SUPPORTING ADULT GUIDANCE

The compass and the circle

Constructions, Loci and Bearings · Lesson 1. For any supporting adult — teacher, practitioner, parent or carer. **You do not need to be a mathematics specialist to support this lesson.**

What this lesson does

This lesson opens the constructions unit by grounding every later construction in one idea: a circle is the set of points a fixed distance from a centre, and a compass is a machine for reproducing that distance. Learners meet the circle as a locus of equal distance, copy a length, and construct an equilateral triangle from a given side, leaving their arcs visible as in formal examination work.

Driving Question: *How can one tool guarantee “exactly the same distance”?*

The mathematics, in plain terms

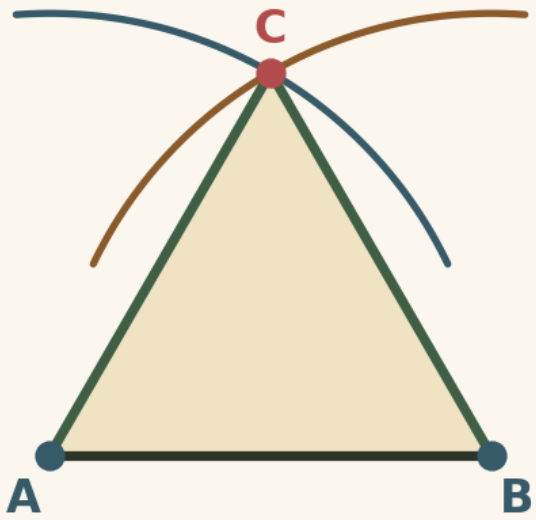
When compasses are opened to a length and the point is placed at A, every mark the pencil makes is exactly that length from A — that mark is an arc of a circle centred on A. If a second arc of the same radius is swung from B, the crossing point is that radius from both A and B at once. Joining the crossing to A and B therefore gives three equal sides. The same two-arc idea, with different radii, constructs any triangle from three given side lengths, provided the two shorter sides together exceed the longest (the triangle inequality).

The worked method the learner sees

These are the two worked examples the learner meets on screen, with the lesson's exact method and notation. They are here for consistency, not because the mathematics is demanding — whether you teach mathematics or are meeting it afresh alongside the learner, working from the same steps and the same language keeps your support aligned with what is on the screen, and lets you point back to a line the learner has already seen. Skip them freely if the method is already familiar.

Example 1 — Constructing an equilateral triangle

Construct an equilateral triangle on the side AB, where AB = 6 cm. Leave the arcs showing.

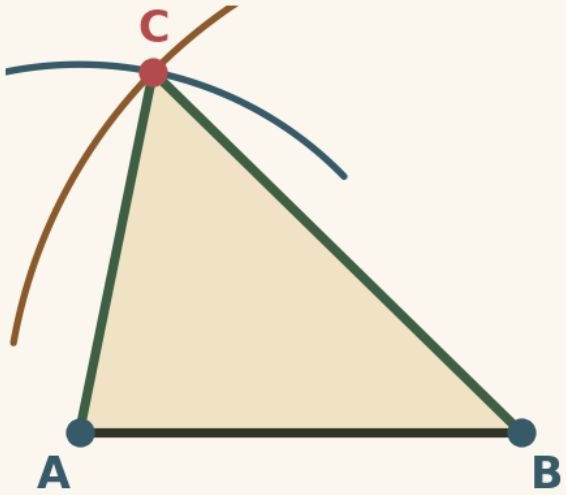


1. Open the compasses to the length of the base.	AB = 6 cm
2. Swing an arc from A, radius AB.	radius = 6 cm
3. Keep the same opening; swing an arc from B, radius AB.	radius = 6 cm
4. Mark C where the two arcs cross, then join A–C and B–C.	join A–C, B–C

Because both arcs have radius AB, CA = CB = AB = 6 cm — an exact equilateral triangle.

Example 2 — A triangle from three given sides (SSS)

Construct a triangle with sides 6 cm, 5 cm and 7 cm.



1. Draw the base AB = 6 cm (the longest chosen for the base here).	AB = 6 cm
2. Swing an arc from A, radius 5 cm.	radius = 5 cm
3. Swing an arc from B, radius 7 cm.	radius = 7 cm
4. Mark C where the arcs cross, then join A–C and B–C.	join A–C, B–C

The arcs cross at C, fixing a triangle with sides 6, 5 and 7 cm. (They only cross because each pair of sides is longer than the third — the triangle inequality.)

Why the construction, not measuring?

It is tempting to let a learner measure and mark 6 cm three times with a ruler. Resist this gently: the point of the lesson is the shift from *near enough* to *provably exact*. Measuring hides the reason the sides are equal; the shared radius reveals it. Encourage learners to leave arcs showing and to say aloud why the crossing must be equidistant from A and B.

The shape of the lesson

Timings are invitations, not deadlines. A learner may need much longer on one phase and skim another — that is expected. Each Cornerstone is given an honest mathematical role here:

Cornerstone	Its role here	Invitational timing
Connection	Re-meet the circle as equal distance from a centre by dragging a point at a fixed distance until the circle appears.	~10 min

Movement	Construct an equilateral triangle step by step — swing each arc, mark the crossing, join the sides.	~14 min
Reflection	Check each side and articulate why the shared radius forces all three to be equal.	~9 min
Creativity	Extend to any triangle from three sides (SSS) and meet the limit set by the triangle inequality.	~8 min
Rest	A short, deliberate pause to let the shift from estimate to exact settle.	~2 min
Nutrition	Name what the learning feeds: a taste for certainty from constraint, and one idea doing a lot of work.	~2 min

Common misconceptions, and gentle repairs

These are the sticking points to expect. In every case, the aim is a question that returns the thinking to the learner — never to supply the answer.

“The two arcs need different openings.”

For an equilateral triangle both arcs use the *same* radius, AB. Ask: “If the crossing must be the same distance from A and from B, what must the two radii be?”

“The circle is just the round line I drew.”

Return to the definition: the circle is *every* point the fixed distance from the centre. Ask them to name three different points on it and check each is the same distance from O.

“Any three lengths make a triangle.”

Try 2, 3 and 6 cm on the screen: the arcs never meet. Ask: “Add the two shorter sides — is that total longer than the longest?” This is the triangle inequality, discovered rather than told.

Rubbing out the arcs to make it “neat.”

The arcs are the evidence the construction is exact. Ask the learner to keep them and to point to the arc that guarantees each equal side.

Protecting the support pathway

The lesson offers support in a deliberate order: **Socratic prompt** → **first try** → **hint** → **second try** → **worked solution**. The worked solution for each question stays locked until the learner has used the prompt, used the hint, and checked two answers. This is by design: the steps *are* the learning.

Please hold this line

Do not read the worked solution aloud, or talk a learner straight to the answer, while it is still locked. If they are stuck, use the Reconnection Routes, the prompt and the hint, or ask one of the repair questions above. Arriving at a correct line of reasoning — even slowly — is worth far more than being handed the result.

Reconnection Routes

If an earlier idea is blocking progress, the lesson’s Reconnection Routes offer short recaps of exactly the prerequisites this lesson needs: measuring a length, and what a triangle is. A learner can choose one independently, or you can invite one without requiring it. Using a route is part of learning, not evidence of falling behind, and it always returns the learner to their place.

Supporting through questions: an example

Suppose a learner has drawn the base AB but is unsure what to do next, or has set the two compass openings to different lengths. The aim is a question that hands the thinking back, not a corrected diagram.

- “What is true about every point on the arc you swung from A?”
- “You want C to be the same distance from A and from B. What does that tell you about the two radii?”
- “Where exactly is C — what has to be true there for both arcs to pass through it?”
- “How could you convince someone the three sides really are equal, without measuring?”

If they stall, that is the moment for a Reconnection Route or the lesson’s prompt and hint — not for the answer.

Questions you might have

Do I need to be good at drawing?

No. Constructions reward care, not artistry. A slightly wobbly arc still crosses in the right place, and leaving the arcs showing is exactly what is wanted.

What if the compasses slip and the opening changes?

That is the most common practical snag. Encourage a firm, slow swing and re-checking the opening against AB before the second arc. If a line is wrong, it is useful information, not a failure.

Is a calculator needed?

Not today — the compass does the measuring. The focus is on why the result is exact, not on arithmetic.

My learner wants to just measure with a ruler. Is that wrong?

It is not wrong as a check, but it misses the point. Invite them to construct it first and then measure to confirm — seeing the ruler agree with the construction is a satisfying moment.

Keeping things regulated and calm

- Keep to one clear step at a time; there is no time pressure and no benefit to speed.
- Treat a wrong or unfinished answer as information for the next step, never as failure.
- Let the learner choose how to record — typed, written, drawn, spoken or annotated.
- If frustration rises, it is fine to pause and return later; the lesson holds their place.
- Avoid any language about age, school year or pace as a judgement of ability.

Recognising progress

Progress is described as Approaching Proficiency → Developing Proficiency → Proficiency → Refining Proficiency across understanding, application, communication and reflection. These describe where a learner is right now, not labels of what they are. Real understanding shown in part is still real understanding, even while other pieces are still settling.

Where they are	What it can look like

Approaching Proficiency	Beginning to engage; names some features and makes a start with support.
Developing Proficiency	Carries out the method with prompts; can explain part of the reasoning.
Proficiency	Works through independently and explains why each step is true.
Refining Proficiency	Applies the idea confidently to a new or unfamiliar case, and could teach it to someone else.

A note on evidence

Evidence can be captured in whatever form suits the learner — a photo of working, a short spoken explanation, an annotated Scratchpad image, or a written solution. There is no single required format. Incomplete work is information for the next connection, never a failure: it tells you exactly where to begin next time. The aim is a true record of the learner's thinking, not a tidy performance.

If a learner is stuck or distressed

Slow the pace and reduce the load: return to one concrete, familiar case and a single small question. Offer a Reconnection Route. Remind them they can pause and come back. A short, successful, low-stakes step rebuilds confidence more reliably than pushing through. Connection before curriculum — always.

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