

Triangle Decision Lab

Draw, measure and test: one triangle, many sizes, or none?

GRADE 7 • 7.G.A.2

CCSS.Math.Content.7.G.A.2 "Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle..."

NAME _____

DATE _____

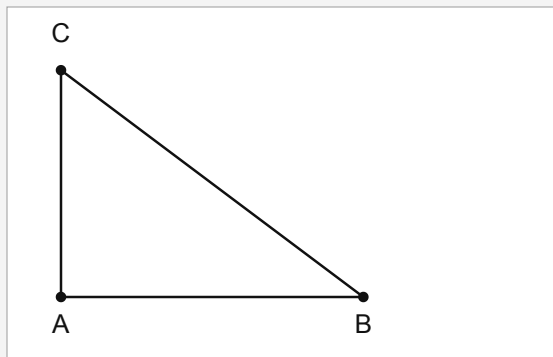
You will need: Use paper, pencil, ruler with centimeters, protractor, and teacher-provided geometry software with point, segment and measurement tools. Complete the technology task on a device; ask the teacher for access before beginning.; Draw your own measured lengths; do not measure the printed example or key. A is a starting point in each blank canvas. Label lengths/angles you construct. Teacher diagrams are reference models and may print at a different scale.

TEST THE CONDITIONS

Triangle angles total 180° . Any two side lengths must add to more than the third. Three valid fixed sides determine one triangle size and shape. Two fixed sides and their included angle also do. Three angles can allow many sizes. A turned or flipped copy counts as the same triangle. A freehand sketch suggests a result; measurements and given conditions justify it.

WORKED EXAMPLE

The reference triangle has $AB = 4$ cm, $AC = 3$ cm and a right angle at A. How would you draw it with a ruler and protractor? Do these conditions fix its size and shape?

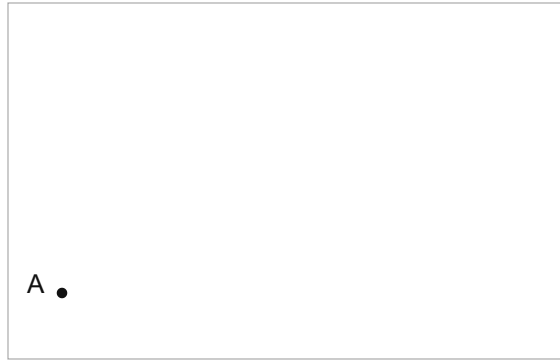


1. From A, draw AB 4 cm long. At A measure a 90° angle with a protractor.
2. On the new ray mark C 3 cm from A. Join C to B.
3. The two fixed sides and their included angle determine one size and shape.

Answer: One triangle, apart from turning or flipping it. These are drawing instructions; the printed reference is not a ruler.

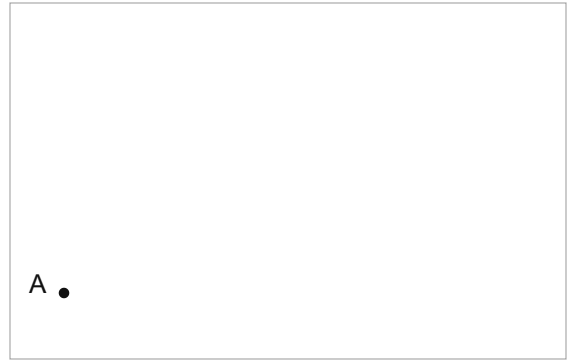
PRACTICE 4 problems

- 1** Freehand: sketch a triangle with angles 45° , 45° and 90° . Label the angles. Explain whether another size could satisfy the same angles.



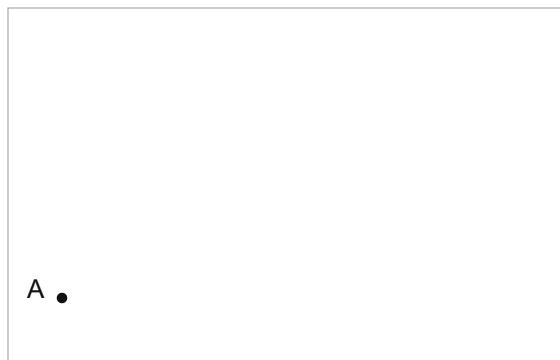
ANSWER _____

- 2** Use ruler and protractor: draw $AB = 4$ cm, $AC = 3$ cm and angle $BAC = 60^\circ$. Join B to C. Label the two lengths and included angle. Does this determine one triangle?



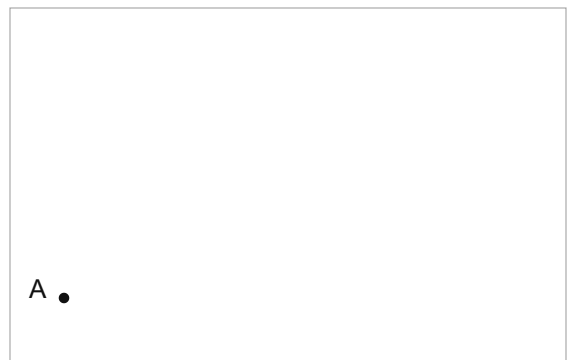
ANSWER _____

- 3** Use a ruler to draw a 6-cm segment. Below it, place a 3-cm and a 2-cm segment end to end. Can sides 6, 3 and 2 cm close to make a triangle? Explain from your drawing.



ANSWER _____

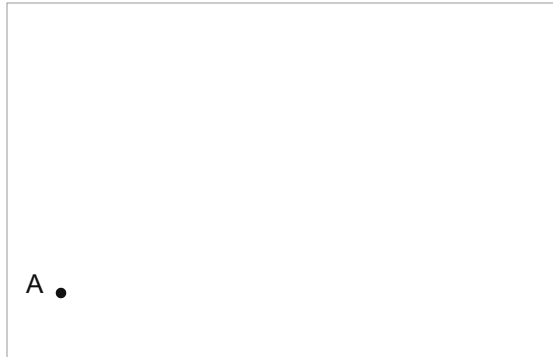
- 4** Use ruler and protractor: draw two triangles with all angles 60° , one with a 2-cm base and one with a 3-cm base. Label the bases and angles. Do three angles fix one size?



ANSWER _____

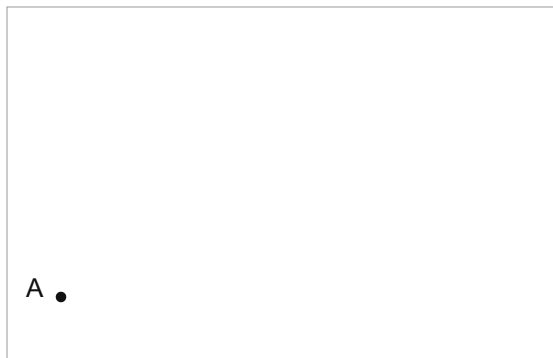
APPLY IT Show your work**1**

A designer needs a 3-4-5 triangle. In geometry software, plot $A(0,0)$, $B(4,0)$ and $C(0,3)$, join them, and display all three side lengths. Save or show the construction to your teacher. Copy a labeled sketch here. Do these three sides determine one triangle?

**REASONING AND ANSWER**

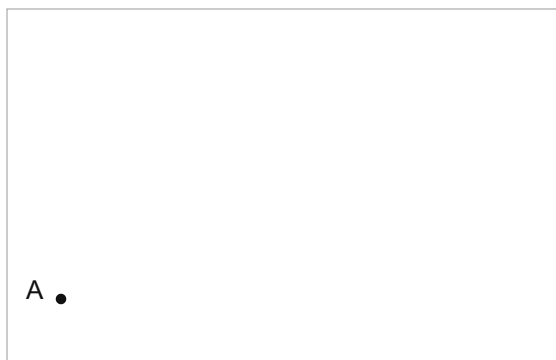
2

A sign order asks for angles $A = 60^\circ$, $B = 30^\circ$ and $C = 100^\circ$. Draw a base and use a protractor to make the first two angles so their rays meet. Label the third angle you actually get. Can the order be filled exactly?

**REASONING AND ANSWER**

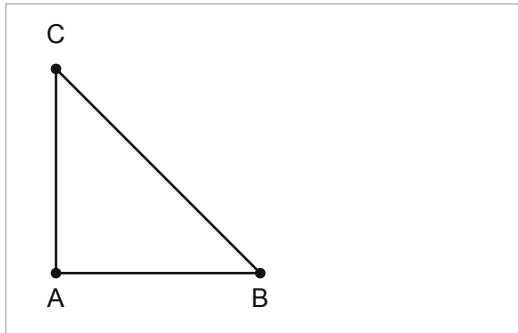
CHALLENGE One step up

Repeat the 60° - 60° - 60° case in your geometry software. Make two different sizes and display their angles and side lengths. Save/show both. Sketch them here, then explain how the digital evidence supports your answer to question 4.

**REASONING AND ANSWER**

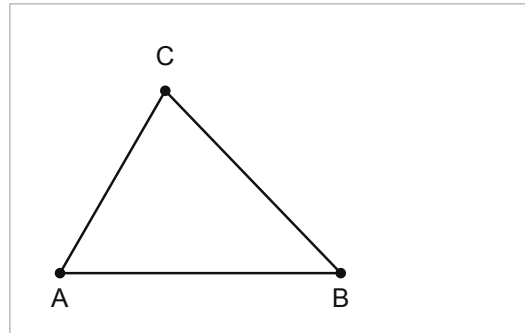
PRACTICE 1

A right isosceles sketch with the three labels.
Many sizes can share these angles.



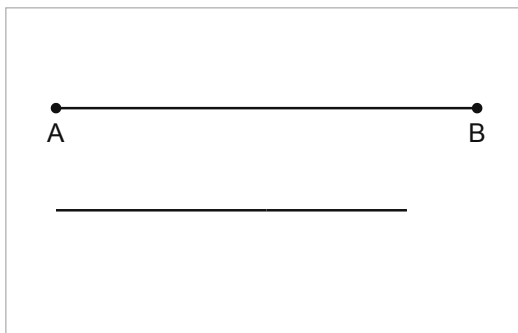
PRACTICE 2

Yes. The two fixed sides and their included 60° angle determine one triangle up to turning or flipping.



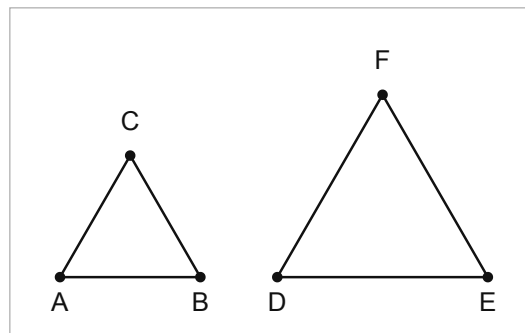
PRACTICE 3

No. Even straightened end to end, $3 + 2 = 5$ cm does not span 6 cm. Bending these sides cannot bridge the gap.



PRACTICE 4

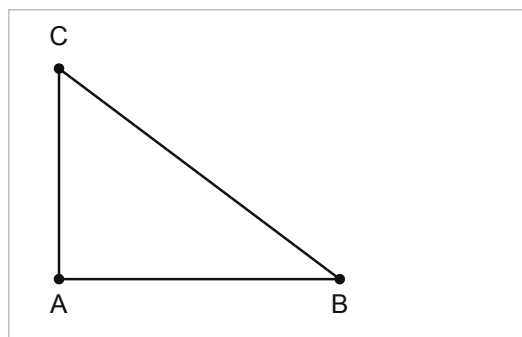
No. Both triangles have 60° angles, but their bases and sizes differ. Three angles do not fix one size.



APPLY IT 1

The digital construction shows $AB = 4$, $AC = 3$, $BC = 5$ units. Three fixed valid sides determine one triangle. A paper sketch alone does not complete the technology task.

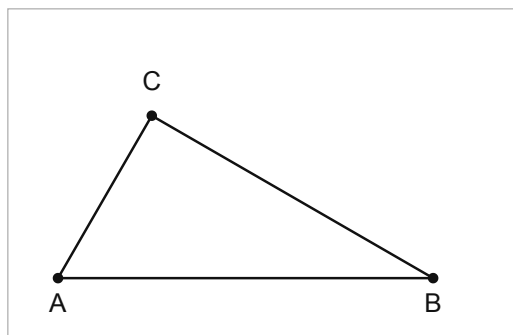
Inspect the saved/on-screen construction and its measurements. A different coordinate placement is acceptable if all side lengths are 3, 4 and 5.



APPLY IT 2

No. The first two angles force $C = 90^\circ$, not 100° ; the ordered angles sum to 190° .

Students should draw and measure the actual 90° third angle. The 180° angle-sum argument explains the conflict.



CHALLENGE

Two different-size equilateral triangles have the same three 60° angles. Their differing side lengths show that the angles alone do not fix one size.

Require the actual ruler/protractor constructions and both digital outputs. Freehand estimates need not have exact measures; measured tasks should agree within ordinary tool accuracy. Check given sides and angles, not merely the appearance. Unique means one size and shape, treating rigidly moved or reflected copies as the same. No trigonometry or unexplained altitude calculation is needed.

