

3-5

Parallel Lines and Triangles

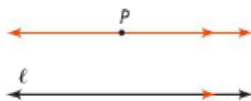
Content Standard
G.CO.10 Prove theorems about triangles ...
 measures of interior angles of a triangle sum to 180° .

Objectives To use parallel lines to prove a theorem about triangles
 To find measures of angles of triangles

Take note

Postulate 3-2 Parallel Postulate

Through a point not on a line, there is one and only one line parallel to the given line.

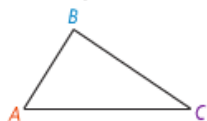


There is exactly one line through P parallel to l .

Take note

Theorem 3-11 Triangle Angle-Sum Theorem

The sum of the measures of the angles of a triangle is 180.

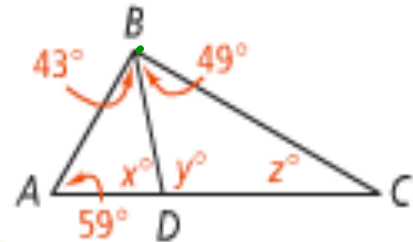


$$m\angle A + m\angle B + m\angle C = 180$$

The proof of the Triangle Angle-Sum Theorem requires an *auxiliary line*. An **auxiliary line** is a line that you add to a diagram to help explain relationships in proofs. The red line in the diagram below is an auxiliary line.

When you know the measures of two angles of a triangle, you can use the Triangle Angle-Sum Theorem to find the measure of the third angle.

Example 1: Find the values of the variables.



$$x + 59 + 43 = 180$$

$$x + 102 = 180$$

$$x = 78$$

$$y + 78 = 180$$

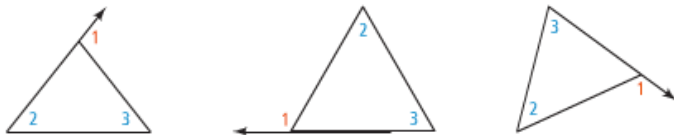
$$y = 102$$

$$z + 102 + 49 = 180$$

$$z + 151 = 180$$

$$z = 29$$

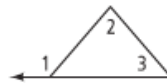
An **exterior angle of a polygon** is an angle formed by a side and an extension of an adjacent side. For each exterior angle of a triangle, the two nonadjacent interior angles are its **remote interior angles**. In each triangle below, $\angle 1$ is an exterior angle and $\angle 2$ and $\angle 3$ are its remote interior angles.



Theorem 3-12 Triangle Exterior Angle Theorem

The measure of each exterior angle of a triangle equals the sum of the measures of its two remote interior angles.

$$m\angle 1 = m\angle 2 + m\angle 3$$



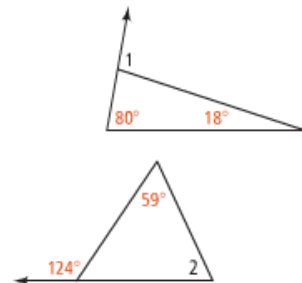
Example 2: Find the measures of the labeled angles.

$$\angle 1 = 80 + 18$$

$$\angle 1 = 98^\circ$$

$$124 = \angle 2 + 59$$

$$65^\circ = \angle 2$$



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