)$, $C'(-4, 1)$.

$$BC = \sqrt{(5-1)^2 + (1-4)^2} = \sqrt{25} = 5 \text{ and}$$

$$B'C' = \sqrt{(-1+4)^2 + (5-1)^2} = \sqrt{25} = 5.$$



11

Match the triangles

★★★

Step 1: rotate ABC by 90° counterclockwise about the origin: $A_1(-1, 1)$, $B_1(-1, 5)$, $C_1(-4, 1)$.

Step 2: translate by $\langle 8, 1 \rangle$: $(-1 + 8, 1 + 1) = (7, 2) = D$,
 $(-1 + 8, 5 + 1) = (7, 6) = E$, $(-4 + 8, 1 + 1) = (4, 2) = F$.

A rotation followed by a translation maps ABC onto DEF , so $\triangle ABC \cong \triangle DEF$.

12 Reflect across a vertical line



U is $5 - 2 = 3$ units to the right of the line, so U' is 3 units to the left: $x = 2 - 3 = -1$.

The y -coordinate is unchanged: $U'(-1, 3)$.

V is $2 - (-3) = 5$ units to the left, so V' is 5 units to the right: $x = 2 + 5 = 7$. So

$V'(7, -2)$.

In general $(x, y) \rightarrow (4 - x, y)$.

13 Moves in a video game



(a) First move: $(3 - 4, 7 - 2) = (-1, 5)$. Second move: $(-1 + 6, 5 + 5) = (5, 10)$.

(b) $\langle -4 + 6, -2 + 5 \rangle = \langle 2, 3 \rangle$. Check: $(3 + 2, 7 + 3) = (5, 10)$. Two translations in a row make one translation.

14 Turning a wheel



(a) Spokes are evenly spaced: $360 \div 6 = 60$, so the angle is 60° .

(b) $360 \div 60 = 6$ turns of 60° .

15 Reflect, then rotate



(a) After the reflection: $(2, -1)$, $(6, -1)$, $(2, -4)$. After the rotation, $(x, y) \rightarrow (-y, x)$: $P'(1, 2)$, $Q'(1, 6)$, $R'(4, 2)$.

(b) $(2, 1) \rightarrow (1, 2)$, $(6, 1) \rightarrow (1, 6)$, $(2, 4) \rightarrow (4, 2)$: the coordinates are swapped, $(x, y) \rightarrow (y, x)$. This is a reflection across the line $y = x$.

16 Does the order matter?



(a) Rotation: $(3, 2) \rightarrow (-2, 3)$. Reflection: $(-2, 3) \rightarrow (-2, -3)$.

(b) Reflection: $(3, 2) \rightarrow (3, -2)$. Rotation: $(3, -2) \rightarrow (2, 3)$.

The results $(-2, -3)$ and $(2, 3)$ differ, so the order of the transformations matters.

17 A half turn about another center



(a) $(1, 0) \rightarrow (-1, 0) \rightarrow (3, 3)$.

(b) The overall rule is $(x, y) \rightarrow (-x + 4, -y + 3)$. The center is the midpoint of a point and its image: for A and $A'(3, 3)$ it is $\left(\frac{1+3}{2}, \frac{0+3}{2}\right) = (2, 1.5)$. Rule:

$(x, y) \rightarrow (4 - x, 3 - y)$, a 180° rotation about $(2, 1.5)$.

18 Drone delivery



(a) The distance is $\sqrt{6^2 + 8^2} = \sqrt{100} = 10$ units.

(b) $10 \times 5 = 50$ meters (about 164 feet).

(c) Yes. In a translation every point moves the same distance in the same direction.

19 Which triangle is congruent?



(a) Rigid motions preserve lengths and angles: $DE = 7$ in., $EF = 9$ in., $\angle E = 40^\circ$ (about 17.8 cm and 22.9 cm).

(b) No. If XYZ were congruent to ABC with Y matching B , then $\angle Y$ would be 40° . Since $45^\circ \neq 40^\circ$, no rigid motion maps one onto the other.

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Not a rigid motion

(a) $O'(0, 0)$ and $N'(6, 8)$.

(b) $ON = \sqrt{9 + 16} = 5$ and $O'N' = \sqrt{36 + 64} = 10$. The distance doubles, so lengths are not preserved: the rule is not rigid.

(c) Yes. It adds 3 to every y , which is the translation $\langle 0, 3 \rangle$.

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