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Previous Year Questions 2024

Q1: If sin α = √3/2 , cos β = √3/2 then tan α. tan β is: (CBSE 2024)

(a) √3

(b) 1/√3

(c) 1

(d) 0

Ans: (c)

sin α = √3/2, ⇒ sin α = sin 60°

⇒ α = 60°

∵ cos β = √3/2,

⇒ cos β = cos 30°

⇒ β = 30°

tan α. tan β = tan 60°. tan 30°

$$= \sqrt{3} \times \frac{1}{\sqrt{3}}$$

= 1

Q2: Evaluate: $\frac{5 \tan 60^\circ}{(\sin^2 60^\circ + \cos^2 60^\circ) \tan 30^\circ}$ **(CBSE 2024)**

Ans:

$$\frac{5 \tan 60^\circ}{(\sin^2 60^\circ + \cos^2 60^\circ) \tan 30^\circ} = \frac{5 \times \sqrt{3}}{1 \times \frac{1}{\sqrt{3}}}$$

$$= 5\sqrt{3} \times \sqrt{3}$$

= 5 × 3

= 15

Q3: Prove that: (cosec θ – sin θ) (sec θ – cos θ) (tan θ + cot θ) = 1 (CBSE 2024)

Ans:

L.H.S. = (cosec θ – sin θ) (sec θ – cos θ) (tan θ + cot θ)

= (cosec θ – sin θ) (sec θ – cos θ) (tan θ + cot θ)

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

$$= \frac{\cos^2\theta}{\sin\theta} \times \frac{\sin^2\theta}{\cos\theta} \times \frac{1}{\sin\theta.\cos\theta}$$

$$= \sin\theta.\cos\theta \frac{1}{\sin\theta.\cos\theta} \quad [\because \sin^2\theta + \cos^2\theta = 1]$$

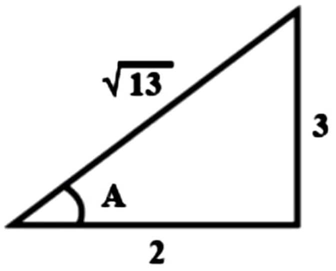
= 1 = R.H.S.

Hence, proved.

Previous Year Questions 2023

Q4: If 2 tan A = 3, then find the value of $\frac{4\sin A + 5\cos A}{6\sin A + 2\cos A}$ is (2023)

Ans:



$$2\tan A = 3 \rightarrow \tan A = \frac{3}{2}$$

$$\Rightarrow \sin A = \frac{3}{\sqrt{13}} \;\&\; \cos A = \frac{2}{\sqrt{13}}$$

$$\Rightarrow \frac{4\sin A + 5\cos A}{6\sin A + 2\cos A} = \frac{12+10}{18+4} = \frac{22}{22} = 1$$

Hence, the answer is 1.

Q5: 5/8 $\sec^2 60°$ - $\tan^2 60°$ + $\cos^2 45°$ is equal to (2023)

(a) 5/3

(b) -1/2

(c) 0

(d) -1/4

Ans: (c)

Sol:

$$= \frac{5}{8}\times(2)^2 - (\sqrt{3})^2 + \left(\frac{1}{\sqrt{2}}\right)^2 = \frac{5}{8}\times 4 - 3 + \frac{1}{2} = 0$$

Q6: Evaluate 2 $\sec^2\theta$ + 3 $\text{cosec}^2\theta$ - 2 sin θ cos θ if θ = 45° (CBSE 2023)

Ans: Since θ = 45°, sec 45° = √2, cosec 45° = √2, sin 45° = 1/√2 cos 45° = 1/√2

$2\sec^2\theta + 3\,\text{cosec}^2\theta - 2\sin\theta\cos\theta$

$$= 2(\sqrt{2})^2 + 3(\sqrt{2})^2 - 2\left(\frac{1}{\sqrt{2}}\right)\left(\frac{1}{\sqrt{2}}\right)$$

= 4 + 6 – 1 = 9

Q7: Which of the following is true for all values of θ($0^{o} \le \theta \le 90^{o}$)? (2023)

(a) $\cos^2\theta - \sin^2\theta - 1$

(b) $\text{cosec}^2\theta - \sec^2\theta - 1$

(c) $\sec^2\theta - \tan^2\theta - 1$

(d) $\cot^2\theta - \tan^2\theta = 1$

Ans: (c)

Let's evaluate each option to determine its validity for all angles between 0° and 90°.

Option (a): $\cos^2\theta - \sin^2\theta - 1$

This expression simplifies to $\cos^2\theta - \sin^2\theta$, which is equal to the cosine of double the angle. Subtracting 1 does not result in a constant value. For example, at 0°, it equals 0, and at 45°, it equals -1. Therefore, it is not always true.

Option (b): $\text{cosec}^2\theta - \sec^2\theta - 1$

Using trigonometric identities, $\text{cosec}^2\theta$ is 1 plus $\cot^2\theta$, and $\sec^2\theta$ is 1 plus $\tan^2\theta$. Subtracting these and then subtracting 1 again does not yield a constant result. For instance, at

Objective Answer Assistant

This assistant provides concise and direct responses to user queries without unnecessary elaboration. Here are some key points:

- Focus on clarity and brevity.
- Deliver direct answers to specific questions.
- Avoid extended explanations unless requested.
- Ideal for users seeking fast information retrieval.

45°, the expression equals -1, which means it is not always true.

Option (c): $\sec^2\theta - \tan^2\theta - 1$

According to the Pythagorean identity, $\sec^2\theta$ minus $\tan^2\theta$ equals 1. Subtracting 1 from both sides gives zero, confirming the identity holds true for all angles where secant and tangent are defined. Thus, this option is always true.

Option (d): $\cot^2\theta - \tan^2\theta = 1$

Calculating $\cot^2\theta$ minus $\tan^2\theta$ at 45° results in 0, not 1. This shows that the expression does not hold for all angles in the given range. Therefore, this option is not always true.

Conclusion: Only option (c) is true for all values of θ between 0° and 90°.

Q8: If $\sin\theta + \cos\theta = \sqrt{3}$, then find the value of $\sin\theta \cdot \cos\theta$. (2023)

Ans: Given, $\sin\theta + \cos\theta = \sqrt{3}$

Squaring both sides, we get $(\sin\theta + \cos\theta)^2 = 3$

$\Rightarrow \sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$

$\Rightarrow 2\sin\theta\cos\theta = 3 - 1 \quad (\because \sin^2\theta + \cos^2\theta = 1)$

$\Rightarrow 2\sin\theta\cos\theta = 2$

$\Rightarrow \sin\theta\cos\theta = 1$

Q9: If $\sin \alpha = 1/\sqrt{2}$ and $\cot \beta = \sqrt{3}$, then find the value of $\operatorname{cosec} \alpha + \operatorname{cosec} \beta$. (2023)

Ans: Given, $\sin \alpha = 1/\sqrt{2}$ and $\cot \beta = \sqrt{3}$

We know that, $\operatorname{cosec} \alpha = 1/\sin\alpha = \sqrt{2}$

Also, $1 + \cot^2\beta = \operatorname{cosec}^2\beta$

$\Rightarrow \operatorname{cosec}^2\beta = 4$

$\Rightarrow \operatorname{cosec} \beta = \sqrt{4} = 2$

Now, $\operatorname{cosec} \alpha + \operatorname{cosec} \beta = \sqrt{2} + 2$

Q10: Prove that the Following Identities: Sec A (1 + Sin A) (Sec A - tan A) = 1 (2023)

Ans: LHS = sec A(1 + sin A)(sec A - tan A)

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

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

$$= \frac{1-\sin^2 A}{\cos^2 A} = \frac{\cos^2 A}{\cos^2 A}$$

= 1

= RHS

Hence proved..

Q11: $(\sec^2 \theta - 1)(\operatorname{cosec}^2 \theta - 1)$ is equal to:

(a) –1

(b) 1

(c) 0

(d) 2 (CBSE 2023)

Ans: (b)

$(\sec^2 \theta - 1)(\operatorname{cosec}^2 \theta - 1) = \tan^2 \theta . \cot^2 \theta$ $\left[\begin{array}{l}\because \sec^2\theta - 1 = \tan^2\theta \\ \operatorname{cosec}^2\theta - 1 = \cot^2\theta\end{array}\right]$

$$= \tan^2\theta . \frac{1}{\tan^2\theta}$$

= 1

Q12: If $\sin \theta - \cos \theta = 0$, then find the value of $\sin^4 \theta + \cos^4 \theta$. (CBSE 2023)

Ans: Given,

$\sin \theta - \cos \theta = 0$

$\sin \theta = \cos \theta$

$\tan \theta = 1$

$\tan \theta = \tan 45°$

$\Rightarrow \theta = 45°$

Now, $\sin^4\theta + \cos^4\theta = \sin^4 45° + \cos^4 45°$

$= \left(\frac{1}{\sqrt{2}}\right)^4 + \left(\frac{1}{\sqrt{2}}\right)^4$

$= \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

Q13: Prove that $\frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A} = \tan A$ (CBSE 2023)

Ans: LHS $= \frac{\sin A - 2\sin^3 A}{2\cos^3 A - \cos A}$

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

$= \frac{\sin A}{\cos A}\left(\frac{1 - 2(1 - \cos^2 A)}{2\cos^2 A - 1}\right)$

$= \tan A\left(\frac{1 - 2 + 2\cos^2 A}{2\cos^2 A - 1}\right)$

$= \tan A\left(\frac{2\cos^2 A - 1}{2\cos^2 A - 1}\right)$

$= \tan A$

= RHS

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Previous Year Questions 2022

Q14: Given that $\cos\theta = \sqrt{3}/2$, then the value of $\frac{\text{cosec}^2\theta - \sec^2\theta}{\text{cosec}^2\theta + \sec^2\theta}$ is (2022)

(a) -1

(b) 1

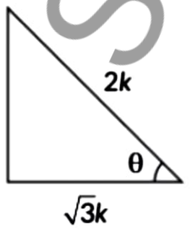
(c) 1/2

(d) -1/2

Ans: (c)

Sol:

Given, $\cos\theta = \sqrt{3}/2 = B/H$



Let $B = \sqrt{3}k$ and $H = 2k$

$\therefore\ P=\sqrt{(2k)^2-(\sqrt{3}k)^2}$ [By Pythagoras Theorem]

$\Rightarrow \sqrt{k^2} = k$

$\therefore\quad \text{cosec}\theta=\frac{H}{P}=\frac{2k}{k}=2 \qquad \sec\theta=\frac{H}{B}=\frac{2k}{\sqrt{3}k}=\frac{2}{\sqrt{3}}$

$$\therefore\quad \frac{\text{cosec}^2\theta-\sec^2\theta}{\text{cosec}^2\theta+\sec^2\theta}=\frac{(2)^2-\left(\frac{2}{\sqrt{3}}\right)^2}{(2)^2+\left(\frac{2}{\sqrt{3}}\right)^2}=\frac{4-\frac{4}{3}}{4+\frac{4}{3}}=\frac{8}{16}=\frac{1}{2}$$

Q15: $\frac{1}{\text{cosec}\theta(1-\cot\theta)}+\frac{1}{\sec\theta(1-\tan\theta)}$ is equal to (2022)

(a) 0

(b) 1

(c) sinθ + cosθ

(d) sinθ - cosθ

Ans: (c)

Sol: We have,

$$\frac{1}{\text{cosec}\theta(1-\cot\theta)}+\frac{1}{\sec\theta(1-\tan\theta)}$$

$$=\frac{\sin\theta}{1-\frac{\cos\theta}{\sin\theta}}+\frac{\cos\theta}{1-\frac{\sin\theta}{\cos\theta}}$$

$$\left[\because \frac{1}{\text{cosec}\theta}=\sin\theta, \frac{1}{\sec\theta}=\cos\theta, \tan\theta=\frac{\sin\theta}{\cos\theta}, \cot\theta=\frac{\cos\theta}{\sin\theta}\right]$$

$$=\frac{\sin^2\theta}{\sin\theta-\cos\theta}+\frac{\cos^2\theta}{\cos\theta-\sin\theta}=\frac{\sin^2\theta-\cos^2\theta}{\sin\theta-\cos\theta}=\sin\theta+\cos\theta$$

Q16: The value of θ for which 2 sin2θ = 1, is (2022)

(a) 15°

(b) 30°

(c) 45°

(d) 60°

Ans: (a)

Sol: Given, 2 sin2θ = 1 ⇒ sin2θ = 1/2

⇒ 2θ = 30°

⇒ θ = 15°

Q17: If $\sin^2\theta + \sin\theta = 1$, then find the value of $\cos^2\theta + \cos^4\theta$ is (2022)

(a) -1

(b) 1

(c) 0

(d) 2

Ans: (b)

Sol: Given, $\sin^2\theta + \sin\theta = 1$ ---(i)

$\sin\theta = 1 - \sin^2\theta$

$\Rightarrow \sin\theta = \cos^2\theta$ ---(ii)

$\therefore \cos^2\theta + \cos^4\theta$

$= \sin\theta + \sin^2\theta$ [From (ii)]

$= 1$ [From (i)]

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Previous Year Questions 2021

Q18: If 3 sin A = 1. then find the value of sec A. (2021 C)

Ans: We have, $3 \sin A = 1$

$\therefore \sin A = 1/3$

Now by using $\cos^2 A = 1 - \sin^2 A$, we get

$$\cos^2 A = 1 - \frac{1}{9} = \frac{8}{9} \Rightarrow \cos A = \frac{2\sqrt{2}}{3}$$

$$\therefore \sec A = \frac{1}{\cos A} = \frac{1}{\frac{2\sqrt{2}}{3}} = \frac{3}{2\sqrt{2}}$$

Q19: Show that: $\frac{1+\cot^2\theta}{1+\tan^2\theta} = \cot^2\theta$ **(2021 C)**

Ans: We have, L.H.S.

$$\frac{1+\cot^2\theta}{1+\tan^2\theta} = \frac{\text{cosec}^2\theta}{\sec^2\theta}$$

[By using $1 + \tan^2\theta = \sec^2\theta$ and $1 + \cot^2\theta = \text{cosec}^2\theta$]

$$\Rightarrow \frac{1/\sin^2\theta}{1/\cos^2\theta} = \frac{\cos^2\theta}{\sin^2\theta} = \cot^2\theta = \text{R.H.S.}$$

Hence,

$$\frac{1+\cot^2\theta}{1+\tan^2\theta} = \cot^2\theta$$

Previous Year Questions 2020

Q20: If $\sin\theta = \cos\theta$, then the value of $\tan^2\theta + \cot^2\theta$ is (2020)

(a) 2

(b) 4

(c) 1

(d) 10/3

Ans: (a)

Sol: We have, sin θ = cos θ

or sin θ / cos θ = 1

⇒ tan θ = 1 and cot θ = 1 [∵ cot θ = 1/tanθ]

∴ $\tan^2\theta + \cot^2\theta = 1^2 + 1^2 = 2$

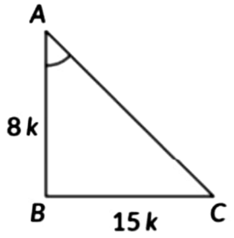
Hence, A option is correct.

Q21: Given 15 cot A = 8, then find the values of sin A and sec A. (2020)

Ans: In right angle ΔABC we have

15 cot A = 8

⇒ cot A = 8/15



Since, cot A = AB/BC

∴ AB/BC = 8/15

Let AB = 8k and BC = 15k

By using Pythagoras theorem, we get

$AC^2 = AB^2 + BC^2$

⇒ $(8k)^2 + (15)^2 = 64k^2 + 225k^2 = 289k^2 = (17k)^2$

$$\Rightarrow \quad AC = \sqrt{(17k)^2} = 17k$$

$$\therefore \quad \sin A = \frac{BC}{AC} = \frac{15k}{17k} = \frac{15}{17} \text{ and } \cos A = \frac{AB}{AC} = \frac{8k}{17k} = \frac{8}{17}$$

So, sec A = 1/cosA = 17/8

Q22: Write the value of $\sin^2 30° + \cos^2 60°$. (2020)

Ans: We have, $\sin^2 30° + \cos^2 60°$

$$= \left(\frac{1}{2}\right)^2 + \left(\frac{1}{2}\right)^2 = \frac{1}{4} + \frac{1}{4} = \frac{1+1}{4} = \frac{2}{4} = \frac{1}{2}$$

Q23: The distance between the points (a cos θ + b sin θ, 0) and (0, a sin θ − b cos θ) is (2020)

(a) $a^2 + b^2$

(b) a + b

(c) $\sqrt{a^2 + b^2}$

(d) $a^2 - b^2$

Ans: (c)

Sol: Given the point A (cos θ + b sin θ , 0), (0 , a sin θ − b cos θ)

By distance formula,

The distance of

$$AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

So,

$$AB = \sqrt{(a\cos\theta + b\sin\theta - 0)^2 + (0 - a\sin\theta + b\cos\theta)^2}$$

$$= \sqrt{(a^2(\sin^2\theta + \cos^2\theta) + b^2(\sin^2\theta + \cos^2\theta)}$$ [∵ $\cos^2\theta + \sin^2\theta = 1$]

But according to the trigonometric identity,

$\sin^2\theta + \cos^2\theta = 1$

Therefore,

$AB = \sqrt{a^2 + b^2}$

Q24: 5 $\tan^2\theta$ - 5 $\sec^2\theta$ = ________. (2020)

Ans: We have $5(\tan^2\theta - \sec^2\theta)$

= 5(-1) = - 5 [By using $1 + \tan^2\theta = \sec^2\theta \Rightarrow \tan^2\theta - \sec^2\theta = -1$]

Q25: If sinθ + cosθ = √3. then prove that tan θ + cot θ = 1 (2020)

Ans: sin θ + cos θ =√3

= $(\sin\theta + \cos\theta)^2 = 3$

= $\sin^2\theta + \cos^2\theta + 2\sin\theta\cos\theta = 3$

⇒ 2sin θ cos θ = 2

⇒ sin θ cos θ = 1

⇒ $\sin\theta\cos\theta = \sin^2\theta + \cos^2\theta$

$$\Rightarrow 1 = \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}$$

⇒ tan θ + cot θ = 1

Q26: If x = a sinθ and y = b cosθ , write the value of $(b^2x^2 + a^2y^2)$. (CBSE 2020)

Ans: Given, x = a sin θ and y = b cos θ

$b^2x^2 + a^2y^2 = b^2(a^2\sin^2\theta) + a^2(b^2\cos^2\theta)$

$= a^2b^2[\sin^2\theta + \cos^2\theta]$

$= a^2b^2$ [$\sin^2\theta + \cos^2\theta = 1$]

Q27: Prove that: $2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1 = 0$. (CBSE 2020)

Ans: We know that,

$\sin^2\theta + \cos^2\theta = 1$

So, $(\sin^2\theta + \cos^2\theta)^2 = 1^2$

So, $(\sin^2\theta + \cos^2\theta)^2 = 1^2$

$\Rightarrow \sin^4\theta + \cos^4\theta + 2\sin^2\theta\cos^2\theta = 1$

i.e., $\sin^4\theta + \cos^4\theta = 1 - 2\sin^2\theta\cos^2\theta$ ...(i)

Also, $(\sin^2\theta + \cos^2\theta)^3 = 1^3$

$\Rightarrow \sin^6\theta + \cos^6\theta + 3\sin^2\theta\cos^2\theta(\sin^2\theta + \cos^2\theta) = 1$

$\Rightarrow \sin^6\theta + \cos^6\theta + 3\sin2\theta\cos^2\theta(1) = 1$

i.e., $\sin^6\theta + \cos^6\theta = 1 - 3\sin^2\theta\cos^2\theta$ ...(ii)

Now,

LHS $= 2(\sin^6\theta + \cos^6\theta) - 3(\sin^4\theta + \cos^4\theta) + 1$

$= 2(1 - 3\sin^2\theta\cos^2\theta) - 3(1 - 2\sin^2\theta\cos^2\theta) + 1$

$= 2 - 3 + 1$

$= 0$

Hence, proved.

Q28: Prove that: $(\sin^4\theta - \cos^4\theta + 1)\operatorname{cosec}^2\theta = 2$. [CBSE 2020].

Ans: L.H.S. $= (\sin^4\theta - \cos^4\theta + 1)\operatorname{cosec}^2\theta$

$= [(\sin^2\theta + \cos^2\theta)(\sin^2\theta - \cos^2\theta) + 1]\operatorname{cosec}^2\theta$

$[(1)(\sin^2\theta - \cos^2\theta) + 1]\operatorname{cosec}^2\theta$ as $[\sin^2\theta + \cos^2\theta = 1]$

$= [\sin^2\theta + (1 - \cos^2\theta)]\operatorname{cosec}^2\theta$

$= (\sin^2\theta + \sin^2\theta)\operatorname{cosec}^2\theta$

$= (2\sin^2\theta)\operatorname{cosec}^2\theta$

$= 2\sin^2\theta \times \frac{1}{\sin^2\theta} \quad \left[\because \operatorname{cosec}\theta = \frac{1}{\sin\theta}\right]$

$= 2 \times 1$

$= 2 =$ R.H.S.

Hence, proved.