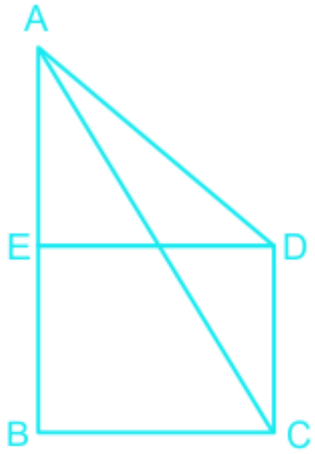
Date : 30th Nov 2023 **Quantitative Aptitude - Trigonometry** English

Q:1 From the top of a cliff 60 m high, the angle of depression of the top and bottom of a tower is observed to be 30° and 60° respectively. Find the height of the tower.
1. 20 m
2. 60 m
3. 80 m
4. 40 m

Q:2 If $[\sin^2\theta + \cot^2\theta - \cos^2\theta + \text{cosec}\theta] = 9/2$, then find the value of $\cos 2\theta$.
1. $\sqrt{3}/2$
2. 1/2
3. 0
4. 1

Q:3 If $\cos(a - b) = 3\cos(a + b)$, then what is the value of tan a tan b?
1. 0
2. ½
3. 1
4. -1

Q:4 In the following figure, CD is a building that is two-thirds taller than another building AB, which is $30\sqrt{3}$ m away from it. If the angle of inclination from the top of building AB to the feet of CD is 60°, what is the value of the angle of declination from the top of building AB to the top of building CD?



1. 15°
2. 22.5°
3. 60°
4. 30°

Q:5 If $8\sin^2\theta + 14\sin\theta - 15 = 0$ then, find the value of $\sqrt{\csc\theta - \sin\theta + \cot^2\theta}$.
1. 36/49
2. 49/36
3. 7/6
4. 6/7

Q:6 A coconut tree is 90 feet high it is broken by the wind and its upper part meets the ground at an angle of 30°. Find the distance of the point where the top of the tree meets the ground from its root.
1. $30\sqrt{3}$ feet
2. $36\sqrt{3}$ feet
3. $24\sqrt{3}$ feet
4. $27\sqrt{3}$ feet

Q:7 In an instant, the length of the shadow of a tree is the square root of 3 times the height of the tree. Find the angle of elevation.
1. 15°
2. 30°
3. 45°
4. 60°

Q:8 If $(\sin A = \cos 30°)$, what is the value of $(2\tan^2 A - \tan 45°)$, given that A is an acute angle?
1. 5
2. 4
3. 2
4. 0

Q:9 The angle of elevation of the top of a wall from point P on the track is 30°. On moving a distance of 72 m towards the foot of the wall, the angle of elevation increases to 45°. Find the height of the wall.
1. $72(\sqrt{3} + 1)$ m
2. $36(\sqrt{3} + 1)$ m
3. $18(\sqrt{3} + 1)$ m
4. 36 m

Q:10 If $\cot(A + C) + \cot B = 0$, then what is the value of $(\tan A + \tan B + \tan C)/(\tan A \tan B \tan C)$? $(A + B + C \leq \pi)$
1. 0
2. -1

Asutosh Mukherjee Road, College Para, Hathi More, Siliguri, West Bengal
+91 - 8436586516, +91-8436900456
thedhronas@gmail.com
thedronas.com
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3. 1
4. 3

Asutosh Mukherjee Road, College Para, Hathi More, Siliguri, West Bengal
+91 - 8436586516, +91-8436900456
thedhronas@gmail.com
thedronas.com

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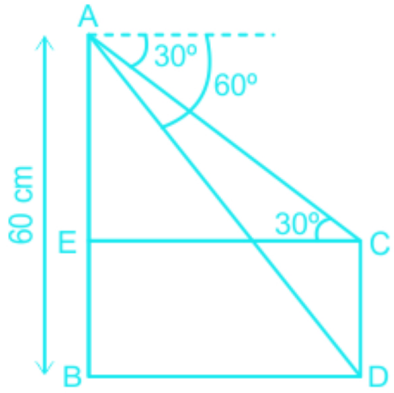
Answer Key

1. (4)	**2.** (2)	**3.** (2)	**4.** (3)	**5.** (3)
6. (1)	**7.** (2)	**8.** (1)	**9.** (2)	**10.** (3)

Answers and Solutions

Q:1 The correct answer is **Option 4** i.e. **40 m.**
Let, AB be the cliff and CD be the height of the tower



In triangle ABD, we have
tan 60° = AB/BD
⇒ √3 = 60/BD
BD = 60/√3 = EC ....(i)
In triangle AEC,
tan 30° = AE/EC
⇒ 1/√3 = AE/(60/√3)
⇒ AE = 1/√3 × 60/√3 = 20
Hence,
CD = (AB - AE) = (60 - 20) = 40 meters

Q:2 The correct answer is **Option 2** i.e. **1/2.**
$[\sin^2\theta + \cot^2\theta - \cos^2\theta + \text{cosec}\theta] = 9/2$
Put $\theta = 30°$
$\Rightarrow [(1/2)^2 + (\sqrt{3})^2 - (\sqrt{3}/2)^2 + (2)] = 9/2$
$\Rightarrow [(1/4) + (3) - (3/4) + (2)] = 9/2$
$\Rightarrow (1 + 12 - 3 + 8)/4 = 9/2$
$\Rightarrow [18/4] = 9/2$
$\Rightarrow 9/2 = 9/2$
Hence , $\theta = 30°$
Now,
$\Rightarrow \text{Cos } 2\theta = x$
$\Rightarrow \text{Cos } (2 \times 30°) = x$
$\Rightarrow \text{Cos } 60° = 1/2$
Hence,
$\Rightarrow \text{Cos } 2\theta = 1/2$

Q:3 The correct answer is **Option 2** i.e. **½.**
$\Rightarrow \cos(a - b) - \cos(a + b) = 2 \sin a \sin b$
$\Rightarrow \cos(a + b) + \cos(a - b) = 2 \cos a \cos b$
$\Rightarrow \{\cos(a - b) - \cos(a + b)\}/\{\cos(a + b) + \cos(a - b)\} = (\sin a \sin b)/(\cos a \cos b)$.....(1)
If $\cos(a - b) = 3 \cos(a + b)$ [given]
$\Rightarrow \{3\cos(a + b) - \cos(a + b)\}/\{3\cos(a + b) + \cos(a + b)\} = \tan a \tan b$ [From (1)]
$\Rightarrow ½ = \tan a \tan b$

Q:4 The correct answer is **Option 3** i.e. **60°.**
In triangle ABC,
$\angle ACB = 60°$
$\tan \angle ACB = AB/BC$
$\tan 60° = AB/(30\sqrt{3})$
$AB = 30\sqrt{3} \times \sqrt{3} = 90$ m
$\therefore CD = 2/3 \times AB = 60$ m
$AE = (90 - 60) = 30$ m
In triangle AED
$\tan \angle ADE = AE/ED$
$\Rightarrow 30/(30\sqrt{3}) = 1/\sqrt{3}$
$\therefore \angle ADE = 30°$
Now angle of declination = $\angle EAD = (180 - 90 - 30) = 60°$

Q:5 The correct answer is **Option 3** i.e. **7/6.**
$8\sin^2\theta + 14\sin\theta - 15 = 0$
$\Rightarrow 8\sin^2\theta + 20\sin\theta - 6\sin\theta - 15 = 0$
$\Rightarrow 4\sin\theta(2\sin\theta + 5) - 3(2\sin\theta + 5) = 0$
$\Rightarrow (2\sin\theta + 5)(4\sin\theta - 3) = 0$
$\Rightarrow \sin\theta = 3/4$, and $-5/2$(Can't possible)
$\Rightarrow \sin\theta = 3/4 = P/H$
$\Rightarrow B = \sqrt{16 - 9} = \sqrt{7}$
So, the value of $\text{cosec}\theta - \sin\theta + \cot^2\theta = 4/3 - 3/4 + 7/9 = 49/36$
$\Rightarrow \sqrt{\csc\theta - \sin\theta + \cot^2\theta} = 7/6$

Q:6 The correct answer is **Option 1** i.e. **30√3 feet.**

Asutosh Mukherjee Road, College Para, Hathi More, Siliguri, West Bengal
+91 - 8436586516, +91-8436900456
thedhronas@gmail.com
thedronas.com
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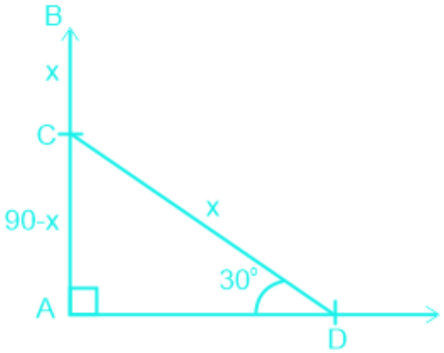
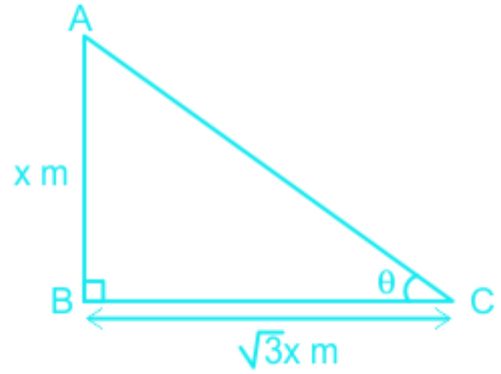


Given:
Total height of tree = 90 feet
Let upper broken part = BC = CD = x feet
∴ Remaining part = AC = (90° - x) feet
In △ACD
sin 30° = AC/CD
⇒ 1/2 = (90° - x)/x
⇒ x = 180° - 2x
⇒ 3x = 180°
⇒ x = 60°
CD = x = 60° feet
AC = 90° - x = 90° - 60° = 30° feet
∴ Required distance
AD(d) = √{(60)^2- (30)^2} = 30√3

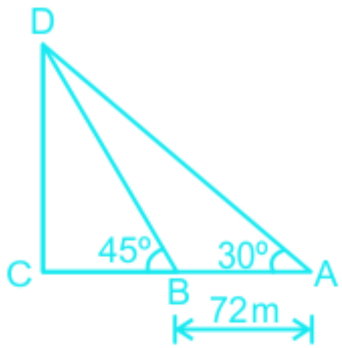
Q:7 The correct answer is **Option 2** i.e. **30°.**
Let,
The height of the tree = AB = x meters
According to the question-
Length of the shadow of the tree = BC = √(3)x meters



By applying,
⇒ tanθ = P/B = x/[√(3)x] = 1/√(3)
⇒ tanθ = 1/√3
⇒ tanθ = tan30°
So, θ = 30°
Hence, the angle of elevation = 30°

Q:8 The correct answer is **Option 1** i.e. **5.**
Here,
⇒ Sin A = cos30° or,
⇒ Sin A = cos (90° - 60°) or,
⇒ Sin A = sin 60°
So,
⇒ A = 60°
Now, Put A = 60° in [2tan^{2}A - tan45°], we get
⇒ (2(√3)^2 - 1) [where tan45° = 1 and tan60° = √3]
⇒ (2 × 3 - 1)
⇒ (6 - 1) = 5

Q:9 The correct answer is **Option 2** i.e. **36(√3 + 1) m.**
tan30° = 1/√3 and, tan45° = 1
Distance moved = 72 m
In Δ BCD,
⇒ tan 45°= DC/BC
So, DC = BC (tan45^0 = 1) and,
In ΔACD,
⇒ tan 30° = CD/AC



In Δ BCD
Let, DC = x
⇒ tan 45°= DC/BC
⇒ 1 = x/BC
⇒ BC = x
And,
⇒ tan 30° = CD/AC
⇒ 1/√3 = x/(72 + x)
⇒ 72 + x = √3x
⇒ (√3 - 1)x = 72

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+91 - 8436586516, +91-8436900456
thedhronas@gmail.com
thedronas.com
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$\Rightarrow x = 72/(\sqrt{3} - 1)$
Rationalize the denominator $= 72/(\sqrt{3} - 1) \times (\sqrt{3} + 1)/(\sqrt{3} + 1)$
$\Rightarrow x = 36(\sqrt{3} + 1)$ m
Hence, the height of the wall is $36(\sqrt{3} + 1)$ m

Q:10 The correct answer is **Option 3** i.e. **1.**
$\Rightarrow \cot(A + C) = -\cot B$
$\Rightarrow \cot(A + C) = \cot(\pi - B)$
$\Rightarrow A + C = \pi - B$
$\Rightarrow A + C + B = \pi$
Now we know that if $A + B + C = \pi = 180°$
Then, the value of
$\Rightarrow \tan A + \tan B + \tan C = \tan A \tan B \tan C$
$\therefore (\tan A + \tan B + \tan C)/(\tan A \tan B \tan C) = 1$

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