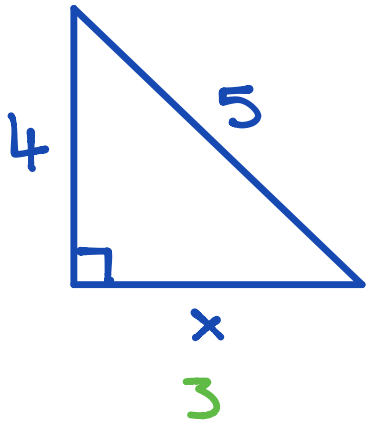
Pythagorean Theorem

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

- only works on right triangles.
- a and b are the legs, c is the hypotenuse

Ex.1 Find the missing side.



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

$4^2+x^2=5^2$

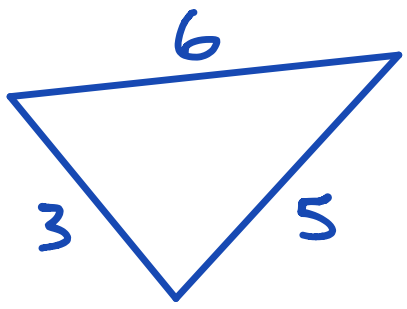
$16+x^2=25$

$-16 \quad -16$

$\sqrt{x^2}=\sqrt{9}$

$x=3$

Ex.2 verify if it's a right triangle.



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

$3^2+5^2=6^2$

$9+25=36$

$34 \neq 36$

Trig Ratios

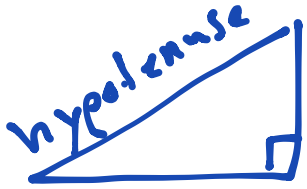
Trigonometry- the study of triangles.

Ratio- the relation between two quantities.

Adjacent side- the leg next to an acute angle in a right triangle that is not the hypotenuse.

Opposite side- the side across from an angle in a triangle.

Hypotenuse- the side opposite the 90° degree angle in a right triangle.



Complementary angles- two angles whose sum is 90 degrees.

Right triangle- a triangle with one angle that measures 90 degrees.

Sine- $\frac{\text{opposite side}}{\text{hypotenuse}}$

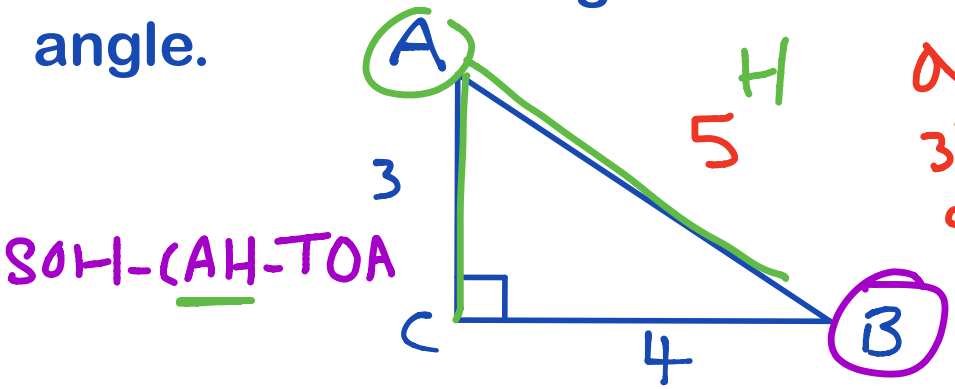
Cosine- $\frac{\text{adjacent side}}{\text{hypotenuse}}$

SOH-CAH-TOA

Tangent- $\frac{\text{opposite side}}{\text{adjacent side}}$

Theta- a Greek letter commonly used to refer to unknown angle measures. θ

Ex.1 Find all the trig functions for each angle.



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

$3^2+4^2=x^2$

$9+16=x^2$

$\sqrt{25}=\sqrt{x^2}$

$x=5$

$\sin A=\frac{4}{5}$

$\cos A=\frac{3}{5}$

$\tan A=\frac{4}{3}$

$\sin B=\frac{3}{5}$

$\cos B=\frac{4}{5}$

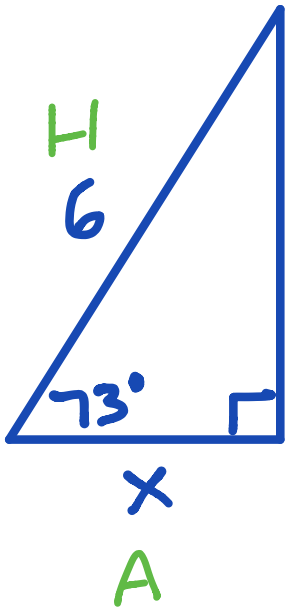
$\tan B=\frac{3}{4}$

Solving for missing sides

- Choose the trig ratio that matches the given information, then solve for the missing side.

SOH-CAH-TOA

Ex. 1



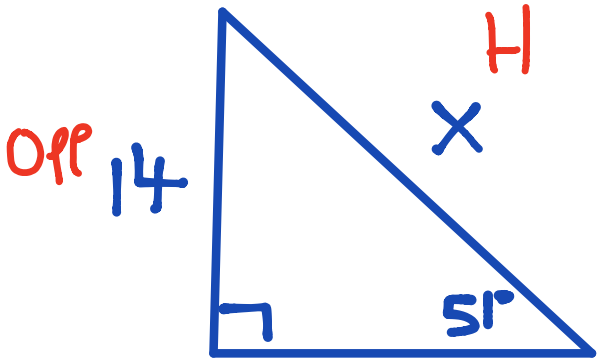
$6\cos 73^\circ = \frac{x}{6}$ (6)

$x = 6(\cos 73^\circ)$

$x = 1.75$

Ex.2

SOH-CAH-TOA



$X \cdot \sin 51^\circ = \left(\frac{14}{X}\right) X$

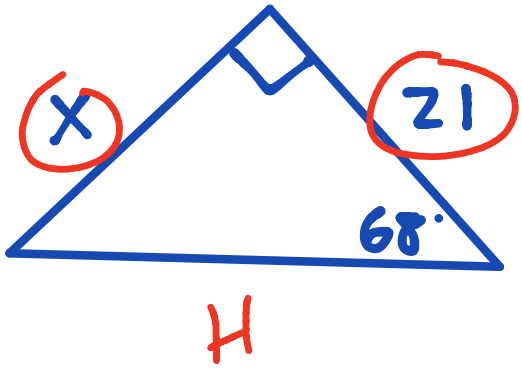
$\frac{X \cdot \sin 51}{\sin 51} = \frac{14}{\sin 51}$

$X = \frac{14}{\sin 51}$

$\boxed{X = 18}$

Ex.3

~~SOH-CAH-TOA~~



$21(\tan 68^\circ) = \left(\frac{X}{21}\right) 21$

$X = 21(\tan 68^\circ)$

$\boxed{X = 52}$

Solving for the missing angle

- Choose the trig ratio that matches the given information, then solve for the missing angle by using arcsin, arccos, or arctan.

Ex.1 solve for the angle.

A $\sin A = 0.5150$

$\sin^{-1}(\sin A) = \sin^{-1}(0.5150)$

$A = \sin^{-1}(0.5150)$

$A = 31°$

B $\cos W = 0.6157$

$W = \cos^{-1}(0.6157)$

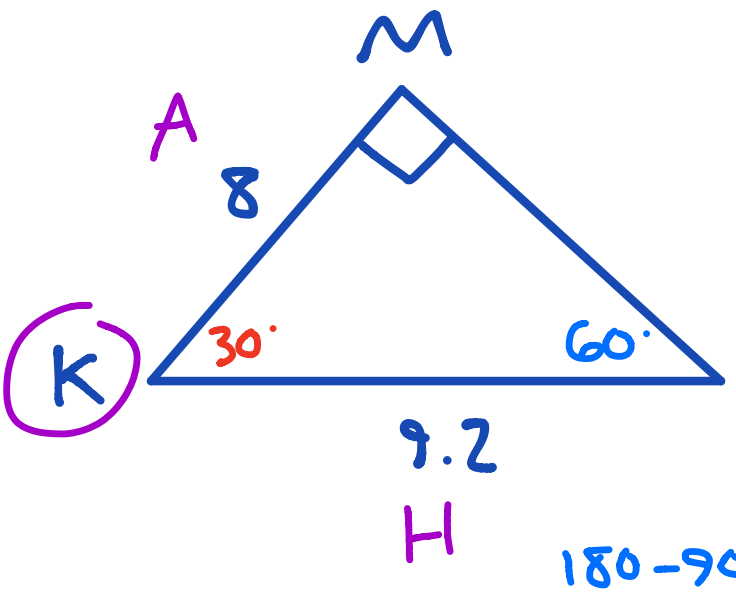
$W = 52°$

C $\tan W = 19.0811$

$W = \tan^{-1}(19.0811)$

$W = 87^\circ$

Ex.2 Solve for angle K.



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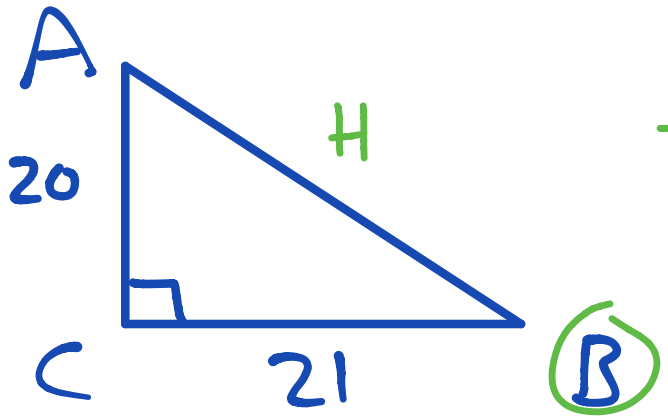
$\cos K = \frac{8}{9.2}$

$K = \cos^{-1}\left(\frac{8}{9.2}\right)$

$K = 30^\circ$

$180 - 90 - 30 = 60$

Ex.3 Find angle B.



$\tan B = \frac{20}{21}$

$B = \tan^{-1}\left(\frac{20}{21}\right)$

$B = 44^\circ$

Reciprocal Trig Functions

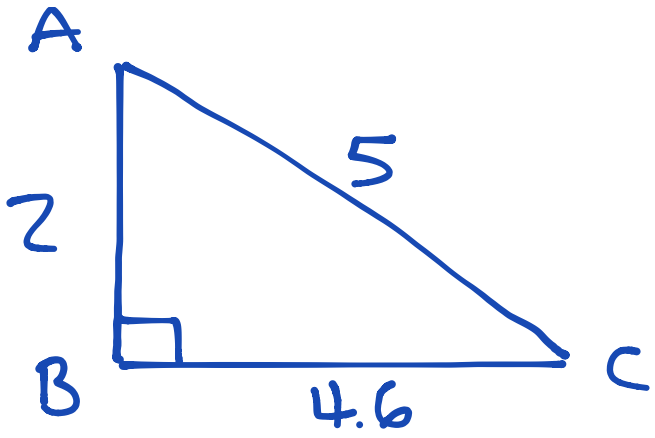
Reciprocal- is a number that when multiplied by the original the product is one.

$$\frac{\sin\theta}{1} = \frac{opp}{hyp} \qquad \csc\theta = \frac{hyp}{opp} = \frac{1}{\sin\theta}$$

$$\cos\theta = \frac{adj}{hyp} \qquad \sec\theta = \frac{hyp}{adj} = \frac{1}{\cos\theta}$$

$$\tan\theta = \frac{opp}{adj} \qquad \cot\theta = \frac{adj}{opp} = \frac{1}{\tan\theta}$$

Ex.1 Find cosecant, secant, and cotangent of angle C.

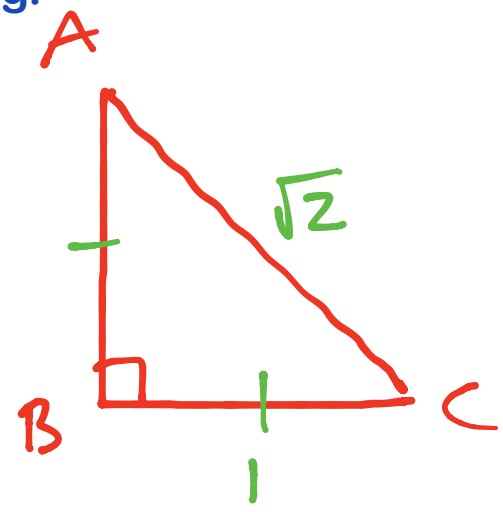


$\sin C = \frac{2}{5}$ $\quad \csc C = \frac{5}{2}$

$\cos C = \frac{4.6}{5}$ $\quad \sec C = \frac{5}{4.6}$

$\tan C = \frac{2}{4.6}$ $\quad \cot C = \frac{4.6}{2}$

Ex.2 what are the secant, cosecant, and cotangent ratios for an isosceles right triangle with legs that are one unit long.



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

$\sqrt{2} = \sqrt{c^2}$

$c = \sqrt{2}$

$\csc A = \frac{\sqrt{2}}{1}$ $\quad \sec A = \frac{\sqrt{2}}{1}$ $\quad \cot A = 1$

Ex.3 Evaluate each.

$\sin 60^\circ \approx .87$

$\cos 59^\circ \approx .52$

$\cot 65^\circ = \frac{1}{\tan 65^\circ} \approx .47$

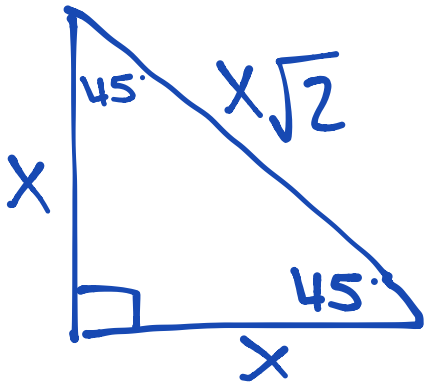
$\tan 25^\circ \approx .47$

$\sec 30^\circ = \frac{1}{\cos 30^\circ} \approx 1.15$

Special Right Triangles

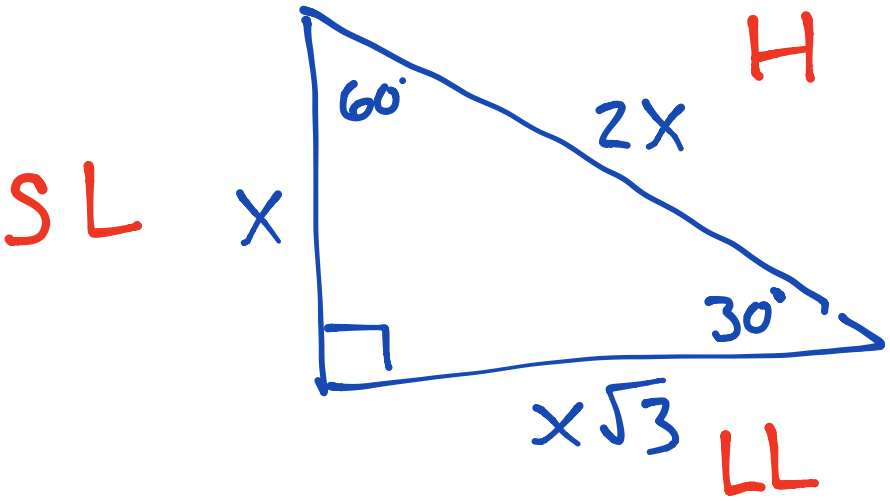
- Right triangles whose angle measures are 45-45-90 or 30-60-90.

45-45-90: the hypotenuse is $\sqrt{2}$ times as long as the leg.



Hypotenuse = leg · √2

30-60-90: the hypotenuse is twice as long as the shorter leg, and the longer leg is √3 times as long as the shorter leg.

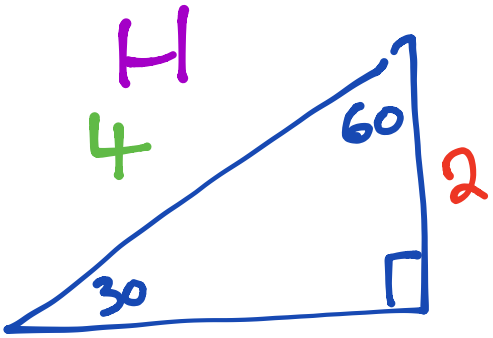


Hypotenuse = 2 · shorter leg

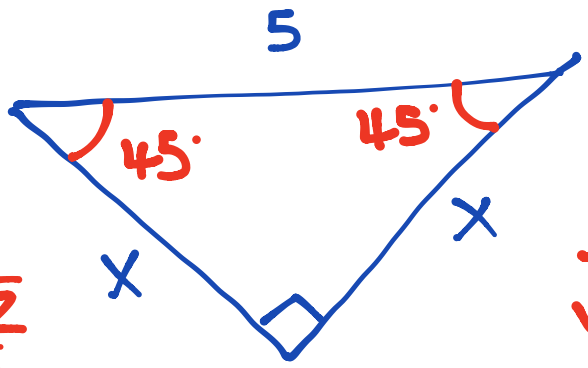
√3 · shorter leg

Longer Leg = 13 · sin

Ex.1



Ex.2 Find the value of x.

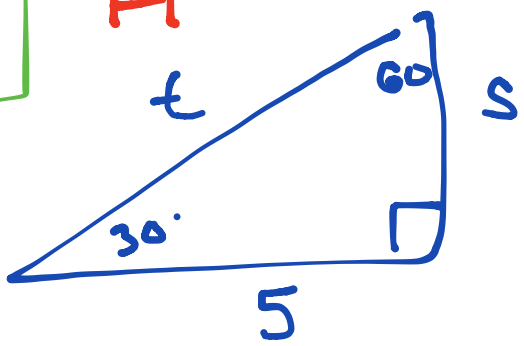


$\frac{5\sqrt{2}}{2}$

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

Ex.3 Find the value of s and t.

$\frac{10\sqrt{3}}{3}$

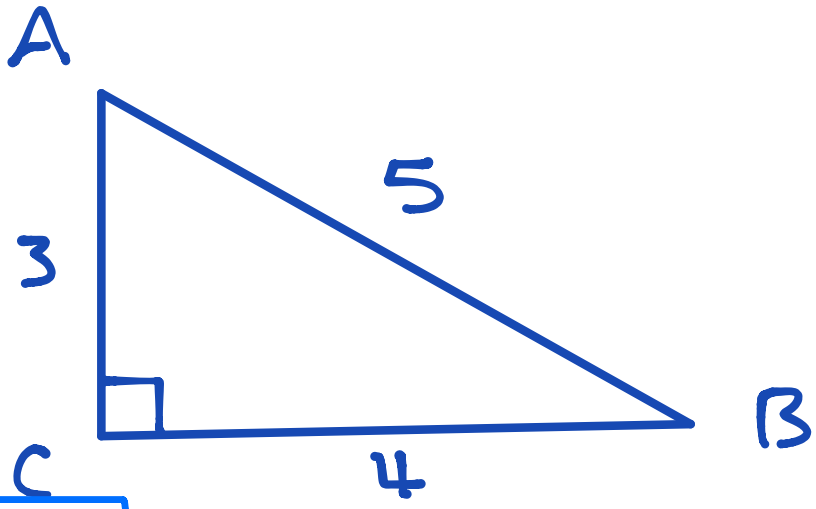


SL $\frac{5}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{5\sqrt{3}}{3}$

LL

Complements



$\sin A = \frac{4}{5}$

$\cos B = \frac{4}{5}$

$\cos A = \frac{3}{5}$

$\sin B = \frac{3}{5}$

- $\sin A = \cos B$, if $A+B = 90^\circ$

Confunction Identities

$\sin\theta = \cos(90^\circ - \theta)$

$\cos\theta = \sin(90^\circ - \theta)$

Ex.1 Find sin 28 if cos 62 = 0.469

$\sin 28 = \cos 62$

$\sin 28 = 0.469$

Ex.2 Find a value of X for which sinX = cos15.

$\sin 75 = \cos 15$ $\quad 90 - 15 = 75$

$x = 75$

Sin ___ = cos ___

Trig Application