Chapter 5 – Trigonometric Ratios

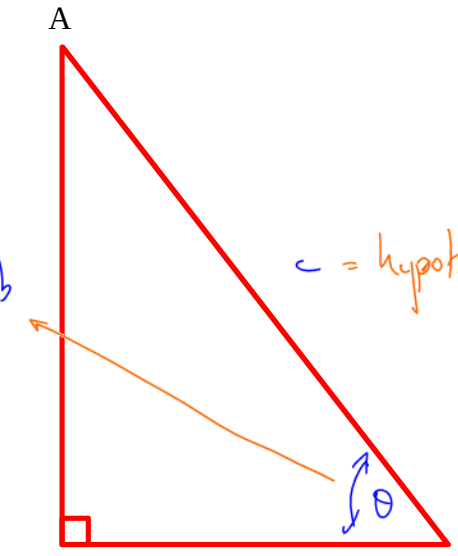
5.1 – Trigonometric Ratios of Acute Angles

Recall from Grade 10 the mnemonic

SOH CAH TOA

We use SOH CAH TAO to calculate the so-called "trig ratios" for a **right angle triangle**.

Consider the triangle:



θ = theta

c = hypotenuse

b: opp

a: adjacent

Note: "opposite" & "adjacent" depend on the angle we are considering.

$\sin = \frac{opp}{hyp}$

$\cos = \frac{adj}{hyp}$

$\tan = \frac{opp}{adj}$

The Trigonometric Ratios

Primary Trig Ratios

sine, cosine, tangent

Consider angle A

$\sin(A) = \frac{a}{c}$ $\frac{opp}{hyp}$

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

$\tan(A) = \frac{a}{b}$

Reciprocal Trig Ratios

cosecant (csc), secant (sec), cotangent (cot)

$\csc(A) = \frac{1}{\sin(A)} = \frac{c}{a}$

$\sec(A) = \frac{1}{\cos(A)} = \frac{c}{b}$

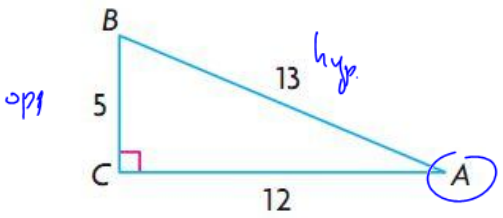
$\cot(A) = \frac{1}{\tan(A)} = \frac{b}{a}$

Example 5.1.1

From your text, Pg. 280 #1

SOH CAH TOA

Given $\triangle ABC$, state the six trigonometric ratios for $\angle A$.



$\sin(A) = \frac{5}{13}$ $\quad \csc(A) = \frac{13}{5}$

$\cos(A) = \frac{12}{13}$ $\quad \sec(A) = \frac{13}{12}$

$\tan(A) = \frac{5}{12}$ $\quad \cot(A) = \frac{12}{5}$

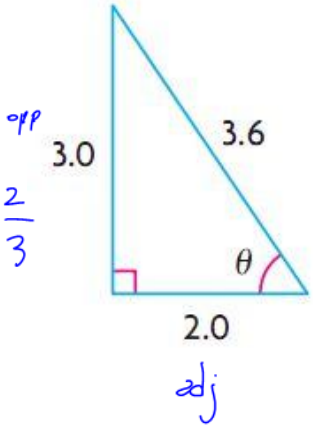
Example 5.1.2

SOH CAH TOA

For the given right triangle determine:

a) $\csc(\theta)$, $\sec(\theta)$, and $\cot(\theta)$.

b) the angle θ to the nearest degree.



a) $\csc(\theta) = \frac{3.6}{3} = 1.2$ $\quad \sec(\theta) = \frac{3.6}{2.0} = 1.8$ $\quad \cot(\theta) = \frac{2}{3}$

b) $\sin(\theta) = \frac{3}{3.6}$

$\theta = \sin^{-1}\left(\frac{3}{3.6}\right) = 56^\circ$

arcsin

Example 5.1.3

a) Determine the corresponding reciprocal ratio:

i) $\sin(\theta) = \frac{2}{5}$ $\qquad$ ii) $\tan(\theta) = -\frac{3}{1}$

$\csc(\theta) = \frac{5}{2}$ $\qquad \cot(\theta) = -\frac{1}{3}$

b) Calculate to the nearest hundredth: $\sec(34^\circ)$

$\sec(34^\circ) = \frac{1}{\cos(34^\circ)} = 1.21$

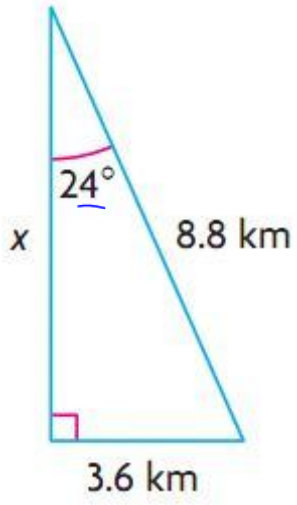
c) Determine the value of θ to the nearest degree: $\csc(\theta) = 2.46$

$\csc(\theta) = 2.46$

$\Rightarrow \sin(\theta) = \frac{1}{2.46}$ $\quad \theta = \sin^{-1}\left(\frac{1}{2.46}\right) = 24^\circ$

Example 5.1.4

Given the right triangle, determine the unknown side using two different trig ratios:



tangent : cosine

$\cos(24) = \frac{x}{8.8}$

$\Rightarrow x = (8.8)\cos(24)$

$= 8.04$

adj

$\frac{\tan(24)}{1} = \frac{3.6}{x}$

$x \cdot \tan(24) = 3.6$

$\Rightarrow x = \frac{3.6}{\tan(24)}$

$= 8.09$

opp

Example 5.1.5

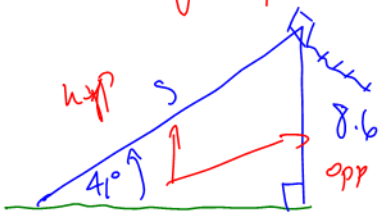
From your text, Pg. 282 #11

A kite is flying 8.6 m above the ground at an angle of elevation of 41°. Calculate the length of string, to the nearest tenth of a metre, needed to fly the kite using

a) a primary trigonometric ratio

b) a reciprocal trigonometric ratio

Pictures are your friend



$\sin(41) = \frac{8.6}{s}$

$s = \frac{8.6}{\sin(41)} = 13.1\text{ m}.$

∴ The string is 13.1 m long.

Class/Homework: Pg. 280 – 282 # 3, 4, 5i,ii,iv, 6, 7, 8a, 12, 14, 15