Foundation

UDAAN 2025
MATHS
TRIGONOMETRY

DHA: 02

Time Taken = 28 Minutes 30 Seconds
Score = 43/48

Q 1 Determine the value of A and B, if $\sin(A - B) = \frac{1}{2}$, $\cos(A + B) = \frac{1}{2}$, and $0° < A + B \leq 90°$, where $A > B$.

(A) 45° and 15°
(B) 35° and 55°
(C) 45° and 25°
(D) 15° and 25°

Q 2 Evaluate the expression $\sin 60° \cos 30° + \sin 30° \cos 60°$.

(A) 2 (B) 1
(C) 5 (D) 8

Q 3 $\operatorname{cosec} 3x = \frac{\cot 30° + \cot 60°}{1 + \cot 30° \cot 60°}$. Find 3x

(A) 35° (B) 30°
(C) 65° (D) 60°

Q 4 $\frac{\tan 60° - \tan 30°}{1 + \tan 60° \tan 30°}$

(A) $\frac{1}{\sqrt{8}}$ (B) $\frac{1}{\sqrt{2}}$
(C) $\frac{1}{\sqrt{3}}$ (D) $\frac{1}{\sqrt{6}}$

Q 5 $\frac{\tan^2 60° + 4\cos^2 45° + 3sec^2 30° + 5\cos^2 90°}{\operatorname{cosec} 30° + sec 60^2 - cot^2 30°}$

Important Question

(A) 9 (B) 12
(C) 8 (D) 5

Q 6 $\frac{5\sin^2 30° + \cos^2 45° - 4\tan^2 30°}{2\sin 30° \cos 30° + \tan 45°}$

Important Question

(A) $\frac{4}{5\left(8+\sqrt{3}\right)}$ (B) $\frac{6}{6\left(2+\sqrt{3}\right)}$
(C) $\frac{5}{6\left(2+\sqrt{3}\right)}$ (D) $\frac{8}{6\left(4+\sqrt{3}\right)}$

Q 7 $\sin^2 45° (1 + \cot^2 45°) + \cos^2 45° (1 + \tan^2 45°) + \sin^2 20° + \cos^2 20°$. = 1

(A) 4 (B) 8
(C) 2 (D) 3

Q 8 $\frac{\sin 70^o}{\cos 20^o} + \frac{\operatorname{cosec} 20^o}{sec 70^o} - 2\cos s 20^o \cos ec 20^o$

(A) 5 (B) 0
(C) 4 (D) 3

Didn't understand

Q 9 For the given statements select the correct option.

Assertion: The value of $\sin\theta = \frac{4}{3}$ in not possible.

Reason: Hypotenuse is the largest side in any right angled triangle.

(A) Assertion is false but reason is true
(B) Assertion is true but reason is false.
(C) Both assertion and reason are true but reason is not the correct explanation of assertion
(D) Both assertion and reason are true and reason is the correct explanation of assertion.

Direction (10 - 12) Read the following passage and answer the given questions.

'Skysails' is that genre of engineering science that uses extensive utilization of wind energy to move a vessel in the sea water. The sky sails technology allows the towing kite to gain a height of anything between 100 m to 300 m. The sailing kite is made in such a way that it can be raised to its proper elevation and then brought back with the help of a telescopic mast that enables the kite to be raised properly and effectively. Based on the following figure related to sky sailing answer the questions:

Q10 In the given figure, if $\tan\theta = \cot(30° + \theta)$, where θ and $30° + \theta$ are acute angles, then the value of θ is:

(A) 45° (B) 30°
(C) 60° (D) None of these

Q11 The value of $\tan 30° . \cot 60°$ is:

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

Q12 If $\cos A = \frac{1}{2}$, then the value of $9\cot^2 A - 1$ is:

(A) 1 (B) 2
(C) 3 (D) 4

Answer Key

Q1	**A**
Q2	**B**
Q3	**D**
Q4	**C**
Q5	**A**
Q6	**C**
Q7	**D**
Q8	**B**
Q9	**D**
Q10	**B**
Q11	**D**
Q12	**C**

Hints & Solutions

Q 1 Text Solution:

Given that: $\sin(A - B) = \frac{1}{2}$

$\cos(A + B) = \frac{1}{2}$, and $0° < A + B \leq 90°$, where $A > B$.

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

Therefore, $A - B = \sin^{-1}\left(\frac{1}{2}\right) = 30°$ ….(1)

$\cos(A + B) = \frac{1}{2}$

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

$A + B = 60°$ …(2)

On solving the equation (1) and (2), we get

$A = 45°$ and $B = 15°$.

Therefore, the values of A and B are 45° and 15°, respectively

Video Solution:

Q 2 Text Solution:

Given Expression: $\sin 60° \cos 30° + \sin 30° \cos 60°$

$\sin 30° = \frac{1}{2}$

$\cos 30° = \frac{\sqrt{3}}{2}$

$\sin 60° = \frac{1}{2}$

Now, substitute the values of in 30°, cos 30°, sin 60°,

cos 60°, $\sin 60° \cos 30° + \sin 30° \cos 60° = \left(\frac{\sqrt{3}}{2}\right)$

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

$= \left(\frac{3}{4}\right) + \left(\frac{1}{4}\right)$

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

Therefore, $\sin 60° \cos 30° + \sin 30° \cos 60° = 1$.

Video Solution:

Q 3 Text Solution:

$\cot 30° = \sqrt{3}$; $\cot 60° = \frac{1}{\sqrt{3}}$

$= \frac{\cot 30° \cot 60°}{1 + \cot 30° \cot 60°} = \frac{\sqrt{3} + \frac{1}{\sqrt{3}}}{1 + \sqrt{3} \times \frac{1}{\sqrt{3}}} = \frac{\frac{(3+1)}{\sqrt{3}}}{2}$

$= \frac{4}{\sqrt{3}} \times \frac{1}{2} = \frac{2}{\sqrt{3}}$

So, cosec 3 × = $\frac{2}{\sqrt{3}}$

We know $\frac{2}{\sqrt{3}}$ = cosec 60°

Therfore $3x = 60$ or $x = 20°$

Video Solution:

Q 4 Text Solution:

$\tan 60° = \sqrt{3}$; $\tan 30° = \sqrt{3}$

$\frac{\tan 60° - \tan 30°}{1 + \tan 60° \tan 30°}$

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

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

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

Video Solution:

Q 5 Text Solution:

By trigonometric ratios we have

$\tan 60° = \sqrt{3} \cos 45° = \frac{1}{\sqrt{2}} \sec 30° = \frac{2}{\sqrt{3}}$

$\cos 90° = 0$ $\operatorname{cosec} 30° = 2$ $\sec 60° = 2$ $\cot 30° = \sqrt{3}$

By substituting above values in (i), we get

$$\frac{\left(\sqrt{3}\right)^2 + 4.\left(\frac{1}{\sqrt{3}}\right)^2 + 2 + \left[\frac{2}{\sqrt{3}}\right]^2 + 5(0)^2}{2 + 2\sqrt{2}\left(+\sqrt{3}\right)^2}$$

$= \frac{3 + 4.\frac{1}{2} + 3\frac{4}{3}}{4 - 3} = \frac{3 + 2 + 4}{1} = 9$

Video Solution:

Q 6 Text Solution:

$\frac{5\sin^2 30° + \cos^2 45° - 4\tan^2 30°}{2\sin 30° \cos 30° + \tan 45°}$

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

$= \frac{\frac{15 + 6 - 16}{12}}{\frac{\sqrt{3} + 2}{2}} = \frac{\frac{5}{12}}{\frac{2 + \sqrt{3}}{2}}$

$= \frac{5}{12} \times \frac{2}{2 + \sqrt{3}} = \frac{5}{6\left(2 + \sqrt{3}\right)}$

Video Solution:

Q 7 Text Solution:

$\sin^2 45° (1 + \cot^2 45°) + \cos^2 45 (1 + \tan^2 45°) + \sin^2 20° + \cos^2 20°$

$\left(\frac{1}{\sqrt{2}}\right)^2 \left[1 + (1)^2\right] + \left(\frac{1}{\sqrt{2}}\right)^2 \left[1 + (1)^2\right] + \sin^2 20° + \cos^2 20°$

$= \frac{1}{2} \times 2\frac{1}{2} \times 2 + 1$ [$\because \sin^2 20° + \cos^2 20° = 1$]

$= 1 + 1 + 1 = 3$

Video Solution:

Q 8 Text Solution:

$\sin(70°) = \sin(90° - 20°) = \cos 20°$

$\cos 70° = \cos(90° - 20°) = \sin 20°$

$\Rightarrow \quad \frac{\cos 20°}{\cos 20°} + \frac{\sec 70°}{\sec 70°} - 7 \sin 20° \operatorname{cosec} 20°$

1 + 1 – 2 (1) = 0

Video Solution:

Q 9 Text Solution:

We know that,

$\sin\theta = \frac{\text{Height}}{\text{Hypotnuse}}$

Now, considering the above data,

Height = 4 unit and Hypotenuse = 3 unit

We also know that, the triangle must be right angled triangle to get the value of sinq

So, now apply the Pythagoras theorem to get the base of the triangle. we get base = $\sqrt{3^2 - 4^2}$

$\sqrt{9 - 16}$

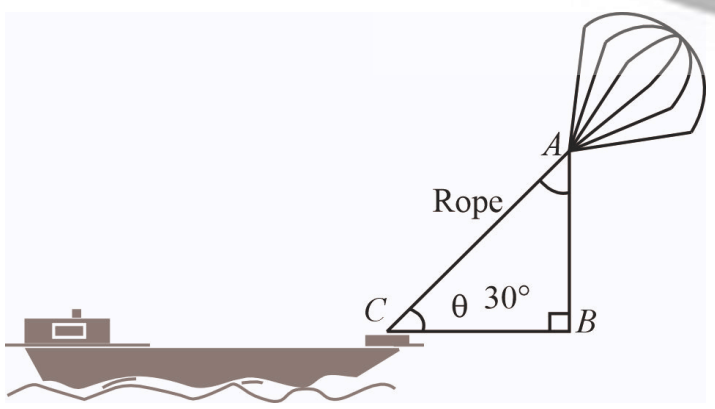
$\sqrt{-7}$

Which is not possible.

Hence, assertion is true and to follow the Pythagoras theorem the hypotenuse has to be the largest side in the triangle.

Video Solution:

Q10. Text Solution:



Given,

$\tan\theta = \cot(30° + \theta)$

$\tan\theta = \tan[90° - (30° + \theta)]$

$\tan\theta = \tan(90° - 30° - \theta)$

$\tan\theta = \tan(60° - \theta)$

Comparing angles

$\theta = 60° - \theta$

$\theta + \theta = 60°$

$2\theta = 60°$

Comparing angles

$2\theta = 60°$

$\theta = \frac{60^\circ}{2}$

$\theta = 30°$

So, the correct answer is (B).

Video Solution:

Q11. Text Solution:

$\tan 30° \times \cot 60°$

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

Q12. Text Solution:

Given,

$\cos A = \frac{1}{2}$

$\cos A = \cos 60°$

$\therefore A = 60°$

Now,

$9\cot^2 A - 1 = 9 \times \cot^2 60° - 1$

$= 9 \times \left(\frac{1}{\sqrt{3}}\right)^2 - 1$

$9 \times \frac{1}{3} - 1$

$= 3 - 1$

$= 2$

So, the correct answer is (C).