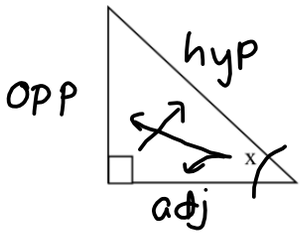
1.1 Trigonometry in Right Triangles

Learning Goals: I am learning to…

- ☐ Identify and label the opposite, adjacent and hypotenuse sides in a right triangle
- ☐ Use the primary trigonometric ratios to determine an unknown side and/or angle in a right triangle
- ☐ Identify which ratio to used based on the given information

The **primary trigonometric ratios** are used to solve for any missing side or angle in a right triangle.

SOH	CAH	TOA
$\sin\theta = \frac{opp}{hyp}$	$\cos\theta = \frac{adj}{hyp}$	$\tan\theta = \frac{opp}{adj}$

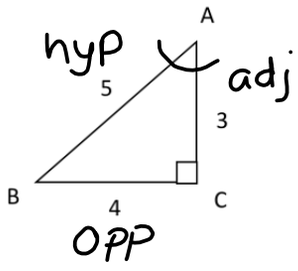


1. Always label the sides relative to the angle of interest (i.e opp, adj, hyp)
2. Decide which ratio (sin/cos/tan) you need to use based on what you have been given/need to find (use a process of elimination)
3. Set up the ratio with your known sides/angles
4. Solve for the unknown side or angle

Example 1: Determine the ratios of sin A, cos A, and tan A.

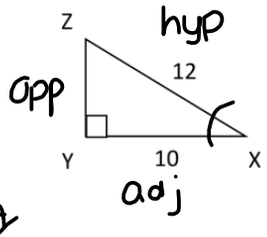
$\sin A = \frac{opp}{hyp}$ $\cos A = \frac{adj}{hyp}$ $\tan A = \frac{opp}{adj}$

$\sin A = \frac{4}{5}$ $\cos A = \frac{3}{5}$ $\tan A = \frac{4}{3}$



Example 2: Solve for ∠ X in each.

a)



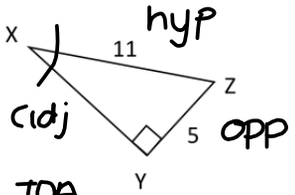
SOH CAH TOA

$\cos\theta = \frac{adj}{hyp}$ $\cos X = \frac{10}{12}$

$X = \cos^{-1}\left(\frac{10}{12}\right)$

$X = 33.6°$

b)



SOH CAH TOA

$\sin\theta = \frac{opp}{hyp}$ $\sin X = \frac{5}{11}$

$X = \sin^{-1}\left(\frac{5}{11}\right)$

$X = 27.0°$

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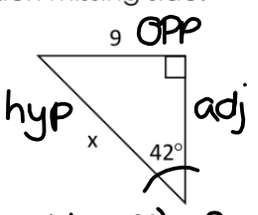
Example 3: Solve for each missing side.

a)

SOH CAH TOA

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

$\frac{\sin 42^\circ}{1} = \frac{9}{x}$



$x(\sin 42^\circ) = 9$

$\frac{x(\sin 42^\circ)}{\sin 42^\circ} = \frac{9}{\sin 42^\circ}$

$x = 13.5$

b)

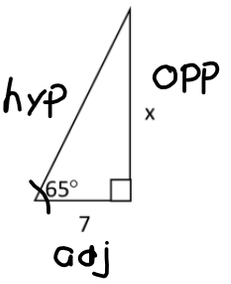
SOH CAH TOA

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

$\frac{\tan 65^\circ}{1} = \frac{x}{7}$

$7(\tan 65^\circ) = x$

$15.0 = x$



Example 4: A 9.5 m ladder leans against a vertical wall. If the foot of the ladder is 2 m from the base of the wall, what angle does the ladder make with the ground?

let θ rep. the angle with the ground.

SOH CAH TOA

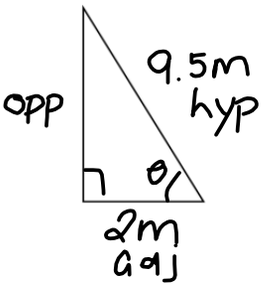
$\cos\theta = \frac{adj}{hyp}$

$\cos\theta = \frac{2}{9.5}$

$\theta = \cos^{-1}\left(\frac{2}{9.5}\right)$

$\theta = 77.8^\circ$

∴The angle with the ground is 77.8°



Example 5: A 200 m cable attached to the top of an antenna makes an angle of 37° with the ground. How tall is the antenna?

let h. rep. the height of the tower.

SOH CAH TOA

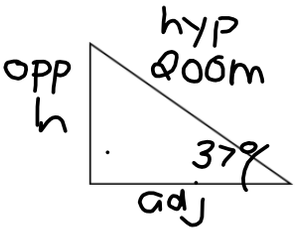
$\sin\theta = \frac{opp}{hyp}$

$\sin 37^\circ = \frac{h}{200}$

$200(\sin 37^\circ) = h$

$120.4\text{m} = h$

∴The height of the antenna is 120.4m.



Example 6: Solve for x and y.

① $\angle y = 180^\circ - 90^\circ - 49^\circ$

$\angle y = 41^\circ$

③ SOH CAH TOA

$\frac{\sin 54^\circ}{1} = \frac{9.8}{x}$

$\frac{x(\sin 54^\circ)}{\sin 54^\circ} = \frac{9.8}{\sin 54^\circ}$

$x = 12.1\text{cm}$

② common side, z

SOH CAH TOA

$\frac{\cos 49^\circ}{1} = \frac{z}{15}$

$15(\cos 49^\circ) = z$

$9.8\text{cm} = z$