SOME APPLICATIONS OF TRIGONOMETRY
PPT-4

SUBJECT : MATHEMATICS
CHAPTER NUMBER: 09
CHAPTER NAME : SOME APPLICATIONS OF TRIGONOMETRY

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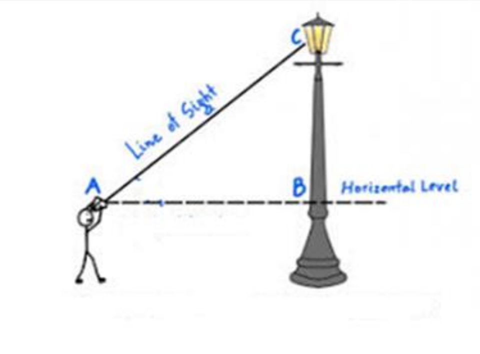
PREVIOUS KNOWLEDGE TEST

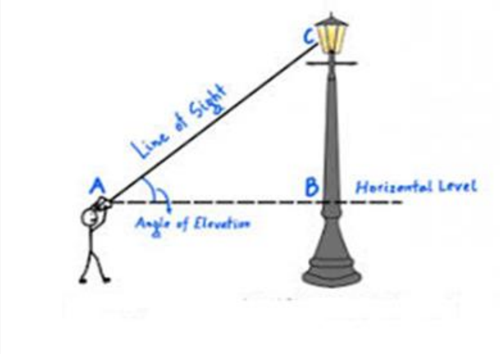
Line of sight: line of sight is the line drawn from the eye of an observer to the point in the object viewed by the observer

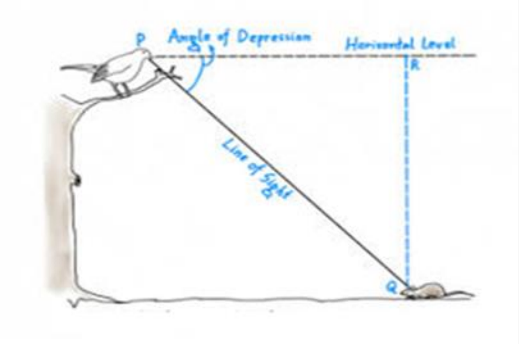
Horizontal level: It is the horizontal line through the eye of the observer

Angle of elevation: The angle of elevation of the point viewed is the angle formed by the line of sight with the horizontal when the point being viewed is above the horizontal level, i.e., the case when we raise our head to look at the object.

Angle of depression: The angle of depression of a point on the object being viewed is the angle formed by the line of sight with the horizontal when the point is below the horizontal level, i.e., the case when we lower our head to look at the point being viewed







LEARNING OUTCOME

1.Students will be able to analyze word problem and to draw the corresponding figure.

2.Students will be able to apply the knowledge of trigonometry in solving real life problems. .

Problem solving on heights and distances:
https://youtu.be/GyGKE8JFqrk(12.13)

1. The angle of elevation of the top of a tower from two points distant a and b from its foot are complementary. Prove that the height of the tower is $\sqrt{ab}$.

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n. Let AB be the tower of height h metres

P and Q are the two points of observation such that $BP = a$, $BQ = b$,

Let $\angle AQB = \theta \Rightarrow \angle APB = 90° - \theta$

In right ΔABP, $\frac{AB}{BP} = \tan(90° - \theta)$

$\Rightarrow h = a\tan(90° - \theta) = a\cot\theta$ ...(1)

In right ΔABQ, $\frac{AB}{BQ} = \tan\theta$

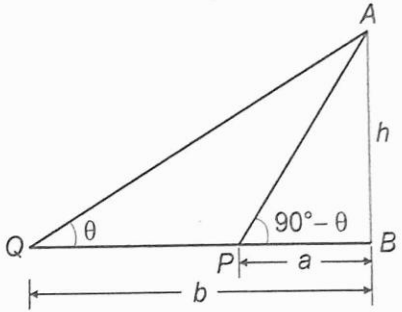
$\Rightarrow h = b\tan\theta$ ...(2)

On multiplying equations (1) and (2), we get

$h^2 = ab\cot\theta \cdot \tan\theta = ab \Rightarrow h^2 = ab$

$\therefore h = \sqrt{ab}$

Hence, the height of the tower is $\sqrt{ab}$.



2. The shadow of a tower standing on a level plane is found to be 45 m longer when Sun's elevation is 30° than when it is 60°. Find the height of the tower.

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. Let AB be the tower of height h metres.

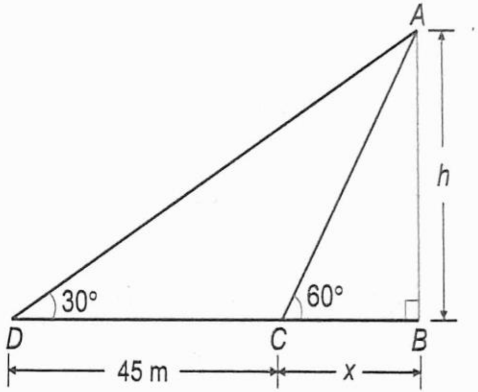
BD is the shadow of the tower when sun's altitude is 30° and BC is the shadow when sun's altitude is 60°. Then,

$$DC = 45 \text{ m}, \quad \text{let } BC = x \text{ m} \quad \Rightarrow \quad BD = (45 + x) \text{ m}$$

In ΔABD, $\frac{AB}{BD} = \tan 30°$ or $\frac{h}{45 + x} = \frac{1}{\sqrt{3}}$

$$\Rightarrow \quad x = (h\sqrt{3} - 45) \text{ m} \quad \text{...(1)}$$

In ΔABC, $\frac{h}{x} = \tan 60°$ or $x = \frac{h}{\sqrt{3}}$ ...(2)



Equating (1) and (2), we get

$$h\sqrt{3} - 45 = \frac{h}{\sqrt{3}} \quad \text{or} \quad 3h - 45\sqrt{3} = h$$

or $$2h = 45\sqrt{3}$$

$$\Rightarrow \quad h = 22.5 \times 1.732 = 38.97 \text{ m.}$$

3. From the top of a tower h m high, the angles of depression of two objects, which are in line with the foot of the tower are α and β ($\beta > \alpha$). Find the distance between the two objects..

3. From the top of a tower h m high, the angles of depression of two objects, which are in line with the foot of the tower are α and β (β > α). Find the distance between the two objects..

. AB is the tower of height h metres, C and D are the position of the two objects.

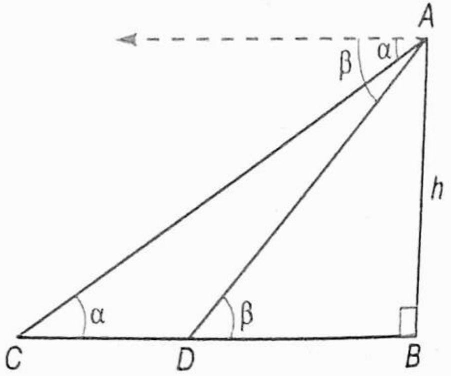
From right ΔABC, we have

$$\cot\alpha = \frac{BC}{AB} = \frac{BC}{h}$$

From right ΔABD, we have

$$\cot\beta = \frac{BD}{AB} = \frac{BD}{h}$$

$$\therefore \quad \cot\alpha - \cot\beta = \frac{BC - BD}{h} = \frac{CD}{h}$$



Hence, the distance between the two objects, $CD = h(\cot\alpha - \cot\beta)$.

4. The angle of elevation of a cloud from a point 60m above a lake is 30^0 and the angle of depression of its reflection in he lake is 60^0, find the height of the cloud.

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Let AB be the surface of the lake.

Let C be the cloud and C' its reflected image in the lake.

Let P be the point of observation. Then, $PA = 60$ m.

Draw $PQ \perp CC'$.

Then, $\angle CPQ = 30°$, $\angle C'PQ = 60°$.

If h is the height of the cloud above the lake, then

$$CB = C'B = h \text{ metres}$$

$$\therefore \quad CQ = (h - 60)\text{ m}, \ C'Q = (h + 60)\text{ m}$$

From right ΔCQP, we have

$$\tan 30° = \frac{CQ}{PQ} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h-60}{PQ} \qquad ...(i)$$

From right $\Delta C'QP$, we have

$$\tan 60° = \frac{C'Q}{PQ} \Rightarrow \sqrt{3} = \frac{h+60}{PQ} \qquad ...(ii)$$

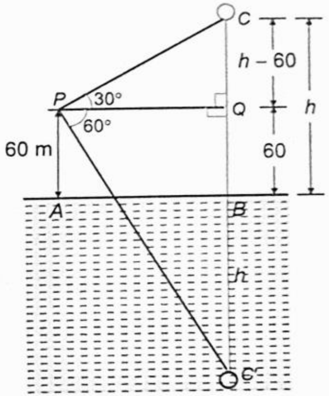
Dividing (ii) by (i), we get

$$\sqrt{3} \times \sqrt{3} = \frac{h+60}{h-60}$$

$$\Rightarrow \quad 3h - 180 = h + 60$$

$$\Rightarrow \quad 2h = 240 \quad \Rightarrow \quad h = 120 \text{ m}$$

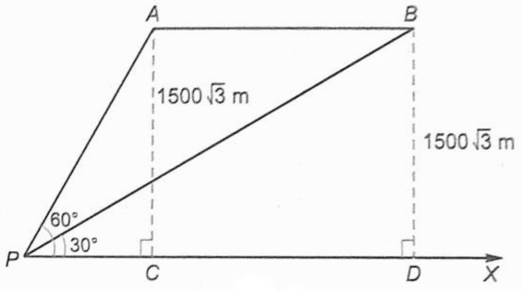
Hence, the height of the cloud from the lake is 120 m.



5. The angle of elevation of a jet plane from a point P on the ground is 60^0.After a flight of 15 seconds, the angle of elevation changes to 30^0,If the plane is flying at a constant height of $1500\sqrt{3}$ m, find the speed of the plane.

5. The angle of elevation of a jet plane from a point P on the ground is 60^0.After a flight of 15 seconds, the angle of elevation changes to 30^0,If the plane is flying at a constant height of $1500\sqrt{3}$ m, find the speed of the plane.

Let A and B be the two positions of the jet plane and PX be the horizontal level from the point of observation P.



Draw $AC \perp PX$ and $BD \perp PX$.

Then, $\angle APC = 60°$ and $\angle BPD = 30°$

$$AC = BD = 1500\sqrt{3} \text{ m}$$

From right ΔPCA, we have

$$\tan 60° = \frac{AC}{PC} \quad \text{or} \quad \sqrt{3} = \frac{1500\sqrt{3}}{PC}$$

$$\therefore \quad PC = \frac{1500 \times \sqrt{3}}{\sqrt{3}} = 1500 \text{ m}$$

Also, from right ΔPDB, we have : $\tan 30° = \frac{BD}{PD}$ or $\frac{1}{\sqrt{3}} = \frac{1500\sqrt{3}}{PD}$

$$\therefore \quad PD = 1500 \times 3 = 4500 \text{ m}$$

Distance, $AB = CD = PD - PC = 4500 - 1500 = 3000$ m

Thus, the jet plane covers a distance of 3000 m in 15 seconds.

Hence, the speed of the jet plane $= \frac{3000 \text{ m}}{15 \text{ s}} = 200 \text{ m/s} = 200 \times \frac{3600}{1000} \text{ km/h} = 720$ km/h.

HOME ASSIGNMENT Ex 8.1 Q 1 to 15(MCQ). Exemplar Maths

AHA

1. : A spherical balloon of radius r subtends an angle θ at the eye of an observer. If the angle of elevation of its center is ϕ, find the height of the center of the balloon..

THANKING YOU

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