Warm UP

What are the different ways you can classify triangles? Draw and label at least 3 different types.

Essential ?

- How do you determine if three side lengths will make a triangle?
- How do you determine the range of the third side of a triangle?

Standard

- MCC7.G.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.

Triangle Inequality Investigation Log Sheet

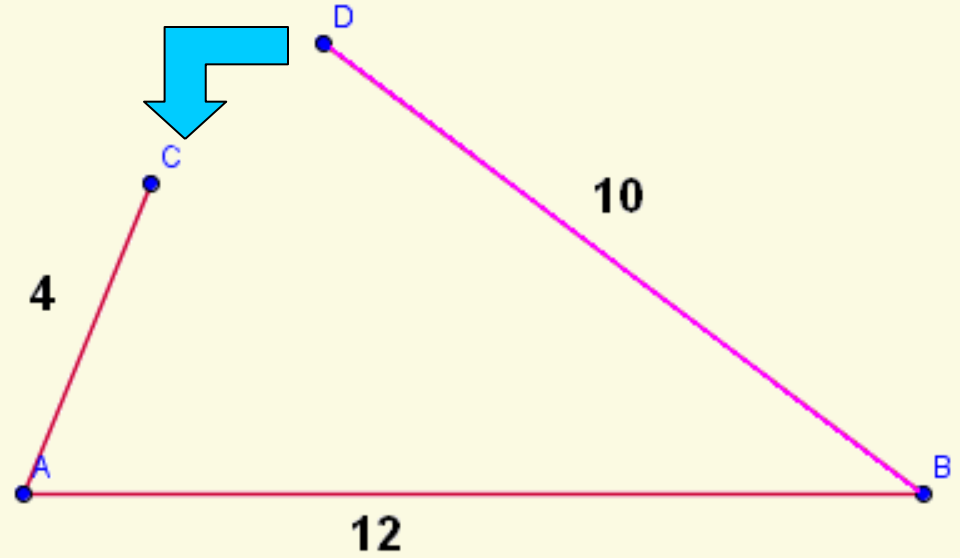
Side Lengths	Shortest side	Middle side	Longest side	Sum of the shortest + middle sides	Do these side lengths form a triangle?
10, 9, 8					
10, 6, 3					
10, 6, 4					
10, 6, 5					
9, 6, 3					

1. Using your ruler, break the Spaghetti noodles into the lengths **10in, 9in, 8in, 7in, 6in, 5in, 4in, and 3in**
2. Use the lengths of the Spaghetti to try and make triangles with the lengths listed. Complete the table as you work.
3. On a sheet of black construction paper tape three examples of your lab. 2 that make a triangle, and 1 that doesn't make a triangle. Glue your log sheet to the construction paper.
4. Come up with a statement or rule about the lengths of the sides of triangles that you got out of this experiment that you might see in a geometry book.

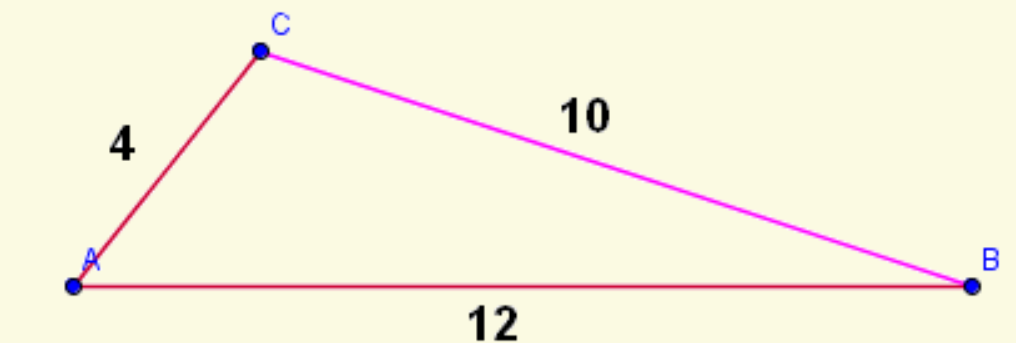
Glue this to your paper also.

Triangle Inequality Theorem:

Can you make a triangle?

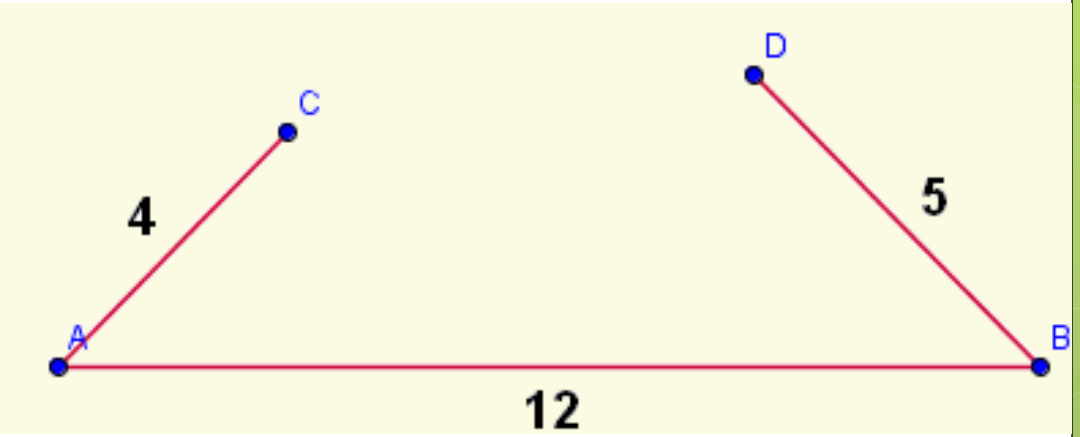


Yes!



Triangle Inequality Theorem:

Can you make a triangle?



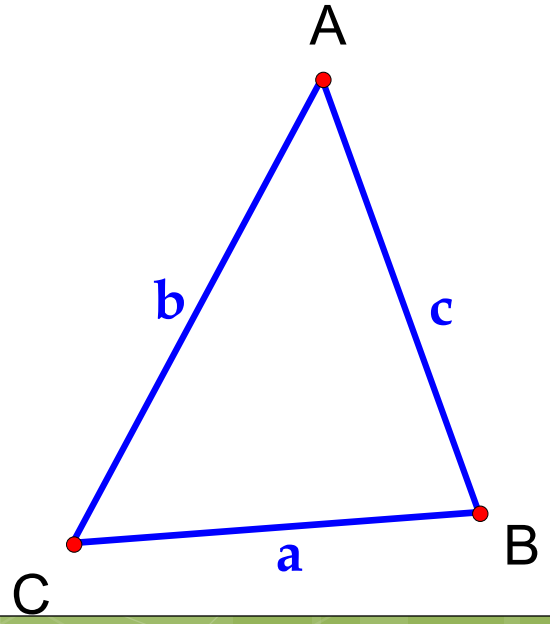
NO

because

$4 + 5 < 12$

Triangle Inequality Theorem:

The sum of the lengths of any two sides of a triangle is greater than the length of the third side.



$$a + b > c$$

$$a + c > b$$

$$b + c > a$$

Video

Determine if the following side lengths make a Triangle.

1. 2, 3, 4
2. 2, 3, 6
3. 5, 5, 10
4. 8, 9, 10
5. 1, 1, 4
6. 20, 20, 20

Finding the range of the third side:

Example Given a triangle with sides of length 3 and 7, find the range of possible values for the third side.

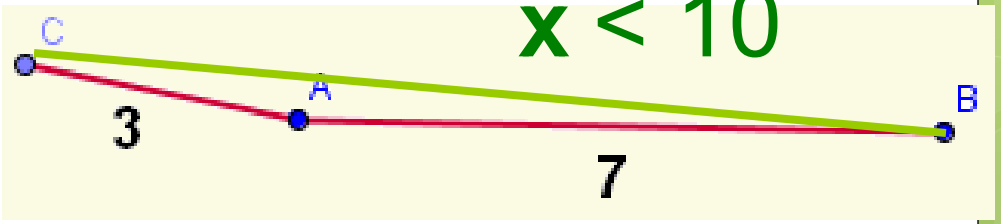
Solution Let x be the length of the third side of the triangle.

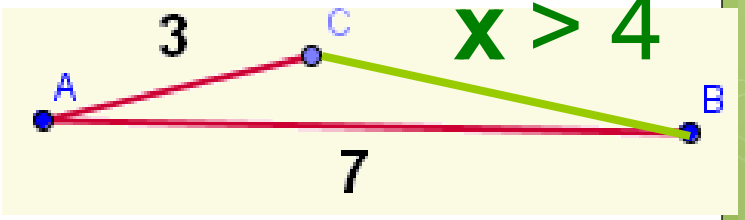
The maximum value:

$x < 3 + 7 = 10$

The minimum value:

$x > 7 - 3 = 4$





So $4 < x < 10$ (x is between 4 and 10.)

Finding the range of the third side:

Given *The lengths of two sides of a triangle*

Since the third side cannot be larger than the other two added together, we find the maximum value by adding the two sides.

Since the third side and the smallest side given cannot be larger than the other side, we find the minimum value by subtracting the two sides.

Difference < Third Side < Sum

Finding the range of the third side:

Example Given a triangle with sides of length a and b, find the range of possible values for the third side.

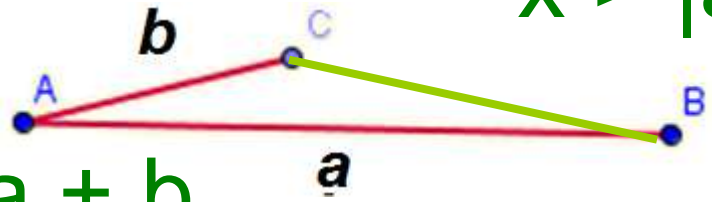
Solution Let x be the length of the third side of the triangle.

The maximum value:

$x < a + b$

The minimum value:

$x > |a - b|$



So $|a - b| < x < a + b$

(x is between $|a - b|$ and $a + b$.)

Find the range of the third side.

1. 9 and 15
2. 23 and 14
3. 21 and 47
4. 18 and 17
5. 15 and 9

Warm UP

1. Will you have a triangle if you have side lengths 20, 23, and 43? Why or why not?

2. Does the side lengths of 20, 23, and 44 make a triangle?

Essential ?

- How do you determine if three side lengths will make a triangle?
- How do you determine the range of the third side of a triangle?

Standard

- MCC7.G.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.

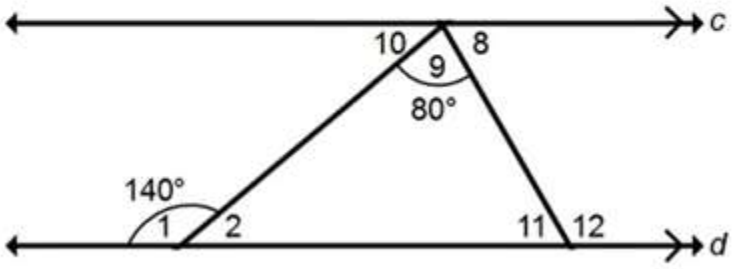
Triangle Sum Theorem

A straight angle measures _____°

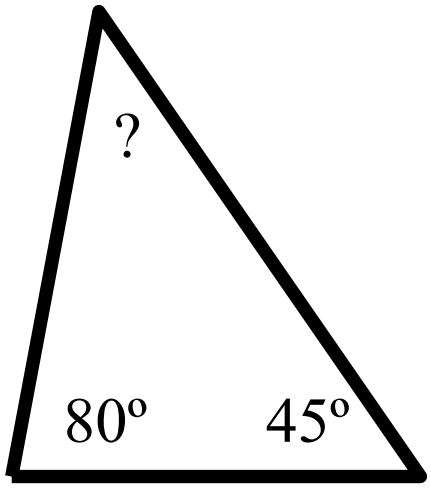
Putting all the angles of a triangle together forms a _____

Therefore, the sum of all the angles in a triangle is _____

Find the measures of ∠2 and ∠11.



Remember that all the angles in a triangle added together equal 180.º



So: 80º + 45º + ? º = 180º

It's an equation!

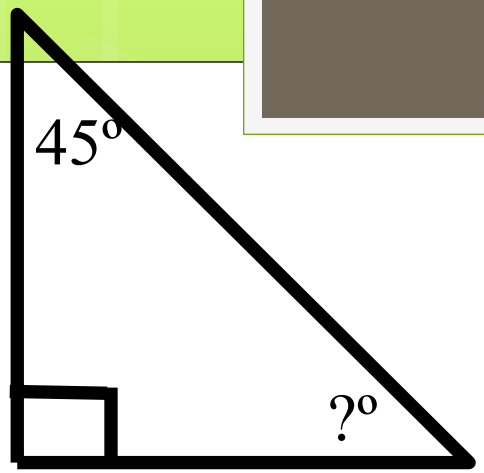
Step 1: Add 80º + 45º

125º + ?º = 180º

Step 2: Subtract 125º from both sides

?º = 55º ← Answer!

√ Check: 80º + 45º + 55º = 180º



So... 45º + 90º + ?º = 180º

Step 1: Add 45º + 90º

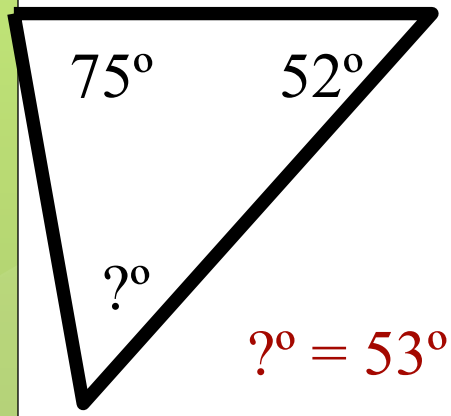
135º + ?º = 180º

Step 2: Subtract 135º from both sides

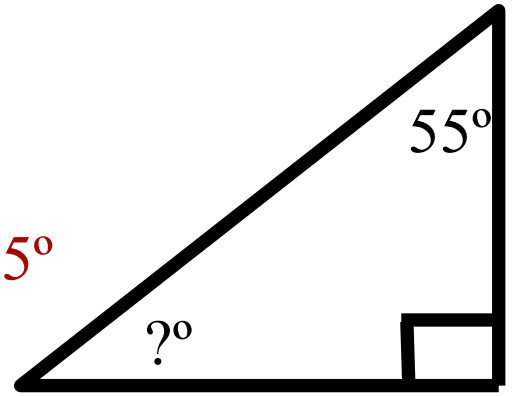
?º = 45º ← Answer!

√ Check: 45 + 90º + 45º = 180º

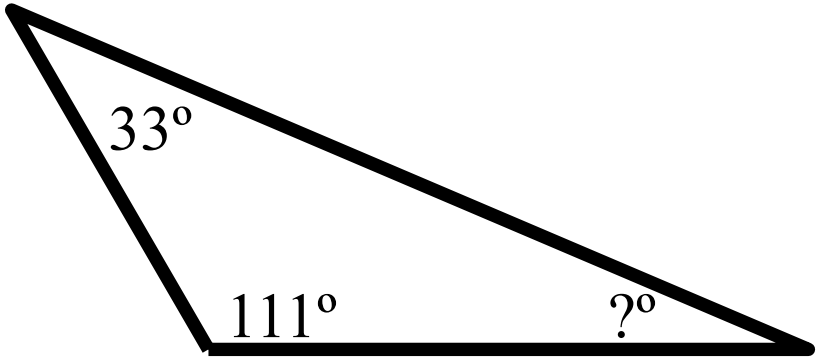
Try a few on your own!



?° = 53°



? = 35°



? = 36°

Triangle Inequalities

INVESTIGATION: The second relationship involves the lengths of the sides of a triangle in relation to the triangle's angles.

MATERIALS NEEDED:

On a clean sheet of paper, construct a large acute triangle on the top half of your paper, and a large obtuse triangle in the bottom half. For each triangle:

Step 1: Measure the angles in the triangle. Label the largest, $\angle$ L, the second largest, $\angle$ M, and the smallest, $\angle$ S.
Step 2: Measure the three sides. Which is the largest? Label it by placing a lower case l near the middle of the side. Which side is the second largest? Label it m in the same way. Which side is the smallest? Label it s.

Which side, s, m, or l is opposite the largest angle?
Which side is opposite the second largest angle?
Which side is opposite the smallest angle?

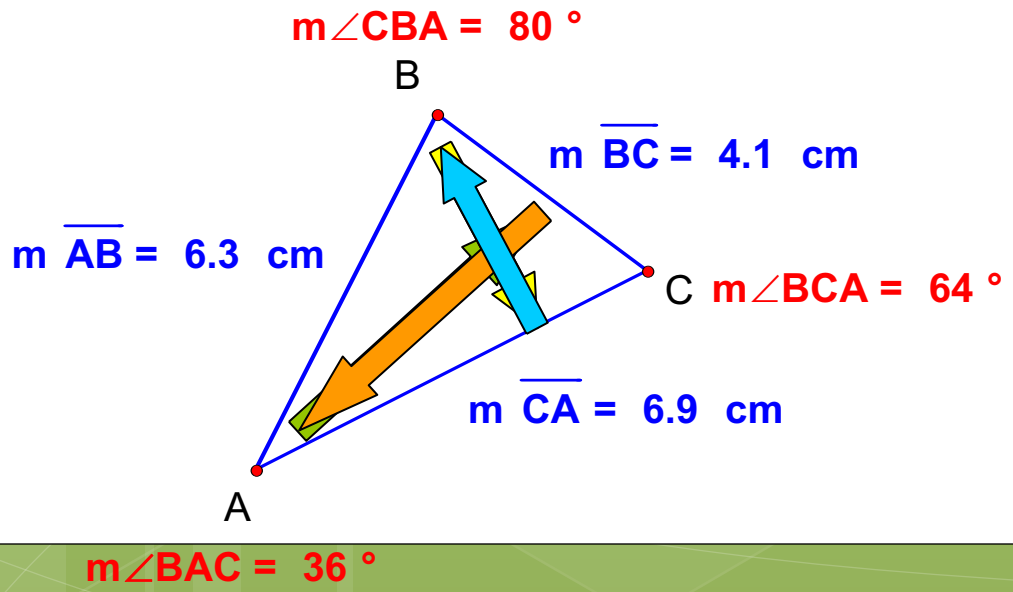
Use your results to complete the following: In a triangle, _____

_____

_____.

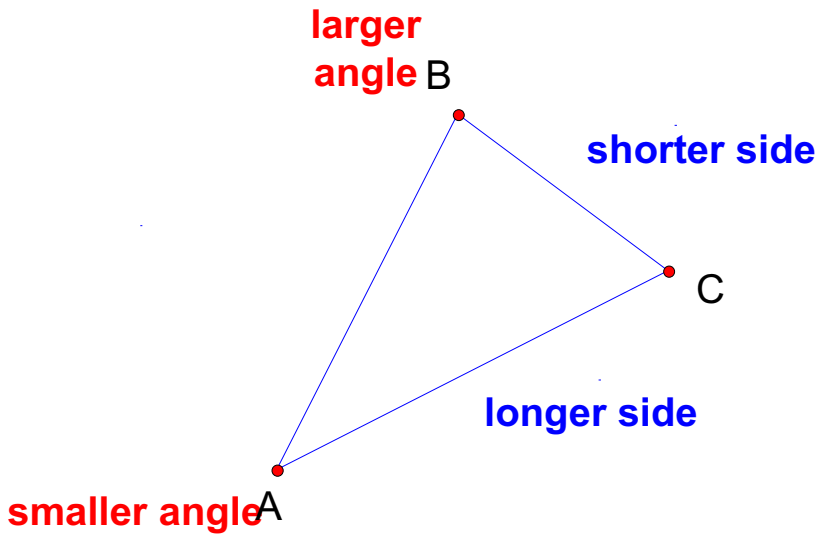
In a Triangle:

- The smallest angle is opposite the smallest side.
- The largest angle is opposite the largest side.
- The smallest side is opposite the smallest angle.
- The largest side is opposite the largest angle.



Theorem

•If one *angle* of a triangle is larger than a second angle, then the *side* opposite the first angle is larger than the side opposite the second angle.



Theorem

- If one *side* of a triangle is larger than a second side, then the *angle* opposite the first side is larger than the angle opposite the second side.

EXERCISE SET A

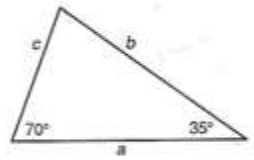
For each set of lengths, determine whether it is possible to draw a triangle with sides of the given measures. If possible, write *yes*. If not possible, write *no*. Be prepared to explain your reasoning.

1. 3cm,4cm,5cm
2. 4 m,5m,9m
3. 5 ft 6ft 12 ft.
4. 3.5 cm,4.5 cm, 7 cm
5. 4", 5", 7 ½"
6. .5m, .6m,12 cm

EXERCISE SET B

In problems 1 and 2, the letter on each side of the Δs indicates the size of that size. In problems 3 and 4, the letter indicates the size of the angle. **Rank order the letters from large to small**. NOTE: You may need to use Δ Sum to determine missing angle measures in some triangles.

1.*



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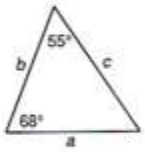

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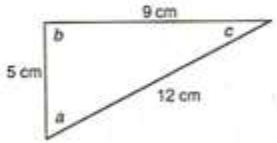

4.