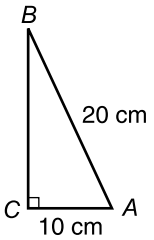
5-2

Study Guide

Trigonometric Ratios in Right Triangles

The ratios of the sides of right triangles can be used to define the **trigonometric** ratios known as the **sine, cosine,** and **tangent.**

Example 1 **Find the values of the sine, cosine, and tangent for $\angle A$.**



First find the length of $\overline{BC}$.

$(AC)^2 + (BC)^2 = (AB)^2$ *Pythagorean Theorem*

$10^2 + (BC)^2 = 20^2$ *Substitute 10 for AC and 20 for AB.*

$(BC)^2 = 300$

$BC = \sqrt{300}$ or $10\sqrt{3}$ *Take the square root of each side. Disregard the negative root.*

Then write each trigonometric ratio.

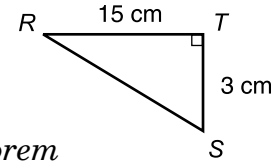
$\sin A = \frac{\textit{side opposite}}{\textit{hypotenuse}}$ $\cos A = \frac{\textit{side adjacent}}{\textit{hypotenuse}}$ $\tan A = \frac{\textit{side opposite}}{\textit{side adjacent}}$

$\sin A = \frac{10\sqrt{3}}{20}$ or $\frac{\sqrt{3}}{2}$ $\cos A = \frac{10}{20}$ or $\frac{1}{2}$ $\tan A = \frac{10\sqrt{3}}{10}$ or $\sqrt{3}$

Trigonometric ratios are often simplified but never written as mixed numbers.

Three other trigonometric ratios, called **cosecant, secant,** and **cotangent,** are reciprocals of sine, cosine, and tangent, respectively.

Example 2 **Find the values of the six trigonometric ratios for $\angle R$.**



First determine the length of the hypotenuse.

$(RT)^2 + (ST)^2 = (RS)^2$ *Pythagorean Theorem*

$15^2 + 3^2 = (RS)^2$ *RT = 15, ST = 3*

$(RS)^2 = 234$

$RS = \sqrt{234}$ or $3\sqrt{26}$ *Disregard the negative root.*

$\sin R = \frac{\textit{side opposite}}{\textit{hypotenuse}}$ $\cos R = \frac{\textit{side adjacent}}{\textit{hypotenuse}}$ $\tan R = \frac{\textit{side opposite}}{\textit{side adjacent}}$

$\sin R = \frac{3}{3\sqrt{26}}$ or $\frac{\sqrt{26}}{26}$ $\cos R = \frac{15}{3\sqrt{26}}$ or $\frac{5\sqrt{26}}{26}$ $\tan R = \frac{3}{15}$ or $\frac{1}{5}$

$\csc R = \frac{\textit{hypotenuse}}{\textit{side opposite}}$ $\sec R = \frac{\textit{hypotenuse}}{\textit{side adjacent}}$ $\cot R = \frac{\textit{side adjacent}}{\textit{side opposite}}$

$\csc R = \frac{3\sqrt{26}}{3}$ or $\sqrt{26}$ $\sec R = \frac{3\sqrt{26}}{15}$ or $\frac{\sqrt{26}}{5}$ $\cot R = \frac{15}{3}$ or 5