MBF 3C
4.3

Reciprocal Trigonometric Ratios

All 6 Trig Ratios

We know of 3 basic trig ratios that we use frequently:

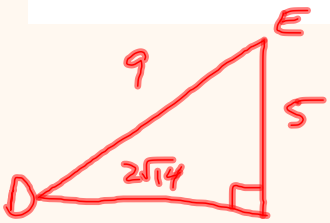
Sine	Cosine	Tangent
$sin\theta = \frac{O}{H}$	$cos\theta = \frac{A}{H}$	$tan\theta = \frac{O}{A}$

But there are 3 other ratios that can be used:

Cosecant	Secant	Cotangent
$csc\theta = \frac{H}{O}$	$Sec\theta = \frac{H}{A}$	$Cot\theta = \frac{A}{O}$
$csc\theta = \frac{1}{Sin\theta}$	$Sec\theta = \frac{1}{Cos\theta}$	$Cot\theta = \frac{1}{tan\theta}$

Example

In ΔDEF, if $csc\ D = \frac{9}{5}$, then determine cot D



$DF = \sqrt{9^2 - 5^2}$

$= \sqrt{56}$

$= \sqrt{4}\sqrt{14}$

$= 2\sqrt{14}$

$\csc D = \frac{9}{5}$, then $\sin D = \frac{5}{9}$

$\cot D = \frac{A}{O}$

$\cot D = \frac{2\sqrt{14}}{5}$

$\sec E = \frac{9}{\sqrt{5}}$

$\cot E = \frac{5}{2\sqrt{14}}$

Example

Each angle is in the first quadrant. Determine the measure of each angle, to the nearest degree.

a) $\csc A = 8$

$\sin A = \frac{1}{8}$

$A = \sin^{-1}\left(\frac{1}{8}\right)$

$A = 7°$

b) $\sec B = \frac{5}{2}$

$B = 66°$

c) $\cot C = \frac{5}{16}$

$C = 73°$

d) $\csc \theta = 2$

$\theta = 30°$

$\sin \theta = \frac{1}{2}$

$\theta = 30°$

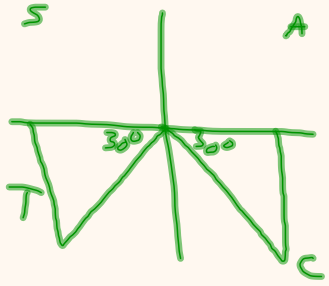
Example

Determine two angles between 0° and 360° that have a cosecant of −2.

$\csc\theta = -2$ $\quad \sin\theta = -\frac{1}{2}$

$\theta = 180 + 30^\circ$
$= 210^\circ$

$\theta = 360 - 30^\circ$
$= 330^\circ$



Example

Simplify:

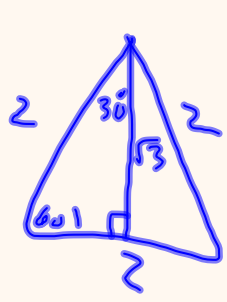
$\sec 60^\circ + \csc 30^\circ$

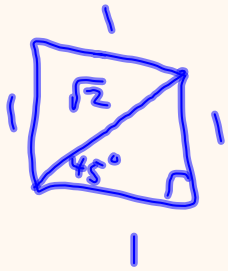
$= \frac{1}{\cos 60^\circ} + \frac{1}{\sin 30^\circ}$

$= \frac{1}{\frac{1}{2}} + \frac{1}{\frac{1}{2}}$

$= 2 + 2$

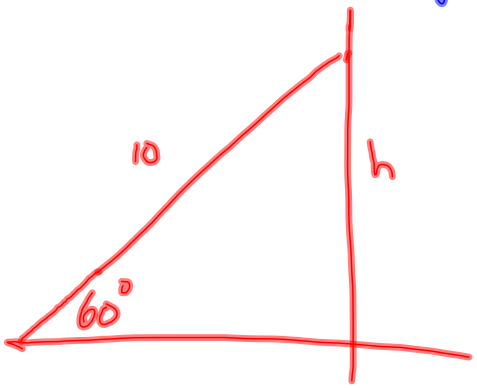
$= 4$





Example:

A 10 m ladder leans against a wall. It makes a 60° angle with the floor. How high up does it reach?



$\sin 60 = \frac{h}{10}$

$10 \sin 60 = h$

$10\left(\frac{\sqrt{3}}{2}\right) = h$

$h = 5\sqrt{3}$ m