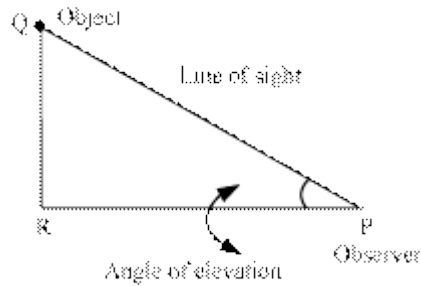


Some Applications of Trigonometry

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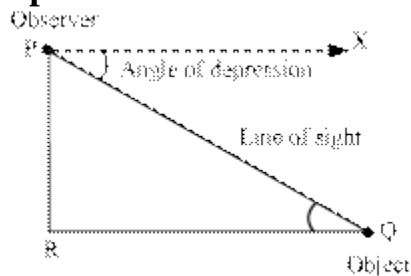
- **Line of sight:** It is the line drawn from the eye of an observer to a point on the object viewed by the observer.
- **Angle of Elevation:**



Let P be the position of the eye of the observer. Let Q be the object above the horizontal line PR.

Angle of elevation of the object Q with respect to the observer P is the angle made by the line of sight PQ with the horizontal line PR. That is, $\angle QPR$ is the angle of elevation.

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- **Angle of Depression**



Let P be the position of the eye of the observer. Let Q be the object below the horizontal line PX.

Angle of depression of the object Q with respect to the observer P is the angle made by the line of sight PQ with the horizontal line PX. That is, $\angle XPQ$ is the angle of depression. It can be seen that

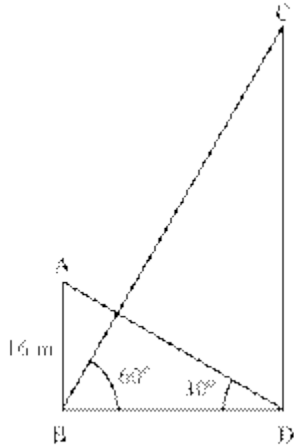
$$\angle PQR = \angle XPQ \quad [\text{Alternate interior angles}]$$

The height or length of an object or the distance between two distant objects can be calculated by using trigonometric ratios.

Example:

The angle of elevation of the top of a tower from the foot of a building is 60° and the angle of elevation of the top of the building from the foot of the tower is 30° . If the building is 16 m tall, then what is the height of the tower?

Solution:



Let AB and CD be the building and the tower respectively.

It is given that, angles of elevation $\angle ADB = 30^\circ$, $\angle CBD = 60^\circ$

In $\triangle ABD$,

$$\frac{AB}{BD} = \tan 30^\circ$$

$$\Rightarrow \frac{16}{BD} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow BD = 16\sqrt{3} \text{ m} \quad \text{---(1)}$$

Now, in $\triangle CBD$

$$\frac{CD}{BD} = \tan 60^\circ$$

$$\Rightarrow \frac{CD}{16\sqrt{3}} = \sqrt{3} \quad \text{[using (1)]}$$

$$\Rightarrow CD = 16\sqrt{3} \times \sqrt{3} \text{ m} = 48 \text{ m}$$

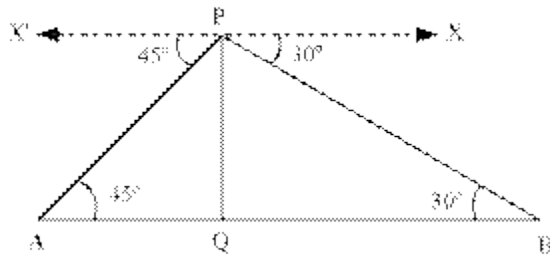
Thus, the height of the tower is 48 m.

Example:

Two wells are located on the opposite sides of a 18 m tall building. As observed from the top of the building, the angles of depression of the two wells are 30° and 45° . Find the distance between the wells. [Use $\sqrt{3} = 1.732$]

Solution:

The given situation can be represented as



Here, PQ is the building. A and B are the positions of the two wells such that:

$$\angle XPB = 30^\circ, \angle XPA = 45^\circ$$

$$\text{Now, } \angle PAQ = \angle XPA = 45^\circ$$

$$\angle PBQ = \angle XPB = 30^\circ$$

In $\triangle PAQ$, we have

$$\frac{PQ}{AQ} = \tan 45^\circ$$

$$\Rightarrow \frac{18}{AQ} = 1$$

$$\Rightarrow AQ = 18 \text{ m}$$

In $\triangle PBQ$, we have

$$\frac{PQ}{QB} = \tan 30^\circ$$

$$\Rightarrow \frac{18}{QB} = \frac{1}{\sqrt{3}}$$

$$\Rightarrow QB = 18\sqrt{3}$$

$$\therefore AB = AQ + QB = (18 + 18\sqrt{3}) \text{ m}$$

$$= 18(1 + \sqrt{3}) \text{ m}$$

$$= 18(1 + 1.732) \text{ m}$$

$$= 18 \times 2.732 \text{ m}$$

$$= 49.176 \text{ m}$$