Constructing Triangles from Three Measurements

Apply the skill to decisions and designs

Name _____ **Date** _____ **Score** _____ / 6

QUICK REVIEW

A nonflat triangle requires the two shortest sides to sum to more than the longest. Equality gives a straight, collapsed figure. Three side lengths (SSS) determine one triangle shape when they close; its mirror image is the same shape. Each square on a construction grid represents 1 cm on a side.

Worked example

Can $2, 4, 6$ cm form a nonflat triangle?

1. The two shortest sides total $2 + 4 = 6$ cm.
2. That equals the longest side, 6 cm; it is not greater.
3. The segments lie flat, so enclosed area is 0 cm^2, not a triangle.

Answer: No.

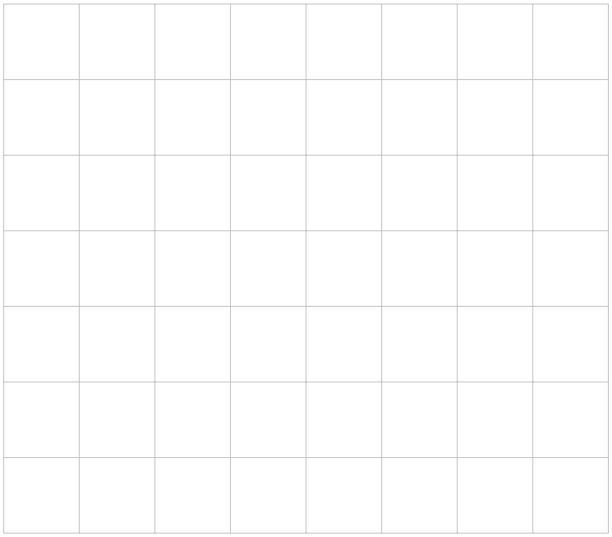
Practice Problems

Show your thinking.

1. A frame uses rods $5, 6, 7$ cm. Decide whether it closes as a nonflat triangle. If it can, give the perimeter; if it cannot, find the minimum whole-cm replacement for the shortest rod while holding the other two fixed. If possible, show the full-size ruler-and-compass construction on a separate sheet of centimeter-grid paper. Leave your arcs visible.

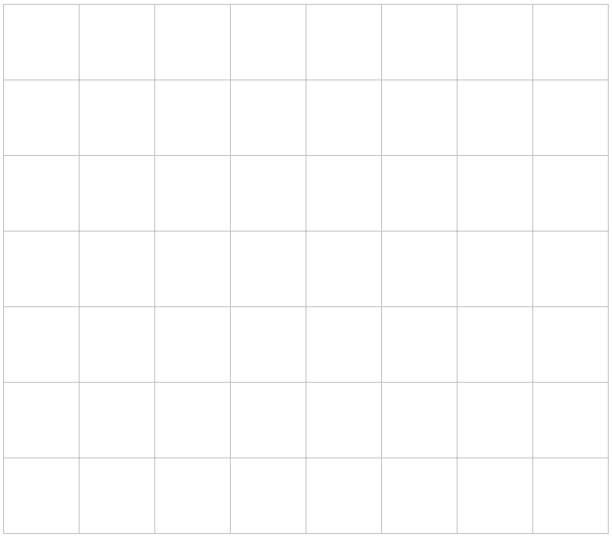
2. A frame uses rods $4, 5, 10$ cm. Decide whether it closes as a nonflat triangle. If it can, give the perimeter; if it cannot, find the minimum whole-cm replacement for the shortest rod while holding the other two fixed.

3. Construct a brace with perpendicular legs 6 and 7 cm on the grid, using the longer leg as the base. Verify the two lengths, included angle, and area.



4. A frame uses rods $4, 7, 11$ cm. Decide whether it closes as a nonflat triangle. If it can, give the perimeter; if it cannot, find the minimum whole-cm replacement for the shortest rod while holding the other two fixed.

5. Construct a triangular sign on the grid with a 7 cm horizontal base and base angles $60°, 60°$. Find the third angle and identify its side pattern.



6. Design a third whole-cm rod to join rods $7, 10$ cm. Give the shortest and longest possible lengths and check each boundary.

Answer Key

1. Yes; perimeter 18 cm.
2. No triangle. Replace the shortest rod with 6 cm.
3. One SAS shape up to flipping; area 21 cm^2.
4. No triangle. Replace the shortest rod with 5 cm.
5. Third angle 60°; one equilateral shape, sides 7 cm.
6. Whole-cm third lengths 4 through 16.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Two shortest lengths sum to $5 + 6 = 11$ cm.
2. Compare with longest 7 cm: $11 > 7$.
3. Draw a 7 cm base. Swing an arc of radius 5 cm from one end and 6 cm from the other. Join their intersection to both ends.
4. Perimeter $5 + 6 + 7 = 18$ cm.

Problem 2

1. Two shortest lengths sum to $4 + 5 = 9$ cm.
2. Compare with longest 10 cm: $9 \leq 10$.
3. The two shorter segments cannot meet.
4. The new length must exceed $10 - 5 = 5$ cm. The first whole length is 6 cm, and $6 + 5 = 11 > 10$.

Problem 3

1. Draw a horizontal 7 cm base. At one end draw a vertical ray to form 90°.
2. Mark 6 cm on that ray, then join the two free endpoints.
3. Area $= (1/2)(7)(6) = 21$ cm^2; the two sides and included angle fix one shape.

Problem 4

1. Two shortest lengths sum to $4 + 7 = 11$ cm.
2. Compare with longest 11 cm: $11 \leq 11$.
3. The segments lie flat.
4. The new length must exceed $11 - 7 = 4$ cm. The first whole length is 5 cm, and $5 + 7 = 12 > 11$.

Problem 5

1. Two base angles sum to $60 + 60 = 120^\circ$.
2. Third angle $180 - 120 = 60^\circ$, so all three angles match.
3. Draw base 7 cm; 60° rays from its ends meet at the third vertex. All sides equal 7 cm, so the shape is unique up to reflection.

Problem 6

1. Triangle inequalities give $x > 10 - 7 = 3$.
2. Also $x < 10 + 7 = 17$.
3. Whole lengths are $4, \ldots, 16$; lower equality and upper equality would both make a flat figure.

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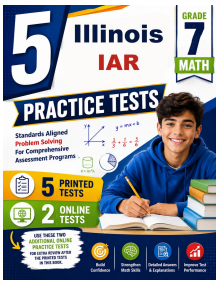

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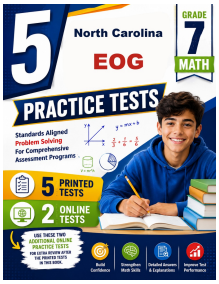

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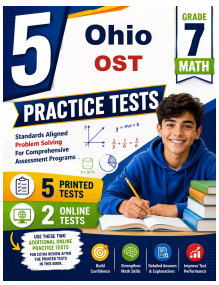

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