Lesson 81 SHAPE & SPACE

Shape and angle construction review

CURRICULUM ALIGNMENT

SHA.SHP.4a construct 3-D and 2-D models or structures given defined measurements and/or specific conditions.

SHA.SHP.4b investigate and construct angles in the context of shape; and solve angle-related problems.

MEA.MSR.4b find, interpret and deduce measures experimentally with increasing precision.

WHAT THIS LESSON TEACHES

Build a triangle from three given side lengths using ruler and compass so only one unique triangle results.

→ From sides 6 cm, 5 cm, 4 cm, only one triangle can be built.

→ From sides 7 cm, 6 cm, 5 cm, the arcs cross at one point to fix the third vertex.

MODEL THIS ON THE BOARD

CONSTRUCT TRIANGLE FROM SIDES 7 CM, 6 CM, 5 CM

1. Draw the base line **7** cm long using a ruler.
2. Open compass to **6** cm and draw an arc from one end of the base.
3. Open compass to **5** cm and draw an arc from the other end of the base.
4. Mark the point where the two arcs cross.
5. Join this point to both ends of the base to complete the triangle.

DISCUSSION STARTER

REFLECT Which is harder — measuring an angle accurately or drawing one? Why?

LESSON ARC

Open by asking which parts of an unfinished triangle you'd construct versus work out. On the board, reconstruct a 6-5-4 cm triangle with compass arcs, then land 180° − angle 1 − angle 2 for the third angle without a protractor. Pupils build a 7-6-5 cm triangle in their copy, measure two angles, reason the third, and ring it. Class Challenge is a self-designed labelled triangle; the maths-talk wrap contrasts measured error with exact reasoning.

TEACHING MOVES

1. **Getting Started.** Take three hands-up answers, not open call-outs. Listen for the split pupils need to make — 'construct' means draw with compass and ruler, 'work out' means deduce the angle. That distinction is the spine of the whole lesson.
2. **Watch and Notice.** Talk over the 6-5-4 cm build; stress that the two arcs cross at only one point, so only one triangle closes. Then write '180° − angle 1 − angle 2' on the board and let a pupil say the third value before you complete the subtraction — the angle appears from reasoning, not the protractor.
3. **Try It Together.** One pupil works the 7-6-5 cm board build while the class follows on their own paper — watching is the participation. Before the protractor confirms the third angle, ask the class to predict it from 180° minus the other two, then revoice: 'so we already knew it before we measured.' Watch for pupils reading the wrong protractor scale on the second angle.

4. **Build It in Your Copy.** Walk the room glancing at the ringed angle and whether all three add to 180° — this is practice, not marking. Any pupil whose arcs didn't cross needs to check the compass width matches the given side length.
5. **Class Challenge.** Hold one completed exemplar design on the board before pupils start, so they can see the target. Circulate briskly; the core every pupil must produce is one constructed triangle with one reasoned angle. Take one or two designs to the board at the end for the class to check the reasoned angle.
6. **What Did We Notice?.** Listen for pupils saying a calculated angle is exact while a measured one carries reading error. Revoice: 'so the protractor can be a millimetre off, but 180° minus the other two can't be.' Head off the idea that measuring is the 'real' way — reasoning is often the exact one.

COMMON MISCONCEPTIONS

⚠ Pupils reach for the protractor to measure the third angle even after finding the first two — they don't see that 180° minus the other two gives it exactly.

Before anyone lifts a protractor, cover the third corner and ask 'what must it be, if all three make 180°?' Write the subtraction, get the value, then let them measure to confirm the match — measuring becomes the check, not the method.

⚠ Pupils read the wrong scale on the protractor (e.g. call a 60° angle 120°) because they follow the outer numbers instead of the inner.

At the point where you spot it, have the pupil place a finger on the 0° arm first and count up from there. A quick 'is this angle bigger or smaller than a right angle?' catches the flip before they record it.

⚠ Pupils set the compass to the wrong width so the two arcs don't cross and the triangle won't close.

Show that each arc's radius must equal its given side length — 6 cm arc opens to exactly 6 cm on the ruler. Have them re-measure the compass against the ruler before swinging.

DIFFERENTIATION

EMERGING

- Pre-rule the base line to length in the copy so pupils start straight at the two arcs rather than the whole build.
- Give the two angle values already labelled on the diagram so the pupil's only job is the 180° subtraction — reasoning without the measuring load.

DEVELOPING

- After the copy task, hand a triangle with only ONE angle given and ask what else they'd need before they could find the others — pushes them to notice one angle isn't enough.
- Ask them to build a second triangle where two of the three angles are equal, and predict what that does to the side lengths.

PROFICIENT

- In the Class Challenge, narrate a harder variant from the front: design a triangle where the reasoned third angle comes out to exactly 90°, and explain what side condition forced it.
- Pull them ahead into the Student Activity Book page and ask them to write, for a younger pupil, why 180° minus two angles is more trustworthy than measuring the third.

↗ **Cross-curricular:** Tie to Visual Arts — pupils construct an accurate triangular frame or logo, using the 180° rule to check their angles rather than eyeballing them.

ANSWER KEY

Scaffold: visual check on the page

Q1: SSS triangle 6 cm, 5 cm, 4 cm

Q2: SSS triangle sides 7 cm, 6 cm, 5 cm

Q3: ≈75.5°, 58° (third ≈46.5°)

a) Always — The compass arcs cross at only one possible point.

b) Sometimes — It depends if the angles are adjacent to the side or not.

c) Never — The sides must satisfy the triangle inequality.

d) Never — Reasoning from 180 degrees is exact while measuring can have error.

EXTENSION SHEET · STRETCH ANSWERS

S1: 64°

S2: 47° is acute

S3: 57°