

Section 4.1 Angles of Triangles

New Vocabulary

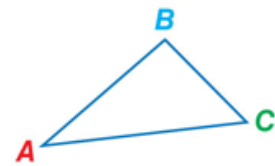
- auxiliary line
- exterior angle
- remote interior angles
- flow proof
- corollary

Section 4.1 Angles of Triangles

Theorem 4.1 Triangle Angle-Sum Theorem

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

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

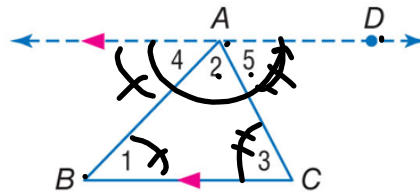


Proof Triangle Angle-Sum Theorem

Given: $\triangle ABC$

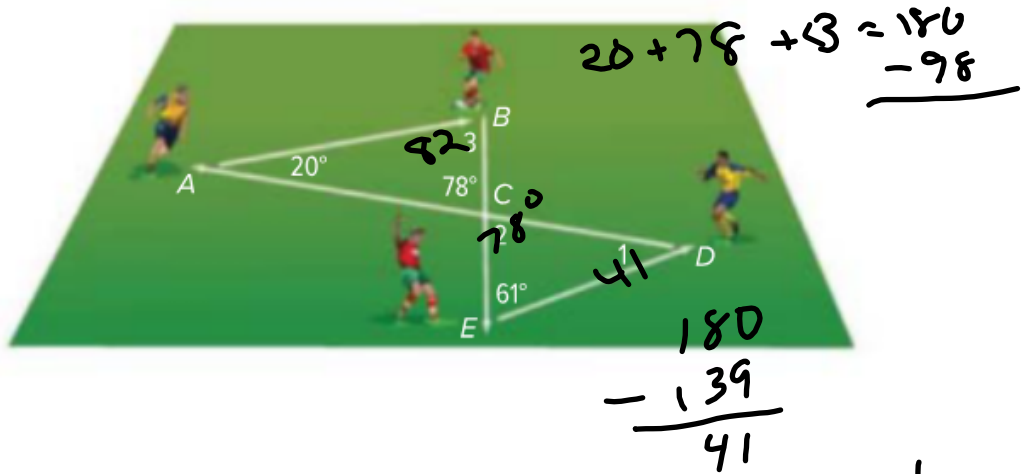
Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180$

Proof:

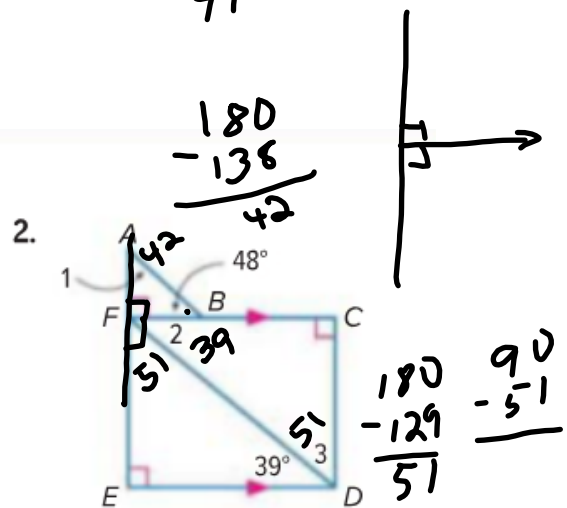
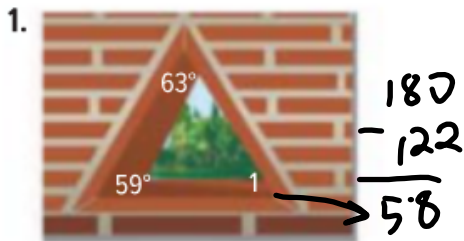


Statements	Reasons
1. $\triangle ABC$	1. Given
2. Draw \overleftrightarrow{AD} through A parallel to \overline{BC} .	2. Parallel Postulate
3. $\angle 4$ and $\angle BAD$ form a linear pair.	3. Def. of a linear pair
4. $\angle 4$ and $\angle BAD$ are supplementary.	4. If 2 \angle s form a linear pair, they are supplementary.
5. $m\angle 4 + m\angle BAD = 180$	5. Def. of suppl. \angles
6. $m\angle BAD = m\angle 2 + m\angle 5$	6. Angle Addition Postulate
7. $m\angle 4 + m\angle 2 + m\angle 5 = 180$	7. Substitution
8. $\angle 4 \cong \angle 1, \angle 5 \cong \angle 3$	8. Alt. Int. \angle Theorem
9. $m\angle 4 = m\angle 1, m\angle 5 = m\angle 3$	9. Def. of $\cong \angle$s
10. $m\angle 1 + m\angle 2 + m\angle 3 = 180$	10. Substitution

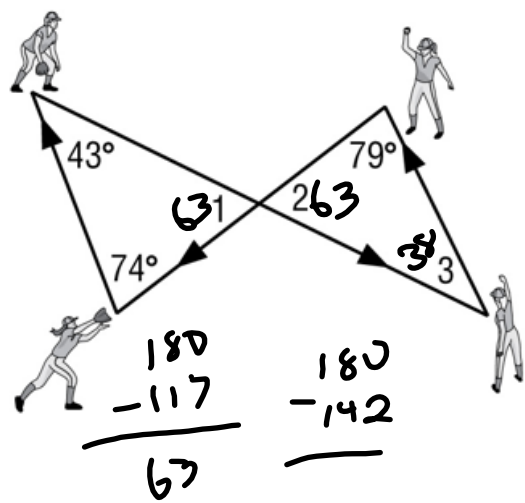
Soccer The diagram shows the path of the ball in a passing drill created by four friends. Find the measure of each numbered angle.



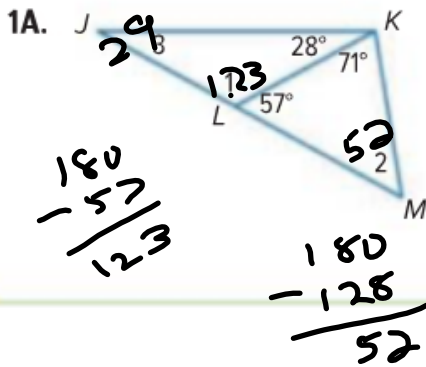
Find the measures of each numbered angle.



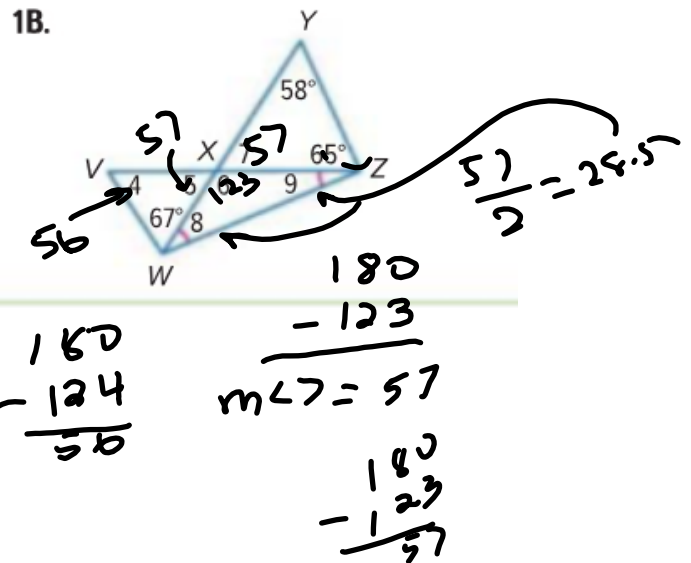
SOFTBALL The diagram shows the path of the softball in a drill developed by four players. Find the measure of each numbered angle.



Find the measures of each numbered angle.



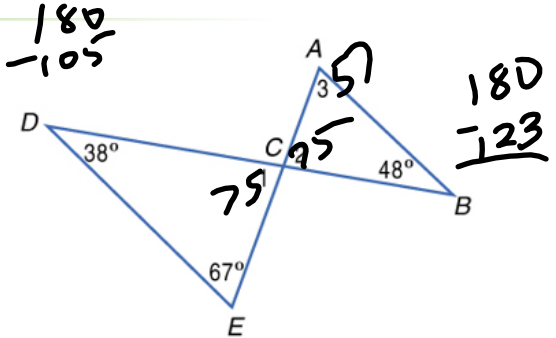
$$\begin{array}{r} 180 \\ - 151 \\ \hline 29 \end{array}$$



$$\begin{array}{r} 180 \\ - 124 \\ \hline 56 \end{array}$$

$$\begin{array}{r} 180 \\ - 123 \\ \hline 57 \\ \frac{57}{2} = 28.5 \end{array}$$

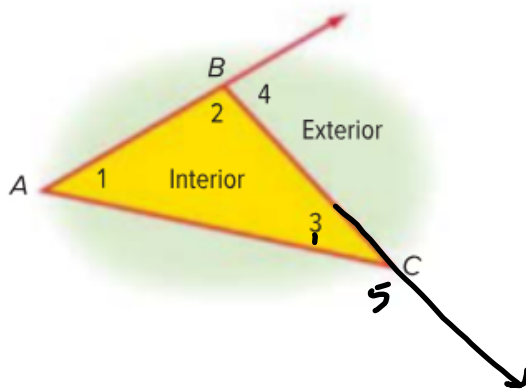
Find the measure of $\angle 3$.



$$\begin{array}{r} 180 \\ - 105 \\ \hline 75 \end{array}$$

$$\begin{array}{r} 180 \\ - 123 \\ \hline 57 \end{array}$$

2 Exterior Angle Theorem In addition to its three interior angles, a triangle can have **exterior angles** formed by one side of the triangle and the extension of an adjacent side. Each exterior angle of a triangle has two **remote interior angles** that are not adjacent to the exterior angle.



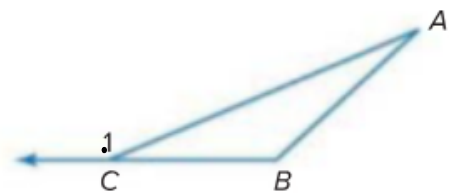
$\angle 4$ is an exterior angle of $\triangle ABC$.
Its two remote interior angles are $\angle 1$ and $\angle 3$.

$\angle 5 \rightarrow \angle 2, \angle 3$
Remote

Theorem 4.2 Exterior Angle Theorem

The measure of an exterior angle of a triangle is equal to the sum of the measures of the two remote interior angles.

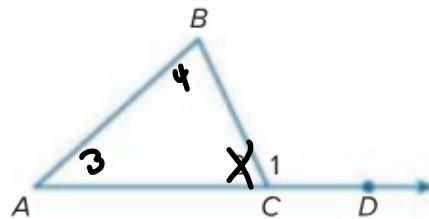
Example $m\angle A + m\angle B = m\angle 1$

**Proof** Exterior Angle Theorem

Given: $\triangle ABC$

Prove: $m\angle A + m\angle B = m\angle 1$

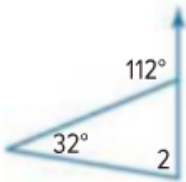
Flow Proof:



$$\begin{aligned} \angle 1 + \angle 2 &= 180 \\ \angle 2 + \angle 3 + \angle 4 &= 180 \end{aligned}$$

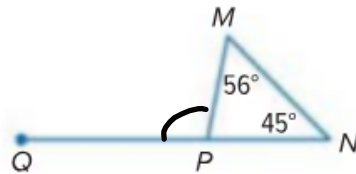
Find each measure.

3. $m\angle 2$



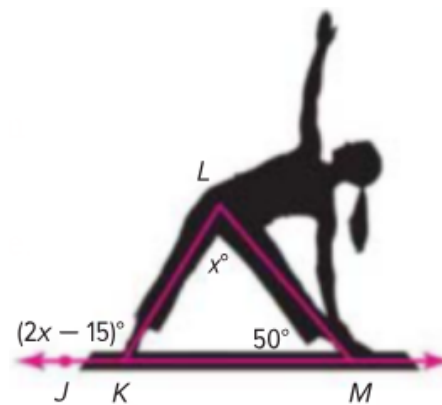
$$\begin{array}{r} 112 = 32 + m\angle 2 \\ - 32 \\ \hline 80 = m\angle 2 \end{array}$$

4. $m\angle MPQ$

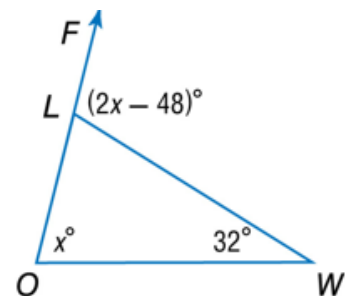


$$m\angle MPQ = 56 + 45 = 101^\circ$$

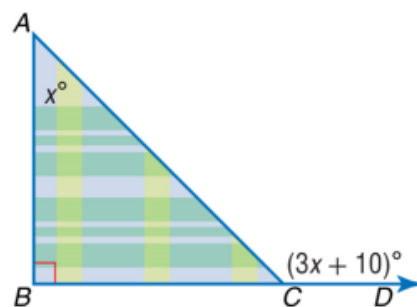
FITNESS Find the measure of $\angle JKL$ in the Triangle Pose shown.



GARDENING Find the measure of $\angle FLW$ in the fenced flower garden shown.



The piece of quilt fabric is in the shape of a right triangle. Find the measure of $\angle ACD$.

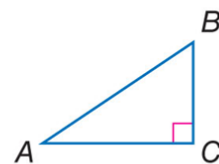


Corollaries Triangle Angle-Sum Corollaries

4.1 The acute angles of a right triangle are complementary.

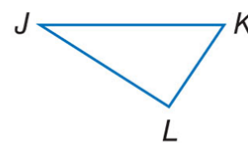
Abbreviation: *Acute \angle s of a rt. \triangle are comp.*

Example: If $\angle C$ is a right angle, then $\angle A$ and $\angle B$ are complementary.



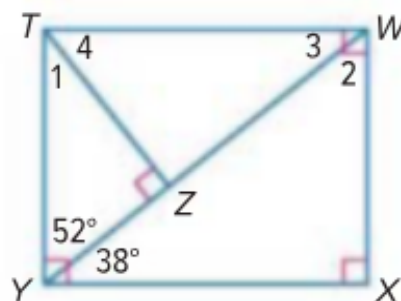
4.2 There can be at most one right or obtuse angle in a triangle.

Example: If $\angle L$ is a right or an obtuse angle, then $\angle J$ and $\angle K$ must be acute angles.



Example 3 Find Angle Measures in Right Triangles

Find the measures of each numbered angle.

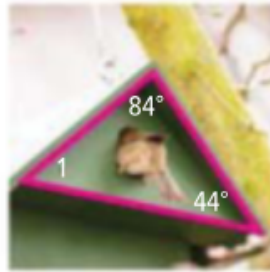


Find the measure of each numbered angle.

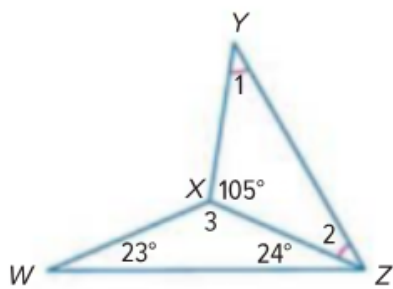
12.



13.



14.



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