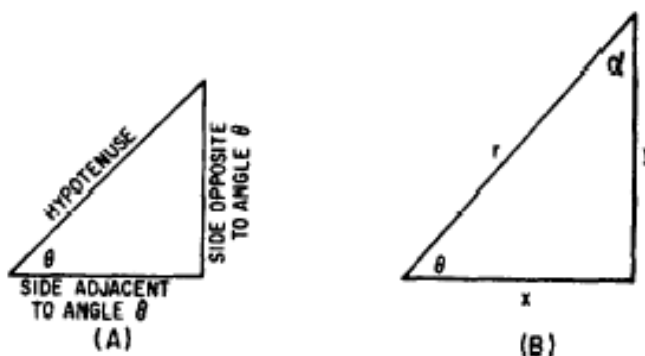


TRIGONOMETRIC RATIOS

The relationships between the angles and the sides of a right triangle are expressed in terms of TRIGONOMETRIC RATIOS. For example, in the following figure, the sides of the triangle are named in accordance with their relationship to angle θ . In trigonometry, angles are usually named by means of Greek letters. The Greek name of the symbol θ is theta.



The six trigonometric ratios for the angle θ are listed in the following table. In this course you have to learn the first three of them.

Name of ratio	Abbreviation
sine of θ	$\sin \theta$
cosine of θ	$\cos \theta$
tangent of θ	$\tan \theta$
cotangent of θ	$\cot \theta$
secant of θ	$\sec \theta$
cosecant of θ	$\csc \theta$

The ratios are defined as follows:

- $\sin \theta = \frac{\text{side opposite } \theta}{\text{hypotenuse}} = \frac{y}{r}$
- $\cos \theta = \frac{\text{side adjacent to } \theta}{\text{hypotenuse}} = \frac{x}{r}$
- $\tan \theta = \frac{\text{side opposite } \theta}{\text{side adjacent to } \theta} = \frac{y}{x}$
- $\cot \theta = \frac{\text{side adjacent to } \theta}{\text{side opposite } \theta} = \frac{x}{y}$
- $\sec \theta = \frac{\text{hypotenuse}}{\text{side adjacent to } \theta} = \frac{r}{x}$
- $\csc \theta = \frac{\text{hypotenuse}}{\text{side opposite to } \theta} = \frac{r}{y}$

sine and cosine

If we always had to say "the ratio of the height to the hypotenuse" and "the ratio of the base to the hypotenuse," it would just take too many words. So, mathematicians have come up with two words to describe these ratios.

The ratio of the height to the hypotenuse is called the sine (pronounced like the word "sign").

The ratio of the base to the hypotenuse is called the cosine (pronounced like "co-sign").

Abbreviation and Pronunciation

The word **sine** is abbreviated as **sin**, but it's still pronounced "sign." This is really important. Your parents or friends will be interested to hear this:



I learned all about **sin** on the Internet today. /sɪn/

They will be shocked to hear you say this:



I learned all about sin on the Internet today. /sɪn/

The word **cosine** is abbreviated as **cos** (but still pronounced "co-sign"). Luckily, you can't get into trouble if you mispronounce it.

The other acute angle in the above figure is labeled α (Greek alpha). The side opposite α is x and the side adjacent to α is y . Therefore the six ratios for α are as follows:

$$1. \sin \alpha = \frac{x}{r}$$

$$2. \cos \alpha = \frac{y}{r}$$

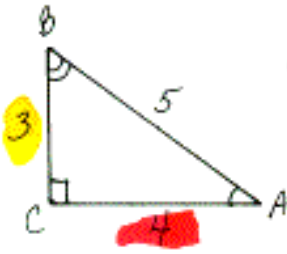
$$3. \tan \alpha = \frac{x}{y}$$

$$4. \cot \alpha = \frac{y}{x}$$

$$5. \sec \alpha = \frac{r}{y}$$

$$6. \csc \alpha = \frac{r}{x}$$

Ex:



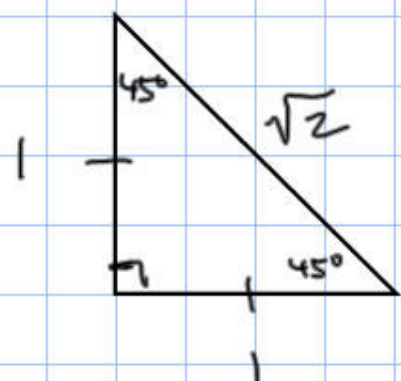
length of leg opposite angle A
length of hypotenuse = $\sin A = \frac{3}{5}$

length of leg adjacent to angle A
length of hypotenuse = $\cos A = \frac{4}{5}$

length of leg opposite angle A
length of leg adjacent to angle A = $\tan A = \frac{3}{4}$

TWO SPECIAL TRIANGLES

A) Isosceles Right triangle



isosceles right triangle

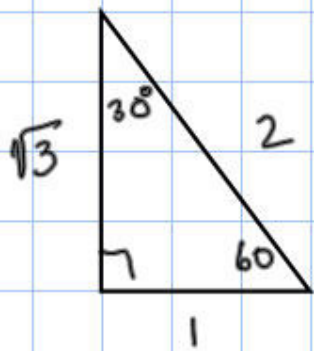
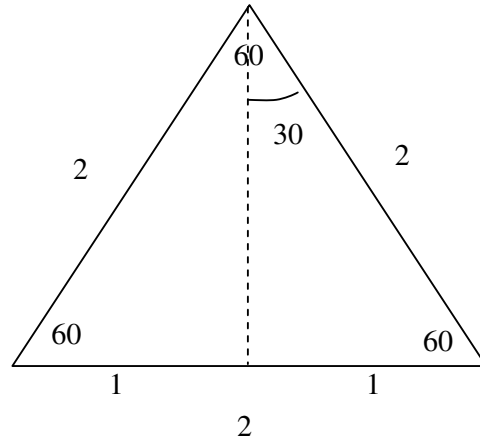
$1^2 + 1^2 = h^2$
 $1 + 1 = h^2$
 $2 = h^2$
 $\sqrt{2} = h$

$\sin 45 = \frac{1}{\sqrt{2}}$

$\cos 45 = \frac{1}{\sqrt{2}}$

$\tan 45 = \frac{1}{1} = 1$

B) 30-60-90 Right triangle



30-60-90 Δ

$$L^2 + 1^2 = 2^2$$

$$L^2 + 1 = 4$$

$$L^2 = 3$$

$$L = \sqrt{3}$$

$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\cos 60^\circ = \frac{1}{2}$$

$$\tan 60^\circ = \frac{\sqrt{3}}{1} = \sqrt{3}$$

	0°	30°	45°	60°	90°
$\sin \theta$	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
$\cos \theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
$\tan \theta$	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	$\pm \infty$

Letra griega (Mayúscula, minúscula)	Nombre en español	English name	English pronunciation
A α	Alfa	Alpha	/ˈælfə/
B β	Beta	Beta	/ˈbi:tə/, US /ˈbertə/
Γ γ	Gamma	Gamma	/ˈgæmə/
Δ δ	Delta	Delta	/ˈdeltə/
E ε	Épsilon	Epsilon	/ˈɛpsɪlən/, UK also /ɛpˈsaɪlən/
Z ζ	Dseta	Zeta	/ˈzi:tə/, US /ˈzertə/
H η	Eta	Eta	/ˈi:tə/, US /ˈertə/

Θ θ	Theta	Theta	/ˈθi:tə/, US /ˈθertə/
Ι ι	Iota	Iota	/aɪˈoʊtə/
Κ κ	Kappa, Cappa	Kappa	/ˈkæpə/
Λ λ	Lambda	Lambda	/ˈlæmdə/
Μ μ	Mi	Mu	/ˈmjuː/
Ν ν	Ni	Nu	/ˈnjuː/, US /ˈnuː/
Ξ ξ	Xi	Xi	/ˈzaɪ/, /ˈksaɪ/
Ο ο	Ómicron	Omicron	/ˈɒmɪkrən/, traditional UK /ˈoʊmaɪkrən/
Π π	Pi	Pi	/ˈpaɪ/
Ρ ρ	Rho	Rho	/ˈrou/
Σ σ ς	Sigma	Sigma	/ˈsɪgmə/
Τ τ	Tau	Tau	/ˈtaʊ/, also /ˈtɔː/
Υ υ	Ípsilon	Upsilon	/juːpˈsaɪlən/, /ˈʊpsɪlən/, US /ˈʌpsɪlən/
Φ φ	Fi	Phi	/ˈfaɪ/
Χ χ	Ji	Chi	/ˈkaɪ/

Ψ ψ	Psi	Psi	/ˈsaɪ/, /ˈpsaɪ/
Ω ω	Omega	Omega	US /oʊˈmeɪɡə/, traditional UK /ˈoʊmɪɡə/ ^{[2]}