

Constructing triangles from given measurements

CURRICULUM ALIGNMENT

SHA.SHP.4a

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

WHAT THIS LESSON TEACHES

To build a triangle from three given side lengths (SSS), draw the base then use a compass to swing arcs from each end with the other two lengths; their crossing point is the third corner.

→ Base 6 cm with arcs of 5 cm and 4 cm cross at one point.

→ Sides 5 cm, 5 cm, 5 cm always make the same equilateral triangle.

MODEL THIS ON THE BOARD

BUILD TRIANGLE WITH SIDES 5 CM, 4 CM, 3 CM

- 1 Draw the 5 cm base with ruler.
- 2 Set compass to 4 cm and swing arc from one end.
- 3 Set compass to 3 cm and swing arc from the other end.
- 4 Mark the point where the arcs cross as the third corner.

LESSON ARC

Open with a hands-up gut check: do three given side lengths fix one unique triangle? Demo on the interactive — draw the base, swing both compass arcs, join the crossing point — including the 2 cm, 2 cm, 9 cm case where the arcs never meet. Pupils rotate through three SSS builds at the board, then construct 6 cm–5 cm–4 cm in their own copy with ruler and compass. Class Challenge runs four more builds on the interactive. Close by drawing the triangle-inequality rule from the arcs that fell short.

TEACHING MOVES

1. **Getting Started.** Take three hands-up answers only — no open debate. Leave the uniqueness question hanging: 'let's see by the end whether you were right.' Don't tip the answer; the constructions settle it.
2. **Watch and Notice.** Narrate the same three moves on every panel: draw the base, swing both arcs, join the cross. On 6-5-4 ask why one crossing locks the shape. On 2-2-9 trace both short arcs with your finger so the class sees them fall short — keep the inequality wording brief; they own the reasoning in What Did We Notice?
3. **Try It Together.** Run the circle tool through 5-4-3, then 6-6-4, then 5-5-5. A pupil swings each arc; the class answers out loud: did they cross, where, does it close? Watch for the compass set to the wrong length before the swing. Rotate three or four pupils.
4. **Construct the Triangle in Your Copy.** One full 6-5-4 construction, no rush — first hands-on compass triangle for many. Walk the room for planted point and one smooth arc. If a pupil struggles to rule the base, rule it for them so attention stays on the arcs.
5. **Class Challenge.** Four triangles, about two minutes each. Pupil builds, class confirms, Check, Next. Flag the 5-4-3 set: resetting the compass between the two arcs is the step most forget. Keep turns moving — don't re-teach the method.

6. What Did We Notice?. Point back to the on-screen 2-2-9 arcs that never met. When a pupil gets close, re-voice sharply: 'the two shorter sides must add to more than the longest, or the arcs never meet.' Tie back to Getting Started — right three sides fix one triangle; wrong three fix none.

COMMON MISCONCEPTIONS

⚠ Pupils leave the compass on the first side length and swing both arcs at the same radius — e.g. on 5-4-3 both arcs come out at 4 cm.

Stop at the board. Show the slider reset out loud before the second arc: 'base 5, first arc 4, now open to 3.' Have the next pupil say the new setting before they swing.

⚠ A pupil says 2 cm, 2 cm and 9 cm will still make 'a long thin triangle' — they think any three lengths close.

Bring back the Watch and Notice failure panel and trace both short arcs again. Ask: 'where would the third corner sit?' The gap between the arcs is the answer.

⚠ The compass point slips or the arms open mid-swing, so the arcs miss even when the sides should work.

Kneel beside and restate technique: point planted firmly, arms locked, one smooth swing. Rebuild that one arc together before they try the join.

DIFFERENTIATION

EMERGING

- Rule the 6 cm base in their copy for them so all attention goes on setting and swinging the two arcs.
- Stay on the equilateral sets (4-4-4 or 5-5-5) at the board — one compass setting for every side.

DEVELOPING

- After the copybook 6-5-4, ask them to predict before swinging: will these arcs cross once, twice, or not at all — then check.
- On the 5-4-3 Class Challenge build, have them say each compass setting aloud before the swing.

PROFICIENT

- Pose: find three whole-centimetre sides that only just close (shorter two sum to one more than the longest) and three that fail — construct one of each in the copy.
- After a successful build, ask: if we flip the triangle over the base, is it a different triangle or the same one? Push the 'unique up to flipping' idea.

✂ **Cross-curricular:** Link to STE / woodwork — the same set-and-swing compass skill used when marking out a triangular frame.

ANSWER KEY

Scaffold: visual check on the page

Q1: isosceles $\triangle$ (sides 7 cm, 8 cm, 7 cm)

Q2: equilateral $\triangle$ 5 cm

Q3: no triangle (arcs miss)

a) Sometimes : True when the lengths meet the triangle rule; false if they cannot form a triangle.

b) Never : $2 + 3$ is less than 6, so the arcs never meet.

c) Always : The SSS rule fixes the shape no matter where the base is drawn.

d) Always : Only valid lengths allow the compass arcs to reach each other.

EXTENSION SHEET · STRETCH ANSWERS

S1: isosceles

S2: 39°

S3: an isosceles triangle

S4: a trapezium

S5: scalene