7.3: Right Triangle Trigonometry

Six trig ratios

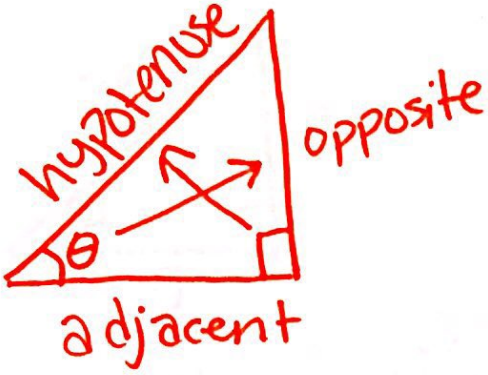
sine (sin) — secant (sec)

cosine (cos) — cosecant (csc)

tangent (tan) — cotangent (cot)

↑ reciprocal relationships

"SOH CAH TOA"



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

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

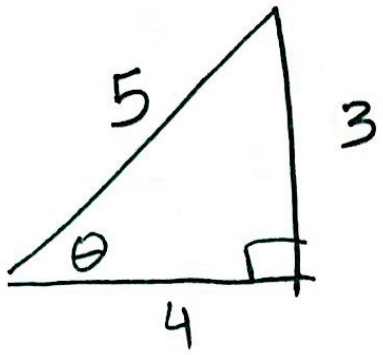
$\tan\theta = \frac{opp}{adj}$

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

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

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

Ex 1) Given $\sin\theta = \frac{3}{5}$ ($\frac{opp}{hyp}$) and $\cos\theta = \frac{4}{5}$ ($\frac{adj}{hyp}$) find all trig ratios

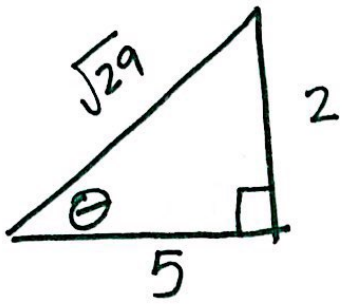


$\sin\theta = \frac{3}{5}$ $\quad \csc\theta = \frac{5}{3}$

$\cos\theta = \frac{4}{5}$ $\quad \sec\theta = \frac{5}{4}$

$\tan\theta = \frac{3}{4}$ $\quad \cot\theta = \frac{4}{3}$

Ex 2) Given $\tan\theta = \frac{2}{5}$ ($\frac{o}{a}$) find all trig ratios



$5^2 + 2^2 = h^2$

$\sqrt{29} = \sqrt{h^2}$

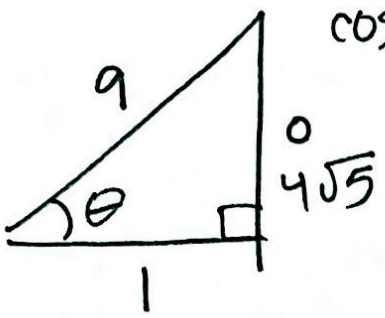
$h = \sqrt{29}$

$\sin\theta = \frac{2}{\sqrt{29}} \cdot \frac{\sqrt{29}}{\sqrt{29}} = \frac{2\sqrt{29}}{29}$ $\quad \csc\theta = \frac{\sqrt{29}}{2}$

$\cos\theta = \frac{5}{\sqrt{29}} \cdot \frac{\sqrt{29}}{\sqrt{29}} = \frac{5\sqrt{29}}{29}$ $\quad \sec\theta = \frac{\sqrt{29}}{5}$

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

Ex 3) Given $\sec\theta = \frac{9}{1}$ (h/a), find all trig ratios.



$\cos\theta = \frac{1}{9}$

$o^2 + 1^2 = 9^2$

$\sqrt{o^2} = \sqrt{80}$

$20 \quad 4$

$4 \quad 5 \quad 2 \quad 2$

$2 \quad 2$

$2 \cdot 2 \quad 2 \quad 2 \quad 5$

$2 \cdot 2\sqrt{5}$

$4\sqrt{5}$

$\sin\theta = \frac{4\sqrt{5}}{9}$

$\csc\theta = \frac{9}{4\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{9\sqrt{5}}{4 \cdot 5} = \frac{9\sqrt{5}}{20}$

$\cos\theta = \frac{1}{9}$

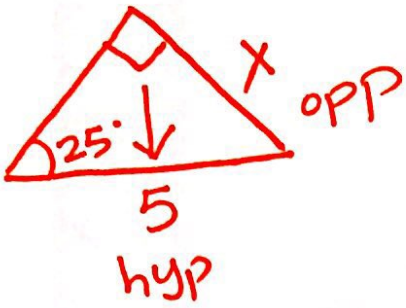
$\sec\theta = 9$

$\tan\theta = \frac{4\sqrt{5}}{1} = 4\sqrt{5}$

$\cot\theta = \frac{1}{4\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{5}}{20}$

Right Triangle Trig to Find sides/angles

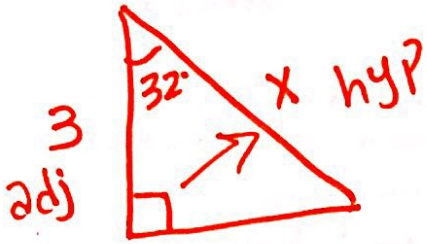
Ex 4) Solve for X



$5 \cdot \sin 25^\circ = \frac{X}{5} \cdot 5$

$X = 2.113$

Ex 5) Solve for X



$X \cdot \cos 32^\circ = \frac{3}{X} \cdot X$

$\frac{X \cdot \cos 32^\circ}{\cos 32^\circ} = \frac{3}{\cos 32^\circ}$

$X = 3.538$

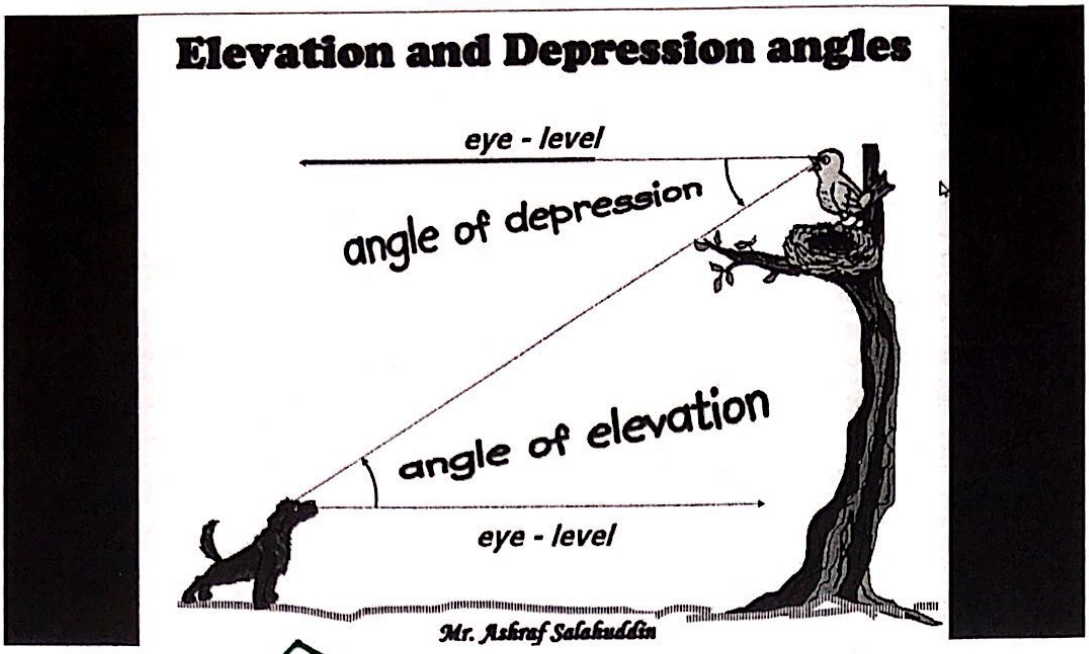
Ex 6) Solve for θ.

$\tan^{-1}(\tan\theta) = \tan^{-1}\left(\frac{11}{17}\right)$

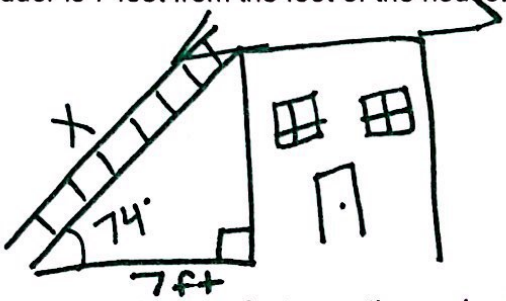
$\theta = \tan^{-1}\left(\frac{11}{17}\right)$

$\theta = 32.905$

you try:

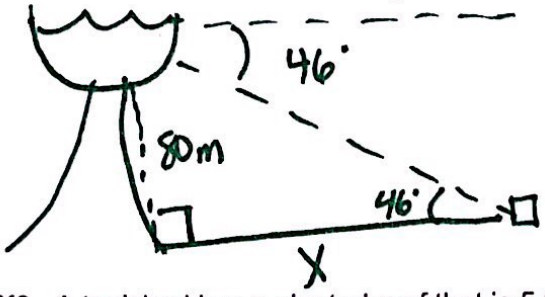


EX1. A ladder leaning against a house makes an angle of 74° with the ground. The foot of the ladder is 7 feet from the foot of the house. How long is the ladder?



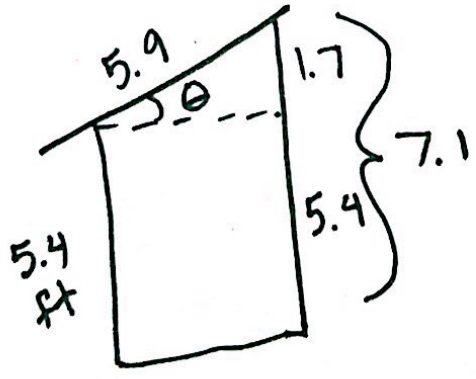
$X = 25.396$ ft

EX2. From the top of a tower, the angle of depression to a stake on the ground is 46°. The top of the tower is 80 meters above ground. How far is the stake from the foot of the tower?



$X = 77.255$ m

EX3. A toolshed has a slanted roof that is 5.9 feet long. The height of the front edge of the roof is 7.1 feet. The height of the back edge of the roof 5.4 feet. At what angle does the roof rise from the horizontal?



$\theta = 16.746°$