**Postulate 3-2  Parallel Postulate**

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

You can draw \( 1 \) line(s) through \( P \) parallel to line \( \ell \).

\[ \begin{align*}
\text{If } & \angle 1 = 100^\circ, \quad \angle 2 = 30^\circ, \\
\text{then } & \angle 3 = 130^\circ \\
\text{or } & \angle 4 = 180^\circ - 130^\circ
\end{align*} \]

**Theorem 3-11  Triangle Angle-Sum Theorem**

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

Find each angle measure.

\[ \begin{align*}
\text{If } & \angle C = 50^\circ, \\
\text{then } & \angle B + \angle A = 180^\circ - 50^\circ = 130^\circ
\end{align*} \]

\[ \begin{align*}
\text{If } & \angle L = 45^\circ, \\
\text{then } & \angle M + \angle N = 180^\circ - 45^\circ = 135^\circ
\end{align*} \]

The 2 acute angles of a right triangle add up to 90°.
LET'S PROVE THE TRIANGLE ANGLE-SUM THEOREM!!!

Given: \( \triangle ABC; PR \parallel AC \)

Prove: \( m \angle A + m \angle 2 + m \angle C = 180 \)

**Statements**
1. \( \triangle ABC \)
2. \( PR \parallel AC \)
3. \( \angle PBC \) and \( \angle 3 \) are supplementary
4. \( m \angle PBC + m \angle 3 = 180 \)
5. \( m \angle PBC = m \angle 1 + m \angle 2 \)
6. \( m \angle 1 + m \angle 2 = m \angle 3 = 180 \)
7. \( \angle 1 \equiv \angle A \) and \( \angle 3 \equiv \angle C \)
8. \( m \angle 1 = m \angle A \) and \( m \angle 3 = m \angle C \)
9. \( m \angle A + m \angle 2 + m \angle C = 180 \)

**Reasons**
1. Given
2. Given
3. Linear Pair Postulate
4. Def., Supplementary
5. Angle Addition
6. Substitution
7. AIA
8. Def., Congruence
9. Substitution

EXAMPLE 1
Use the diagram below. Find the values of the variables.

* Use \( \triangle ABD \) to find \( x \)

\[
\begin{align*}
x + 59 + 43 & = 180 \\
x + 102 & = 180 \\
x & = 78
\end{align*}
\]

* Use \( \triangle ABD \) to find \( y \)

\[
\begin{align*}
x + y + 49 & = 180 \\
x & = 102 \\
y + 49 & = 180 \\
y & = 131
\end{align*}
\]

* Use \( \triangle ABC \) to find \( z \)

\[
\begin{align*}
z + 78 + y & = 180 \\
z + 78 + 102 & = 180 \\
z & = 9 \text{ (as } 9 < 180)\]
\]

\[
\begin{align*}
z + z + 49 & = 180 \\
z + 49 & = 91 \\
z & = 42
\end{align*}
\]
EXAMPLE 2
The ratio of the angle measures of the acute angles in a right triangle is 1:2. Find the angle measures

\[ \frac{1x}{2x} \]

\[ 3x = 90 \]
\[ x = 30 \]

\[ 30^\circ, 60^\circ, 90^\circ \]

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**Theorem 3-12** Triangle Exterior Angle Theorem

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.

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

\[ m\angle \text{ext} = m\angle \text{int}_1 + m\angle \text{int}_2 \]

Circled the number of each exterior angle and draw a box around the number of each remote interior angle.
EXAMPLE 3
Find the value of the variable.

A. 
\[ 2(x + 4) = x + 50 \]
\[ 2x + 8 = x + 50 \]
\[ x = 42 \]

B. 
\[ 3x + 10 = x + 70 \]
\[ 2x = 60 \]
\[ x = 30 \]

EXAMPLE 4—CONSTRUCTIONS
A. Constructing a line parallel to a given line through a point not on the line.
B. Constructing a perpendicular to a given line through a given point not on the line.

C. Constructing a perpendicular to a given line at a given point on the line.
Postulate 3-3 Perpendicular Postulate

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

HOMEWORK: PAGES 176-177 #23-24, 29-35, 42 plus the following problems...

A. The following variable expressions represent the angles of a triangle. Find the value of the variable, then find the measures of the angles.

\[ m\angle A = (3x - 17)^\circ \]
\[ m\angle B = (x + 40)^\circ \]
\[ m\angle C = (2x - 5)^\circ \]

B. A right triangle has exterior angles at each of its acute angles with measures in the ratio 13 : 14. Find the measures of the two acute angles of the right triangle.