Vocabulary
Angle-Angle (AA) Similarity Postulate

If two angles of one triangle are congruent to two angles of another triangle, then the two triangles are similar.

**EXAMPLE 1**
**Use the AA Similarity Postulate**

Determine whether the triangles are similar. If the are, write a similarity statement. *Explain* your reasoning.

**Solution**
Because they are both right angles, \( \angle B \) and \( \angle E \) are congruent.
By the Triangle Sum Theorem, \( 38^\circ + 90^\circ + m\angle A = 180^\circ \), so \( m\angle A = 52^\circ \). Therefore, \( \angle A \) and \( \angle D \) are congruent.
So, \( \triangle ABC \sim \triangle DEF \) by the AA Similarity Postulate.

**EXAMPLE 2**
**Show that triangles are similar**

Show that the two triangles are similar.

a. \( \triangle TUV \) and \( \triangle HJK \)
b. \( \triangle LMN \) and \( \triangle PQN \)

**Solution**

a. Because each triangle is isosceles with a vertex angle of 115°, you can determine that each base angle is 32.5°.
So, \( \triangle TUV \sim \triangle HJK \) by the AA Similarity Postulate.

b. The diagram shows that \( LM \parallel PQ \), so \( \angle L \equiv \angle P \) by the Corresponding Angles Postulate. By the Reflexive Property, \( \angle L \equiv \angle L \).
So, \( \triangle LMN \sim \triangle PQN \) by the AA Similarity Postulate.
Exercises for Examples 1 and 2

Determine whether the triangles are similar. If they are, write a similarity statement.

1. 

2. 

3. 

4. 

Vocabulary

Theorem 6.2 Side-Side-Side (SSS) Similarity Theorem: If the corresponding side lengths of two triangles are proportional, then the triangles are similar.

Theorem 6.3 Side-Angle-Side (SAS) Similarity Theorem: If an angle of one triangle is congruent to an angle of a second triangle and the lengths of the sides including these angles are proportional, then the triangles are similar.

EXAMPLE 1

Use the SSS Similarity Theorem

Is either triangle $\triangle RST$ or $\triangle XKZ$ similar to $\triangle ABC$?
Solution

Compare $\triangle ABC$ and $\triangle RST$ by finding ratios of corresponding side lengths.

<table>
<thead>
<tr>
<th>Shortest sides</th>
<th>Longest sides</th>
<th>Remaining sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{AB}{RS} = \frac{3}{3} = 1$</td>
<td>$\frac{CA}{RT} = \frac{5}{4}$</td>
<td>$\frac{BC}{ST} = \frac{4}{4} = 1$</td>
</tr>
</tbody>
</table>

The ratios are not all equal, so $\triangle ABC$ and $\triangle RST$ are not similar.

Compare $\triangle ABC$ and $\triangle XYZ$ by finding ratios of corresponding side lengths.

<table>
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<th>Remaining sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{AB}{XY} = \frac{3}{6} = \frac{1}{2}$</td>
<td>$\frac{CA}{ZX} = \frac{5}{10} = \frac{1}{2}$</td>
<td>$\frac{BC}{YZ} = \frac{4}{8} = \frac{1}{2}$</td>
</tr>
</tbody>
</table>

All of the ratios are equal, so $\triangle ABC \sim \triangle XYZ$.

Exercise for Example 1

1. Which of the three triangles are similar? Write a similarity statement.

EXAMPLE 2

Use the SSS Similarity Theorem

Find the value of $x$ that makes $\triangle ABC \sim \triangle DEF$.

Solution

STEP 1 Find the value of $x$ that makes corresponding side lengths proportional.

$$\frac{27}{18} = \frac{15}{2(x+1)}$$
Write proportion.

$$27 \cdot 2(x + 1) = 18 \cdot 15$$
Cross Products Property

$$54x + 54 = 270$$
Simplify.
Solve for $x$

**STEP 2 Check** that the side lengths are proportional when $x = 4$.

\[
AC = 8x + 1 = 33 \quad EF = 2(x + 1) = 10
\]

\[
\frac{AB}{DE} = \frac{27}{18} = \frac{3}{2} \quad \frac{BC}{EF} = \frac{15}{10} = \frac{3}{2} \quad \frac{AC}{DF} = \frac{33}{22} = \frac{3}{2}
\]

When $x = 4$, the triangles are similar by the SSS Similarity Theorem.

**EXAMPLE 3**

**Use the SSS Similarity Theorem**

Find the value of $x$-that makes $\triangle POR \sim \triangle TUV$

**Solution**

Both $\angle R$ and $\angle V$ equal $60^\circ$, so $\angle R \cong \angle V$. Next, find the value of $x$ that makes the sides including these angles proportional. Solving the proportion $\frac{3x + 4}{20} = \frac{30}{24}$, you obtain $x = 7$. So, by the SAS Similarity Theorem, the triangles are similar when $x = 7$.

**Exercises for Examples 2 and 3**

Find the value of $X$-that makes the triangles similar.

2.

3.