**Content Objective:** I will be able to use similarity theorems to determine if two triangles are similar.

<table>
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<th>TERM</th>
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| SIMILAR POLYGONS | - Polygons with the same ______ but different _______.  
|             | - The corresponding angles are __________________ and  
|             | the corresponding sides are ___________________.  
|             | - The ratios of the corresponding sides are ___________.  
|             | - The ratio of the corresponding sides is called the  
|             | __________  __________.                                                      |         |

**AA Similarity**

If two angles of one triangle are ___________ to two angles of another triangle, then the triangles are ________________.

Can these triangles be proven similar by AA? If so, write a similarity statement.

**EXAMPLE 1:**

| YES or NO | Δ_________ ~ Δ__________ |
|___________|________________________|

**QUICK CHECK:**

| YES or NO | Δ_________ ~ Δ__________ |
|___________|________________________|
Given $\overline{AB} \parallel \overline{CD}$, $AB = 4$, $AE = 3x + 1$, $CD = 8$, and $ED = x + 12$.

**EXAMPLE 2:**

*Find $AE$:*

$AE = ______________$

**QUICK CHECK:**

*Find $DE$:*

$DE = ______________$

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**SAS Similarity**

In two triangles, if a pair of corresponding angles is ______ and the sides including the angle are ________________, then the triangles are ________________.

**EXAMPLE 3:** Can these triangles be proven similar by SAS? If so, write a similarity statement.

** YES ** or ** NO **

$\triangle \underline{\text{ ____________ }} \sim \triangle \underline{\text{ ____________ }}$
EXAMPLE 4: Are the triangles below similar by SSS? If so, write a similarity statement.

YES or NO

\[ \triangle \underline{\text{___________}} \sim \triangle \underline{\text{___________}} \]

Determine if triangles with the given side lengths are similar. If the triangles are similar, what is the common ratio?

EXAMPLE 5:
The measures of the sides of \( \triangle ABC \) are 4, 5, and 7. The measures of \( \triangle XYZ \) are 16, 20, and 28.

YES or NO

\[ \triangle \underline{\text{___________}} \sim \triangle \underline{\text{___________}} \]

QUICK CHECK: \( \triangle PQR \) has sides 3, 5, & 6. \( \triangle STU \) has sides 2.5, 2, and 3.

YES or NO

\[ \triangle \underline{\text{___________}} \sim \triangle \underline{\text{___________}} \]
EXAMPLE 6: Are the two triangles similar? If so, state how and write a similarity statement. Solve for \( x \) and \( y \).

a.

\[
\begin{align*}
\triangle WXY & \sim \triangle WZV \\
\frac{WZ}{WX} &= \frac{WY}{WV} \\
\end{align*}
\]

YES or NO

HOW? ____________

\( \Delta _____ \sim \Delta _____ \)

b.

\[
\begin{align*}
\triangle JKM & \sim \triangle JMN \\
\frac{JK}{JM} &= \frac{KM}{JM} \\
\end{align*}
\]

YES or NO

HOW? ____________

\( \Delta _____ \sim \Delta _____ \)

c.

\[
\begin{align*}
\triangle CGE & \sim \triangle CFG \\
\frac{CG}{CF} &= \frac{GE}{GF} \\
\end{align*}
\]

YES or NO

HOW? ____________

\( \Delta _____ \sim \Delta _____ \)
Example 7:

\[ \begin{align*}
&x = \underline{\phantom{000}} \\
&y = \underline{\phantom{000}} \\
&x = \underline{\phantom{000}} \\
&y = \underline{\phantom{000}}
\end{align*} \]

Quick Check:

\[ \begin{align*}
&x = \underline{\phantom{000}} \\
&y = \underline{\phantom{000}} \\
&x = \underline{\phantom{000}} \\
&y = \underline{\phantom{000}}
\end{align*} \]
SAS Inequality Theorem (The Hinge Theorem): If two sides of one triangle are congruent to two sides of another triangle, but the included angle of the first triangle larger than the included angle of the second triangle, then the third side of the first triangle is longer than the third side of the second triangle.

**Proof.**

Given: \( \triangle ABC \) and \( \triangle RST; \) \( BA \cong SR; \) \( m \angle B > m \angle S \)

Prove: \( AC > DF \)

Construct \( \overline{BP} \) so that \( m \angle PBC = m \angle RST. \) On \( \overline{BP}, \) take point \( X \) so that \( BX = SR. \) Either \( X \) is on \( \overline{AC} \) or \( X \) is not on \( \overline{AC}. \) In either case, we must have \( \triangle XBC \cong \triangle RST \) by SAS postulate and \( \overline{XC} \cong \overline{RT} \) by CPCTC.

**Case 1:** \( X \) is on \( \overline{AC}. \)

By the Segment Addition Postulate \( AC = AX + XC, \) so \( AC > XC. \) But from our congruence above we had \( XC \cong RT. \) By substitution we have \( AC > RT \) and we have proven case 1.

**Case 2:** \( X \) is not on \( \overline{AC}. \)

Construct the bisector of \( \angle ABX \) so that it intersects \( \overline{AC} \) at point \( Y. \) Draw \( \overline{XY} \) and \( \overline{XC}. \)

Recall that \( AB = RS = BX. \)

Note that \( \triangle ABY \cong \triangle XBY \) by SAS postulate. Then \( \overline{AY} \cong \overline{XY}. \) So, \( XY + YC > XC \) by the Triangle Inequality Theorem. Now \( XY + YC = AC \) by the segment addition postulate, and \( XC = RT \) by our original construction of \( \overline{XC}, \) so by substitution we have \( AC = XY + YC > XC = RT \) or \( AC > RT \) and we have proven case 2.