MATHS BASEMAKER

Class 10 CBSE — Chapter 9: Some Applications of Trigonometry

Q1. A ladder 15 m long just reaches the top of a vertical wall. If the ladder makes an angle of 60° with the wall, then the height of the wall is:

(a) $15\sqrt{3}/2$ m (b) 7.5 m

(c) $15/\sqrt{3}$ m (d) 30 m

Q2. If two towers of heights h_1 and h_2 subtend angles of 60° and 30° respectively at the mid-point of the line joining their feet, then the ratio $h_1 : h_2$ is:

(a) 1 : 2 (b) 1 : 3

(c) 3 : 1 (d) $\sqrt{3}$: 1

Q3. An observer 1.5 m tall is 28.5 m away from a tower 30 m high. The angle of elevation of the top of the tower from his eye is:

(a) 30° (b) 45°

(c) 60° (d) 90°

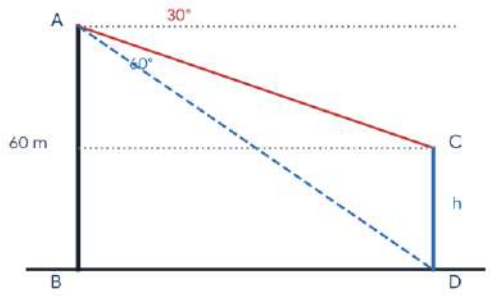
Q4A straight highway leads to the foot of a tower. A man standing at the top of the tower observes a car at an angle of depression of 30°, which is approaching the foot of the tower with a uniform speed. Six seconds later, the angle of depression of the car is found to be 60°. Find the time taken by the car to reach the foot of the tower from this point.

Q5. In the given figure, from the top of a 60 m high building, the angles of depression of the top and the bottom of a vertical lamp-post are observed to be 30° and 60° respectively. Find:

(i) the horizontal distance between the building and the lamp-post.

(ii) the height of the lamp-post.

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Q6. The angle of elevation of a jet fighter from a point A on the ground is 60°. After a flight of 30 seconds horizontally, the angle of elevation changes to 30°. If the jet is flying at a constant height of 3600√3 m, find the speed of the jet plane in km/h.

Q7. From a point on the ground, the angles of elevation of the bottom and the top of a transmission tower fixed at the top of a 20 m high building are 45° and 60° respectively. Find the height of the transmission tower. (take √3 = 1.732)

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HINTS & STEPS

Q1. Solution & Steps

Hint: The angle given is with the wall (vertical), not the ground. Use cos 60° = wall height / length of ladder.

Let height of wall be h and length of ladder be 15 m.

Angle between wall and ladder = 60°.

cos 60° = h / 15

1/2 = h / 15 => h = 15 / 2 = 7.5 m.

Answer: (b) 7.5 m

Q2. Solution & Steps

Hint: Mid-point divides the distance between feet into equal segments of length d. Express h_1 and h_2 using tan 60° and tan 30°.

Let the distance between feet of towers be 2d. Mid-point distance to each foot = d.

For first tower: tan 60° = h_1 / d => $h_1 = d\sqrt{3}$.

For second tower: tan 30° = h_2 / d => $h_2 = d / \sqrt{3}$.

Ratio $h_1 : h_2 = (d\sqrt{3}) / (d / \sqrt{3}) = (\sqrt{3} * \sqrt{3}) / 1 = 3 / 1 = 3 : 1$.

Answer: (c) 3 : 1

Q3. Solution & Steps

Hint: Subtract observer's height from total tower height: perpendicular = 30 - 1.5 = 28.5 m.

Height of tower above eye-level = 30 - 1.5 = 28.5 m.

Horizontal distance from tower = 28.5 m.

Let angle of elevation be θ.

tan θ = (height above eye-level) / (horizontal distance)

tan θ = 28.5 / 28.5 = 1.

Since tan 45° = 1, θ = 45°.

Answer: (b) 45°

Q4. Solution & Steps

Hint: Let height of tower be h. Relate distances using tan 30° and tan 60°, then compute time = remaining distance / speed.

Let tower height be h. Let car be at point C (angle 30°) and move to point D (angle 60°).

In right triangle with angle 60°:

tan 60° = h / x => $\sqrt{3}$ = h / x => $h = x\sqrt{3}$.

In right triangle with angle 30°:

tan 30° = h / (CD + x) => $1/\sqrt{3}$ = h / (CD + x) => $CD + x = h\sqrt{3}$.

Substitute $h = x\sqrt{3}$:

CD + x = (x√3) * √3 = 3x => CD = 2x.

Distance CD = 2x is covered in 6 seconds.

Speed of car = Distance / Time = 2x / 6 = x/3 metres/second.

Time to cover remaining distance x = Distance / Speed = x / (x/3) = 3 seconds.

Answer: 3 seconds

Q5. Solution & Steps

Hint: Angle of depression 60° to foot gives horizontal distance. Angle of elevation 30° gives remaining vertical segment.

Let building be AB = 60 m, lamp-post be CD = h, and horizontal distance be x m.

From right triangle ABD with ground angle 60°:

tan 60° = 60 / x

√3 = 60 / x => x = 60 / √3 = 20√3 m.

Horizontal distance between building and lamp-post = 20√3 m.

In upper right triangle with lamp-post top:

Height difference = 60 - h.

tan 30° = (60 - h) / x

1/√3 = (60 - h) / (20√3)

20 = 60 - h => h = 60 - 20 = 40 m.

Height of lamp-post = 40 m.

Answer: (i) 20√3 m, (ii) 40 m

Q6 Solution & Steps [HOTS / Olympiad / CBSE Board Classic]

Hint: Constant height H = 3600√3 m. Find initial and final horizontal distances from the ground observation point, compute horizontal distance covered, then convert speed to km/h.

Let initial horizontal distance be x_1 and final horizontal distance be x_2.

Initial position (angle 60°):

tan 60° = (3600√3) / x_1

√3 = (3600√3) / x_1 => x_1 = 3600 m.

Final position after 30 seconds (angle 30°):

tan 30° = (3600√3) / x_2

1/√3 = (3600√3) / x_2 => x_2 = (3600√3) * √3 = 3600 * 3 = 10800 m.

Distance covered by jet in 30 seconds = x_2 - x_1

= 10800 - 3600 = 7200 m.

Speed in m/s = Distance / Time = 7200 / 30 = 240 m/s.

Converting speed to km/h:

Speed = 240 * (18 / 5) = 48 * 18 = 864 km/h.

Answer: 864 km/h

Q7. Solution & Steps

Hint: Right triangle with building gives base distance directly via tan 45° = 1. Then use tan 60° for total height.

Let building height be 20 m and transmission tower height be h.

Let ground point be at distance x from building base.

tan 45° = 20 / x

1 = 20 / x => x = 20 m.

For the top of transmission tower (total height = 20 + h):

tan 60° = (20 + h) / x

√3 = (20 + h) / 20

20 + h = 20√3

h = 20(√3 - 1) = 20(1.732 - 1) = 20(0.732) = 14.64 m.

Answer: 14.64 m