

TEACHER GUIDE

Geometry through evidence

Build and investigate triangles



Grade 7 • NC.7.G.2 • Geometry

Seven teaching sections • 30 choice items • 30 open/performance tasks

Includes detailed scripts, diagrams, blank workspaces, worked keys, instructional scoring, and evidence records.

Current North Carolina standards for 2026–27. The 2026 adoption begins in 2028–29 and is not substituted here.

Free sample | Contents

NC.7.G.2 | Seventh Grade mathematics

This sample contains 13 complete selected pages from the 106-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-11, 75-76

Representative activities

M01: sample PDF page(s) 9; original page(s) 8

M02: sample PDF page(s) 11; original page(s) 10

O01: sample PDF page(s) 10; original page(s) 9

O02: sample PDF page(s) 12; original page(s) 11

Selected teacher prompts and keys: original page(s) 75-76

Using this sample

Read the preparation and access guidance before using a selected activity.

Keep teacher keys and private preparation pages separate from student copies.

Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

TEACHER GUIDE

Standard, targets, and evidence

Understand the characteristics of angles and side lengths that create a unique triangle, more than one triangle or no triangle. Build triangles from three measures of angles and/or sides.

T • I can build triangles from three measures and justify whether the result is unique, multiple, or impossible.

Essential question: How can a geometric representation justify both a calculation and a claim?

Unique means one triangle up to congruence, including reflections. Multiple can mean two noncongruent SSA triangles or infinitely many sizes from valid angle-only information. Degenerate straight figures are not triangles.

Collect individual models/constructions, equations, calculations with units, and explanations. Recognition alone is insufficient evidence for creating, building, or explaining.

Mathematical practices: make sense of conditions; use tools strategically; model; argue from a drawing and critique a claim; attend to precision. All contexts and data are original instructional examples.

TEACHER GUIDE

Navigation, materials, and access

Pages 1–4: teacher orientation and worked model. Page 5: reusable workspace. Page 6: teacher reference chart. Seven section scripts each precede their assigned M/O student pages. Worked keys, an evidence record, and official citations close the packet. Print selected student pages without the teacher keys.

Use the bank over 4–6 lessons of 25–40 minutes. A selected core is one M and one O from each section. Other items support later practice and conferences. The 60 items are not a single timed test; construction may span sessions.

Prerequisites: ratios, arithmetic, units, basic shapes, and interpreting labelled figures. For equations, review inverse operations. For construction, review using ruler, compass, and protractor without drawing the answer for the learner.

Materials: pencil, ruler, protractor, compass or traced circles, blank/grid paper, and large paper shapes or blocks. Calculators may check arithmetic after the model is explained. Adult assistance with cutting is optional; avoid blades and tiny pieces.

Access: neutral read-aloud, enlarged workspace, tactile rays/outlines, AAC, oral or signed explanation, or a scribe following exact student directions. Do not select formulas, locate the unknown vertex, or supply an equation during independent evidence. Record mathematical cues separately from access supports.

Differentiation: use fewer conditions or smaller numbers for guided practice, then return to a fresh full-target task. Extend by creating a counterexample, a different scale/model, or a second solution. Score mathematics rather than spelling, accent, or drawing style.

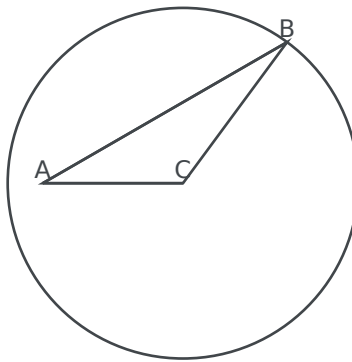
No fixed speed cutoff or official mastery score is implied. Actual performance is required even when a learner answers choice items correctly.

TEACHER MODEL

Connect the figure to the reasoning

Given $AC = 5$ cm, $BC = 6.25$ cm, angle $CAB = 30^\circ$, how many noncongruent triangles satisfy the information? Mirror images count as the same triangle.

Say: "I will separate the given conditions from what I must find. I need a representation that preserves every condition. I will justify each equation from that representation, then check the result."



Draw $AC = 5$ cm horizontally. From A draw a 30° ray for AB. A circle centered C with radius 6.25 cm meets the forward ray at $AB \approx 10.058$ cm. Mark each intersection as a possible B, then join BC. Only one intersection is on the forward ray, giving one triangle. Accept small tool-measurement variation; the stated mathematical conditions decide the category. An unattempted construction is insufficient performance evidence.

Ask: "Which condition or feature supports that step? How could I test a proposed answer?" Keep this worked page separate from the student bank. Use a different bank item for independent evidence.

REUSABLE STUDENT ORGANIZER

Construct • reason • check

Name: _____ Date: _____ Item: _____

Given information and what I need to determine:

Construction / labelled diagram (use a separate sheet if larger):

Equations, units, explanation, and a check:

TEACHER REFERENCE

Anchor chart: name the relationship

Start with the conditions

Name which vertex owns each angle and which endpoints own each side. A different placement of the same three numbers can change the result.

Three side lengths

The two shorter lengths must add to more than the longest. If valid, two arc intersections across the base are reflected, congruent copies.

Two sides and the included angle

Draw one side, make the given angle at its endpoint, then mark the other given length along that ray. The third vertex is fixed.

Angles and a side

Two angles determine the third by a sum of 180° . A specified side fixes size. Three angles alone can fix shape but permit infinitely many sizes.

Two sides and a nonincluded angle

Draw the specified angle ray and a circle for the opposite side. Count forward ray intersections. Zero, one, or two intersections can occur.

Evidence for a claim

For uniqueness, explain why the remaining vertex is fixed. For multiple triangles, exhibit noncongruent examples. For none, explain the incompatible lengths, angles, or intersections.

Use this chart during instruction. Remove it if it would supply the mathematical decision being assessed; record any chart use as support. Ask learners to explain the rule through a figure rather than only recalling it.

TEACHER SCRIPT

Warm-up

Bank M01–M04 / O01–O04. Suggested core: M01, O01. Reserve the remaining items for later sessions.

Purpose: Surface prerequisite ideas and establish what the figure says.

0–4 minutes • Say: “Read each condition. Tell me what is fixed and what we need to find. Which units describe length, angle, area, or volume?” Ask students to mark the givens without calculating.

4–12 minutes • Students start the selected O item. Say: “Show a representation that obeys every condition. Point to the given information in your model.” In independent/exit work, withhold mathematical cues and record access only.

12–22 minutes • Discuss two approaches. Say: “Does the representation account for the whole figure? Which equality follows from it? Check units and substitute a result back.” Use the selected M item diagnostically; ask why each alternative fails.

22–30 minutes • Each learner explains one step independently. Retain their construction and equation. If a construction needs longer, continue next session rather than reducing it to guessing.

Look/listen for: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

Misconception response: Separate side lengths from angles. Lay out the base, then use rays/arcs to locate the third vertex. Ask whether alternative intersections change size/shape or merely reflect it.

Early finish: change one condition, predict the effect, then verify with a new model. Partners must each retain their own construction and explanation; a group answer does not replace individual evidence.

WARM-UP

M01 • Interpret and decide

Name: _____ Date: _____

Target: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

Given $AC = 5$ cm, $BC = 6.25$ cm, angle $CAB = 30^\circ$, how many noncongruent triangles satisfy the information? Mirror images count as the same triangle.

- A. No triangle
- B. Infinitely many noncongruent triangles
- C. One triangle, up to congruence
- D. Two noncongruent triangles

Explain your choice; test another option:

WARM-UP

001 • Build and explain

Name: _____ Date: _____

Target: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

Use a ruler, protractor, and compass (or traced circles) to investigate $AC = 5$ cm, $BC = 6.25$ cm, angle $CAB = 30^\circ$. Attempt the construction. Show all noncongruent solutions when there are finitely many; show two different sizes if infinitely many. If none exists, record the attempted rays/arcs and explain the conflict. Label every given measure.

My labelled construction / model (use additional paper if needed):

Equations, explanation, and check:

WARM-UP

M02 • Interpret and decide

Name: _____ Date: _____

Target: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

Given $AB = 9$ cm, $AC = 4.5$ cm, $BC = 3$ cm, how many noncongruent triangles satisfy the information? Mirror images count as the same triangle.

- A. One triangle, up to congruence
- B. Two noncongruent triangles
- C. No triangle
- D. Infinitely many noncongruent triangles

Explain your choice; test another option:

WARM-UP

002 • Build and explain

Name: _____ Date: _____

Target: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

Use a ruler, protractor, and compass (or traced circles) to investigate $AB = 9$ cm, $AC = 4.5$ cm, $BC = 3$ cm. Attempt the construction. Show all noncongruent solutions when there are finitely many; show two different sizes if infinitely many. If none exists, record the attempted rays/arcs and explain the conflict. Label every given measure.

My labelled construction / model (use additional paper if needed):

Equations, explanation, and check:

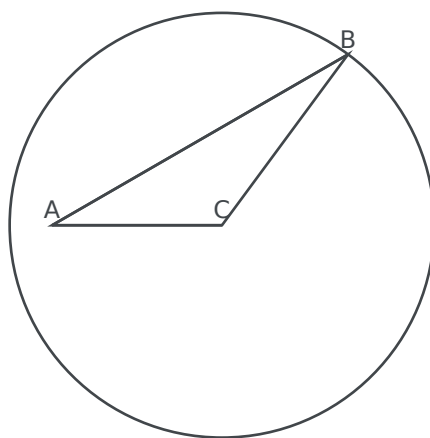
TEACHER KEY

M01 / O01 • Worked solution

Target T: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

M01: C. One triangle, up to congruence

O sample: Draw $AC = 5$ cm horizontally. From A draw a 30° ray for AB. A circle centered C with radius 6.25 cm meets the forward ray at $AB \approx 10.058$ cm. Mark each intersection as a possible B, then join BC. Only one intersection is on the forward ray, giving one triangle. Accept small tool-measurement variation; the stated mathematical conditions decide the category. An unattempted construction is insufficient performance evidence.



Alternative checks: the ray/arc construction above rules out each other count. A reflected solution is not a second noncongruent triangle; one successful triangle does not prove uniqueness.

Performance evidence: Unique means one triangle up to congruence, including reflections. Multiple can mean two noncongruent SSA triangles or infinitely many sizes from valid angle-only information. Degenerate straight figures are not triangles.

Accept equivalent justified work. Record a correct result separately from the completeness of the construction/model and the reasoning.

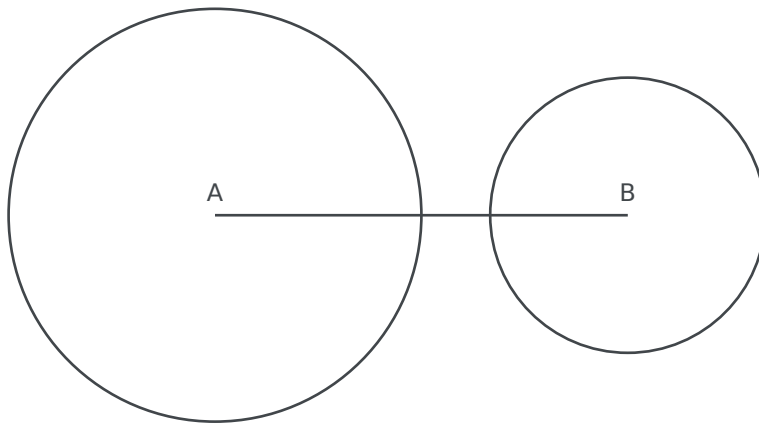
TEACHER KEY

M02 / 002 • Worked solution

Target T: Build triangles from three measures and justify whether the result is unique, multiple, or impossible.

M02: C. No triangle

O sample: The two shorter sides total 7.5 cm, which is less than the 9 cm side. The arcs do not meet. There is no nondegenerate triangle. Accept small tool-measurement variation; the stated mathematical conditions decide the category. An unattempted construction is insufficient performance evidence.



Alternative checks: the ray/arc construction above rules out each other count. A reflected solution is not a second noncongruent triangle; one successful triangle does not prove uniqueness.

Performance evidence: Unique means one triangle up to congruence, including reflections. Multiple can mean two noncongruent SSA triangles or infinitely many sizes from valid angle-only information. Degenerate straight figures are not triangles.

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