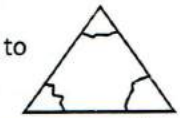
Triangle Sum Theorem & Triangle Exterior Angle Theorem



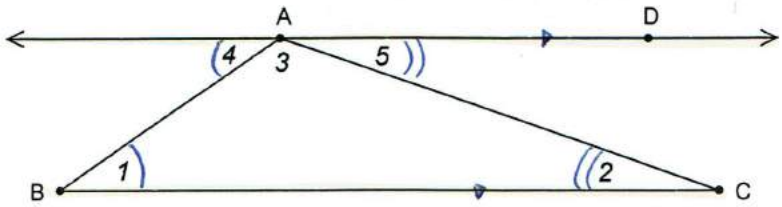
You have learned that the sum of the measures of the angles of a triangle is 180^0. We will look at 3 ways to justify this idea.

1. Draw a triangle using a straightedge. Cut it out carefully. Tear off each vertex and reposition the pieces so that the original triangle vertices are all together and each side of one of the angles is adjacent to a side of the other two angles. What do you notice?

2. Use dynamic software to draw a triangle and measure its angles. Does the sum of the angles equal 180^0? Drag a vertex to different locations. Does the new sum still equal 180^0?

3. Let's examine how we can formally prove this idea. If we start with any ΔABC, we know a line exists that passes through point A and and is parallel to $\overline{BC}$. We also know that angles along a line have measures whose sum is 180^0. (This is related to the idea that linear pairs is supplementary). We will start with these ideas as our given knowledge.

Provide the missing steps and reasons For the proof below.



Given: $\overleftrightarrow{AD} \parallel \overline{BC}$

$m\angle 4 + m\angle 3 + m\angle 5 = 180°$

Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180°$

given

$\overleftrightarrow{AD} \parallel \overline{BC}$

If $\parallel$, alt. int. $\angle$s are $\cong$

$\angle 1 \cong$ $\angle 4$

$\angle 2 \cong$ $\angle 5$

def. of $\cong$ $\angle$s

$m\angle 1 =$ $m\angle 4$

$m\angle 2 =$ $m\angle 5$

given

$m\angle 4 + m\angle 3 + m\angle 5 = 180°$

substitution prop. of =

$m\angle$ 1 $+ m\angle 3 + m\angle$ 2 $= 180°$

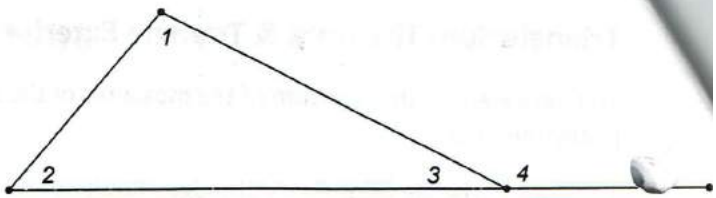
commutative property of addition

$m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Δ Sum Thm

Triangle Sum Theorem: The sum of the measures of the angles of a triangle is $180°$.

Triangle Exterior Angle Theorem



The exterior angle of a triangle is an angle formed by extending one side of a triangle. In the diagram below, **$\angle 4$ is an exterior angle**. The two interior angles (the ones inside the triangle) that are not adjacent (not beside) the exterior angle are called the remote interior angles. **The remote interior angles for $\angle 4$ are $\angle 1$ and $\angle 2$.** There is a special relationship between the exterior angle of a triangle and its two remote interior angles.

Fill in the following responses and justifications to see if you can determine the relationship.

The sum of meas. of $\angle$s of $\triangle$ is 180°

$m\angle 1 + m\angle 2 + m\angle 3 = 180°$

Lin. prs. are supp.

$\angle 3$ *and* $\angle 4$ *are supplementary*

Definition of supplementary angles

$m\angle 3 + m\angle 4 = 180°$

Substitution prop. of =

$m\angle 1 + m\angle 2 + m\angle 3 = m\angle 3 + m\angle 4$

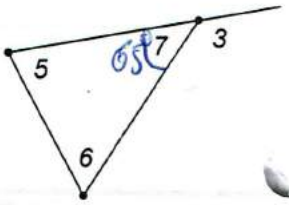
Subtraction property of equality

$m\angle 4 = m\angle 1 + m\angle 2$

Triangle Exterior Angle Theorem: The measure of an exterior angle of a triangle is equal to sum of measures of its remote interior $\angle$s.

Checkpoint:

1. $m\angle 5 = 70°$, $m\angle 6 = 45°$, $m\angle 7 =$ 65°, $m\angle 3 =$ 115°



2. $m\angle 3 = 120°$, $m\angle 6 = 30°$, $m\angle 5 =$ 90°

3. $m\angle 5 = (15x - 70)°$, $m\angle 6 = (2x)°$, $m\angle 3 = (10x)°$, $x =$ 10

$15x - 70 + 2x = 10x$

$7x = 70$

$x = 10$

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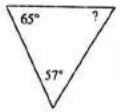
Name_____

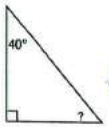
Date_____ Period____

Angles in a Triangle

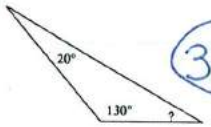
Find the measure of each angle indicated.

1) 

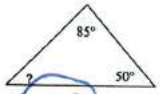
58°

2) 

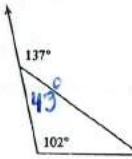
50°

3) 

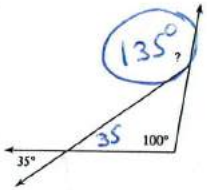
30°

4) 

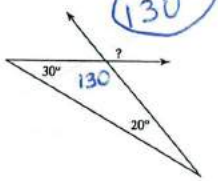
45°

5) 

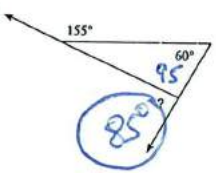
145°

6) 

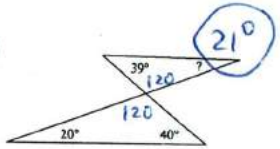
135°
?

7) 

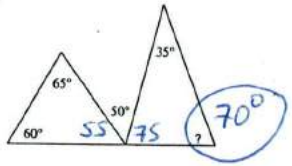
130°

8) 

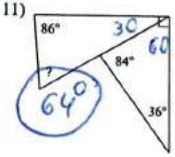
85°

9) 

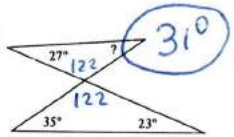
21°

10) 

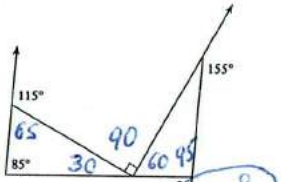
70°

11) 

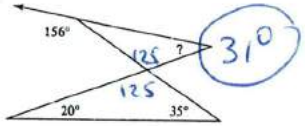
64°

12) 

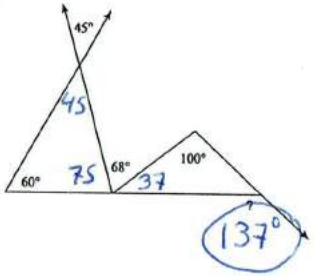
31°

13) 

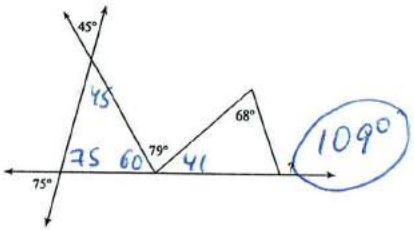
85°

14) 

31°

15) 

137°

16) 

109°

17