

ANSWER MAZE



RIGID AND NON-RIGID TRANSFORMATIONS

Rigid or Not? What a Rigid Motion Keeps

One page · 10–15 minutes · nothing to prepare

FREE

6

Riley measured $PQ = 5$ and $P'Q' = 5$, nothing else. Does the rule keep every distance?

Yes — PQ did → go to 4
Not known yet — too few → go to 3

“Every distance” means every pair of points of the plane. How many pairs were measured?

3

Every point is reflected in a line, so the image goes the other way round. Is the rule rigid?

Yes — all of them hold → go to 8
No — it is backwards → go to 7

Read the three properties again. Which one mentions the way round?

8

A rule keeps the area of every figure. Must it keep every distance?

Yes — nothing got bigger → go to 4
No — area is not on the list → go to 1

Look at the shear on the strip: a square slid sideways row by row.

1

Every point moves 100 squares right. Two points were 3 squares apart. How far apart are their images?

More — they went a long way → go to 7
3 — nothing stretched → go to 5

Move both points 100 squares to the right, then count the gap between them again.

1. **Hand out page 3.** That is the whole preparation.
2. **Say this once:** “Rigid means every distance and every angle is kept, for every point of the plane. Moving it, turning it, or flipping it over is not a change. One pair that agrees proves nothing.”
3. **Start at box 6.** Six boxes and you are out. **Write every box number in the row at the foot as you go.**

Student sheet	page 3, one per student. The three properties are printed on it, with a slide, a mirror image, a stretch and a shear as pictures.
Answers	page 4.

The route is 6 → 3 → 8 → 1 → 5 → 2 → out. Boxes 4 and 7 are not on it. **They look like every other box:** a question, two answers, two box numbers and a hint. No box has a drawing. Both answers in these two boxes lead back onto the route.

The wrong answers come from two opposite mistakes, and each box off the route is for one of them. Three boxes send a wrong answer to box 4. A student there believes that *if what was measured agreed, the rule is rigid*. This is the most common mistake in the lesson. Examples are one segment that kept its length, a figure that kept its area, and $(x, y) \rightarrow (x, 3y)$ keeping the length of PQ. Three boxes send a wrong answer to box 7. A student there believes that *if it looks changed, it is not rigid*. Examples are a mirror image that looks backwards, a slide of 100 squares, and a turn of 47° about a point far away. The hints tell the student what to check. They never give the answer.

What the row at the foot tells you in one glance. A clean run is **six numbers**. A longer row shows where the student went wrong. The number just before 4 or 7 is the box they got wrong. Which of those two boxes it is tells you which mistake they made.



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 6 · what a rigid motion keeps

Name _____

Period _____

Date _____

A **rigid motion** keeps lines straight. It keeps the distance between *every* two points of the plane the same. It keeps every angle measure the same. Nothing else is on the list. Not position. Not the way round.



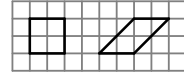
a slide
rigid



a mirror image
rigid, but the other way round



a stretch in one direction
not rigid, though lengths across it
are kept



a shear
not rigid, though the area is kept

1

Every point moves 100 squares right. Two points were 3 squares apart. How far apart are their images?

More — they went a long way → go to 7
3 — nothing stretched → go to 5

Move both points 100 squares to the right, then count the gap between them again.

2

Every point turns 47° about a point far off the page: the image sits at an odd slant. Rigid?

Yes — nothing breaks → you are out
No — look how far it went → go to 7

Check the three properties one at a time: lines, distances, angles.

3

Every point is reflected in a line, so the image goes the other way round. Is the rule rigid?

Yes — all of them hold → go to 8
No — it is backwards → go to 7

Read the three properties again. Which one mentions the way round?

4

Triangle ABC kept its sides. The distance from A to point M, which is off the triangle, went from 4 to 6. Is the rule rigid?

No — the 4 became 6 → go to 3
Yes — the triangle is whole → go to 6

M is a point of the plane as well. Count its distance too.

5

$(x, y) \rightarrow (x, 3y)$ sends P(1, 2) and Q(6, 2) to points 5 apart, as before. Is the rule rigid?

No — one pair is not all → go to 2
Yes — PQ is still 5 → go to 4

Try the two points (0, 0) and (0, 1) under this rule.

6

Riley measured $PQ = 5$ and $P'Q' = 5$, nothing else. Does the rule keep every distance?

Yes — PQ did → go to 4
Not known yet — too few → go to 3

"Every distance" means every pair of points of the plane. How many pairs were measured?

7

A rule sends every point of the plane somewhere else. Can it be a rigid motion?

No — everything moved → go to 3
Yes — moving is allowed → go to 8

Look for position in the list of three properties.

8

A rule keeps the area of every figure. Must it keep every distance?

Yes — nothing got bigger → go to 4
No — area is not on the list → go to 1

Look at the shear on the strip: a square slid sideways row by row.

Write every box number here as you go. A clean run is six numbers.



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Answer Maze — answers

For the teacher

The route, in order. Boxes 4 and 7 are not on the route and come last in the table. A student reaches them only by giving a wrong answer.

6 → 3 → 8 → 1 → 5 → 2 → out

	Box	Right answer	Wrong answer goes to	Right goes to
1	Box 6	Not known yet — too few	Yes — PQ did → box 4	box 3
2	Box 3	Yes — all of them hold	No — it is backwards → box 7	box 8
3	Box 8	No — area is not on the list	Yes — nothing got bigger → box 4	box 1
4	Box 1	3 — nothing stretched	More — they went a long way → box 7	box 5
5	Box 5	No — one pair is not all	Yes — PQ is still 5 → box 4	box 2
6	Box 2	Yes — nothing breaks	No — look how far it went → box 7	out
	Box 4	No — the 4 became 6	Yes — the triangle is whole → box 6	box 3
	Box 7	Yes — moving is allowed	No — everything moved → box 3	box 8

Why the hard answers are right. A mirror image, a slide and a turn keep every distance and every angle, however far the figure moves. A shear keeps area but changes distances. $(x, y) \rightarrow (x, 3y)$ keeps the length of PQ, but it sends (0, 0) and (0, 1) to points 3 apart.

Guessing does not get a student out. Every simple guessing rule, such as always taking the first answer, goes wrong within the first four boxes.

One shortcut does work. A student can start at “you are out” and follow the arrows backwards, because four of the route boxes are each reached by only one arrow. That student writes the correct row without answering a single question, so ask them to explain one box.