

## Nets – flat to 3D and back

### CURRICULUM ALIGNMENT

SHA.SHP.4a

construct 3-D and 2-D models or structures given defined measurements and/or specific conditions.

### INTERACTIVES

3D Shape Inspector · display

Net Folder · challenge, display, explore

### WHAT THIS LESSON TEACHES

**Isometric paper** is a triangular grid (instead of squares). It lets you draw 3-D shapes that look realistic on a flat page: **vertical edges** stay vertical, and **horizontal edges** slope along the grid lines (at 30° from the horizontal).

- A **cube** drawn on isometric paper shows three of its faces — top, left, and right — meeting at one corner.
- Edges that are equal length on the real cube are equal length on the isometric drawing too — count grid steps to keep them matching.

### LESSON ARC

Open the net-folder interactive and unfold a box flap by flap before naming anything. In Watch and Notice, run the three snapshots — cube/cuboid recap, cube net, cuboid net — naming which flat square becomes which face. Pupils take turns folding six-square arrangements at the board, predicting gap-or-fold first, then sketch a labelled cuboid net in their copy. Student Activity Book practice consolidates the eleven distinct cube nets.

### TEACHING MOVES

1. **Getting Started.** Run the net-folder interactive and open the box one flap at a time so the unfolding is the whole event. Take two or three hands-up answers — not call-outs — and hold the word 'net' back; it lands next step. An empty cereal box on the visualiser is a nice upgrade but not needed.
2. **Watch and Notice.** Narrate the three snapshots in order. On the cube net say which square becomes which face: 'this one folds to be the top, these four wrap round to be the sides.' On the cuboid net, before you confirm, ask the class to name which two rectangles match in size — keeps the pace active rather than a long demo.
3. **Try It Together.** Aim for three or four arrangements. Before each fold take a quick show of hands — folds or doesn't fold? — then fold to check. When one fails, pause on the gap or overlap and revoice a strong answer: 'so two squares ended up trying to be the same face.' Hand out the pre-cut paper nets so pupils fold a real one alongside the screen.
4. **Sketch the Cuboid Net in Your Copy.** Pupils sketch the cuboid net — three matched pairs — and label top, front, side. Walk the room glancing for pupils who've correctly matched the same-size rectangles; this is copybook practice, not marking.
5. **Class Challenge.** Pupils take turns at the board predicting then folding; the class confirms each before moving on. Keep it brisk. Lean on the two failures — the missing-face gap and the overlap — as the teaching points, then put the eleven-distinct-nets question to the whole class to verify together.
6. **What Did We Notice?.** Listen for pupils noticing the squares can't all sit in a straight line and that no two can fold onto the same face. Revoice: 'so every face of the cube needs exactly one square, and no two can want to be the same face.' Head off the idea that any six joined squares must make a cube — the folded failures are the proof.

## COMMON MISCONCEPTIONS

⚠ Pupils assume any six squares joined edge-to-edge will fold into a cube — 'it's got six squares, so it has to work.'

Fold the straight-line arrangement on the net-folder: it wraps round and leaves the top and bottom open. Have a pupil point to the gap, then fold a paper cut-out of the same arrangement so they see the open faces in their hands.

⚠ Pupils call the overlap arrangement a success because it 'closes up' — they don't notice two squares have landed on the same face.

Pause the fold on screen at the overlap and ask: 'how many squares are trying to be this one face?' Hold up the paper version folded to the same point so the doubled-up square is visible, then count — six faces, but only five covered.

## DIFFERENTIATION

### EMERGING

- Give the classic cross-shaped net first and let pupils fold the paper cut-out before predicting on the board — fold-then-name rather than predict-then-fold.
- Pre-label the top face on the screen net so pupils only track where the four sides and bottom land.

### DEVELOPING

- After the copybook sketch, ask pupils to draw a second cuboid net laid out differently and check it still has three matched pairs.
- Challenge them to find a six-square arrangement that fails and say in one sentence whether it's a gap or an overlap and why.

### PROFICIENT

- Set the eleven-distinct-nets question as an open investigation: find and verify as many as you can, then explain how you know two of your nets aren't really the same one rotated.
- Direct fast finishers to the extension bank on their device while you circulate.

- **Cross-curricular:** Tie to Visual Arts — pupils design a net for a small gift box and fold it up to check it closes with no gaps.

## ANSWER KEY

**a)** Visual check: three faces visible (front + right + top), vertical edges vertical, horizontal edges along the 30°/60° grid lines.

**Q1:** a cuboid

**Q2:** a tetrahedron

**Q3:** a cone

**Q4:** a square-based pyramid

## EXTENSION SHEET · STRETCH ANSWERS

**S1:** a square-based pyramid

**S3:** a square-based pyramid

**S2:** a cuboid