SOH-CAH-TOA

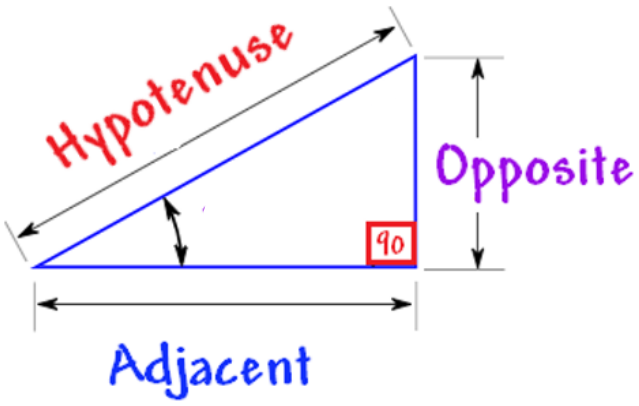
Ok so last class we talked about how we changed

$$(x\ ,\ y)\ \text{ to }\ (\cos\ ,\ \sin)$$

And this worked great for finding things on the unit circle

But the question remained why is cosine 'x' and sine 'y'

The right triangle

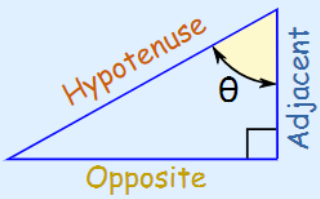


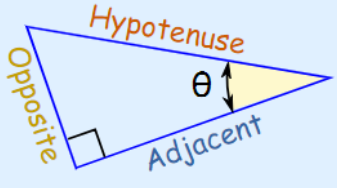
Firstly, the names Opposite, Adjacent and Hypotenuse come from the right triangle.

- **"Opposite" is opposite to the angle θ**
- **"Adjacent" is adjacent (next to) to the angle θ**
- **"Hypotenuse" is the long one**

Adjacent is always next to the angle

And **Opposite** is opposite the angle





Sine, Cosine and Tangent

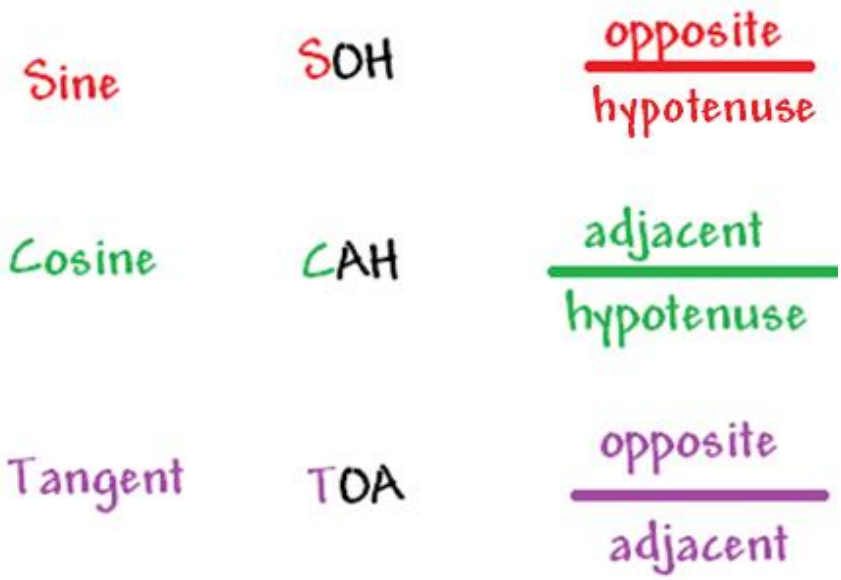
And Sine, Cosine and Tangent are the three main functions in trigonometry (shortened to sin, cos and tan)

The calculation is simple

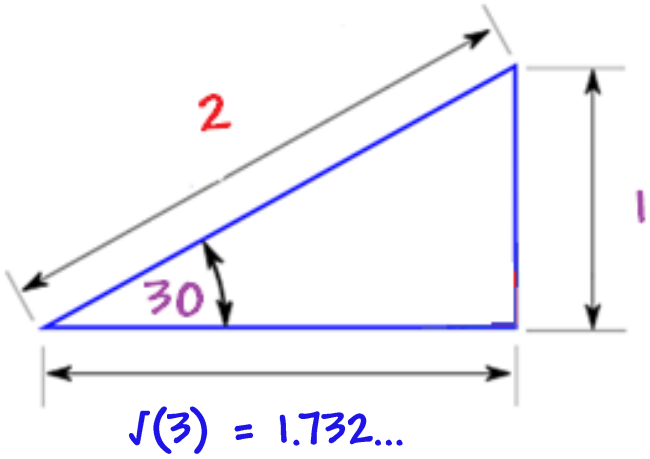
Just take one side of a right angled triangle divided by another side ...

we just have to know which sides, and that is where "sohcahtoa" helps. Or if you aren't great at spelling…

'Some old horse, caught another horse, taking oats away'

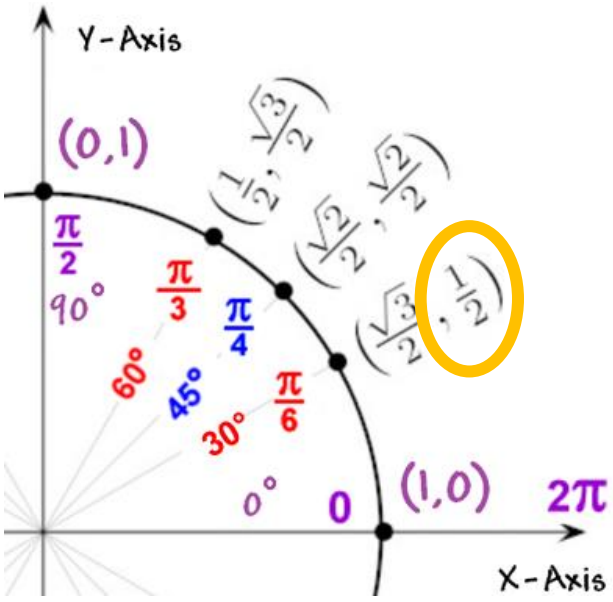


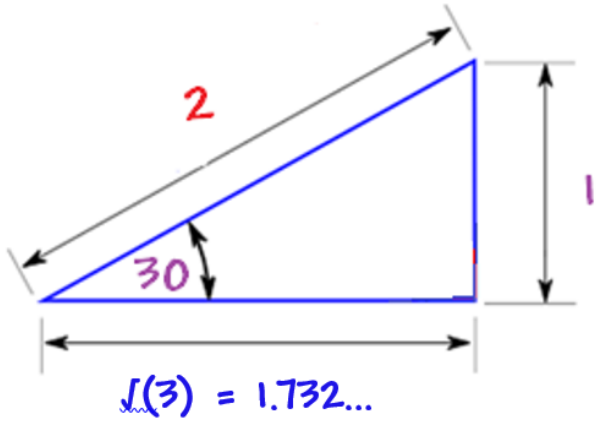
Check it out:



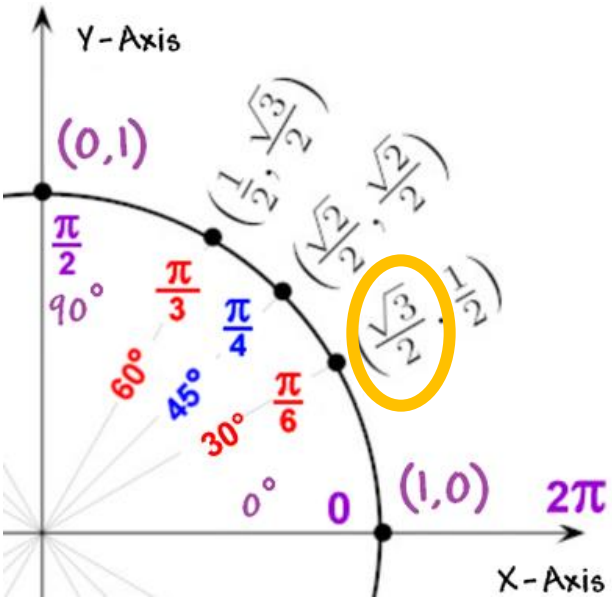
$$\sin(30) = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{1}{2}$$

Notice I would get the same answer by finding Sin(30) on the unit circle



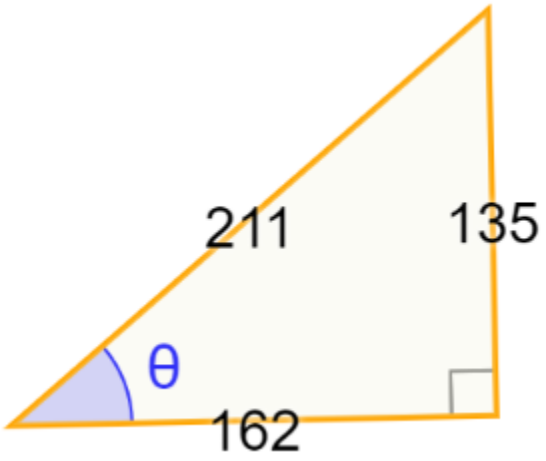


$$\cos(30) = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{\sqrt{3}}{2}$$



$$\tan(30) = \frac{\text{opposite}}{\text{adjacent}} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$$

Try it:

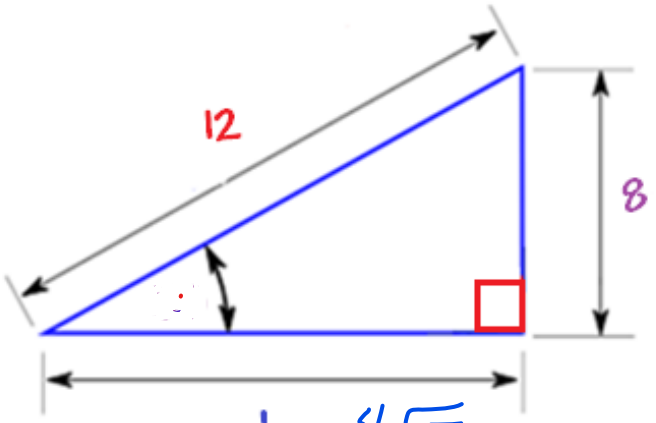


$$\sin(\theta) = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos(\theta) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan(\theta) = \frac{\text{opposite}}{\text{adjacent}}$$

Try it:



Find b

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

$8^2 + b^2 = 12^2$

$64 + b^2 = 144$

$b^2 = 144 - 64$

$b^2 = 80$

$b = \sqrt{80}$

8 10

4 2 2 5

2 2

$b = 2 \cdot 2\sqrt{5}$

$b = 4\sqrt{5}$

$\sin\theta = \frac{opp}{hyp} = \frac{8}{12} = \frac{2}{3}$

$\cos\theta = \frac{adj}{hyp} = \frac{4\sqrt{5}}{12} = \frac{\sqrt{5}}{3}$

$\tan\theta = \frac{opp}{adj} = \frac{8}{4\sqrt{5}} = \frac{2}{\sqrt{5}}$

$= \frac{2}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$

Rationalize