NOTES:

10: Trigonometric Ratios

Trigonometric Ratios in a Right-Angled Triangle:

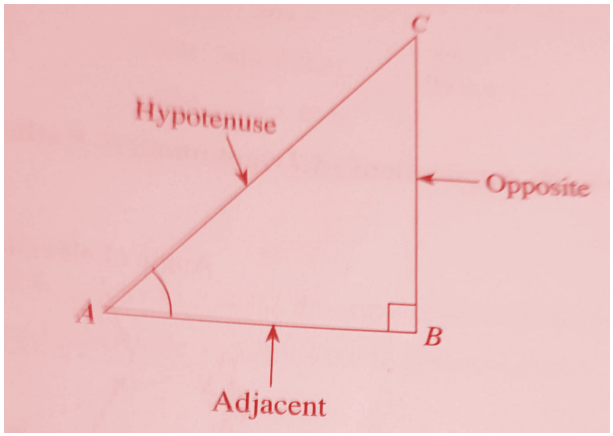
1. In a **right-angled** triangle ABC in which $\angle B = 90°$, the three trigonometric ratios of angle A are:

a) **Sine** of angle A or $\sin A = \frac{opp}{hyp} = \frac{BC}{AB}$

b) **Cosine** of angle A or $\cos A = \frac{adj}{hyp} = \frac{AB}{AC}$

c) **Tangent** of angle A or $\tan A = \frac{opp}{adj} = \frac{BC}{AB}$

where AC is the hypotenuse, BC is the opposite side and AB is the adjacent side, with respect to angle A



Notes:
(i) The three trigonometric ratios are only applicable to right-angled triangles.
(ii) Sine, Cosine, and Tangent are functions, they are not algebraic terms. They always come with angles, e.g. $\tan x,\ \sin A,\ \cos \angle ABC$.
(iii) In any right-angled triangle, the hypotenuse remains the same. The opposite and adjacent sides change with reference to the angle used in the same triangle. For example, in the above triangle ABC,

- $\sin C = \frac{opp}{hyp} = \frac{AB}{AC}$,
- $\cos C = \frac{adj}{hyp} = \frac{BC}{AC}$,
- $\tan C = \frac{opp}{adj} = \frac{AB}{BC}$.

2. To remember the three trigonometric ratios, we can use the mnemonic 'TOA CAH SOH' , where

- 'SOH' refers to $\sin = \frac{opp}{hyp}$,
- 'CAH' refers to $\cos = \frac{adj}{hyp}$,
- 'TOA' refers to $\tan = \frac{opp}{adj}$,

Continue on the next page.

Use of Calculators:

3. When we use a calculator to compute the trigonometric ratios of an angle or to find an angle from a given trigonometric ratio, we need to set the mode of the calculator to "DEG" since the angles are measured in degrees.

For example:

- ☐ To find a particular trigonometric ratio of an angle, e.g. $sin\ 53.2°$

  The sequence of calculator keys is:

sin	5	3	.	2	=

  $\therefore sin\ 53.2° = 0.8007\ (4\ s.f.)$

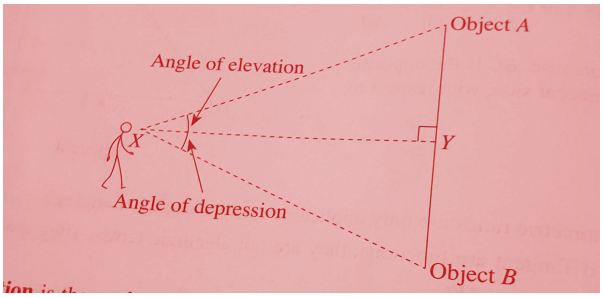
- ☐ To find an unknown angle from a given trigonometric ratio,
  e.g. $cos\ x° = 0.5$, then $x° = cos^{-1}(0.5)$.

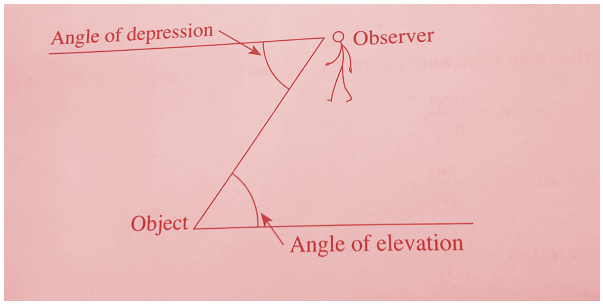
  The sequence of calculator keys is:

$2^{nd}\ F$	cos	0	.	5	=

  $\therefore x° = 60°$

Real-Life Applications of Trigonometric Ratios:





4. The **angle of elevation** is the angle formed between the horizontal line XY and the line from the observer's eye, X, to a certain object, A, above the horizontal line XY.

5. The **angle of depression** is the angle formed between the horizontal line XY and the line from the observer's eye, X, to a certain object, B, beneath the horizontal line XY.

6. The angle of elevation measured from the object is equal to the angle of depression measured from the observer's line of sight (since the horizontals for the observer and the object are parallel, the alternate angles are equal).

Version 1