Tender Heart High School, Sector 33B, Chd.

CLASS : 9

SUBJECT : Mathematics

TEACHER : Ms. Reena

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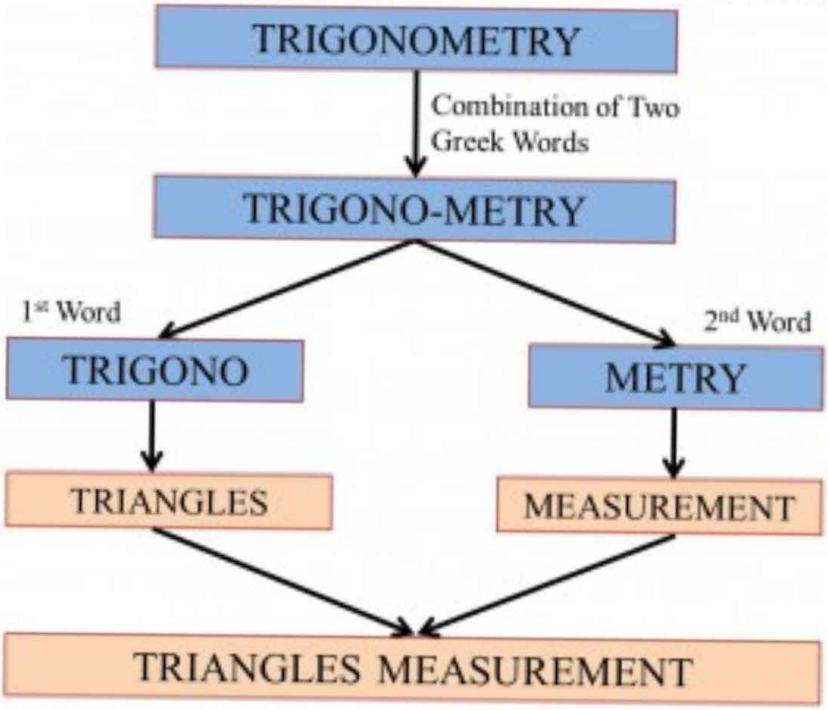
Chapter - 20

Trigonometric Ratios



The word Trigonometry comes from the Greek words "trigono" which means triangle and "metron" which means measure.

So, Trigonometry deals with the measurement of angles and sides of a triangle.

More specifically, trigonometry is about right - angled triangles, where one of the internal angles is 90°.

Trigonometry is a system that helps us to work out missing or unknown sides lengths or angles in a triangle.

Class 9, Mathematics

Teacher: Ms. Reena

Students, lets revise: What is a triangle?
A triangle is a polygon with three edges and three vertices. Or we can say that;
A triangle is a closed, two-dimensional shape with three straight sides.

Students, we need to brush up on the basics before we read further here. First of all, lets discuss about Right-Angled Triangles:-
A right-angled triangle has a single right angle. By definition, that means that all sides cannot be the same length.
A typical right-angled triangle is shown in figure number 1.

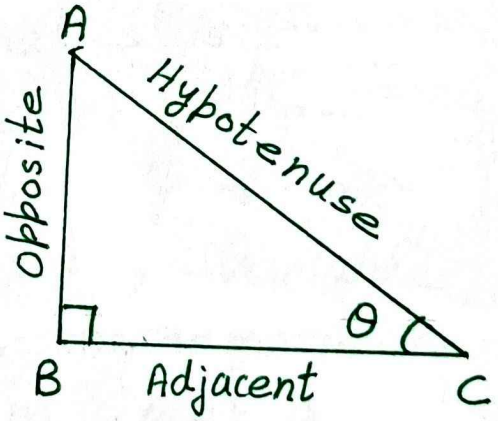


Figure 1

1) The right angle is indicated by the little box at point B (in figure 1)
2) The other angle C (∠C) is indicated by θ (Theta)
3) The hypotenuse is the side opposite to the 90° angle in a right triangle, it is the longest side of the triangle.
4) The side opposite θ is called the opposite (perpendicular).
5) The side next to θ which is not the hypotenuse is called the adjacent (base).

6) The terms perpendicular and base are sometimes used for the opposite and adjacent sides respectively.
i.e. side opposite to angle C is AB
but side opposite to angle A is BC

Now, students a very important point I like to mention here is that angles are usually denoted by Greek letters :-
θ (Theta), ϕ (Phi), α (Alpha), β (Beta), γ (Gamma), etc.

Why we use Greek letters in Mathematics?
Because European mathematics is very heavily rooted in mathematics of ancient Greece; and due to the need for many symbols to represent constants, variables, functions and other other mathematicians frequently use letters from Greek alphabet in their work.

Students, we have already done Pythagoras Theorem in the previous Chapter. And you all know that "Pythagoras" was also a Greek philosopher.

Class 9, Mathematics

Teacher: Ms. Reena

let us continue with the discussion of today's topic. i.e. Trigonometrical Ratios.

There are six functions of an angle commonly used in trigonometry. Their names are :-

1) sin (sine)
2) cos (cosine)
3) tan (tangent)
4) cosec (cosecant)
5) sec (secant)
6) cot (cotangent)

These six trigonometric functions in relation to a right triangle are displayed in the given figure 3

Here, each function is the ratio of two sides of the triangle. The only difference between the six functions is which pair of sides we use.

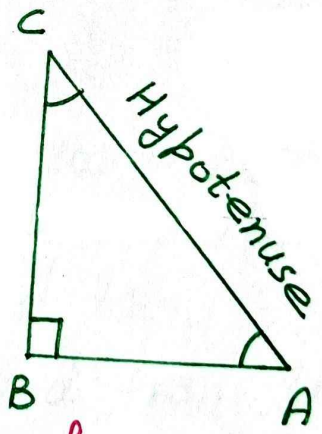


figure 3

Is it clear to you everyone ?

Now, let us consider the figure 3

1) sine function (sin), defined as the ratio of the side opposite the angle to the hypotenuse.

i.e. $\sin A = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{BC}{AC}$

and $\sin C = \frac{AB}{AC}$ [∵ side opposite to angle C is AB]

2) Cosine function (cos), defined as the ratio of the adjacent leg (the side of the triangle joining the angle to the right angle) to the hypotenuse.

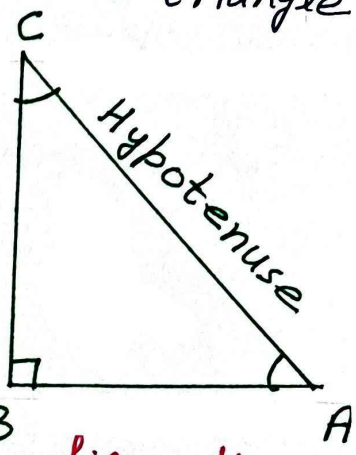


figure 4

i.e. $\cos A = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{AB}{AC}$

and $\cos C = \frac{BC}{AC}$ [$\because$ side adjacent to angle C is BC]

3) Tangent function (tan), defined as the ratio of the opposite leg to the adjacent leg.

i.e. $\tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{BC}{AB}$

and $\tan C = \frac{AB}{BC}$

Students, all these three ratios are primary ones that you need to understand completely. i.e. sin, cos and tan.
The other three can be derived from the three primary functions.

4) cosecant or $\text{cosec} = \frac{1}{\sin}$

$\Rightarrow \text{cosec } A = \frac{\text{hypotenuse}}{\text{opposite}} = \frac{AC}{BC}$

and $\text{cosec } C = \frac{AC}{BA}$

Class 9, Mathematics

5) secant or $\sec = \frac{1}{\cos}$

$\Rightarrow \sec A = \frac{\text{hypotenuse}}{\text{adjacent}} = \frac{AC}{AB}$

and $\sec C = \frac{AC}{BC}$

6) cotangent or $\cot = \frac{1}{\tan}$

$\Rightarrow \cot A = \frac{\text{adjacent}}{\text{opposite}} = \frac{AB}{BC}$

and $\cot C = \frac{BC}{AB}$

Students, here remember one important point that each trigonometrical ratio is a real number and has no unit.

Reciprocal relations :-

1) $\sin\theta = \frac{1}{\text{cosec}\,\theta}$

i.e. $\sin\theta . \text{cosec}\,\theta = \frac{\text{opposite}}{\text{Hypotenuse}} \times \frac{\text{Hypotenuse}}{\text{opposite}} = 1$

2) $\cos\theta = \frac{1}{\sec\theta}$

i.e. $\cos\theta . \sec\theta = \frac{\text{adjacent}}{\text{Hypotenuse}} \times \frac{\text{Hypotenuse}}{\text{adjacent}} = 1$

3) $\tan\theta = \frac{1}{\cot\theta}$

i.e. $\tan\theta . \cot\theta = \frac{\text{opposite}}{\text{adjacent}} \times \frac{\text{adjacent}}{\text{opposite}} = 1$