

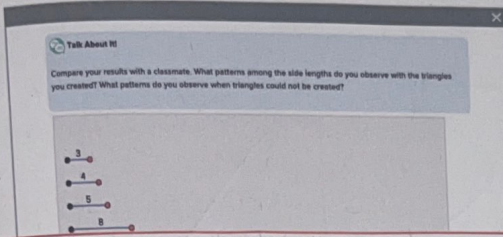
Triangles

I Can... classify and draw triangles, freehand, with tools, and with technology given certain conditions, such as angle measures or side lengths.

امثال المستطيل

Explore Create Triangles

Online Activity You will use Web Sketchpad to explore the relationships among the side lengths or angle measures in a triangle.



050 7175602

Mrs Ayq

What Vocabulary Will You Learn?

- acute triangle
- equilateral triangle
- isosceles triangle
- obtuse triangle
- right triangle
- scalene triangle
- triangle

Talk About It!

Explain to a classmate why right equilateral and obtuse equilateral triangles are not possible.

Learn Classify Triangles

A **triangle** is a figure with three sides and three angles. The sum of the measures of the angles is 180° .

A triangle can be classified by its angle measures.

acute triangle	three acute angles
obtuse triangle	one obtuse angle
right triangle	one 90° angle

A triangle can also be classified by its sides.

scalene triangle	three unequal sides
isosceles triangle	at least two congruent sides
equilateral triangle	three congruent sides

Classify each triangle by its angles and sides.



Right isosceles obtuse-scalene

angles in a triangle

An equilateral triangle must have three angles with the same measure.

The only way for all 3 angles to have the same measure is for them to be acute. There cannot be Right angles or 3 obtus

Study Tip

Congruent sides are sides that are equal in length. To indicate congruent sides, an equal number of tick marks are drawn on the corresponding sides.

Learn Draw Triangles Freehand

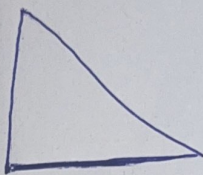
You can draw a triangle freehand given the angle and side length descriptions.

Go Online Watch the video to learn how to draw triangles freehand.

The video shows how to draw an obtuse scalene and a right isosceles triangle freehand. Use the spaces below for your drawings.

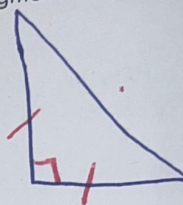
Draw an obtuse scalene triangle.

Start by drawing an obtuse angle. The two segments of the angle should have different lengths. Connect the two segments.



Draw a right isosceles triangle.

Draw a right angle. Draw the line segments so they appear to be the same length. Connect the two segments to form a triangle. Label the right angle. Draw tick marks on the two congruent segments.



Think About It!

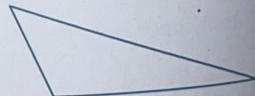
What is an obtuse angle? What are congruent sides?

Example 1 Draw Triangles Freehand

Draw a triangle with one obtuse angle and no congruent sides. Classify the triangle by its sides and angles. Then determine if these characteristics create a unique triangle or more than one triangle.

Part A Draw a triangle with one obtuse angle and no congruent sides.

Step 1 Draw an obtuse angle. The angle should be greater than 90° and less than 180° .



Step 2 Draw the sides. None of the sides should appear to be congruent.

(continued on next page)

Part B Classify the triangle by its sides and angles. The triangle has one obtuse angle and no congruent sides.

obtuse scalene

Part C Determine if these characteristics create a unique triangle or more than one triangle.

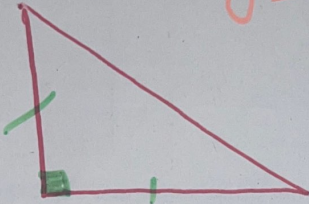
If the triangle is facing a different way or turned, it does not create a new triangle. You can draw a different triangle with the same characteristics by drawing an angle with a different measure but still obtuse. The sides can be many different lengths as long as they are not congruent. So, these characteristics create more than one triangle.

Check

A triangle has one right angle and two congruent sides.

Part A Draw the triangle.

Show your work here



المثل القائم المتساوي الساقين

Part B Classify the triangle by its sides and angles.

Right isosceles

Part C Is it possible to draw a different triangle with those same characteristics? If so, explain what would be different. If not, explain why not.

yes, the lengths of the sides can be longer or shorter while still having two congruent sides and one right angle

Go Online You can complete an Extra Example online.

Mrs/ Aya

Talk About It!
Make a conjecture about three characteristics that would create a unique triangle. Draw an example to support your conjecture. Then find a counterexample, if one exists.

When the lengths of all three sides of the triangles are given, a unique triangle is created

Learn Draw Triangles Using Tools

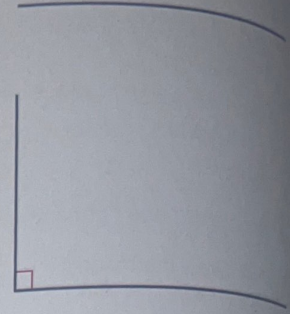
You can draw figures with greater precision if you use tools such as a ruler or a protractor.

Go Online Watch the video to see how to draw the following triangles with the given conditions, using tools.

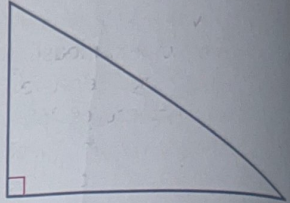
Draw a triangle that has a 90° angle and a side that measures 5 centimeters.

Use a ruler to draw a line segment that is 5 centimeters long.

Use a protractor to draw a 90° angle from one endpoint. Because you are only given one length, the second side can be any length.



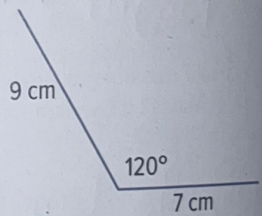
Connect the endpoints to draw the third side.



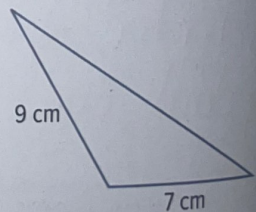
Draw a triangle that has a 120° angle and sides that measure 7 centimeters and 9 centimeters.

Use a ruler to draw a line segment that is 7 centimeters long.

Use a protractor to mark a 120° angle at one endpoint. Draw the side that is 9 centimeters long.



Connect the endpoints of the two segments to draw the third side of the triangle.



Talk About It!

How do tools help you draw a triangle with greater precision?

Ruler and protractor allow me to draw triangle with precise side length and angle measure

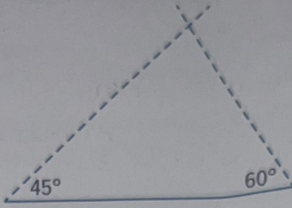
Example 2 Draw Triangles Using Tools

Use a ruler and a protractor to determine whether or not it is possible to draw a triangle with a 45° angle, a 60° angle, and a 75° angle. If so, draw the triangle. If not, explain why.

Step 1 Draw a line segment. Because side lengths are not given, the segment can be any length. This will be the base of the triangle.

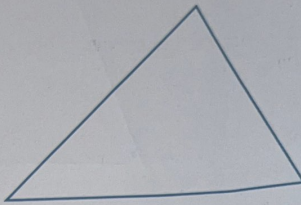


Step 2 Draw the first angle. Use the protractor to draw a 45° angle from one end of the segment.



Step 3 Draw the second angle. Use the protractor to draw a 60° angle from the other end of the segment.

Step 4 Extend the sides of the angles to determine whether they intersect. Use a protractor to measure the third angle. Because the third angle measures 75° , a triangle with the given angle measures is possible.



So, a triangle with angle measures of 45° , 60° , and 75° is possible.

Check

Use a ruler and a protractor to determine if it is possible to draw a triangle with a 32° angle, an 82° angle, and a 67° angle. If it is possible, draw the triangle. If not, explain why.

It is not possible because the sum of the angles is 181° .

اصحاب المستقل

Mrs Aya

Talk About It!

Without drawing the triangle, how do you know a triangle with a 45° angle, a 60° angle, and a 75° angle is possible?

$$45 + 60 + 75 = 180$$

So the triangle is possible

Talk About It!

Is it possible to draw a different triangle with those same characteristics? If so, draw the triangle. If not, explain.

Yes, I can

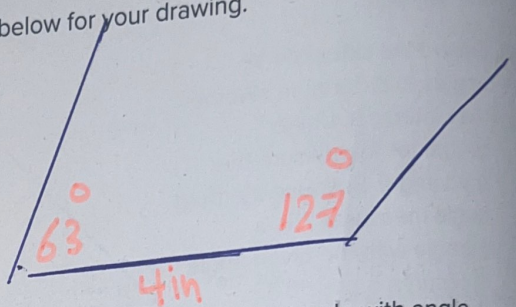
Draw a triangle using the same angle measures but with shorter or longer

side length

Example 3 Draw Triangles Using Tools

Use a ruler and a protractor to determine whether or not it is possible to draw a triangle with a 63° angle, a 127° angle, and a side of 4 inches between the two angles. If not, explain why.

- Step 1** Use the ruler to draw a line segment that measures 4 inches. This can be the base of your triangle.
- Step 2** Use the protractor to draw a 63° angle from one end of the segment.
- Step 3** Use the protractor to draw a 127° angle from the other end of the segment.
- Step 4** Determine if the sides intersect.
- Use this space below for your drawing.



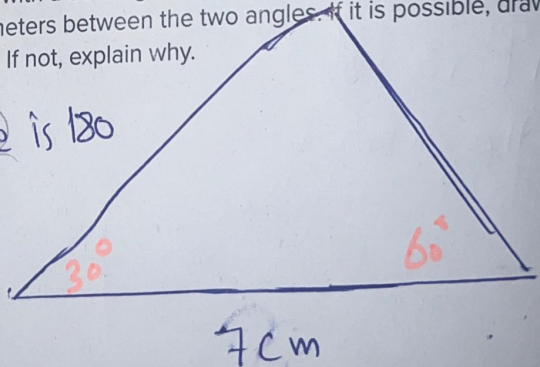
So, because the sides do not intersect, a triangle with angle measures of 63° , 127° , and a side of 4 inches between the two angles is not possible.

Talk About It!

Without trying to draw the triangle, how do you know a triangle with a 63° angle, a 127° angle, and a 4-inch side is not possible?

Check

Use a ruler and a protractor to determine if it is possible to draw a triangle with a 30° angle, a 60° angle, and a side that measures 7 centimeters between the two angles. If not, explain why.



Go Online You can complete an Extra Example online.

اصول الهندسة

Mrs/Aya

I can't determine the sum of the angle measure is 180
 $63 + 127$ is already greater than 180
without even knowing the measure of the third angle

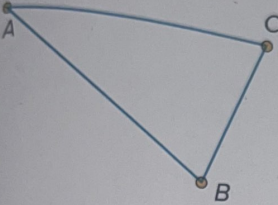
Learn Draw Triangles with Technology

You can create triangles with even greater precision by using technology. If you are given a set of conditions, you can use geometry software, such as Web Sketchpad, to determine if the conditions determine a unique triangle, more than one triangle, or no triangle.

Go Online Use Web Sketchpad to complete the activity.

Web Sketchpad was used to create a triangle with a 32° angle and two 74° angles. Do these conditions determine a unique triangle, or no triangle?

$$\begin{aligned} m\angle BAC &= 32.0^\circ & AB &= 3.26 \text{ in.} \\ m\angle CBA &= 74.0^\circ & AC &= 3.26 \text{ in.} \\ m\angle ACB &= 74.0^\circ & BC &= 1.80 \text{ in.} \end{aligned}$$



The side lengths can vary, but the angle measures stay the same. So, the given conditions create more than one triangle.

Pause and Reflect

Use Web Sketchpad to verify that more than one triangle can be drawn that satisfies the given conditions of having one 32° angle and two 74° angles. Sketch and label at least 2 triangles below that meet these conditions.

Record your observations here

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Mrs / Aya

Talk About It!

Without using technology, is there another way to determine how many triangles can be drawn?

when only angle measures are given, the triangle can be created using different more than 1 triangle can be created

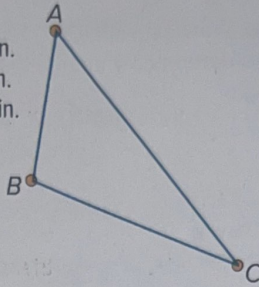
Example 4 Draw Triangles with Technology

Use technology to determine whether or not it is possible to draw a triangle with side lengths of 3, 5, and 6 inches. If so, draw the triangle. If not, explain why.

Go Online Use Web Sketchpad to complete the example.

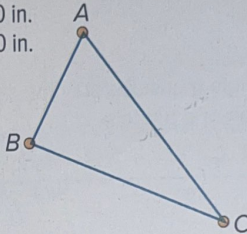
Step 1 One side must have a length of 6 inches. Let $BC = 6$ inches.

$AB = 3.7$ in.
 $AC = 7.7$ in.
 $BC = 6.0$ in.



Step 2 Using Web Sketchpad, drag the vertices to create a triangle so that $AC = 5$ inches and $AB = 3$ inches.

$AB = 3.0$ in.
 $AC = 5.0$ in.
 $BC = 6.0$ in.



Ans 1A7a
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Talk About It!

Can you create more than one triangle with these conditions? Explain.

No

only one triangle

can be formed with

three given side

lengths. Changing

the angle will

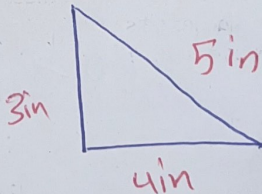
result in different

side lengths

Check

Determine whether or not it is possible to draw a triangle with side lengths 3, 4, and 5 inches. If so, use a sketch to draw the triangle. If not, explain why.

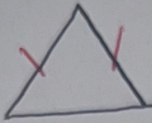
Show your work here



Go Online You can complete an Extra Example online.

Practice

1. Draw a triangle with three acute angles and two congruent sides. Classify the triangle by its sides and angles. Then determine if these characteristics create a unique triangle or more than one triangle. (Example 1)

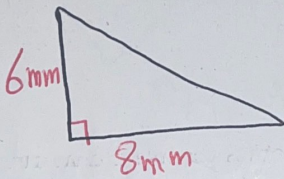


acute, isosceles triangle, more than one

3. Use a ruler and a protractor to determine whether or not it is possible to draw a triangle with a 50° angle, a 60° angle, and an 80° angle. If so, draw the triangle. If not, explain why. (Examples 2 and 3)

No, the sum of the angle measure is greater than 180° , so the endpoint of the sides cannot meet

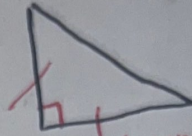
5. Use a ruler and a protractor to determine whether or not it is possible to draw a triangle with a 6 millimeter side, an 8 millimeter side, and a 90° angle between them. If so, draw the triangle. If not, explain why. (Examples 2 and 3)



7. Use Web Sketchpad or other geometry software to determine whether or not it is possible to draw a triangle with side lengths of 2, 2, and 5 inches. If so, draw the triangle. If not, explain why. (Example 4)

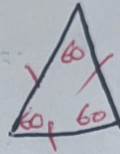
No, The sum of the two sides is not greater than than the third side

2. Draw a triangle with one right angle and two congruent sides. Classify the triangle by its sides and angles. Then determine if these characteristics create a unique triangle or more than one triangle. (Example 1)



Right, isosceles triangle, more than one

4. Use a ruler and a protractor to determine whether or not it is possible to draw a triangle with a 60° angle, a 60° angle, and a 60° angle. If so, draw the triangle. If not, explain why. (Examples 2 and 3)



6. Use a ruler and a protractor to determine whether or not it is possible to draw a triangle with a 75° angle, a 115° angle, and a side of 4 inches between the two angles. If so, draw the triangle. If not, explain why. (Examples 2 and 3)

No, The sum of the angle measures is greater than 180° so the endpoint of the sides cannot meet

Test Practice

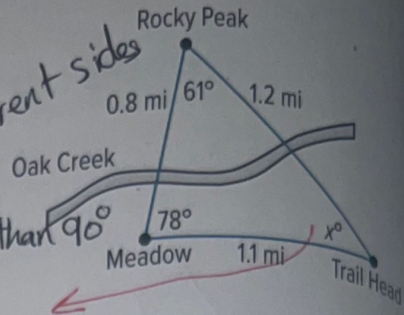
8. **Multiselect** Select all of the sets of measurements that can form a triangle.

- $35^\circ, 15^\circ, 130^\circ$
- $90^\circ, 3 \text{ inches}, 7 \text{ inches}$
- $70^\circ, 70^\circ, 70^\circ$
- 17 inches, 8 inches, 2 inches
- 5 inches, 6 inches, 7 inches

Apply

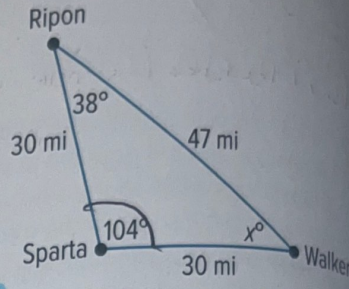
9. The figure shows the Oak Creek trail, which is shaped like a triangle. Solve the equation $61 + 78 + x = 180$ to find the value of x in the figure. Then classify the triangle by its angles and by its sides.

41, acute, scalene
 Because less than 90
 $61 + 78 + x = 180$
 $x = 180 - 139 = 41$



10. The three towns of Ripon, Sparta, and Walker form a triangle as shown. Solve the equation $38 + 104 + x = 180$ to find the value of x in the triangle. Then classify the triangle by its angles and by its sides.

$38 + 104 + x = 180$
 $142 + x = 180$
 $x = 180 - 142 = 38$



Obtuse angle → Because there is angle more than 90
 isosceles → Because there is 2 sides are equal

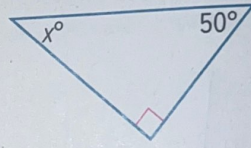
11. **MP Reason Abstractly** Without drawing the triangle, how do you know a triangle with a 95° angle, a 95° angle, and a 5-inch side is not possible?

The sum of the two given angles measures is greater than 180° and the sum of the measures of the angles of a triangle is 180°

13. **MP Justify Conclusions** Construct an argument to explain why it is possible for a triangle to contain three acute angles.

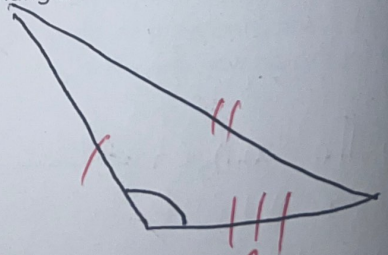
The sum of the interior angles of a triangle equal 180° three acute angles can have a sum of 180 , (ex $60^\circ, 60^\circ, 60^\circ$) and all acute angle

12. Find the value of x in the diagram. Then, find the supplement of the missing angle.



$x = 40$
 The supplement is 140

14. Draw a triangle with one angle greater than 90° and no congruent sides. Then classify the triangle.



obtuse, scalen triangle