# 12-3 Drawing Triangles with Given Conditions 2

**CCSS: 7.G.A.2:** Draw geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Digital Resources

## Launch

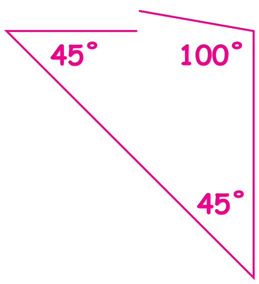
SAMPLE SOLUTIONS ARE SHOWN BELOW.

MP5, MP6

The sign maker again tries to sketch two triangle-shaped signs. Sign 1 has angle measures 45°, 45°, and 100°. Sign 2 has angle measures 30°, 60°, and 90°.

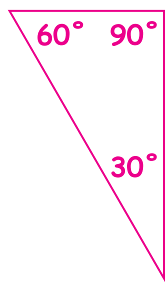
Draw the two signs and label the angle measures. Can the sign maker make both signs? Explain.

**Sign 1**




Sign 1 has the correct angles but is not a triangle. You can't make a triangle with these angles.

**Sign 2**




Sign 2 has the correct angles and is a triangle.

No, the sign maker cannot make Sign 1 because it does not actually form a triangle.

**Reflect** What rule would you make about drawing triangles based on this problem?

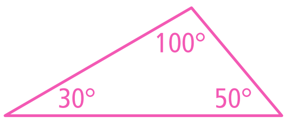
Sample: You can't have a triangle with angles that add up to more than 180°.

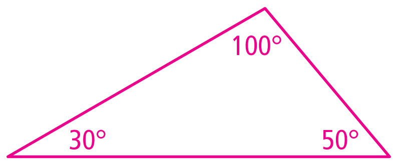
## Got It?

### PART 1 Got It (1 of 2)

Draw two different triangles with angle measures 30°, 100°, and 50°.

Sample:




### PART 1 Got It (2 of 2)

If you form a triangle from three given angle measures, do you always get a unique triangle, or more than one triangle?

If you can actually form a triangle with three given angle measures, you can always get more than one triangle because the side lengths can vary.

# Got It?

## PART 2 Got It (1 of 2)

Given triangle $ABC$, where $BC = 10$ units, $m\angle ABC = 35°$, and $m\angle ACB = 80°$, can you draw a unique triangle, more than one triangle, or no triangle? Explain.

You can draw more than one orientation of the triangle, but a triangle with the given measurements is unique. You can turn and slide the triangles to lie on top of each other to see that they have the same shape and size.

## PART 2 Got It (2 of 2)

If you form a triangle from two given angle measures and the length of their included side, do you always get a unique triangle, or more than one triangle?

If you can actually form a triangle from two given angle measures and the included side length, you will always get a unique triangle.

## Got It?

### PART 3 Got It (1 of 2)

Given triangle $ABC$ with $BC = 13$, $m\angle CAB = 70°$, and $m\angle ACB = 60°$, can you draw a unique triangle, more than one triangle, or no triangle?

You can draw more than one orientation of the triangle, but a triangle with the given measurements is unique as long as the position of the side of length 13 is the same in relation to the given angles in each triangle. You can turn and slide the triangles to lie on top of each other to see that they have the same shape and size.

### PART 3 Got It (2 of 2)

If you form a triangle from two given angle measures and the length of a side that is *not* included, do you always get a unique triangle, or more than one triangle?

If you can actually form a triangle with the two given angle measures and a side length that is not included, and the side length is always in the same position in relation to the given angles, you will get a unique triangle.

# Close and Check

## Focus Question

MP2, MP6

What is the minimum number of side lengths and angle measures you need to draw a unique triangle?

Sample: You need a minimum of three pieces of information to draw a unique triangle. The information can be three side lengths, two side lengths and the included angle measure, or two angle measures and a side length.

## Do you know HOW?

**1.** Given triangle DEF, where $m\angle D = 72°$, $m\angle E = 96°$, and $m\angle F = 17°$, can you draw a *unique triangle, more than one triangle,* or *no triangle?*

no triangle

**2.** Given triangle *LMN*, where $LM = 23$ units, $m\angle NLM = 33°$, and $m\angle NML = 97°$, can you draw a *unique triangle, more than one triangle,* or *no triangle?*

unique triangle

**3.** For triangle *JKL*, two side lengths and the measure of the nonincluded angle are given. Can you draw a *unique triangle, more than one triangle,* or *no triangle?*

more than one triangle

SAMPLE SOLUTIONS ARE SHOWN BELOW.

## Do you UNDERSTAND?

**4. Reasoning** If you are given the length of $\overline{LN}$ instead of $\overline{LM}$ in Exercise 2, would your answer be the same?

Yes. Two angle measures and a nonincluded side will result in one unique triangle as long as the side stays in the same position relative to the angles.

**5. Error Analysis** A classmate says that if you know either three angle measures or three side lengths, then there is one unique triangle that can be constructed. Do you agree? Explain.

No. Three side lengths will result in one unique triangle. Three angle measures will result in any number of similar triangles.