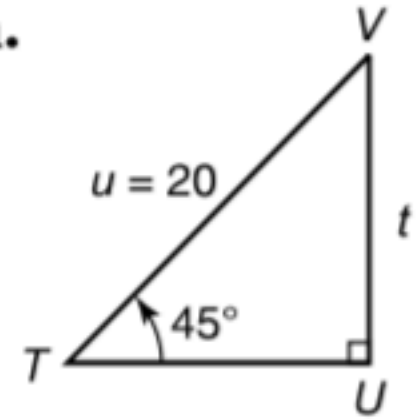
Applying Trigonometric Functions

Trigonometric functions can be used to solve problems involving right triangles.

Example 1 **If $T = 45°$ and $u = 20$, find t to the nearest tenth.**



From the figure, we know the measures of an angle and the hypotenuse. We want to know the measure of the side opposite the given angle. The sine function relates the side opposite the angle and the hypotenuse.

$$\sin T = \frac{t}{u} \qquad sin = \frac{side\ opposite}{hypotenuse}$$

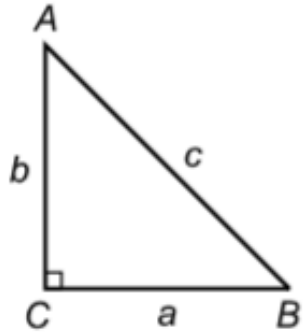
$$\sin 45° = \frac{t}{20}$$ *Substitute 45° for T and 20 for u.*

$$20 \sin 45° = t$$ *Multiply each side by 20.*

$$14.14213562 \approx t$$ *Use a calculator.*

Therefore, t is about 14.1.

Example 2 **If $c = 22$ and $b = 12$, find B.**



In this problem, we know the side opposite the angle and the hypotenuse. The sine function relates the side opposite the angle and the hypotenuse.

$\sin B = \frac{b}{c}$ $\qquad sin = \frac{side\ opposite}{hypotenuse}$

$\sin B = \frac{12}{22}$ $\qquad$ *Substitute 12 for b and 22 for c.*

$B = \sin^{-1}\left(\frac{12}{22}\right)$ $\qquad$ *Definition of inverse*

$B \approx 33.05573115$ or about $33.1°$.

Example 3 **Solve the triangle where $b = 20$ and $c = 35$, given the triangle above.**

$a^2 + b^2 = c^2$

$a^2 + 20^2 = 35^2$

$a = \sqrt{825}$

$a \approx 28.72281323$

$\cos A = \frac{b}{c}$

$\cos A = \frac{20}{35}$

$A = \cos^{-1}\left(\frac{20}{35}\right)$

$A \approx 55.15009542$

$55.15009542 + B \approx 90$

$B \approx 34.84990458$

Therefore, $a \approx 28.7$, $A \approx 55.2°$, and $B \approx 34.8°$.