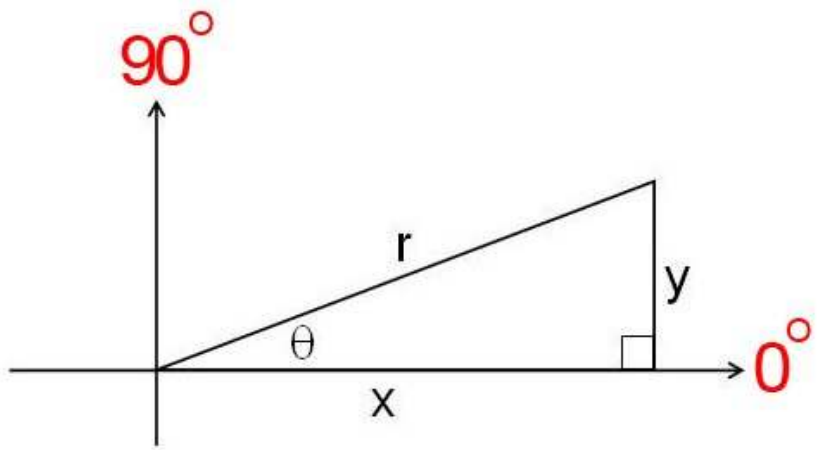
CAMI Education (Pty) Ltd
Reg. No. 1996/017609/07
CAMI House
Fir Drive, Northcliff
P.O. Box 1260
CRESTA, 2118
Tel. 086 100 4000
Fax. 086 601 4400

Understanding the CAMI Trigonometric Clock.

In Trigonometry, all the movement starts in the first quadrant on the X-axis. From there, the angular movement follows an anti-clockwise direction. The first 90 degrees are noted as the first quadrant, followed by the second quadrant from 90 –> 180 degrees, then the third quadrant from 180 –> 270, and lastly, the fourth quadrant from 270 to 360 degrees.

Therefore, with zero degrees being on the right, then +90 degrees would be straight up, as drawn here. This area between 0 and 90 degrees is called the First Quadrant and in the first quadrant, x and y are positive; r is always positive, as it is the radius.



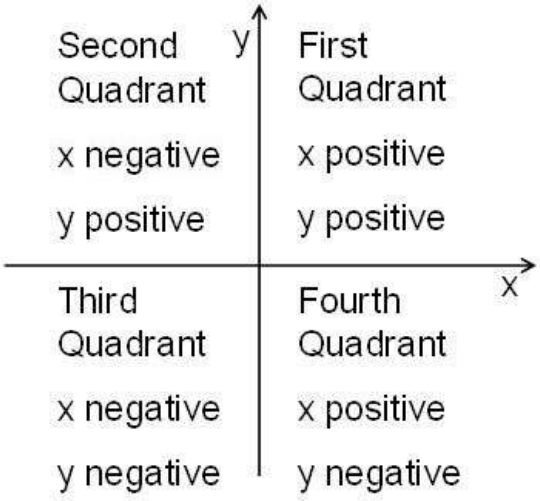
Therefore, when we designed the CAMI Trigonometric clock, we placed the 12 o'clock position on the right hand side, and then we used a reverse-running engine to make sure that the angles of the hands will increase as they move anti-clockwise.

The three trigonometric ratios are all positive for any angle in the first quadrant:

$\sin\theta = y/r$ 'opposite' divided by 'hypoteneuse'.
$\cos\theta = x/r$ 'adjacent' divided by 'hypoteneuse'.
$\tan\theta = y/x$ 'opposite' divided by 'adjacent'.

Trig Ratios in the Four Quadrants

The three trigonometric ratios maintain their identity across the four quadrants i.e.
The coordinates x and y are positive or negative as the relevant quadrant dictates. However, the distance (radius) r remains positive.



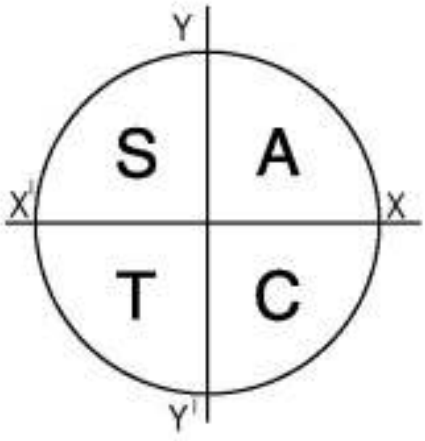
The Second Quadrant
In the second quadrant, x is negative but y and r are both positive. Hence, the two ratios involving x (cosine and tangent) are negative but the sine is positive.

The Third Quadrant
In the third quadrant, x is negative as is y but r is positive. Hence sinθ and cosθ are negative but tanθ , which is the ratio of two negative quantities, is positive.

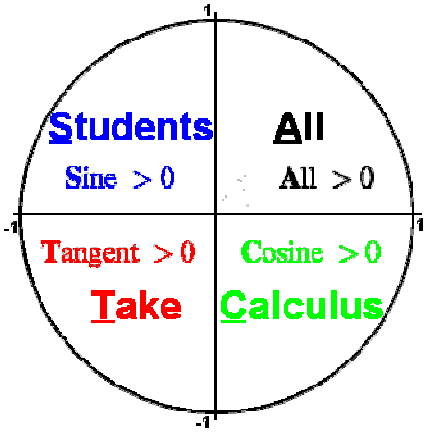
The Fourth Quadrant
In the fourth quadrant, x is positive, y is negative but r is positive. Hence sinθ and tanθ are negative but cosθ is positive.

Students remember this by one of two methods:

Either CAST, like this:

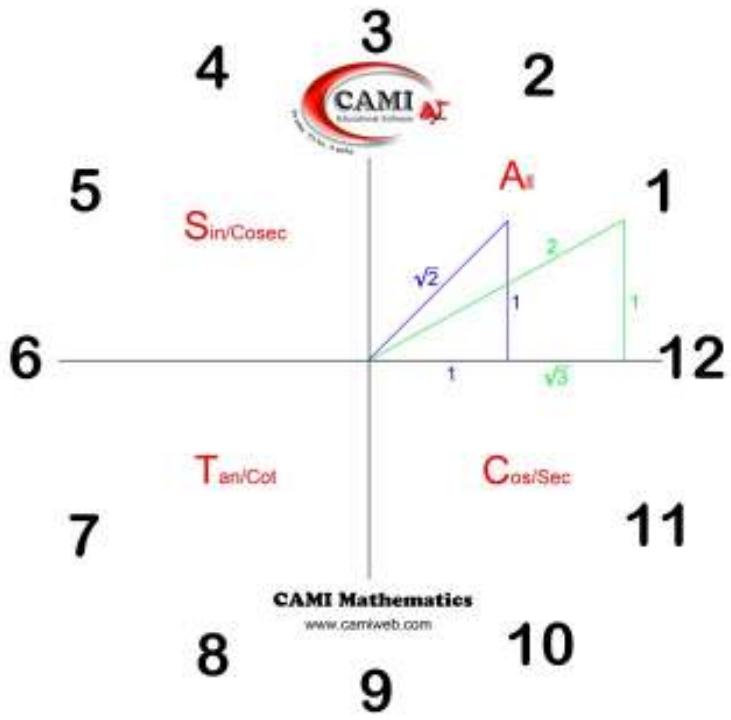


or All Students Takes Calculus, like this:

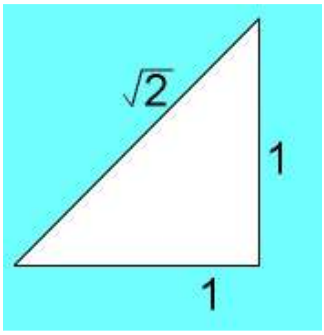


On the CAMI Clock, we have used the CAST nomenclature and placed the letters **CAST** on the CAMI clock face, as this is the easiest way to remember where the relevant trig relations should be placed in the circle.

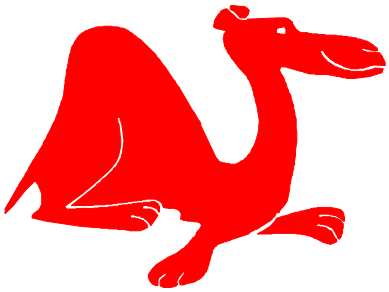
In the first quadrant, all the trig equations are positive, hence we have placed the "**All**" nomenclature in quadrant 1. In the second quadrant, only Sin and Cosec are positive, followed by Tan and Cot in quadrant 3; and Cos and Sec in the fourth quadrant:



We have also integrated the 45 and 30/60° triangles into the CAMI Trig Clock. The students should be encouraged to draw the following two triangles and also write the words SinOS, CosAS and TanOA on their exam paper, for quick and easy reference.

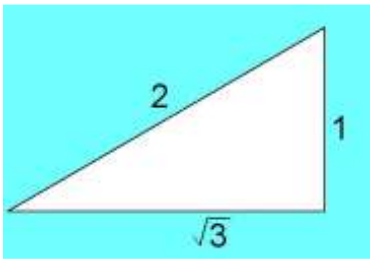


The 45° triangle deals with the numbers 1 and $\sqrt{2}$. As $\sqrt{2}$ equals 1.414, it is longer than 1 and it should therefore be placed on the hypotenuse. The other sides must therefore be 1.



From this triangle, it is now easy to see that Sin 45 = $1/\sqrt{2}$, Cos 45 = $1/\sqrt{2}$, and Tan 45 = 1/1.

The 30° and 60° angles are combined into one triangle as indicated on this sketch. This triangle deals with 1, 2 and $\sqrt{3}$. As $\sqrt{3}$ equals 1.73, it follows that 2 is the longest, and should be placed on the hypotenuse. The length of 1 is the shortest and should be placed on the shortest side, the remaining side therefore being $\sqrt{3}$.



If the learner needs to find the relations of a 30° angle, she places her finger on the (obviously) smallest angle on the left. The side with length 1 then becomes the "Opposite" side and the side with length $\sqrt{3}$ becomes the "Adjacent" side.
From this triangle, it is now easy to see that Sin 30 = 1/2, Cos 30 = $\sqrt{3}/2$, and Tan 30 = $1/\sqrt{3}$.

If the learner needs to find the relations of a 60° angle, she places her finger on the (obviously) bigger angle at the top. The side with length $\sqrt{3}$ then becomes the "Opposite" side and the side with length 1 becomes the "Adjacent" side.
From this triangle, it is now easy to see that Sin 60 = $\sqrt{3}/2$, Cos 60 = 1/2, and Tan 60 = $\sqrt{3}/1$.

We can refer to the hypotenuse as the "Skew" side, enabling us to use the acronyms
SinOS ($\frac{opposite}{skew}$), CosAS ($\frac{adjacent}{skew}$) and TanOA ($\frac{opposite}{adjacent}$), for easy remembering.

The clock also indicates that Sin and Cosec goes together, and are inverses of each other.

Hence SinOS ($\frac{opposite}{skew}$) goes with Cosec being the inverse: ($\frac{skew}{opposite}$)

Similarly Cos and Sec goes together, and are inverses of each other.

Hence CosAS ($\frac{adjacent}{skew}$) goes with Sec being the inverse: ($\frac{skew}{adjacent}$), etc.

We hope that the CAMI Trig Clock will give you lots of fun, whilst helping the learners to remember the trig ratios in all 4 quadrants.

If you need any further information, please do not hesitate to contact us without delay.

CAMI Maths – still the best maths software in the world!