

## 4.4.5 Transformation Composition

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**KEY WORDS** invariant

<!-- Session 2 native-skill companion -->

### Objective

Practise transformation composition within the labelled native lessons. Public original tasks; locally authored answer guidance.

### 1 Key knowledge and worked examples

#### ■ Combined isometries and invariants · Higher

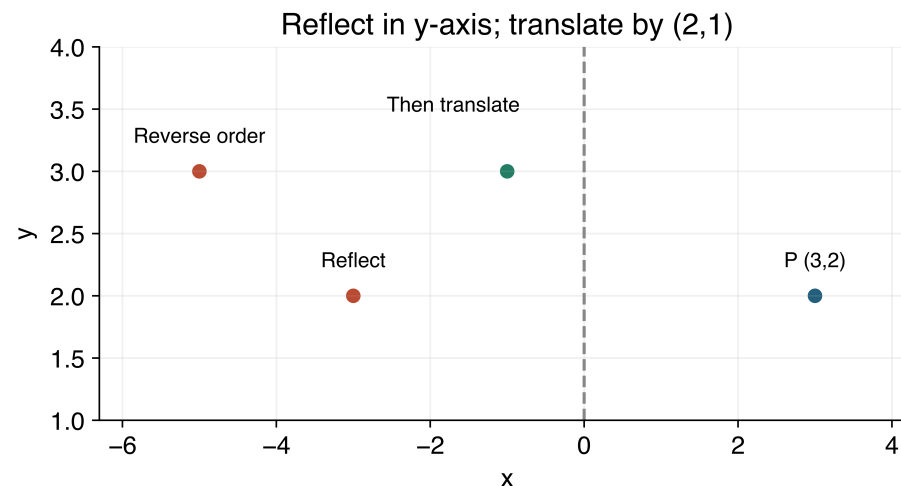
Apply each transformation to the current image in the stated order. Rotations, reflections and translations preserve lengths and angles, so their combinations also preserve them. Reflections reverse orientation; rotations and translations preserve it. Two reflections in parallel lines give a translation; in intersecting lines they give a rotation through twice the directed angle between the mirrors.

$$T \circ R \neq R \circ T \quad \text{in general}$$

Start with  $P=(3,2)$ . Reflect in the  $y$ -axis to get  $(-3,2)$ , then translate by  $(2,1)$  to get  $(-1,3)$ . Reversing the order gives  $(5,3)$  then  $(-5,3)$ , a different point. Reflecting in  $x=0$  followed by  $x=2$  maps  $(3,2)$  to  $(-3,2)$  then  $(7,2)$ , equivalent to translation by  $(4,0)$ . Two reflections reverse orientation twice, restoring it. Reflecting in the  $x$ -axis then  $y$ -axis sends  $(3,2)$  to  $(-3,-2)$ , a  $180^\circ$  rotation about the origin. Every pairwise length and angle is unchanged, but position generally changes.

Preserved length does not mean every point stays fixed. Do not commute transformations unless a checked argument permits it. A single reflection reverses orientation, while two reflections restore it.

AQA G8 Higher requires changes and invariance under combinations of rigid transformations. Describe the resulting map completely and test it on more than one point before making a whole-shape claim.



*Original native-lesson illustration; labels belong to its worked example.*

### 2 Practice

**2.1** (Higher) For  $(3,2)$ , reflect in  $y$ -axis then translate by  $(2,1)$ . Find final  $x$ .

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**2.2** (Higher) Reverse those operations on  $(3,2)$ . Find final  $x$ .

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**2.3** (Higher) Reflect in  $x=0$  then  $x=2$ . Find the translation  $x$ -component.

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### 3 Exam-style questions

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**3.1** Decide whether this claim is true. Justify with a concrete calculation or counterexample: Changing the order of transformations never changes the final image.

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