

RRB NTPC

Previous Years' Questions

Advanced Maths

Part III - Trigonometry



1. If the shadow of a pole is $\sqrt{3}$ times of its height on horizontal surface then angle of elevation is

- (A) 40°
- (B) 50°
- (C) 30°
- (D) 45°

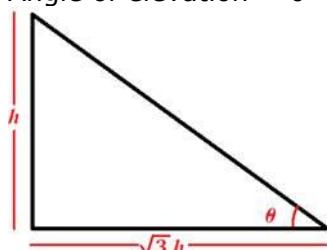
- A. C
- B. D
- C. B
- D. A

Ans. A

Sol. .

Let the height of pole be = h

Angle of elevation = θ



$$\tan \theta = \frac{h}{\sqrt{3}h}$$

$$\tan \theta = \frac{1}{\sqrt{3}}$$

$$\tan \theta = \tan 30^\circ.$$

2. If $\cos A = 12/13$, then $\sin A (1 - \tan A)$ = ?

- (A) $32/135$
- (B) $32/137$
- (C) $35/152$
- (D) $35/156$

- A. (C)
- B. (B)
- C. (D)
- D. (A)

Ans. C

Sol.

$$\cos A = 12/13 = B/H \text{ So } P = 5$$

$$\sin A (1 - \tan A) = 5/13(1 - 5/12) = 35/156$$

3. The elevation angle of two stones are 30° and 45° from an aeroplane to the road in same direction. If aeroplane is flying at 1.365 km high. Then find the distance between the two stones.

- (A) 1 km
- (B) 2 km
- (C) 3 km

- (D) 4 km

- A. (D)

- B. (A)

- C. (C)

- D. (B)

Ans. B

Sol.

$$\text{distance} = 1.365(3^{1/2} - 1) = 1.365 \times 0.732 = 1 \text{ km}$$

4. When the angle of elevation is become 60° to 30° by the Sun, Then shadow of water increases 30 meter more. Find the height of tower.

- (A) $12\sqrt{3}$ metre

- (B) $16\sqrt{3}$ metre

- (C) $17\sqrt{3}$ metre

- (D) $15\sqrt{3}$ metre

- A. (D)

- B. (C)

- C. (B)

- D. (A)

Ans. A

Sol.

Let the height be h

A.T.Q.

$$\tan 60 = \frac{h}{x}$$

$$\tan 30 = \frac{h}{x+30}$$

$$x \tan 60 = (x + 30) \tan 30$$

$$x\sqrt{3} = \frac{x + 30}{\sqrt{3}}$$

$$x = 15$$

$$\text{Then, } h = 15\sqrt{3}.$$

5. The elevation angle of a ladder inclined on wall is 60° , ladder's bottom is 8 metre away from the wall. Find the height of ladder.

- (A) 10 metre

- (B) 13 metre

- (C) 15 metre

- (D) 16 metre

- A. (A)

- B. (B)

- C. (D)

- D. (C)

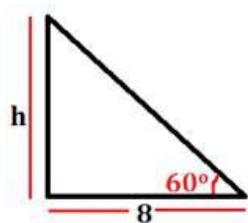


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Ans. C

Sol.



Let the height = h and length of ladder be

|

$$\frac{h}{8} = \tan 60^\circ$$

$$h = 8\sqrt{3}.$$

$$l = (h^2 + 8^2)^{\frac{1}{2}} \\ = 16$$

6. If $\sqrt{3} \tan \theta = 1$, then find the value of $\cos 2\theta$.

(A) $\frac{1}{2}$

(B) $\frac{1}{\sqrt{3}}$

(C) $\frac{1}{3}$

(D) 1

A. (B)

B. (D)

C. (C)

D. (A)

Ans. D

Sol.

$$\sqrt{3} \tan \theta = 1$$

$$\tan \theta = 1/\sqrt{3}$$

$$\theta = 30^\circ$$

$$\cos 2\theta = \cos(2 \times 30^\circ) = \cos 60^\circ = 1/2$$

7. Find the value of $\tan 30^\circ$.

(A) $\sqrt{3}$

(B) $\sqrt{3}/2$

(C) $1/\sqrt{3}$

(D) 1

A. (A)

B. (C)

C. (D)

D. (B)

Ans. B

Sol.

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

8. If $\tan A = \frac{15}{8}$ and $\tan B = \frac{7}{24}$, then $\cos(A+B) = ?$

(A) $\frac{87}{425}$

(B) $\frac{304}{425}$

(C) $\frac{297}{425}$

(D) $\frac{416}{425}$

A. (A)

B. (C)

C. (B)

D. (D)

Ans. A

Sol.

$$\tan A = 15/8$$

Then,

$$\sin A = \frac{15}{\sqrt{15^2+8^2}} = \frac{15}{\sqrt{289}} = 15/17$$

$$\cos A = \frac{8}{\sqrt{15^2+8^2}} = \frac{8}{\sqrt{289}} = 8/17$$

Similarly, $\tan B = 7/24$

$$\begin{aligned} \text{Then, } \sin A &= 7/25 \text{ and } \cos A = 24/25 \\ \cos(A+B) &= \cos A \cos B - \sin A \sin B = \\ &(8/17) \times (24/25) - (15/17) \times (7/25) \\ &= (192 - 105)/425 = 87/425 \end{aligned}$$

9. If $\sin x = \frac{4}{5}$, then $\sec^2 x - 1 = ?$

(A) $\frac{16}{25}$

(B) $\frac{25}{9}$

(C) $\frac{9}{16}$

(D) $\frac{16}{9}$

A. (A)

B. (D)

C. (B)

D. (C)

Ans. B

Sol.

$$\sin x = 4/5$$

$$\cos x = 3/5 \text{ & } \tan x = 4/3$$

$$\sec^2 x - 1 = \tan^2 x = (4/3)^2 = 16/9$$



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10. If $\sin A = \frac{4}{5}$ and $\sin B = \frac{5}{13}$, then $\cos(A + B) = ?$

(A) $\frac{16}{65}$

(B) $\frac{63}{65}$

(C) $\frac{33}{65}$

(D) $\frac{56}{65}$

A. (B)

B. (A)

C. (D)

D. (C)

Ans. B

Sol.

Given $\sin A = 4/5$ than $\cos A = 3/5$

And $\sin B = 5/13$ than $\cos B = 12/13$

$$\begin{aligned} \cos(A+B) &= \cos A \cos B - \sin A \sin B \\ &= 3/5 \times 12/13 - 4/5 \times 5/13 = (36-20)/65 \\ &= 16/65 \end{aligned}$$

11. If $\cot x = \frac{5}{12}$, then $\sin^2 x + 1 = ?$

(A) $\frac{194}{169}$

(B) $\frac{216}{65}$

(C) $\frac{331}{169}$

(D) $\frac{313}{169}$

A. (A)

B. (D)

C. (B)

D. (C)

Ans. B

Sol.

$$\cot x = \frac{B}{P} = \frac{5}{12}$$

$$H = \sqrt{P^2 + B^2} = \sqrt{169} = 13$$

$$\sin x = \frac{P}{H} = \frac{12}{13}$$

$$\sin^2 x + 1 = \left(\frac{12}{13}\right)^2 + 1 = \frac{144 + 169}{169} =$$

12. $\operatorname{cosec}^2 A \times \cos^2 A = ?$

(A) $\tan^2 A$

(B) $\cot^2 A$

(C) 1

(D) $\sec^2 A$

A. (A)

B. (D)

C. (C)

D. (B)

Ans. D

Sol.

$$\operatorname{cosec}^2 A \times \cos^2 A = \frac{1}{\sin^2 A} \times \cos^2 A = \cot^2 A$$

13. If $\sin \theta = \frac{5}{13}$, find $\cos \theta$.

(A) $\frac{8}{13}$

(B) $\frac{12}{13}$

(C) $\frac{23}{13}$

(D) 1

A. (D)

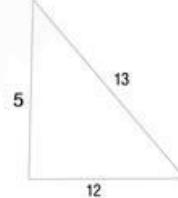
B. (C)

C. (B)

D. (A)

Ans. C

Sol.



$$\sin \theta = 5/13$$

$$\cos \theta = 12/13$$

14. Find the measure of an angle which is one-fourth of its supplementary angle.

(A) 45°

(B) 36°

(C) 90°

(D) 58°

A. (D)

B. (B)

C. (C)

D. (A)

Ans. B

Sol.

Let the angle be 'x', so it's supplementary angle will be $180^\circ - x$

$$\text{According to question } x = \frac{1}{4} \times (180 - x)$$



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$$5x = 180^\circ$$

$$x = 36^\circ$$

15. A 20 m long stair standing against a wall makes an angle of elevation of 30° , find the height of the wall.

- (A) 10 m
- (B) 17.32 m
- (C) 34.64 m
- (D) 30 m

A. (D)

B. (B)

C. (A)

D. (C)

Ans. C

Sol.

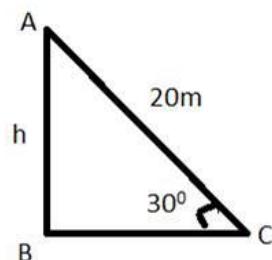
Let height AB = h

In triangle ABC

$$\sin 30^\circ = \frac{AB}{AC}$$

$$\frac{1}{2} = \frac{h}{20}$$

$$h = 10 \text{ m}$$



16. Distance between two straight poles of height 15 m and 20 m is 12 m. Find the distance between the top of two poles.

- (A) 11 m
- (B) 12 m
- (C) 13 m
- (D) 14 m

A. (A)

B. (C)

C. (D)

D. (B)

Ans. B

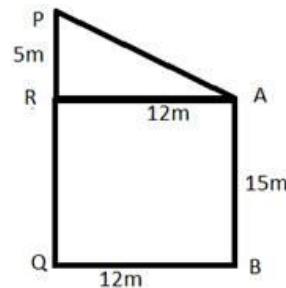
Sol.

$$PQ = 20 \text{ m}$$

$$AB = 15 \text{ m}$$

$$PR = 20 - 15 = 5 \text{ m}$$

$$\text{Distance between top of poles AP} = \sqrt{(12^2 + 5^2)} = 13 \text{ m}$$



17. A 20m long stair is standing against a wall making an angle of 60° from the ground. Find the distance between the foot of the stair and wall.

- (A) 10 m
- (B) 17.32 m
- (C) 34.64 m
- (D) 30 m

A. (B)

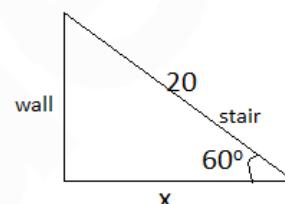
B. (D)

C. (C)

D. (A)

Ans. D

Sol.



Let the distance between foot of stair and wall is x

$$\cos 60^\circ = \frac{x}{20}$$

$$\frac{1}{2} = \frac{x}{20}$$

$$x = 10 \text{ m}$$

18. The pillars of 12 m and 17 m long are standing on the ground. If the distance between their feet is 12 m then find the distance between their top.

- (A) 11 m
- (B) 12 m
- (C) 13 m
- (D) 14 m

A. (D)

B. (A)

C. (C)

D. (B)

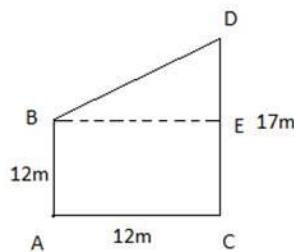
Ans. C

Sol.



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$$DE = 17 - 12 = 5 \text{ m}$$

Therefore,

$$\begin{aligned} BD &= \sqrt{BE^2 + DE^2} \\ &= \sqrt{12^2 + 5^2} \end{aligned}$$

$$BD = 13 \text{ m}$$

19. If $5 \tan \theta = 4$, find the value of $(3 \sin \theta - 2 \cos \theta) \div (2 \sin \theta + 3 \cos \theta)$

- (A) $\frac{6}{23}$
- (B) $\frac{2}{23}$
- (C) $\frac{4}{23}$
- (D) $\frac{5}{23}$

- A. (D)
 - B. (B)
 - C. (C)
 - D. (A)
- Ans. B

Sol.

$$\text{Given, } \tan \theta = 4/5$$

In the above expression,

$$(3 \sin \theta - 2 \cos \theta) \div (2 \sin \theta + 3 \cos \theta)$$

On dividing both numerator and denominator by $\cos \theta$, we get

$$(3\tan \theta - 2) / (2 \tan \theta + 3)$$

On putting the value of $\tan \theta$ in the above equation, we get

$$(3*4/5 - 2) / (2*4/5 + 3) = 2/23$$

20. The value of $\tan(1125^\circ)$ is

- (A) 1
- (B) -1
- (C) 0
- (D) ∞

- A. (C)
 - B. (D)
 - C. (B)
 - D. (A)
- Ans. D

Sol.

$$\tan(360^\circ + 360^\circ + 360^\circ + 45^\circ) = \tan 45^\circ = 1$$

21. The value of $(\cosec^2 \theta + 2 \tan \theta \cot \theta - \cot^2 \theta)$ is

- (A) 3
 - (B) 2
 - (C) 1
 - (D) 0
- A. (D)
B. (B)
C. (C)
D. (A)

Ans. D

Sol.

We know that

$$\cosec^2 \theta = 1 + \cot^2 \theta \Rightarrow \cosec^2 \theta - \cot^2 \theta = 1 \text{ and,}$$

$\cot \theta = 1/\tan \theta \Rightarrow \cot \theta \tan \theta = 1$
putting above values in the expression,

$$\begin{aligned} (\cosec^2 \theta + 2 \tan \theta \cot \theta - \cot^2 \theta) &= (1+2) \\ &= 3 \end{aligned}$$

22. If $\tan \theta = \frac{5}{12}$, then the value of $(\cos \theta + \sin \theta + \tan \theta \times \cot \theta)$

- (A) $\frac{5}{13}$
- (B) $\frac{12}{13}$

- (C) $\frac{17}{13}$
- (D) $\frac{30}{13}$

- A. (C)
- B. (A)
- C. (D)
- D. (B)

Ans. C

Sol.

$$\tan \theta = 5/12$$

$$\cos \theta = 12/13$$

$$\sin \theta = 5/13$$

In the given expression, on putting the above values

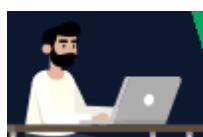
$$\cos \theta + \sin \theta + \tan \theta \times \cot \theta$$

$$= 12/13 + 5/13 + 1$$

$$= 17/13 + 1$$

$$= 30/13$$

23. If $\cos \theta = \frac{4}{5}$, then $(\sec \theta + \cosec \theta)$



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- (A) $\frac{7}{5}$
 (B) $\frac{15}{12}$
 (C) $\frac{35}{12}$
 (D) $\frac{12}{5}$

A. (C)
 B. (A)
 C. (B)
 D. (D)

Ans. A

Sol. If $\cos\theta = 4/5$

$$\text{then } \sec\theta = 5/4 \text{ and } \cosec\theta = 5/3 \\ = 5/4 + 5/3 \\ = 35/12$$

24. The value of $(\sin q + \cos q)^2 = ?$

- (A) $1 + \sin^2 q$
 (B) $\sin^2 q + \cos^2 q$
 (C) $1 + 2 \cos q \sin q$
 (D) $\cos^2 q + 1$

A. (C)
 B. (B)
 C. (D)
 D. (A)

Ans. A

Sol.

$$(\sin q + \cos q)^2 \\ = \sin^2 q + \cos^2 q + 2 \cos q \sin q \\ = 1 + 2 \cos q \sin q$$

25. If $\sin p = 1/\sqrt{2}$; then $(\tan p + \cos p) = ?$

- (A) $\frac{1}{\sqrt{2}}$
 (B) $\frac{2}{\sqrt{2}}$
 (C) $\frac{3}{\sqrt{2}}$
 (D) $\frac{(1+\sqrt{2})}{\sqrt{2}}$

A. (B)
 B. (A)
 C. (C)
 D. (D)

Ans. D

Sol.

$\sin p = 1/\sqrt{2}$

$p = 45$ degrees

$$\tan 45 + \cos 45 = 1+1/\sqrt{2} = \frac{(1+\sqrt{2})}{\sqrt{2}}$$

26. Find the value of $\tan(-405^\circ)$

- (A) 1
 (B) -1
 (C) ∞
 (D) 0
 A. (D)
 B. (C)
 C. (B)
 D. (A)

Ans. C

Sol. $\tan(-405^\circ)$ is in the fourth quadrant.
 $= \tan(-405^\circ) = \tan(-360 - 45) = \tan(-45^\circ)$
 $= -\tan 45^\circ = -1$

27. $\sin^2 21^\circ + \sin^2 69^\circ$ is equal to

- A. $2 \sin^2 21^\circ$
 B. $2 \sin^2 69^\circ$
 C. 1
 D. 0

Ans. C

Sol. $\sin^2 21^\circ + \sin^2(90^\circ - 21^\circ) = \sin^2 21^\circ + \cos^2 21^\circ = 1 \dots \dots \dots (\sin(90^\circ - x) = \sin x)$

28. The least value of $(4 \sec^2 \theta + 9 \cosec^2 \theta)$ is

- A. 1
 B. 19
 C. 25
 D. 7

Ans. C

$$\text{Sol. } (4 \sec^2 \theta + 9 \cosec^2 \theta) \\ \Rightarrow 4(1 + \tan^2 \theta) + 9(1 + \cot^2 \theta) \\ \Rightarrow 13 + (4 \tan^2 \theta + 9 \cot^2 \theta)$$

We know;

$$\Rightarrow \text{AM} \geq \text{GM} \\ \Rightarrow (4 \tan^2 \theta + 9 \cot^2 \theta)/2 \geq \\ \Rightarrow (4 \tan^2 \theta + 9 \cot^2 \theta) \geq 2 \sqrt{36}$$

$$\Rightarrow \geq 12$$

Therefore min value of $(4 \sec^2 \theta + 9 \cosec^2 \theta) = 13 + 12 = 25$

29. If $\cos \theta + \sec \theta = 2$, the value of $\cos^6 \theta + \sec^6 \theta$ is

- A. 1
 B. 2
 C. 4
 D. 8

Ans. B

Sol.

$$\cos \theta + \sec \theta = 2$$

Squaring both the sides;



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$$(\cos \theta + \sec \theta)^2 = \cos^2 \theta + \sec^2 \theta + 2 \cos \theta \sec \theta$$

$$\sec \theta = 1/\cos \theta$$

Thus we get,

$$\cos^2 \theta + \sec^2 \theta = 2, \text{ this means } \theta = 0$$

So on putting $\theta = 0$ we will get the value of $\cos^6 \theta + \sec^6 \theta = 2$

Hence Option B is correct.

Alternate method:

We can also use $\cos \theta = x$

$$x + 1/x = 2$$

$$X = 1 \text{ so } \cos^6 \theta + \sec^6 \theta = 2 \text{ answer}$$

30. From the top of a cliff 90 m high, the angles of depression of the top and bottom of a tower are observed to be 30° and 60° respectively. What is the height of the tower?

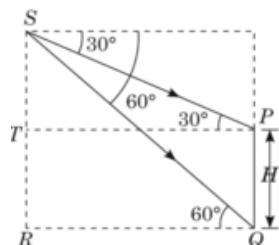
A. 45 m

B. 60 m

C. 75 m

D. 30 m

Ans. B



Sol.

Let H be the height of the tower PQ, SR = 90 m

From Triangle QRS,

$$\tan 60^\circ = \frac{90}{QR}$$

$$QR = \frac{90}{\tan 60^\circ} = 90/\sqrt{3} = 30\sqrt{3}$$

From Triangle PTS,

$$\tan 30^\circ = ST/PT = (90 - H)/QR = (90 - H)/30\sqrt{3}$$

$$\Rightarrow 90 - H = 30\sqrt{3} \times \tan 30^\circ$$

$$90 - H = 30$$

$$H = 60 \text{ m}$$

Hence Option B is correct

31. If $5\cos \theta + 12\sin \theta = 13$, then $\tan \theta$ is equal to

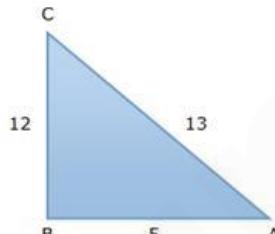
A. $\frac{13}{12}$

B. $\frac{12}{13}$

C. $\frac{12}{5}$

D. $\frac{5}{12}$

Ans. C



Sol.

$$5\cos \theta + 12\sin \theta = 13$$

We know 5,12,13 is a Pythagorean triplet

$$\frac{5}{13}\cos \theta + \frac{12}{13}\sin \theta = 1$$

$$\sin \phi \cos \theta + \cos \phi \sin \theta = \sin 90^\circ$$

$$\sin(\theta + \phi) = \sin 90^\circ$$

$$\theta + \phi = 90^\circ$$

$$\theta = 90^\circ - \phi$$

$$\therefore \tan \theta = \tan(90^\circ - \phi) = \cot \phi$$

$$= \frac{12}{5}$$

32. The angle of elevation of the top of the tower is 60° from a point 20 meter away from the foot of tower. The height of the tower is -

(A) 30.6 metre

(B) 34.6 metre

(C) 36.4 metre

(D) 36 metre

A. (B)

B. (C)

C. (A)

D. (D)

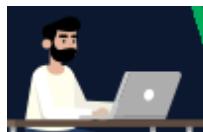
Ans. A

Sol. Distance from the foot of the tower (base) = 20m

The angle of elevation = 60°

now $\tan(60) = \sqrt{3} = \text{height/base}$

$$\text{height} = 20\sqrt{3} = 34.6 \text{ m}$$



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33. The value of $\sqrt{\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta}} \div \frac{\cos \theta}{1 + \sin \theta}$ is equal to:

A. -1

B. 1

C. $\frac{1}{2}$

D. 2

Ans. B

Sol.

$$\begin{aligned} & \sqrt{\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta}} \div \frac{\cos \theta}{1 + \sin \theta} \\ &= \frac{\sec \theta - \tan \theta}{\sqrt{\sec^2 \theta - \tan^2 \theta}} \div \frac{\cos \theta}{1 + \sin \theta} \\ &= \frac{\sec \theta - \tan \theta}{\frac{1}{\cos \theta}} \times \frac{1 + \sin \theta}{\cos \theta} \\ &= \frac{1}{\cos \theta} \times \frac{1 + \sin \theta}{\cos \theta} \\ &= \frac{1 - \sin^2 \theta}{\cos^2 \theta} \\ &= \frac{\cos^2 \theta}{\cos^2 \theta} = 1 \end{aligned}$$

34. P's height is 5 ft. and his shadow's height is 7 ft long. He measured the shadow of his school's building to be 42 ft. Find the height of the building

(A) 50 ft

(B) 36 ft

(C) 30 ft

(D) 32 ft

A. (D)

B. (A)

C. (B)

D. (C)

Ans. D

Sol.

Let θ be the angle of elevation of the sun. Therefore, $\tan \theta = \text{height of the man/length of man's shadow} = \text{height of the building / length of its shadow}$

Height of the building = $(5/7) \times 42 = 30$ ft.

35. If $\frac{\tan \theta + \sin \theta}{\tan \theta - \sin \theta} = \frac{k+1}{k-1}$, then $k = ?$

A. cosec θ

B. sec θ

C. cos θ

D. sin θ

Ans. B

Sol.

$$\text{Given, } \frac{\tan \theta + \sin \theta}{\tan \theta - \sin \theta} = \frac{k+1}{k-1},$$

$$\frac{\sin \theta (\sec \theta + 1)}{\sin \theta (\sec \theta - 1)} = \frac{k+1}{k-1}$$

$$\frac{(\sec \theta + 1)}{(\sec \theta - 1)} = \frac{k+1}{k-1} \quad \text{By comparing, we get } k = \sec \theta$$

$$36. (\cosec \theta - \cot \theta)^2 (1 + \cos \theta)^2 \div \cos^2 \theta = ?$$

A. $\tan^2 \theta$

B. $\cot^2 \theta$

C. $\cosec \theta$

D. $\sin^2 \theta$

Ans. A

Sol.

$$(\cosec \theta - \cot \theta)^2 (1 + \cos \theta)^2 \div \cos^2 \theta$$

$$= \frac{(1 - \cos \theta)^2}{\sin^2 \theta} \times \frac{(1 + \cos \theta)^2}{\cos^2 \theta}$$

$$= \frac{(1 - \cos^2 \theta)^2}{\sin^2 \theta \cos^2 \theta}$$

$$= \frac{\sin^4 \theta}{\sin^2 \theta \cos^2 \theta}$$

$$= \tan^2 \theta$$

$$37. \text{Find the value of } (\sec^2 \theta + 2 \tan \theta \times \cot \theta - \tan^2 \theta)$$

(A) 0

(B) 1

(C) 2

(D) 3

A. (D)

B. (A)

C. (B)

D. (C)

Ans. A

$$\text{Sol. } \sec^2 \theta + 2 \tan \theta \times \cot \theta - \tan^2 \theta$$

$$\sec^2 \theta - \tan^2 \theta + 2$$

$$1+2 = 3$$

38. A person standing on the bank of river observes that the angle of elevation of the top of tree standing on the opposite

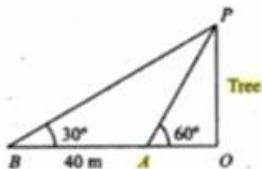


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bank is 60° . When he was 40 m away from the bank, he finds that the angle of elevation to be 30° . What is the height of the tree?

- A. 35.64 m
 - B. 38.64 m
 - C. 42.64 m
 - D. 34.64 m
- Ans. D



Sol.

Let the height of the tree be h

$$\tan 60^\circ = OP/OA = \sqrt{3}$$

$$OP = \sqrt{3} OA$$

$$\text{Also } OP/(OA+40) = \tan 30^\circ = 1/\sqrt{3}$$

$$OA+40 = \sqrt{3} OP = 3OA$$

2 OA=40

$$OA=20$$

$$H=20\sqrt{3}=34.64$$

39. If $\tan^2 \theta - 3 \sec \theta + 3 = 0; 0 < \theta < 90^\circ$, then what is the value of $\sec \theta + \tan \theta$?

A. $2 + \sqrt{3}$

B. $\frac{2}{\sqrt{3}}$

C. $2 - \sqrt{3}$

D. $\sqrt{3}$

Ans. A

Sol.

$$\tan^2 \theta - 3 \sec \theta + 3 = 0$$

$$\sec^2 \theta - 3 \sec \theta + 2 = 0$$

$$(\sec \theta - 2)(\sec \theta - 1) = 0$$

$$\theta = 60^\circ \text{ or } 0^\circ$$

$$\text{But } 0 < \theta < 90^\circ \Rightarrow \theta = 60^\circ$$

$$\sec \theta + \tan \theta = 2 + \sqrt{3}$$

40. For a triangle ABC, $\tan A = \frac{3}{4}$ and $\tan B = \frac{5}{12}$. What is the value of $\sin(2A + B)$?

A. 333/325

B. 323/325

C. 332/352

D. 323/352

Ans. B

Sol.

$$\sin A = \frac{3}{5} \text{ and } \cos A = \frac{4}{5}$$

$$\sin B = \frac{5}{13} \text{ and } \cos B = \frac{12}{13}$$

$$\sin(2A + B) = \sin 2A \cos B + \cos 2A \sin B$$

$$= 2 \sin A \cos A \cos B + (1 - 2 \sin^2 A) \sin B$$

$$= 2 \times \frac{3}{5} \times \frac{4}{5} \times \frac{12}{13} + \left(1 - 2 \times \frac{9}{25}\right) \times \frac{5}{13}$$

$$= \frac{288}{325} + \frac{7}{25} \times \frac{5}{13}$$

$$= \frac{288}{325} + \frac{35}{325} = \frac{323}{325}$$

41. $1 + \tan^2 2^\theta = ?$

(A) $\cot^2 \theta$

(B) $\sec^2 \theta$

(C) $\sec 2^\theta$

(D) $\operatorname{cosec}^2 \theta$

A. (A)

B. (C)

C. (D)

D. (B)

Ans. D

Sol.

$$1 + \tan^2 2^\theta = \sec^2 2^\theta \text{ (trigonometric identity)}$$

42. If $\cot \theta = 4/5$ then find $\frac{5 \cos \theta - \sin \theta}{5 \cos \theta + \sin \theta}$.

A. 3/7

B. 2/5

C. 3/5

D. 1

Ans. C

Sol.

$$\frac{5 \cos \theta - \sin \theta}{5 \cos \theta + \sin \theta}$$

$$= \frac{\sin \theta \left(5 \frac{\cos \theta}{\sin \theta} - 1\right)}{\sin \theta \left(5 \frac{\cos \theta}{\sin \theta} + 1\right)}$$

$$= \frac{\sin \theta \left(5 \frac{\cos \theta}{\sin \theta} - 1\right)}{\sin \theta \left(5 \frac{\cos \theta}{\sin \theta} + 1\right)}$$



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$$\begin{aligned}
 &= \frac{5 \cot \theta - 1}{5 \cot \theta + 1} \\
 &= \frac{5 \times \frac{4}{5} - 1}{5 \times \frac{4}{5} + 1} \\
 &= \frac{3}{5}.
 \end{aligned}$$

43. For a triangle ABC, $\tan A = \frac{3}{4}$ and $\tan B = \frac{5}{12}$. What is the value of $\sin(2A + B)$?

- A. 333/325
- B. 323/325
- C. 332/352

D. 323/352

Ans. B

$$\begin{aligned}
 \text{Sol. } \sin A &= \frac{3}{5} \text{ and } \cos A = \frac{4}{5} \\
 \sin B &= \frac{5}{13} \text{ and } \cos B = \frac{12}{13} \\
 \sin(2A + B) &= \sin 2A \cos B + \cos 2A \sin B \\
 &= 2 \sin A \cos A \cos B + (1 - 2 \sin^2 A) \sin B \\
 &= 2 \times \frac{3}{5} \times \frac{4}{5} \times \frac{12}{13} + \left(1 - 2 \times \frac{9}{25}\right) \times \frac{5}{13} \\
 &= \frac{288}{325} + \frac{7}{25} \times \frac{5}{13} \\
 &= \frac{288}{325} + \frac{35}{325} = \frac{323}{325}
 \end{aligned}$$



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