Lesson 88 SHAPE & SPACE

Combining transformations

CURRICULUM ALIGNMENT

SHA.TRN.4a perform and devise a range of steps involving transformations.

ALG.PRR.4a identify, explain and apply generalisations, including properties of operations, mathematical models and patterns.

INTERACTIVES Transformation Playground · challenge, display, explore

WHAT THIS LESSON TEACHES

A slide moves a shape without turning it, a flip mirrors it across a line, and a turn rotates it around a point. The size and shape never change.

→ Slide a triangle 3 squares right then flip it across the y-axis.

→ Flip a triangle across the y-axis then slide the flipped triangle 3 squares down.

MODEL THIS ON THE BOARD

TWO-STEP TRANSFORMATION ON A GRID

1. Start with triangle vertices A at (2,4), B at (4,4), C at (3,6).
2. Apply a flip across the y-axis: A moves to (-2,4), B to (-4,4), C to (-3,6).
3. Then slide 3 squares down: A ends at (-2,1), B at (-4,1), C at (-3,3).

LESSON ARC

Open with a triangle and a vertical mirror line on the IWB — flip it across the y-axis, freeze, then slide it 3 down, leaving the swap-the-order question live and unanswered. Model three two-step journeys, slowing hardest on flip-then-turn and on the two-slides-equal-one-bigger-slide reveal. Pupils record start/after-flip/after-slide co-ordinates in their copy. The Class Challenge builds to finding a different pair of moves that hits the same target.

TEACHING MOVES

1. **Getting Started.** Run flip-then-slide live, pausing at the halfway point so pupils see the shape mid-journey, and point to the vertical mirror line by name before you flip. Take two or three predictions on the swap-order question but deliberately leave it hanging — 'we'll settle it by the end' — with five seconds of quiet think-time first.
2. **Watch and Notice.** On the second journey (flip then turn), trace the quarter-turn slowly the same way clock hands go — this is the muddle-prone one. On the third journey, after the two slides land, run a single slide of 2 right and 3 up from the same start so both finish on the identical square; hold out until a pupil notices the two slides could be swapped.
3. **Try It Together.** For each sequence, apply the first move, freeze, read off vertices A, B, C, then apply the second from there. Watch for pupils applying move two from the original position rather than the new one. On the third sequence (3 right then 3 left), let a pupil spot that the moves undo each other before you confirm; drop the middle sequence if time is tight.
4. **Record Each Step in Your Copy.** Walk the room checking pupils write the after-flip co-ordinates into the middle row before doing the slide — that middle row is the whole point. No marking; nudge anyone who's jumped straight to the final position.

5. **Class Challenge.** Keep the first three rounds brisk (about 1.5 minutes each) so the final round has real time. On the last round, let two different pupils show two different move-pairs that both land on the target, then revoice that these are equivalent moves — same finish, different route.
6. **What Did We Notice?.** Listen for pupils landing on 'it depends which two moves'. Revoice a strong answer: 'so the only way to be sure is to try both orders and see if they finish in the same square.' Steer away from a flat yes/no.

COMMON MISCONCEPTIONS

⚠ Pupils apply the second move from the triangle's original position instead of from where the first move left it — so a flip-then-slide gets drawn as two separate moves off the starting shape.

Freeze the shape on the board after move one and physically point: 'the slide starts from here now, not back there.' Have the pupil re-read the after-first-move vertices aloud before touching the second move.

⚠ Pupils claim the order of two moves never matters (or always matters) as a flat rule, because two slides happened to swap freely.

Put a flip-then-slide up and challenge them to swap the order and check — it lands somewhere different. Then contrast with two slides swapping fine. Land on 'sometimes — and the way to be sure is to try both.'

DIFFERENTIATION

EMERGING

- Restrict the copybook task to just the flip step first, reading the after-flip co-ordinates aloud with you, before adding the slide as a separate pass.
- Give these pupils the cut-out card shape to physically slide and flip on their squared paper so the 'start the second move from here' idea is in their hands, not just on the grid.

DEVELOPING

- After the copybook table, ask pupils to write a single move that would undo their whole flip-then-slide sequence and return the triangle to its start.
- Swap the slide-3-down for a slide-2-left-and-3-down and ask them to record all three vertices — a two-direction slide raises the counting load.

PROFICIENT

- On the final Class Challenge round, narrate a harder variant: reach the same target using exactly three moves instead of two, then have them explain to the class why their trio still counts as equivalent to a two-move solution.
- Pose in copybook: is there any pair of moves where the order never changes the finish no matter which shape you use? Ask them to justify with an example and a counter-example.

↗ **Cross-curricular:** Link to Geography — pupils describe a route on a local map grid as a sequence of slides and turns, then find a shorter equivalent route.

ANSWER KEY

b) A(-1,5) B(-5,5) C(-3,8)

c) A(-1,2) B(-5,2) C(-3,5)

Q1: (-4, 3)

Q2: (none)

Q3: (none)

Q4: (7, -1)

a) Never — The order of a slide and flip usually changes the final position.

b) Always — Slides commute so order does not matter.

c) Always — All transformations in this lesson preserve size and shape.

d) Always — Order of turn and flip often matters.