

ANSWER MAZE

TRANSFORMATIONS AS FUNCTIONS

Transformations as Functions on Points

One page · 10–15 minutes · nothing to prepare



FREE

5

Under a transformation T , $T(P) = P'$ and $T(P') = P''$. Name the preimage of P'' .

**$P \rightarrow$ go to 3
 $P' \rightarrow$ go to 2**

Read both statements. In each, which point goes in and which comes out?

2

A rule sends every point to the point 3 cm to its right. K is not part of any figure. Where is the image of K ?

**3 cm to the right of $K \rightarrow$ go to 7
 K has no image $\rightarrow$ go to 8**

Read the rule once more: which points does it speak about?

7

A rule was tried on four points. Two of the points went to the same point. No point went to two points. Does this show the rule is not a function?

**No — each input still has one output
 $\rightarrow$ go to 4
Yes — one output has two inputs
 $\rightarrow$ go to 3**

Which does a function limit: outputs for each input, or inputs for each output?

4

A rule sends every point to itself. Is it a transformation?

**No — nothing moves $\rightarrow$ go to 8
Yes — one output each $\rightarrow$ go to 1**

Check the rule against both parts of the definition.

1. **Hand out page 3.** That is the whole preparation.
2. **Say this once:** “A transformation is a rule for every point of the plane, whether it is drawn or not. P is the input and P' is its output, whatever the page looks like.”
3. **Start at box 5.** 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 arrow, the preimage and the image are printed on it as a picture.
Answers	page 4.

The route is $5 \rightarrow 2 \rightarrow 7 \rightarrow 4 \rightarrow 1 \rightarrow 6 \rightarrow \text{out}$. Boxes 8 and 3 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.

Every wrong answer comes from one belief: a transformation is something that happens to a figure. This belief shows up in two ways, and each box off the route is for one of them. Three boxes send a wrong answer to box 8. A student there believes that only the drawn figure moves, and that nothing happened if the picture did not change. So the student says that a point on no figure has no image, or that a rule that moves nothing is not a transformation. Three boxes send a wrong answer to box 3. A student there believes that the image is always the new point and the preimage is always the old one. In fact these are only roles. One point can be the image of one point and the preimage of another.

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 8 or 3 is the box they got wrong. Which of those two boxes it is tells you which belief they hold.



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 · rules on the points of the plane

Name _____

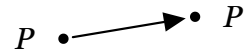
Period _____

Date _____



$$P \rightarrow P'$$

P is the preimage, the input. P' is its image, the output



$$T(P) = P'$$

the same statement. T names the rule

1

T sends triangle ABC to triangle A'B'C', and C' is the new vertex nearest to B. Which point is the image of B?

B' → go to 6

C' → go to 3

Compare what the letters record with what the page shows.

2

A rule sends every point to the point 3 cm to its right. K is not part of any figure. Where is the image of K?

3 cm to the right of K → go to 7

K has no image → go to 8

Read the rule once more: which points does it speak about?

3

Under a transformation, $A \rightarrow B$ and $B \rightarrow C$. What is B?

An image only — the new one → go to 5

An image and a preimage — both roles → go to 2

Look at B in each of the two statements.

4

A rule sends every point to itself. Is it a transformation?

No — nothing moves → go to 8

Yes — one output each → go to 1

Check the rule against both parts of the definition.

5

Under a transformation T, $T(P) = P'$ and $T(P') = P''$. Name the preimage of P''.

P → go to 3

P' → go to 2

Read both statements. In each, which point goes in and which comes out?

6

A rule turns every point a quarter turn about O, the center of a circle. The circle looks just the same after. Did any point of it move?

No — the picture did not change → go to 8

Yes — every one of them → you are out

Follow one point of the circle through the quarter turn.

7

A rule was tried on four points. Two of the points went to the same point. No point went to two points. Does this show the rule is not a function?

No — each input still has one output → go to 4

Yes — one output has two inputs → go to 3

Which does a function limit: outputs for each input, or inputs for each output?

8

Every point goes to a point on the ray from O through it, twice as far from O. O goes to O. What is the image of O?

O itself — its own image → go to 7

None — O does not move → go to 2

Read the last part of the rule again.

Write every box number here as you go. It shows you the way back if you lose your place. A clean run is six numbers.

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Answer Maze — answers

For the teacher

The route, in order. Boxes 8 and 3 are not on the route and come last in the table. A student reaches them only by giving a wrong answer.

5 → 2 → 7 → 4 → 1 → 6 → out

	Box	Right answer	Wrong answer goes to	Right goes to
1	Box 5	P'	P → box 3	box 2
2	Box 2	3 cm to the right of K	K has no image → box 8	box 7
3	Box 7	No — each input still has one output	Yes — one output has two inputs → box 3	box 4
4	Box 4	Yes — one output each	No — nothing moves → box 8	box 1
5	Box 1	B'	C' → box 3	box 6
6	Box 6	Yes — every one of them	No — the picture did not change → box 8	out
	Box 8	O itself — its own image	None — O does not move → box 2	box 7
	Box 3	An image and a preimage — both roles	An image only — the new one → box 5	box 2

Guessing does not get a student out. Every simple guessing rule, such as always taking the first answer, goes wrong at least once before the way out.

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.