

Grade 7 - Drawing Triangles from Given Conditions - Lesson

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To draw a triangle from given conditions, check them first. Three side lengths form a triangle only if the two shorter sides add up to more than the longest side. The three angles must add up to 180 degrees. Three sides, or two sides with the angle between them, give exactly one triangle.

Grade 7 · Common Core State Standards: **7.G.A.2**

Key facts

- Triangle inequality: the sum of any two sides is greater than the third side.
- The angles of a triangle add up to 180° .
- Three fitting side lengths determine exactly one triangle.
- Three angles alone give many triangles of different sizes.
- Two sides and the angle between them determine exactly one triangle.

When can three lengths form a triangle?

Three lengths make a triangle only when the sum of any two lengths is greater than the third. This is the **triangle inequality**. It is enough to check that the two shorter sides add up to more than the longest side.

5

4 3

$4 + 3 = 7$ versus 5: Overlap: a triangle forms

Two short sticks must be longer together than the longest stick.

7

3 2

$3 + 2 = 5$ versus 7: Gap: the short sticks fall short

$2 + 3 = 5$ is less than 7, so the short sticks can't meet.

For example, 3, 4, and 5 form a triangle because $3+4=7>5$. The lengths 2, 3, and 7 do not,

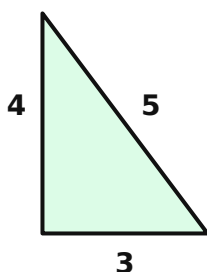
because $2+3=5 < 7$.

Triangle inequality

For sides a , b , and c : $a+b > c$, $a+c > b$, and $b+c > a$. If the sum of two sides **equals** the third, the three sides lie flat in a line and no triangle forms.

What do the angles of a triangle add up to?

The three angles of any triangle add up to 180° . Angles of 50° , 60° , and 70° fit because $50+60+70=180$. Angles of 90° , 60° , and 40° do not fit because their sum is 190.



Three side lengths that satisfy the inequality give exactly one triangle shape.

How many triangles does a set of conditions give?

Some conditions give **exactly one** triangle shape and size, some give **more than one**, and some give **none**. Drawing with a ruler and a protractor shows which.

Given	How many triangles?
3 sides that fit	exactly 1
3 sides that don't fit	none
2 sides + included angle	exactly 1
2 angles + included side	exactly 1
3 angles only	infinitely many

Conditions that determine a triangle.

1. Draw the longest side as the base with a ruler.
2. Set a compass or ruler to the other lengths and mark where the arcs cross, or measure each given angle with a protractor.
3. Check that the finished sketch has the given lengths and angles.

Three angles alone, such as 50,60,70, give infinitely many triangles because you can enlarge or shrink the triangle without changing its angles. Three sides that satisfy the inequality always give just one triangle.

Questions about drawing triangles from given conditions

How do you know if three lengths make a triangle?

Add the two shorter lengths. If the sum is greater than the longest length, a triangle forms. If the sum is equal or less, no triangle forms.

Why do three equal sums not make a triangle?

If the two short sides add up exactly to the long side, they lie flat along the long side. There is no height, so the shape is a line, not a triangle.

What is the sum of the angles in a triangle?

The angles add up to 180° . If two angles are 40° and 60° , the third angle is $180 - 100 = 80$ degrees.

Do three angles give a unique triangle?

No. Any triangle with those angles can be enlarged or shrunk, so there are infinitely many. You need at least one side length too.

What tools do you use to draw a triangle?

A ruler measures side lengths and a protractor measures angles. A compass can mark the third vertex when three side lengths are known.