Constructing Triangles from Three Measurements

Spot mistakes, reason, and work backward

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.

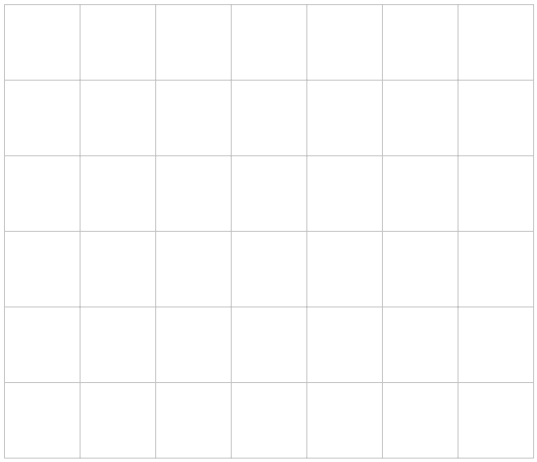
Practice Problems

Show your thinking.

1. A student says sides $4, 5, 6$ cm always make a triangle because all are positive. Check the claim; if possible, state whether these three sides determine one shape up to flipping. If possible, show the full-size ruler-and-compass construction on a separate sheet of centimeter-grid paper. Leave your arcs visible.

2. A student says sides $3, 4, 8$ cm always make a triangle because all are positive. Check the claim; if possible, state whether these three sides determine one shape up to flipping.

3. A student puts the required $90°$ angle away from the corner shared by the 5 cm and 6 cm sides. Explain the repair. Construct on the grid with the longer leg as base, and find the area.



4. A student says sides $3, 6, 9$ cm always make a triangle because all are positive. Check the claim; if possible, state whether these three sides determine one shape up to flipping.

5. A student says a 6 cm base and two $60°$ base angles allow many shapes. Construct on the grid with a horizontal base, and explain why the shape is unique.



6. A student chooses a third rod of 3 cm with rods $6, 9$ cm. Explain why this fails, then find the full whole-cm range that works.

Answer Key

1. Yes for these lengths; one shape up to reflection.
2. No triangle.
3. One SAS shape up to flipping; area 15 cm^2.
4. No triangle.
5. Third angle 60°; one equilateral shape, sides 6 cm.
6. Whole-cm third lengths 4 through 14.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Two shortest lengths sum to $4 + 5 = 9$ cm.

2. Compare with longest 6 cm: $9 > 6$.

3. Draw a 6 cm base. Swing an arc of radius 4 cm from one end and 5 cm from the other. Join their intersection to both ends.

4. The two arc intersections lie on opposite sides of the base and give mirror images of the same shape.

Problem 2

1. Two shortest lengths sum to $3 + 4 = 7$ cm.

2. Compare with longest 8 cm: $7 \leq 8$.

3. The two shorter segments cannot meet.

Problem 3

1. The 90° angle must be at the common endpoint of the two given lengths. Draw a horizontal 6 cm base. At one end draw a vertical ray to form 90°.

2. Mark 5 cm on that ray, then join the two free endpoints.

3. Area $= (1/2)(6)(5) = 15$ cm^2; the two sides and included angle fix one shape.

Problem 4

1. Two shortest lengths sum to $3 + 6 = 9$ cm.

2. Compare with longest 9 cm: $9 \leq 9$.

3. The segments lie flat.

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 6 cm; 60° rays from its ends meet at the third vertex. All sides equal 6 cm, so the shape is unique up to reflection.

Problem 6

1. Triangle inequalities give $x > 9 - 6 = 3$.

2. Also $x < 9 + 6 = 15$.

3. Whole lengths are $4, \ldots, 14$; lower equality and upper equality would both make a flat figure.

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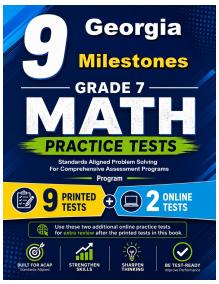

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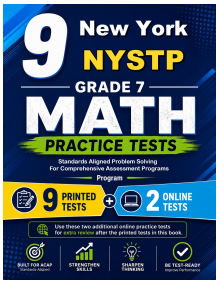

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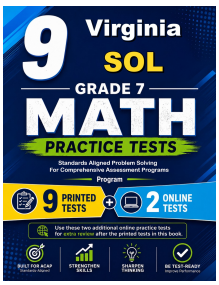

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