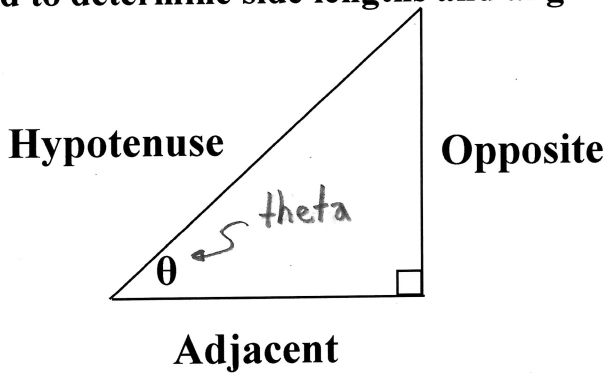


Trigonometric Ratios of Acute Angles

Recall: SOH CAH TOA

→ used to determine side lengths and angles in *right triangles*.



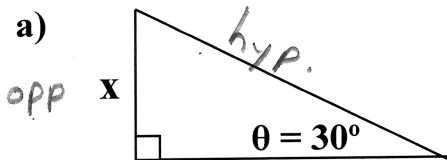
$$\sin \theta = \frac{\text{opp}}{\text{hyp}}$$

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

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

Example 1

Determine the side length x using SOH CAH TOA



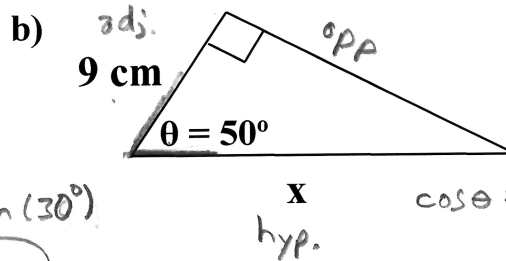
12 cm
adj.

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

$$\tan(30^\circ) = \frac{x}{12}$$

$$x = 12 \tan(30^\circ)$$

$$x \approx 6.9 \text{ cm}$$



adj. 9 cm
opp.
hyp. x

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

$$\cos(50^\circ) = \frac{9}{x}$$

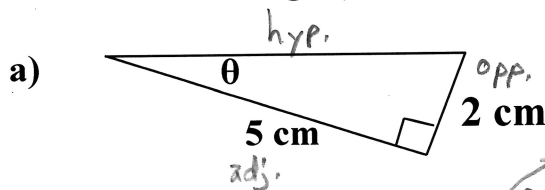
$$x \cos(50^\circ) = \frac{9}{\cos(50^\circ)}$$

$$x \approx 14.0 \text{ cm}$$

deg
rad
grad
* make sure calc is in degree mode

Example 2

Determine the angle θ using SOH CAH TOA.



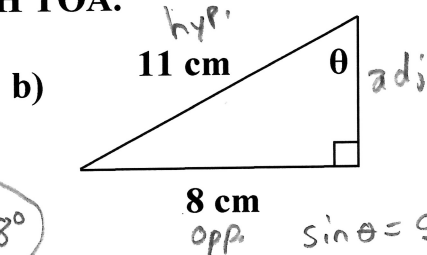
hyp. 5 cm
opp. 2 cm
adj.

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

$$\tan \theta = \frac{2}{5}$$

$$\theta = \tan^{-1}\left(\frac{2}{5}\right)$$

$$\theta \approx 21.8^\circ$$



hyp. 11 cm
adj.
opp. 8 cm

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

$$\sin \theta = \frac{8}{11}$$

$$\theta = \sin^{-1}\left(\frac{8}{11}\right)$$

$$\theta \approx 46.7^\circ$$

Reciprocal trigonometric ratios

The reciprocal trigonometric ratios of the primary trigonometric ratios are defined as 1 divided by each of the primary trigonometric ratios:

<u>c</u> osecant -->	$\csc \theta = \frac{1}{\sin \theta} = \frac{\text{hypotenuse}}{\text{opposite}}$
<u>s</u> ecant -->	$\sec \theta = \frac{1}{\cos \theta} = \frac{\text{hypotenuse}}{\text{adjacent}}$
<u>c</u> otangent -->	$\cot \theta = \frac{1}{\tan \theta} = \frac{\text{adjacent}}{\text{opposite}}$

Example 3

Evaluate to the nearest hundredth.

a) $\sec(25^\circ) = \frac{1}{\cos(25^\circ)}$
 ≈ 1.103

b) $\cot(50^\circ) = \frac{1}{\tan(50^\circ)}$
 ≈ 0.839

c) $\csc(30^\circ) = \frac{1}{\sin(30^\circ)}$
 $= 2$

Example 4

Solve for angle θ .

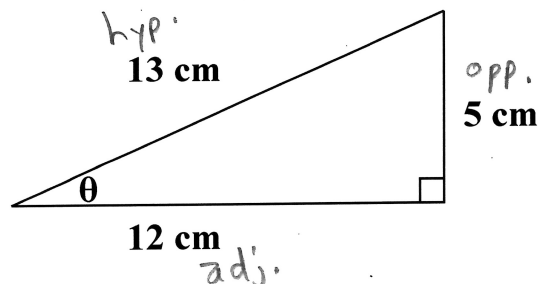
a) $\cot \theta = 4.5$
 $\frac{1}{\tan \theta} = 4.5$
 $\frac{4.5 \tan \theta}{4.5} = \frac{1}{4.5}$
 $\tan \theta = \frac{1}{4.5}$
 $\theta = \tan^{-1}\left(\frac{1}{4.5}\right)$
 $\theta \approx 12.5^\circ$

b) $\csc \theta = 2.1$
 $\frac{1}{\sin \theta} = 2.1$
 $\sin \theta = \frac{1}{2.1}$
 $\theta = \sin^{-1}\left(\frac{1}{2.1}\right)$
 $\theta \approx 28.4^\circ$

c) $\sec \theta = 1.25$
 $\frac{1}{\cos \theta} = 1.25$
 $\cos \theta = \frac{1}{1.25}$
 $\theta = \cos^{-1}\left(\frac{1}{1.25}\right)$
 $\theta \approx 36.9^\circ$

Example 5

Determine angle θ using a reciprocal trigonometric ratio.



$\sec \theta = \frac{\text{hyp.}}{\text{adj.}}$
 $\sec \theta = \frac{13}{12}$
 $\cos \theta = \frac{12}{13}$
 $\theta = \cos^{-1}\left(\frac{12}{13}\right)$
 $\theta \approx 22.6^\circ$