Height and Distance Questions for CGL Tier 2, CGL Tier 1, SSC 10+2 Exams

HEIGHT AND DISTANCE QUIZ 2

Directions: Study the following questions carefully and choose the right answer:

1. The top of two poles of height 24 m and 36 m are connected by a wire. If the wire makes an angle of 60° with the horizontal, then the length of the wire is

A. 6m B. 8√3 m C. 8 m D. 6√3 m

2. From a point P on the ground the angles of elevation of the top of a 10 m tall building is 30°. A flag is hoisted at the top of the building and the angle of elevation of the top of the flagstaff from P is 45° Find the length of the flagstaff. (Take √3 = 1.732)

A. 10(√3 + 2) m B. 10(√3 + 1) m C. 10√3 m D. 7.32 m

3. If the angle of elevation of the sun changes from 30° to 45°, the length of the shadow of a pillar decreases by 20 metres. The height of the pillar is

A. 20(√3 – 1) m B. 20(√3 + 1) m C. 10(√3 – 1) m D. 10(√3 + 1) m

4. The angle of elevation of the top of a tower from two points A and B lying on the horizontal through the foot of the tower are respectively 15° and 30°. If A and B are on the same side of the tower and AB = 48 metre, then the height of the tower is :

A. 24√3 metre B. 24 metre C. 24√2 metre D. 96 metre

5. At a point on a horizontal line through the base of a monument, the angle of elevation of the top of the monument is found to be such that its tangent is 1/5. On walking 138 metres towards the monument the secant of the angle of elevation is found to be √(193) / 12. The height of the monument (in meter) is

A. 35 B. 49 C. 42 D. 56

6. The distance between two pillars of length 16 metres and 9 metres is x metres. If two angles of elevation of their respective top from the bottom of the other are complementary to each other, then the value of x (in metres) is

A. 15 B. 16 C. 12 D. 9

7. The angle of elevation of the top of a building from the top and bottom of a tree are x and y respectively. If the height of the tree is h metre, then (in metre) the height of the building is

A. $\frac{h\cot x}{\cot x+\cot y}$

B. $\frac{h\cot y}{\cot x+\cot y}$

C. $\frac{h\cot x}{\cot x-\cot y}$

D. $\frac{h\cot y}{\cot x-\cot y}$

8. The angle of elevation of the top of a tower from a point A on the ground is 30°. On moving a distance of 20 metres towards the foot of the tower to a point B, the angle of elevation increases to 60°. The height of the tower is

A. √3 m

B. 5√3 m

C. 10√3 m

D. 20√3 m

9. Two poles of equal height are standing opposite to each other on either side of a road which is 100 m wide. From a point between them on road, angle of elevation of their tops are 30° and 60°. The height of each pole (in metre) is

A. 25√3

B. 20√3

C. 28√3

D. 30√3

10. A telegraph post is bent at a point above the ground due to storm. Its top just meets the ground at a distance of 8√3 meters from its foot and makes an angle of 30°, then the height of the post is :

A. 16 metres

B. 23 metres

C. 24 metres

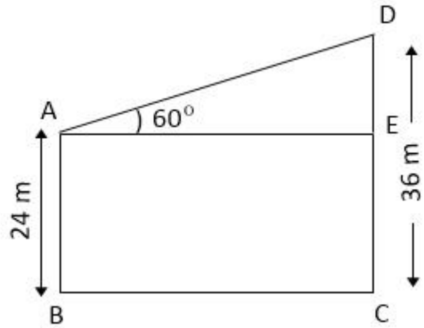
D. 10 metres

Correct answers:

1	2	3	4	5	6	7	8	9	10
B	D	D	B	C	C	C	C	A	C

Explanations:

1.



DE = 36 – 24 = 12 m

From Δ ADE,

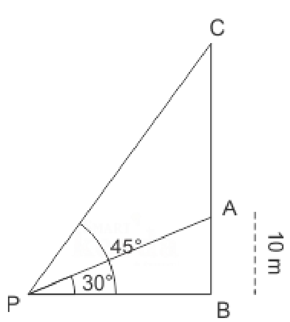
$$\sin 60° = \frac{DE}{AD}$$

$$\Rightarrow \frac{\sqrt{3}}{2} = \frac{12}{AD}$$

$$\Rightarrow AD = \frac{12 \times 2}{\sqrt{3}} = 8\sqrt{3} \text{ m}$$

Hence, option B is correct.

2.



AC = Flag, AB = building = 10 m

$\angle APB = 30°$; $\angle CPB = 45°$

In Δ APB,

$$\tan 30° = \frac{AB}{PB}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{10}{PB}$$

$$\Rightarrow PB = 10\sqrt{3} \text{ m}$$

In ΔPBC,

$$\tan 45° = \frac{BC}{PB}$$

$$\Rightarrow 1 = \frac{AB + AC}{PB}$$

$$\Rightarrow PB = AB + AC \quad \Rightarrow \quad 10\sqrt{3} = 10 + AC$$

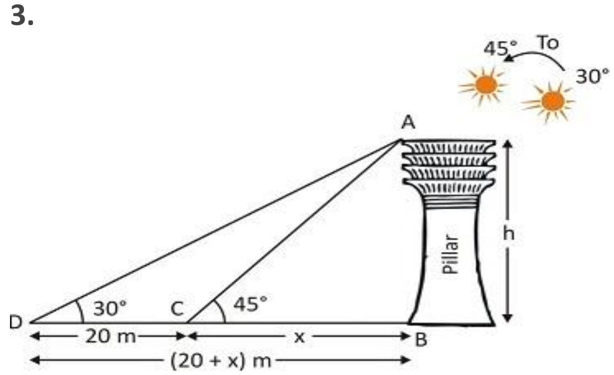
$$\Rightarrow AC = 10\sqrt{3} - 10$$

$$\Rightarrow 10(\sqrt{3} - 1) \text{ m} = 10(1.732 - 1) \text{ m}$$

$$= 10 \times 0.732 = 7.32 \text{ m.}$$

Hence, option D is correct.

3.



Let, the height of the pillar, AB = h metre.

When the sun's angle of elevation was 30°, then the length of shadow of the pillar is BD.

And, when the sun's angle of elevation is 45°, then the length of shadow of the pillar is BC = x metre (let).

When the sun changes from 30° to 45°, then the length of shadow of the pillar decreases CD = 20 (given)

∴ BD = BC + CD = (x + 20) m

In ΔABC,

$\tan 45° = \frac{AB}{BC} \quad \Rightarrow \quad 1 = \frac{h}{x}$

$\Rightarrow h = x \quad ...(i)$

Now, in ΔABD,

$\Rightarrow \tan 30° = \frac{AB}{BD} \quad \Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{x + 20}$

$\Rightarrow h \quad 3 = x + 20$

$\Rightarrow h\sqrt{3} = h + 20 \quad$ [From eq. (i)]

$\Rightarrow h(\sqrt{3} - 1) = 20$

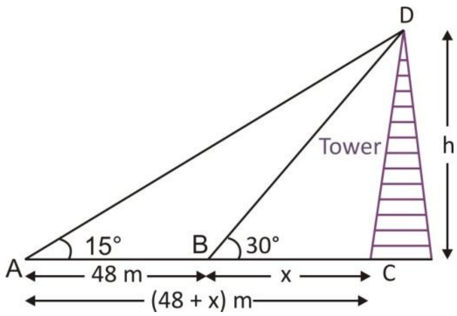
$$\Rightarrow h = \frac{20}{\sqrt{3} - 1} \times \frac{\sqrt{3} + 1}{\sqrt{3} + 1}$$

$$= \frac{20(\sqrt{3} + 1)}{2} = 10(\sqrt{3} + 1)m$$

∴ The height of the pillar is 10 (√3 + 1) metre.

Hence, option D is correct.

4.



Given, AB = 48 m

Let, the height of the tower, CD = h metre

And, BC = x metre

∴ AC = AB + BC = (48 + x) m

In ΔBCD,

$\tan 30° = \frac{CD}{BC} \quad \Rightarrow \quad \frac{1}{\sqrt{3}} = \frac{h}{x}$

$x = h\sqrt{3}$ ...(i)

Now, in ACD,

$\tan 15° = \frac{CD}{AC}$

$\Rightarrow \quad \tan(45° - 30°) = \frac{h}{48 + x}$

$\Rightarrow \frac{\tan 45° - \tan 30°}{1 + \tan 45° \tan 30°} = \frac{h}{48 + x}$

$[\because \tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}]$

$$\Rightarrow \frac{1-\frac{1}{\sqrt{3}}}{1+\frac{1}{\sqrt{3}}} = \frac{h}{48+x}$$

$$\Rightarrow \frac{\sqrt{3}-1}{\sqrt{3}+1} = \frac{h}{48+x}$$

$$\Rightarrow \frac{\sqrt{3}-1}{\sqrt{3}+1} \times \frac{\sqrt{3}-1}{\sqrt{3}-1} = \frac{h}{48+x}$$

$$\Rightarrow \frac{(\sqrt{3}-1)^2}{2} = \frac{h}{48+x}$$

$$\Rightarrow 2-\sqrt{3} = \frac{h}{48+h\sqrt{3}} \quad \text{[From eq. (i)]}$$

$$\Rightarrow h = 96 + 2h\sqrt{3} - 48\sqrt{3} - 3h$$

$$\Rightarrow 4h - 2h\sqrt{3} = 48(2-\sqrt{3})$$

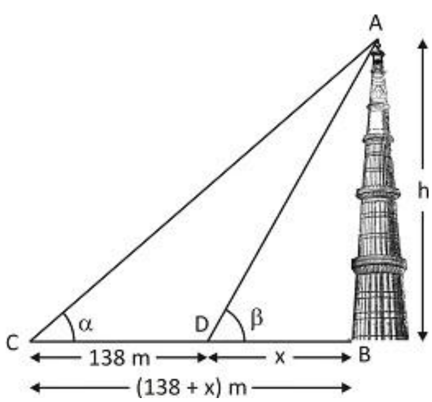
$$\Rightarrow 2h(2-\sqrt{3}) = 48(2-\sqrt{3})$$

$$\Rightarrow h = 24 \text{ m}$$

$\therefore$ The height of the tower is 24 metre.

Hence, option B is correct.

5.



Given, the distance walking, CD = 138 m

Let, The height of the monument, AB = h metre

BD = x metre, ∠ACB = α and ∠ADB = β

$\therefore \tan \alpha = \frac{1}{5}$ and $\sec \beta = \frac{\sqrt{193}}{12}$

$\therefore$ BC = CD + BD = (138 + x) m

We know that,

$$tan\beta = \sqrt{\sec^2 \beta - 1} = \sqrt{\frac{193}{144} - 1} = \sqrt{\frac{49}{144}} = \frac{7}{12}$$

In ΔABC,

$\tan \alpha = \frac{AB}{BC} \Rightarrow \frac{1}{5} = \frac{h}{138 + x}$

x = 5h – 138 ...(i)

Now, in ΔABD,

$\tan \beta = \frac{AB}{BD} \Rightarrow \frac{7}{12} = \frac{h}{x}$

⇒ 7x = 12h

⇒ 7(5h – 138) = 12h [From eq. (i)]

⇒ 35h – 966 = 12h

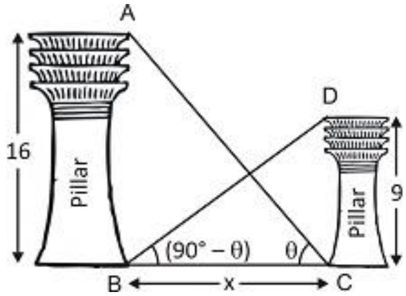
⇒ 23h = 966

⇒ h = 42 m

$\therefore$ The height of the monument is 42 metre.

Hence, option C is correct.

6.



Given, AB = 16 m, CD = 9 m and BC = x metre

And, ∠ACB and ∠CBD are complementary.

∴ Let, ∠ACB = Θ and ∠CBD = (90° – Θ)

In ΔABC,

$$\tan \Theta = \frac{AB}{BC} \Rightarrow \tan \Theta = \frac{16}{x} \quad ...(i)$$

Now, In ΔBCD,

$$\tan (90° - \Theta) = \frac{CD}{BC}$$

$$\cot \Theta = \frac{9}{x} \quad ...(ii)$$

[∵ tan (90° – Θ) = cot Θ]

By multiplying eq. (i) & (ii),

$$\tan \Theta \cot \Theta = \frac{16}{x} \times \frac{9}{x}$$

$$1 = \frac{144}{x^2}$$

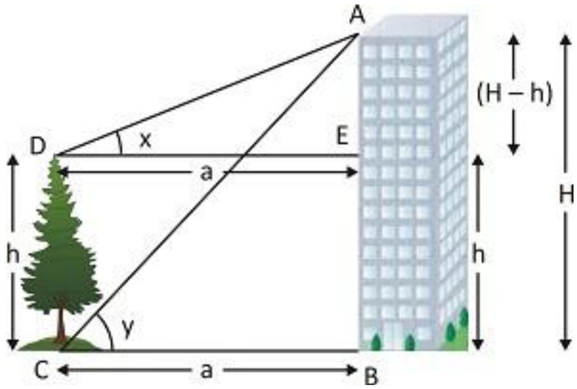
[∵ tan Θ cot Θ = 1]

$x^2 = 144$

x = 12 m

Hence, option C is correct.

7.



Given, the height of the tree, CD = h metre

Let, the height of the building, AB = H metre

And, BC = a metre

∴ AE = AB – EB = (H – h) metre   [∵ CD = BE]

In ΔABC,

$$\cot y = \frac{BC}{AB} = \frac{a}{H}$$

a = H cot y   ...(i)

Now, in ΔADE,

$$\cot x = \frac{DE}{AE} = \frac{a}{H - h}$$

a = (H – h) cot x   ...(ii)

From equations (i) and (ii),

H cot y = (H – h) cot x = H cot x – h cot x

H(cot x – cot y) = h cot x

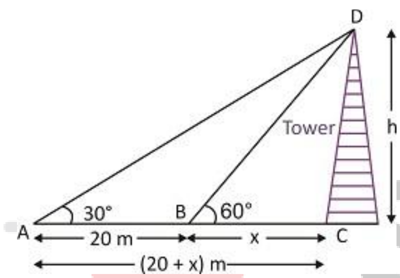
$$H = \frac{h \cot x}{\cot x - \cot y}$$

∴ The height of the building

$$= \frac{h \cot x}{\cot x - \cot y} \text{ metre.}$$

Hence, option C is correct.

8.



Given, AB = 20 m

Let, the height of the tower = h metre

And, BC = x metre

∴ AC = AB + BC = (20 + x) m

In ΔACD,

$$\tan 30° = \frac{CD}{AC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{20 + x}$$

x = h 3 – 20   ...(i)

Now, in ΔBCD,

$$\tan 60° = \frac{CD}{BC} \Rightarrow \sqrt{3} = \frac{h}{x}$$

$h = x\sqrt{3}$

$h = (h\sqrt{3} - 20)\sqrt{3}$ [From eq. (i)]

$h = 3h - 20\sqrt{3}$

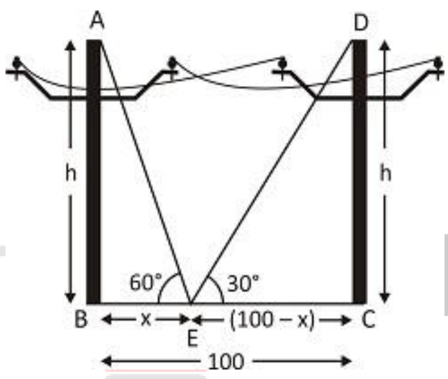
$2h = 20\sqrt{3}$

$h = 10\sqrt{3}$

$\therefore$ The height of the tower is $10\sqrt{3}$ meter.

Hence, option C is correct.

9.



Given, BC = 100 m,

Let, the height of each pole = h metre

And, BE = x metre

$\therefore$ CE = (100 – x) m

In ΔCDE,

$\tan 30° = \frac{CD}{EC} \Rightarrow \frac{1}{\sqrt{3}} = \frac{h}{100 - x}$

$x = 100 - h\sqrt{3}$ ...(i)

Now, in ΔABE,

$\tan 60° = \frac{AB}{BE} \Rightarrow \sqrt{3} = \frac{h}{x}$

$h = x\sqrt{3}$

$h = (100 - h\sqrt{3})\sqrt{3}$ [From eq. (i)]

$h = 100\sqrt{3} - 3h$

$4h = 100\sqrt{3}$

$h = 25\sqrt{3}$

∴ The height of each pole is $25\sqrt{3}$ meter.

Hence, option A is correct.

10.

Given, BC = $8\sqrt{3}$ m

In ΔABC,

$\tan 30° = \frac{AB}{BC}$

$\frac{1}{\sqrt{3}} = \frac{AB}{8\sqrt{3}}$

AB = 8 m

Again,

$\sin 30° = \frac{AB}{AC}$

$$\frac{1}{2} = \frac{8}{AC}$$

AC = 16 m

∴ The height of the post = AC + AB = 16 + 8 = 24 m.

Hence, option C is correct.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