

# Motion Matchup

Use rigid motions to track figures and test congruence.

**HIGH SCHOOL • HSG-CO.B.6**

**CCSS.Math.Content.HSG-CO.B.6** "Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures..."

NAME \_\_\_\_\_

DATE \_\_\_\_\_

## TRACK EVERY VERTEX

Translations, rotations, and reflections preserve side lengths and angle measures. Apply the stated motion to every vertex of a figure. If one figure maps exactly onto another through rigid motion or rigid motions, the figures are congruent.

## WORKED EXAMPLE

Point P(11, 13) is translated 17 units left and 19 units up. Find P'.

1. Moving left subtracts from the x-coordinate.
2.  $x' = 11 - 17 = -6$ .
3. Moving up adds to the y-coordinate:  $y' = 13 + 19 = 32$ .

**Answer: P'(-6, 32)**

## PRACTICE 6 problems

- 1** Triangle ABC has A(-3, 4), B(2, -1), and C(4, 3). Translate the triangle 5 units left and 7 units down. Give the coordinates of A', B', and C'.

**ANSWER** \_\_\_\_\_

- 2** Reflect triangle DEF with D(-2, 5), E(4, 1), and F(3, 7) across the y-axis. Give the coordinates of D', E', and F'.

**ANSWER** \_\_\_\_\_

- 3** Rotate triangle GHI with G(5, -2), H(1, 4), and I(-3, 2) 90 degrees counterclockwise about the origin. Give the image coordinates.

**ANSWER** \_\_\_\_\_

- 4** Rotate triangle KLM with K(-4, 3), L(2, -5), and M(1, 7) 180 degrees about the origin. Give the image coordinates.

**ANSWER** \_\_\_\_\_

- 5** Triangle ABC has A(1, 2), B(5, 2), and C(1, 4). Triangle DEF has D(-3, -3), E(1, -3), and F(-3, -1). Are the triangles congruent? Name a rigid motion that maps ABC to DEF.

**ANSWER** \_\_\_\_\_

- 6** Triangle PQR has P(0, 0), Q(4, 0), and R(0, 3). Triangle STU has S(2, 1), T(7, 1), and U(2, 4). Are the triangles congruent? Explain briefly.

**ANSWER** \_\_\_\_\_

## APPLY IT Show your work

- 1** A game designer places a triangular player icon at  $J(-2, 3)$ ,  $K(2, 3)$ , and  $L(-2, 7)$ . During a screen transition, the icon rotates 90 degrees clockwise about the origin. What are the new coordinates of  $J'$ ,  $K'$ , and  $L'$ ?

WORK SPACE

ANSWER \_\_\_\_\_

- 2** For a club poster, one triangular logo has vertices  $A(1, -3)$ ,  $B(5, -3)$ , and  $C(1, 1)$ . A second logo has vertices  $D(-1, -3)$ ,  $E(-5, -3)$ , and  $F(-1, 1)$ . Are the logos congruent? Identify the rigid motion that maps the first logo to the second.

WORK SPACE

ANSWER \_\_\_\_\_

## CHALLENGE One step up

### CHALLENGE

Quadrilateral  $WXYZ$  has  $W(-2, 1)$ ,  $X(1, 1)$ ,  $Y(2, 4)$ , and  $Z(-1, 4)$ . Its image has  $W'(7, -5)$ ,  $X'(7, -2)$ ,  $Y'(4, -1)$ , and  $Z'(4, -4)$ . Describe a sequence of rigid motions that maps  $WXYZ$  to  $W'X'Y'Z'$ . Then explain why the quadrilaterals are congruent.

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## PART 1 • PRACTICE

| # | PROBLEM                                                                                                                                                                     | ANSWER                                                                                                                                                            |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Triangle ABC has A(-3, 4), B(2, -1), and C(4, 3). Translate the triangle 5 units left and 7 units down. Give the coordinates of A', B', and C'.                             | <b>A'(-8, -3), B'(-3, -8), C'(-1, -4)</b>                                                                                                                         |
| 2 | Reflect triangle DEF with D(-2, 5), E(4, 1), and F(3, 7) across the y-axis. Give the coordinates of D', E', and F'.                                                         | <b>D'(2, 5), E'(-4, 1), F'(-3, 7)</b>                                                                                                                             |
| 3 | Rotate triangle GHI with G(5, -2), H(1, 4), and I(-3, 2) 90 degrees counterclockwise about the origin. Give the image coordinates.                                          | <b>G'(2, 5), H'(-4, 1), I'(-2, -3)</b>                                                                                                                            |
| 4 | Rotate triangle KLM with K(-4, 3), L(2, -5), and M(1, 7) 180 degrees about the origin. Give the image coordinates.                                                          | <b>K'(4, -3), L'(-2, 5), M'(-1, -7)</b>                                                                                                                           |
| 5 | Triangle ABC has A(1, 2), B(5, 2), and C(1, 4). Triangle DEF has D(-3, -3), E(1, -3), and F(-3, -1). Are the triangles congruent? Name a rigid motion that maps ABC to DEF. | <b>Yes. Translate 4 units left and 5 units down.</b>                                                                                                              |
| 6 | Triangle PQR has P(0, 0), Q(4, 0), and R(0, 3). Triangle STU has S(2, 1), T(7, 1), and U(2, 4). Are the triangles congruent? Explain briefly.                               | <b>No. The first triangle has a horizontal side of length 4, while the second has a horizontal side of length 5, so no rigid motion can map one to the other.</b> |

## PART 2 • APPLY IT

- J'(3, 2), K'(3, -2), L'(7, 2)** For a 90-degree clockwise rotation about the origin, use  $(x, y) \rightarrow (y, -x)$ . Apply the rule to each vertex.
- Yes. A reflection across the y-axis maps A to D, B to E, and C to F.** A reflection across the y-axis changes each x-coordinate to its opposite and keeps each y-coordinate the same. The corresponding vertices match exactly.

## CHALLENGE

**Rotate 90 degrees counterclockwise about the origin, then translate 8 units right and 3 units down. The figures are congruent because both transformations are rigid motions that preserve all lengths and angle measures.**

Accept coordinate lists in any vertex order if each image point is correctly matched to its original vertex. Accept equivalent wording for the stated rigid motions, including a translation rule such as  $(x, y) \rightarrow (x - 4, y - 5)$ .