

Grade 8 · Angles, Parallel Lines and Triangles · Lesson

Common Core 8.G.A.5 · mathovore.fr

The angles of a triangle add up to 180° , and an exterior angle equals the sum of the two remote interior angles. When parallel lines are cut by a transversal, corresponding, alternate interior and alternate exterior angles are equal, and same-side interior angles add to 180° .

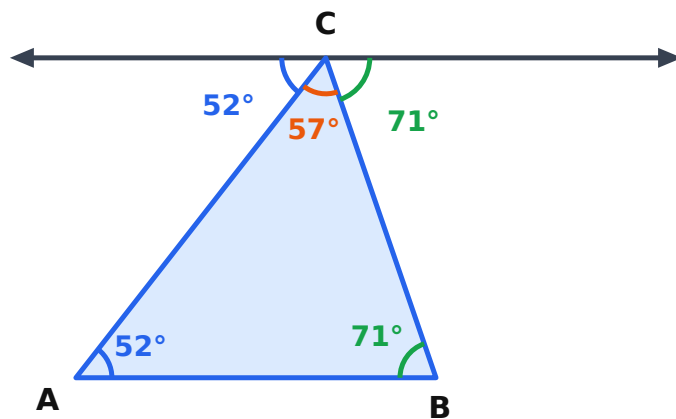
Grade 8 Common Core: 8.G.A.5

Key facts:

- Standard 8.G.A.5: angle sum, exterior angles, parallel lines with a transversal, and the AA criterion.
- Triangle angle sum: 180° .
- Exterior angle = sum of the two remote interior angles.
- Parallel lines: corresponding, alternate interior and alternate exterior angles are equal; same-side interior angles sum to 180° .
- AA criterion: two equal pairs of angles make triangles similar.

What is the angle sum of a triangle?

The three interior angles of every triangle add up to 180° . To see why, draw a line through one vertex parallel to the opposite side. The two new angles beside the vertex equal the other two interior angles, because they are alternate interior angles. Together with the third angle they form a straight line, which is 180° .

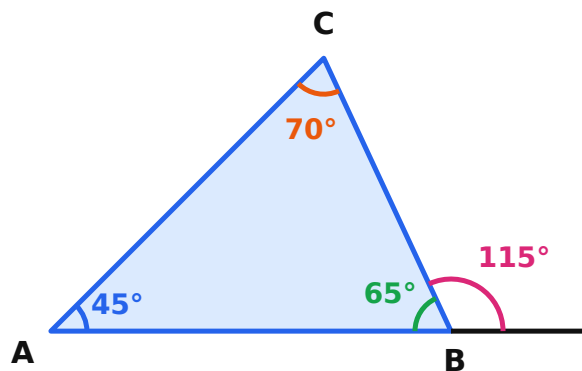


A line through C parallel to AB : the angles 52° , 57° and 71° fill a straight line.

Example. A triangle has angles 52° and 71° . The third angle is $180 - 52 - 71 = 57$, so it measures 57° .

What is the exterior angle theorem?

An **exterior angle** forms when one side of a triangle is extended. It equals the sum of the two **remote interior angles**, the interior angles that are not next to it. The reason: the exterior angle and its neighbor make 180° , and the three interior angles also make 180° . In the figure, $45 + 70 = 115$.



The exterior angle 115° equals $45^\circ + 70^\circ$.

What angles form when a transversal crosses parallel lines?

Vocabulary

Transversal: a line that crosses two or more other lines.

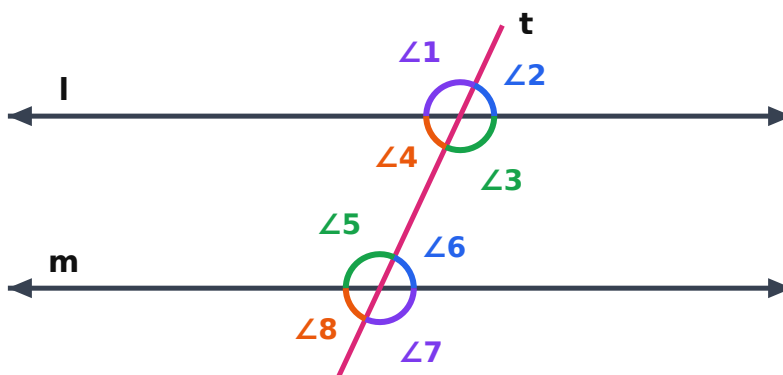
Corresponding angles: angles in the same position at each intersection.

Alternate interior angles: between the lines, on opposite sides of the transversal.

Alternate exterior angles: outside the lines, on opposite sides of the transversal.

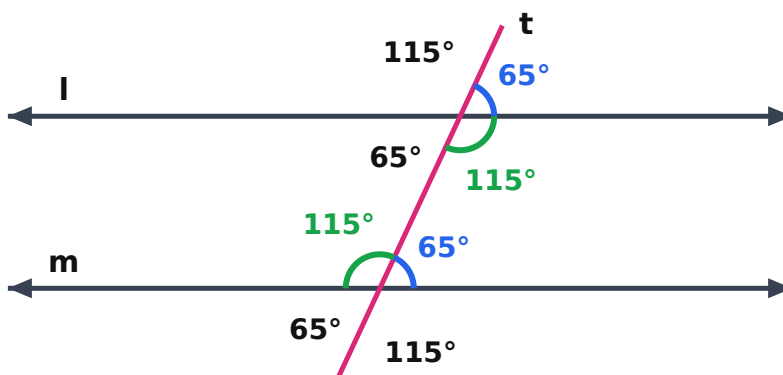
Same-side interior angles: between the lines, on the same side of the transversal.

When the two lines are parallel, corresponding, alternate interior and alternate exterior angles are equal, and same-side interior angles add to 180° .



The eight angles. Colors mark pairs: $\angle 2$, $\angle 6$ corresponding; $\angle 3$, $\angle 5$ alternate interior; $\angle 4$, $\angle 8$ corresponding; $\angle 1$, $\angle 7$ alternate exterior.

Pair type	Example in the figure	Relationship
Corresponding	$\angle 2$ and $\angle 6$	equal
Alternate interior	$\angle 3$ and $\angle 5$	equal
Alternate exterior	$\angle 1$ and $\angle 7$	equal
Same-side interior	$\angle 3$ and $\angle 6$	sum is 180°



If one angle is 65° , the angles are 65° or 115° , and each acute angle plus each obtuse angle makes 180° .

How do you find a missing angle?

1. Name the relationship between the angles.
2. Write an equation: equal angles, or a sum of 180° .
3. Solve for the variable and find each angle.

4. Check that the angles fit the figure.

Worked example. Alternate interior angles measure $(3x+5)^\circ$ and 80° . They are equal, so $3x+5=80$, $3x=75$ and $x=25$. Check: $3(25)+5=80$.

How do angles show that triangles are similar?

The **angle-angle (AA) criterion** says that if two angles of one triangle equal two angles of another, the triangles are similar. The third angles must match too, because each triangle sums to 180° . For example, a triangle with 50° and 60° angles and a triangle with 60° and 70° angles both have angles 50° , 60° , 70° , so they are similar and their sides are proportional.



Two triangles with the same angles are similar: the large one is the small one enlarged.

Angles, Parallel Lines and Triangles: frequently asked questions

What is the sum of the angles in a triangle?

The three interior angles of any triangle add up to 180° . If two angles are 48° and 67° , the third is $180-48-67=65$, so it measures 65° .

What is the exterior angle theorem?

An exterior angle of a triangle equals the sum of the two remote interior angles. If the remote angles are 50° and 65° , the exterior angle is 115° .

Which angles are equal when parallel lines are cut by a transversal?

Corresponding angles, alternate interior angles and alternate exterior angles are equal. Same-side interior angles are not equal in general: they add to 180° .

How can you tell if two lines are parallel using angles?

If a transversal makes equal corresponding angles, or equal alternate interior angles, the lines are parallel. Same-side interior angles that add to 180° also show the lines are parallel.

Why do two equal angles make triangles similar?

If two angles match, the third angles match too, because the angles of each triangle sum to 180° . All three pairs of angles are equal, so one triangle is an enlargement or reduction of the other. This is the AA criterion.