

ANSWER MAZE



COMPOSITIONS OF RIGID MOTIONS

Two Motions: Which Comes First, and Which Way?

One page · 10–15 minutes · nothing to prepare

FREE

5

P is at $(4, -2)$. First, rotate it 90° counterclockwise about the origin. Then translate it by $\langle -3, 1 \rangle$. Where does P land?

$(-1, 5) \rightarrow$ go to 2

$(1, 1) \rightarrow$ go to 3

Look at which motion is named first, and at the middle point it gives.

2

Q is moved in two steps. First, reflect it in the x -axis. Then translate it by $\langle 2, 3 \rangle$. It lands at $(5, 1)$. Where did Q start?

$(7, 2) \rightarrow$ go to 8

$(3, 2) \rightarrow$ go to 7

Look at which point is given: the start, or where the point lands.

Answer Maze — how to run it

10–15 minutes

1. **Hand out page 3**, one per student. Nothing else is needed.
2. **Say this once:** *“Start at box 5. Do the first motion first and write the middle point. Write every box number in the row at the bottom as you go.”*
3. **Check a sheet in a glance.** A clean run is **5 2 7 4 1 6**: six boxes, then out.

Student sheet	page 3, one per student. The <i>middle point</i> is where the point is after the first motion and before the second. Box 3 is the only box whose question tells the student to write it down.
Answers	page 4.

The two boxes off the route catch two kinds of mistake. The first is the order of the two motions. The student does the same two motions the other way round, or thinks the order always matters. That wrong answer sends the student to box 3. The second is which way the motions run. The box gives where a point lands and asks where it started, but the student does the two motions forward from the landing point. That wrong answer sends the student to box 8. Each of these two boxes has a question of its own. Both of its answers lead back onto the route, never past the box after the one the student left.

One route box has a pair where the order does not matter: a slide along the mirror line. The box after it has a pair where the order does matter. So the true answer to “does the order matter?” is: it depends on the two motions.

The row at the bottom is the check. A clean run is six numbers. A detour adds one or more. The hint in every box says what to look at, never which answer is right.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.

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Answer Maze

Start at box 5 · which comes first, and which way?

Name _____

Period _____

Date _____

Start at box 5. Choose an answer and go to the box it names. **Do the first motion first, and write down the middle point.** Each box has a hint at the bottom.

1

P is at $(-4, 3)$. First, reflect it in the line $x = 1$. Then reflect it in the line $x = 3$. Where does P land?

$(0, 3) \rightarrow$ go to 6
 $(-8, 3) \rightarrow$ go to 3

Look at which mirror line comes first, and at the middle point.

2

Q is moved in two steps. First, reflect it in the x -axis. Then translate it by $\langle 2, 3 \rangle$. It lands at $(5, 1)$. Where did Q start?

$(7, 2) \rightarrow$ go to 8
 $(3, 2) \rightarrow$ go to 7

Look at which point is given: the start, or where the point lands.

3

P is at $(2, 3)$. First, translate it by $\langle 0, -5 \rangle$. Write the middle point. Then reflect the middle point in the x -axis. Where does P land?

$(2, -8) \rightarrow$ go to 5
 $(2, 2) \rightarrow$ go to 2

Look at the order of the two motions, and write the middle point down.

4

R is moved in two steps. First, rotate it 90° clockwise about the origin. Then translate it by $\langle 0, 4 \rangle$. It lands at $(-3, 6)$. Where did R start?

$(6, 7) \rightarrow$ go to 8
 $(-2, -3) \rightarrow$ go to 1

Look at which motion comes at the end. That one is undone before the other.

5

P is at $(4, -2)$. First, rotate it 90° counterclockwise about the origin. Then translate it by $\langle -3, 1 \rangle$. Where does P land?

$(-1, 5) \rightarrow$ go to 2
 $(1, 1) \rightarrow$ go to 3

Look at which motion is named first, and at the middle point it gives.

6

S is moved in two steps. First, reflect it in the line $y = x$. Then reflect it in the y -axis. It lands at $(2, -5)$. Where did S start?

$(5, 2) \rightarrow$ go to 8
 $(-5, -2) \rightarrow$ you are out

Look at whether the point given is where the steps start or where they end.

7

P is at $(2, 5)$. Translate it by $\langle 3, 0 \rangle$, and reflect it in the x -axis. Do the two orders give the same point?

Yes, the same point. $\rightarrow$ go to 4
No, two different points. $\rightarrow$ go to 3

Look at the direction of the slide and at the mirror line.

8

A translation by $\langle 3, -2 \rangle$ carries T onto $(1, 4)$. Where is T?

$(-2, 6) \rightarrow$ go to 7
 $(4, 2) \rightarrow$ go to 2

Look at which point is the start and which is the image.

Write each box number as you reach it:

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The route, in order. Boxes 3 and 8 are not on it. They come last in the table.

5 → 2 → 7 → 4 → 1 → 6 → out

	Box	Right answer, and why	Wrong answer, and where it goes
1	Box 5	(-1, 5) The first motion takes (4, -2) to the middle point (2, 4). The second motion takes (2, 4) to (-1, 5).	(1, 1) The student did the translation first. Goes to box 3.
2	Box 2	(3, 2) Check it forward. The first motion takes (3, 2) to (3, -2), and the second takes (3, -2) to (5, 1), where the point lands.	(7, 2) The student did the two motions forward from the landing point. Goes to box 8.
3	Box 7	Yes, the same point. Sliding first takes P to (5, 5) and then to (5, -5). Reflecting first takes P to (2, -5) and then to (5, -5). Both orders end at the same point.	No, two different points. The student thought the order always matters. Goes to box 3.
4	Box 4	(-2, -3) Check it forward. The first motion takes (-2, -3) to (-3, 2), and the second takes (-3, 2) to (-3, 6), where the point lands.	(6, 7) The student did the two motions forward from the landing point. Goes to box 8.
5	Box 1	(0, 3) The first motion takes (-4, 3) to the middle point (6, 3). The second motion takes (6, 3) to (0, 3).	(-8, 3) The student reflected in the two lines in the other order. Goes to box 3.
6	Box 6	(-5, -2) Check it forward. The first motion takes (-5, -2) to (-2, -5), and the second takes (-2, -5) to (2, -5), where the point lands.	(5, 2) The student did the two motions forward from the landing point. Goes to box 8.
	Box 3	(2, 2) The first motion takes (2, 3) to the middle point (2, -2). The second motion takes (2, -2) to (2, 2).	(2, -8) The student did the reflection first. Goes to box 5.
	Box 8	(-2, 6) The translation takes (-2, 6) to (1, 4), so T is at (-2, 6).	(4, 2) The student moved the image by the translation instead of undoing it. Goes to box 2.

To undo two motions, undo the second one first. Undo a translation by the opposite vector. Undo a reflection by the same reflection. Undo a rotation by the same angle the other way. A slide along a mirror line and the reflection in that line give the same point in either order. Most other pairs do not.

Guessing does not get a student out. No simple guessing rule reaches the end. A rule such as always taking the first answer goes wrong within the first two boxes. One shortcut does work: a student can find the route by following the arrows backward from “you are out.” So ask a student with a clean row to explain one box.