Name KEY Date _____ Period _____

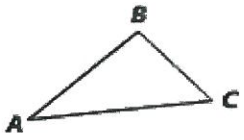
Chapter 4 Congruent Triangles

Lesson 4.2 Angles of Triangles - Notes and Practice

Theorem 4.1 Triangle Angle-Sum Theorem

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

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

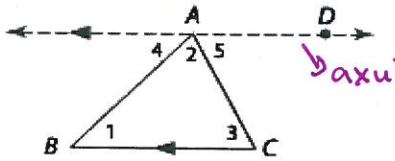


Proof Triangle Angle-Sum Theorem

Given: $\triangle ABC$

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

Proof:

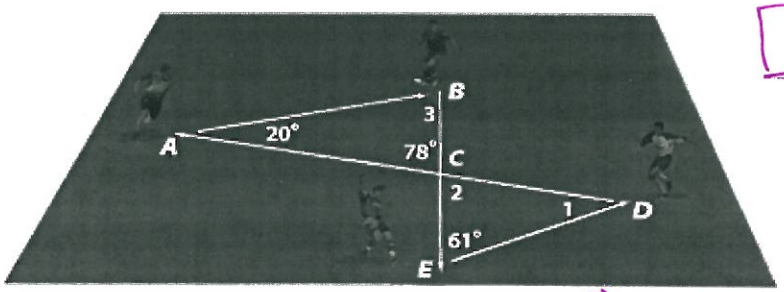


auxiliary line

Statements	Reasons
1. $\triangle ABC$	1. Given
2. Draw $\overleftrightarrow{AD}$ through A parallel to $\overline{BC}$. (auxiliary line)	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 $\measuredangle$ form a linear pair, they are supplementary.
5. $m\angle 4 + m\angle BAD = 180$	5. Def. of suppl. $\measuredangle$
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. $\measuredangle$ Theorem
9. $m\angle 4 = m\angle 1, m\angle 5 = m\angle 3$	9. Def. of $\cong$ $\measuredangle$
10. $m\angle 1 + m\angle 2 + m\angle 3 = 180$	10. Substitution

Real-World Example:

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



$\angle 2 = 78°$, vertical $\angle$s

$\angle 3 = 180° - (20° + 78°)$

$\angle 3 = 180° - 98°$

$\angle 3 = 82°$

$\angle 1 + \angle 2 + 61 = 180°$

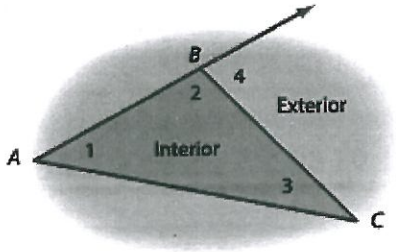
$\angle 1 + 78° + 61 = 180°$

$\angle 1 = 180° - (78° + 61°)$

$\angle 1 = 180° - 139°$

$\angle 1 = 41°$

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.

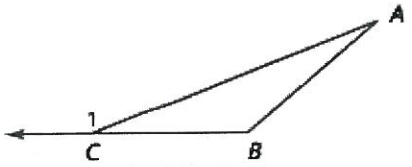


$\angle 4$ is an exterior angle of $\triangle ABC$. Its two remote interior angles are $\angle 1$ and $\angle 3$.

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



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

$\angle JKL = m\angle L + m\angle M$

$2x - 15^\circ = x + 50^\circ$

$+15^\circ \quad +15^\circ$

$2x = x + 65$

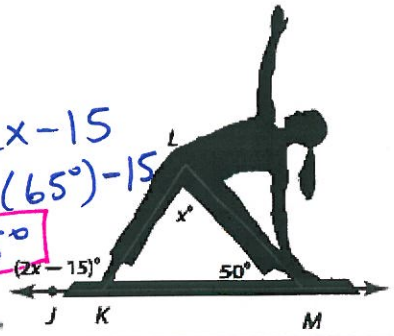
$-x \quad -x$

$x = 65^\circ$

$\angle JKL = 2x - 15$

$\angle JKL = 2(65^\circ) - 15$

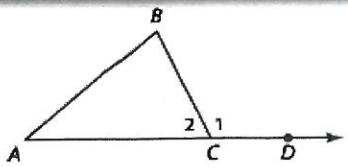
$\angle JKL = 115^\circ$



Proof Exterior Angle Theorem

Given: $\triangle ABC$

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



Flow Proof:

$\triangle ABC$ — Given

$\angle 2$ and $\angle 1$ form a linear pair. — Definition of a linear pair

$\angle 2$ and $\angle 1$ are supplementary. — If 2$\angle$ form a linear pair, they are supplementary.

$m\angle A + m\angle B + m\angle 2 = 180$ — Triangle Angle-Sum Theorem

$m\angle 2 + m\angle 1 = 180$ — Definition of supplementary

$m\angle A + m\angle B + m\angle 2 = m\angle 2 + m\angle 1$ — Substitution

$m\angle A + m\angle B = m\angle 1$ — Subtraction Property of Equality

StudyTip
Flow Proofs Flow proofs can be written vertically or horizontally.

ReadingMath
Flowchart Proof A flow proof is sometimes called a *flowchart* proof.

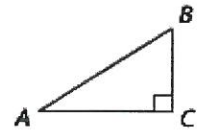
A **corollary** is a theorem with a proof that follows as a direct result of another theorem. As with a theorem, a corollary can be used as a reason in a proof. The corollaries below follow directly from the Triangle Angle-Sum Theorem.

Corollaries Triangle Angle-Sum Corollaries

4.1 The acute angles of a right triangle are complementary.

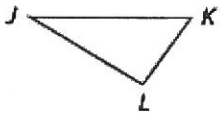
Abbreviation: *Acute ∠s of a rt. △ are comp.*

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.



Practice

Find the measure of each numbered angle.

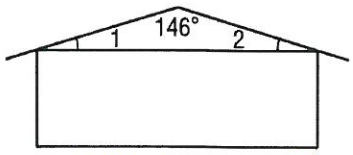
1. 

$\angle 1 + 80^\circ + 73^\circ = 180^\circ$

$\angle 1 + 153^\circ = 180^\circ$

$-153 \quad -153$

$\angle 1 = 27^\circ$

2. 

$180^\circ - 146^\circ = 34^\circ$

$34^\circ \div 2 = 17^\circ$

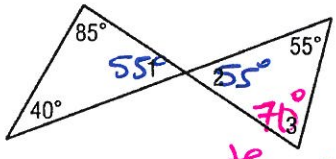
$\angle 1 \cong \angle 2$ so, $\angle 1 = 17$, $\angle 2 = 17$

Find each measure.

3. $m\angle 1 = 180^\circ - (85^\circ + 40^\circ) = 55^\circ$

4. $m\angle 2 = 55^\circ$, vertical $\angle$s.

5. $m\angle 3 = 180^\circ - (55^\circ + 55^\circ) = 70^\circ$

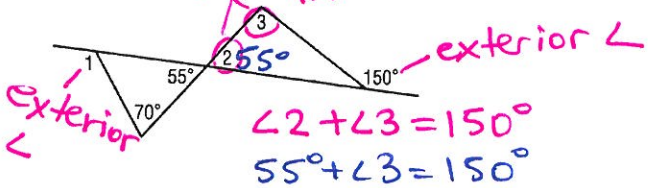


Find each measure.

6. $m\angle 1 = 55^\circ + 70^\circ = 125^\circ$

7. $m\angle 2 = 55^\circ$, vertical $\angle$s

8. $m\angle 3 = 150^\circ - 55^\circ = 95^\circ$



$\angle 2 + \angle 3 = 150^\circ$

$55^\circ + \angle 3 = 150^\circ$

Find each measure.

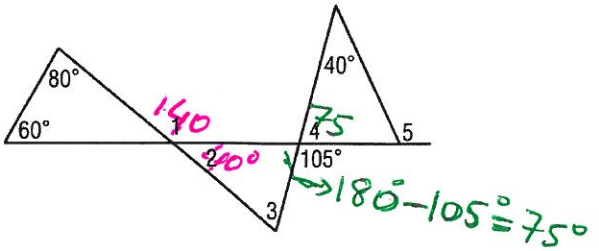
9. $m\angle 1 = 80^\circ + 60^\circ = 140^\circ$

10. $m\angle 2 = 180^\circ - 140^\circ = 40^\circ$

11. $m\angle 3 = 180^\circ - (75^\circ + 40^\circ) = 65^\circ$

12. $m\angle 4 = 75^\circ$, vertical $\angle$s

13. $m\angle 5 = 75^\circ + 40^\circ = 115^\circ$

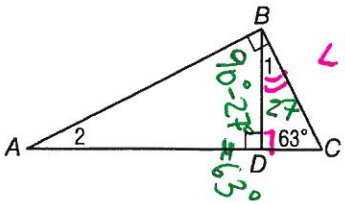


$180^\circ - 105^\circ = 75^\circ$

Find each measure.

14. $m\angle 1 = 180^\circ - 153^\circ = 27^\circ$

15. $m\angle 2 = 180^\circ - (90^\circ + 63^\circ) = 27^\circ$



$\angle 1 = 180^\circ - (90^\circ + 63^\circ)$

ALL PARTS NEED TO BE COMPLETED! SHOW WORK! NO WORK = 0 GRADE!!! KEEP NOTES IN YOUR BINDER. IF YOU LOOSE IT = 0 GRADE!!!