HEIGHT & DISTANCE

1. Consider a triangular plot ABC with sides AB=7m, BC=5m and CA=6m. A vertical lamp-post at the mid point D of AC subtends an angle 30° at B. The height (in m) of the lamp-post is:

(1) $7\sqrt{3}$ (2) $\frac{2}{3}\sqrt{21}$

(3) $\frac{3}{2}\sqrt{21}$ (4) $2\sqrt{21}$

2. If the angle of elevation of a cloud from a point P which is 25 m above a lake be 30º and the angle of depression of reflection of the cloud in the lake from P be 60º, then the height of the cloud (in meters) from the surface of the lake is :

(1) 42 (2) 50 (3) 45 (4) 60

3. Two vertical poles of heights, 20m and 80m stand a part on a horizontal plane. The height (in meters) of the point of intersection of the lines joining the top of each pole to the foot of the other, from this horizontal plane is :

(1) 12 (2) 15
(3) 16 (4) 18

4. Two poles standing on a horizontal ground are of heights 5m and 10 m respectively. The line joining their tops makes an angle of 15º with ground. Then the distance (in m) between the poles, is :-

(1) $\frac{5}{2}(2+\sqrt{3})$ (2) $5(\sqrt{3}+1)$

(3) $5(2+\sqrt{3})$ (4) $10(\sqrt{3}-1)$

5. ABC is a triangular park with AB = AC = 100 metres. A vertical tower is situated at the mid-point of BC. If the angles of elevation of the top of the tower at A and B are $\cot^{-1}\left(3\sqrt{2}\right)$ and $\text{cosec}^{-1}\left(2\sqrt{2}\right)$ respectively, then the height of the tower (in metres) is :

(1) $10\sqrt{5}$ (2) $\frac{100}{3\sqrt{3}}$ (3) 20 (4) 25

6. A 2 m ladder leans against a vertical wall. If the top of the ladder begins to slide down the wall at the rate 25 cm/ sec., then the rate (in cm/sec.) at which the bottom of the ladder slides away from the wall on the horizontal ground when the top of the ladder is 1 m above the ground is :

(1) $25\sqrt{3}$ (2) 25 (3) $\frac{25}{\sqrt{3}}$ (4) $\frac{25}{3}$

7. The angle of elevation of the top of vertical tower standing on a horizontal plane is observed to be 45° from a point A on the plane. Let B be the point 30 m vertically above the point A. If the angle of elevation of the top of the tower from B be 30°, then the distance (in m) of the foot of the tower from the point A is:

(1) $15\left(3-\sqrt{3}\right)$ (2) $15\left(3+\sqrt{3}\right)$

(3) $15\left(1+\sqrt{3}\right)$ (4) $15\left(5-\sqrt{3}\right)$

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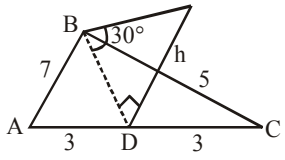
SOLUTION

1. Ans. (2)

$BD = h\cot 30° = h\sqrt{3}$

So, $7^2 + 5^2 = 2(h\sqrt{3})^2 + 3^2)$

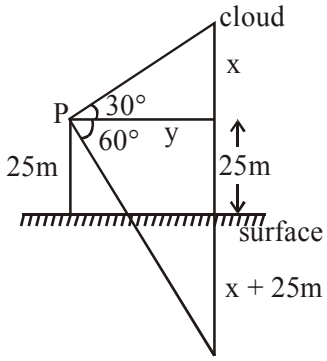


$\Rightarrow 37 = 3h^2 + 9.$

$\Rightarrow 3h^2 = 28$

$\Rightarrow h = \sqrt{\frac{28}{3}} = \frac{2}{3}\sqrt{21}$

2. Ans (2)



$\tan 30° = \frac{x}{y} \Rightarrow y = \sqrt{3}\,x$ .....(i)

$\tan 60° = \frac{25 + x + 25}{y}$

$\Rightarrow \sqrt{3}\,y = 50 + x$

$\Rightarrow 3x = 50 + x$

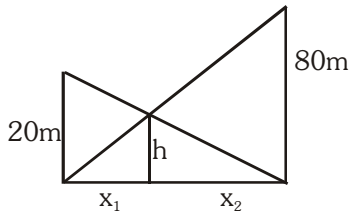
$\Rightarrow x = 25$ m

$\therefore$ Height of cloud from surface

$= 25 + 25 = 50$m

3. Official Ans. by NTA (3)

Sol.



by similar triangle

$\frac{h}{x_1} = \frac{80}{x_1 + x_2}$ ...(1)

by $\frac{h}{x_2} = \frac{20}{x_1 + x_2}$ ..(2)

by (1) and (2)

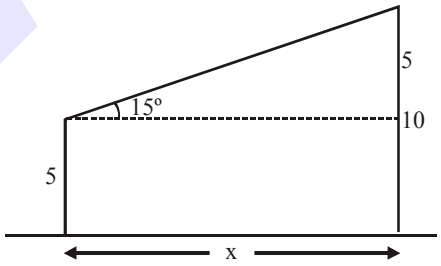
$\frac{x_2}{x_1} = 4$ or $x_2 = 4x_1$

$\Rightarrow \frac{h}{x_1} = \frac{80}{5x_1}$

or h = 16m

4. Official Ans. by NTA (3)

Sol. $\tan 15° = \frac{5}{x}$



$2 - \sqrt{13} = \frac{5}{x}$

$x = 5(2 + \sqrt{3})$

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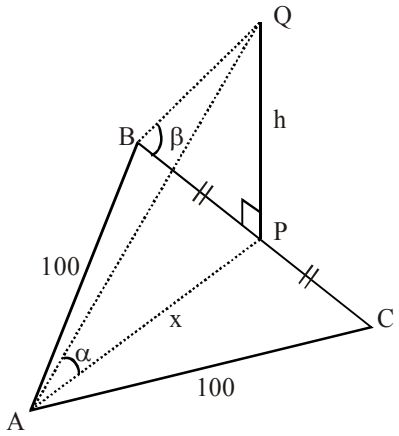
5. Official Ans. by NTA (3)

Sol. $\cot\alpha = 3\sqrt{2}$

& $\operatorname{cosec}\beta = 2\sqrt{2}$



So, $\frac{x}{h} = 3\sqrt{2}$ ...(i)

And $\frac{h}{\sqrt{10^4 - x^2}} = \frac{1}{\sqrt{7}}$ ...(ii)

So, from (i) & (ii)

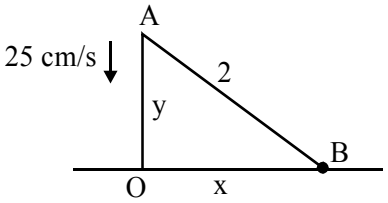
$\Rightarrow \frac{h}{\sqrt{10^4 - 18h^2}} = \frac{1}{\sqrt{7}}$

$\Rightarrow 25h^2 = 100 \times 100$

$\Rightarrow h = 20.$

6. Official Ans. by NTA (3)

Sol.



$x^2 + y^2 = 4 \quad \left(\frac{dy}{dt} = -25\right)$

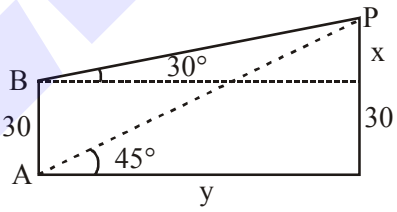
$x\frac{dx}{dt} + y\frac{dy}{dt} = 0$

$\sqrt{3}\frac{dx}{dt} - 1(25) = 0$

$\frac{dx}{dt} = \frac{25}{\sqrt{3}}$ cm/sec

7. Official Ans. by NTA (2)

Sol.



$\tan 45° = 1 = \frac{x + 30}{y} \Rightarrow x + 30 = y$ (i)

$\tan 30° = \frac{1}{\sqrt{3}} = \frac{x}{y} \Rightarrow x = \frac{y}{\sqrt{3}}$ (ii)

from (i) and (ii) $y = 15\left(3 + \sqrt{3}\right)$

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