Trigonometric Ratios

Triangles in Quadrant I

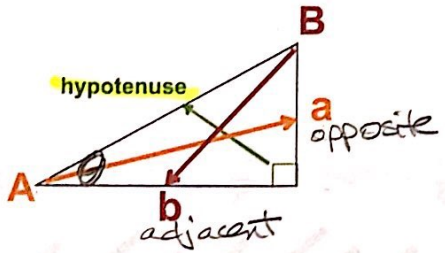
I

a *Trig Ratio* is …

… a ratio of the lengths of two sides of a right Δ

Right Triangles

- **The hypotenuse is opposite the right angle.**
- **The shortest leg is opposite the smallest angle.**
- **The longest leg is opposite the largest angle.**

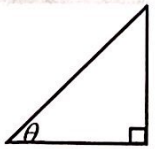


3 Basic Trig Ratios

- Sine (sin)
- Cosine (cos)
- Tangent (tan)

These trig ratios (or trig functions) can be used to SOLVE a right triangle … that means to find all the side lengths and angle measures of the right triangle.

Know!



- $\sin\theta = \frac{opposite}{hypotenuse}$
- $\cos\theta = \frac{adjacent}{hypotenuse}$
- $\tan\theta = \frac{opposite}{adjacent}$

Just remember Chief...

SOHCAHTOA

Sine Opposite Hypotenuse Cosine Adjacent Hypotenuse Tangent Opposite Adjacent

$S = \frac{o}{h}$ $C = \frac{a}{h}$ $\tan = \frac{o}{a}$

Each trig function has a *RECIPROCAL* function.

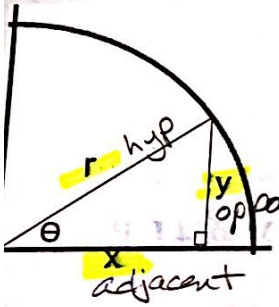
Know

- sine → cosecant (csc)
- cosine → secant (sec)
- tangent → cotangent (cot)

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

$\csc\theta = \frac{hyp}{opp}$ $\sec\theta = \frac{hyp}{adj}$ $\cot\theta = \frac{adj}{opp}$

Six Trig Ratios of ∠ Θ

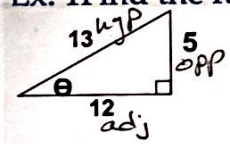


$\sin\theta = \frac{y}{r}\ \frac{opp}{hyp}$ $\csc\theta = \frac{r}{y}\ \frac{H}{O}$

$\cos\theta = \frac{x}{r}\ \frac{adj}{hyp}$ $\sec\theta = \frac{r}{x}\ \frac{h}{a}$

$\tan\theta = \frac{y}{x}\ \frac{opp}{adj}$ $\cot\theta = \frac{x}{y}\ \frac{a}{O}$

Ex. 1 Find the ratios for the 6 trig functions



$\sin\theta = \frac{o}{h} = \frac{5}{13}$ $\csc\theta = \frac{13}{5}$

$\cos\theta = \frac{a}{h} = \frac{12}{13}$ $\sec\theta = \frac{13}{12}$

$\tan\theta = \frac{o}{a} = \frac{5}{12}$ $\cot\theta = \frac{12}{5}$

special Right Triangle

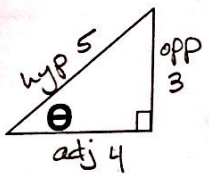
5, 12, 13

3, 4, 5

Ex. 2 Find the ratios for the 6 trig functions.

Use Pythagorean Theorem to find the missing side length

Given: $\csc\theta = 5/3$ $\frac{H}{O}$



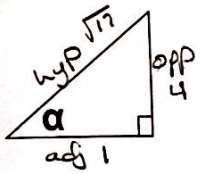
$\sin\theta = \frac{3}{5}$ $\csc\theta = \frac{5}{3}$

$\cos\theta = \frac{a}{h} = \frac{4}{5}$ $\sec\theta = \frac{5}{4}$

$\tan\theta = \frac{o}{a} = \frac{3}{4}$ $\cot\theta = \frac{4}{3}$

Ex. 3 Find the ratios for the 6 trig functions.

Given: $\tan\alpha = \frac{4}{1}$ $\frac{o}{a}$



$\sin a = \frac{o}{h} = \frac{4}{\sqrt{17}} = \frac{4\sqrt{17}}{17}$ $\csc a = \frac{\sqrt{17}}{4}$

$\cos a = \frac{a}{h} = \frac{1}{\sqrt{17}} = \frac{\sqrt{17}}{17}$ $\sec a = \frac{\sqrt{17}}{1} = \sqrt{17}$

$\tan a = 4$ $\cot a = \frac{1}{4}$

$a^2 + b^2 = c^2$

$4^2 + 1^2 = c^2$

$16 + 1 = c^2$

$17 = c^2$

$\sqrt{17} = c$

Rationalize the denominator

$\frac{4}{\sqrt{17}} \cdot \frac{\sqrt{17}}{\sqrt{17}} = \frac{4\sqrt{17}}{17}$

$\frac{1}{\sqrt{17}} \cdot \frac{\sqrt{17}}{\sqrt{17}} = \frac{\sqrt{17}}{17}$