Objective: In this lesson, you will use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.

The two triangles in the diagram are congruent by the ASA.

Because the two triangles are congruent, it follows that $BC = BD$.

Example

Jamie needs to determine the distance across a river. She selects a rock, $R$, on the opposite river bank. She finds a tree, $T$, on her side of the river such that $RT$ is perpendicular to the river. Next, Jamie walks 50 yards down the river from the tree, $T$, to a spot, $C$. Using a compass that she made from two sticks, she measures $TCR$. She then walks from $C$ in a direction that makes the same angle as $TCR$ with the river bank on her side of the river. She keeps walking in that direction until she sees the tree and the rock in a straight line from her position. She marks this point $B$ and then paces from $B$ to $T$ to measure the distance from point $B$ to the tree. If $BT$ turns out to be 75 yards, what is $RT$, the distance across the river?
Example

As part of a history project, four students are making a 12-foot-tall model of a pyramid. The four faces of the pyramid will be congruent triangles. Each face will be given to a different student in the group to add texture and paint. The student working on the back face of the pyramid takes some measurements and determines that he will need enough material to cover 84 square feet. How much material will the student working on the left face need to cover her side of the pyramid?

_____________________

Using Similarity Criteria to Solve Problems

Watch the video that describes how you can use indirect measurement to find the height of an object.

How tall was the tree in the video? ________________

Try this one on your own:

A 6 ft high fence casts a 12 ft. long shadow at the same time that a tree next to it cast a 48 ft long shadow. How tall is the tree? (Draw a Picture)

_____________________

Find the length of $BC$.

Example

A fire hydrant that is 1.5 feet high casts a shadow that is 2.5 feet long. At the same time of day, a lamppost casts a shadow 15 feet long. What is the height of the lamppost?

Area of $\triangle DEF = .5 \times 3 \times 2 = 3$ units$^2$

Area of $\triangle ABC = .5 \times 9 \times 6 = 27$ units$^2$

$$\frac{\text{area of } \triangle ABC}{\text{area of } \triangle DEF} = \left(\frac{BC}{EF}\right)^2 = \left(\frac{6}{2}\right)^2 = 9$$

The area of $\triangle ABC$ is 9 times bigger than the area of $\triangle DEF$. 
Example

\( \triangle XYZ \) and \( \triangle ABC \) are similar triangles.

Given the dimensions shown in the diagram, what is the area of \( \triangle ABC \)?

Express the answer in square units.

\[
\begin{align*}
\text{perimeter of } \triangle ABC & \quad \text{perimeter of } \triangle DEF \\
\therefore \frac{BC}{EF} & = \frac{6}{2} = 3
\end{align*}
\]

The perimeter of \( \triangle ABC \) is 3 times bigger than \( \triangle DEF \).