5-5

Study Guide

Solving Right Triangles

When we know a trigonometric value of an angle but not the value of the angle, we need to use the inverse of the trigonometric function.

Trigonometric Function	Inverse Trigonometric Relation
$y = \sin x$	$x = \sin^{-1} y$ or $x = \arcsin y$
$y = \cos x$	$x = \cos^{-1} y$ or $x = \arccos y$
$y = \tan x$	$x = \tan^{-1} y$ or $x = \arctan y$

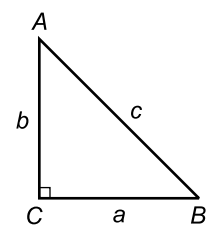
Example 1 **Solve $\tan x = \sqrt{3}$.**

If $\tan x = \sqrt{3}$, then x is an angle whose tangent is $\sqrt{3}$.

$x = \arctan \sqrt{3}$

From a table of values, you can determine that x equals 60°, 240°, or any angle coterminal with these angles.

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 $B \approx 34.8°$.