

THE O.P. GUPTA

ADVANCED MATH CLASSES

Class XII - Mathematics (041)

Topics - Inverse Trig. Functions

Alpha Test Series-3

(For Academic session 2025-26)

Max. Marks - 30

Time - 60 Minutes

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Followings are of 2 Marks each (Q01-05).

Q01. Find the domain of $f(x) = \sin^{-1}(3x - 4) + \cos^{-1} x$. Also, find the range of $f(x)$.

Q02. Draw the graph of $y = \cos^{-1} x$, where $x \in \left[-1, \frac{1}{2}\right]$. Also, write its range.

Q03. Using principal values, find the value of $(m + n)$, where $m = 4\sin^{-1}\left(-\frac{\sqrt{2}}{2}\right) + 2\cot^{-1}(-1) - \sec^{-1}\left(\frac{2}{\sqrt{3}}\right)$
and $n = \tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right)$.

Q04. Using principal values, find the value of $\tan^{-1}\left(\tan \frac{12\pi}{11}\right) + \sin^{-1}\left(\sin \frac{9\pi}{10}\right)$.

Q05. Find the value of $2\sin^{-1} x - 3\cos^{-1} x$, if $x^2 + 2x + 1 = 0$. [2 × 5 = 10]

Followings are of 3 Marks each (Q06-07).

Q06. Find the real solutions of the equation : $\tan^{-1}\sqrt{x(x+1)} + \sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$.

Q07. Express $\tan^{-1}\left(\frac{\cos x}{1 - \sin x}\right)$, $-\frac{\pi}{2} < x < \frac{\pi}{2}$ in the simplest form.

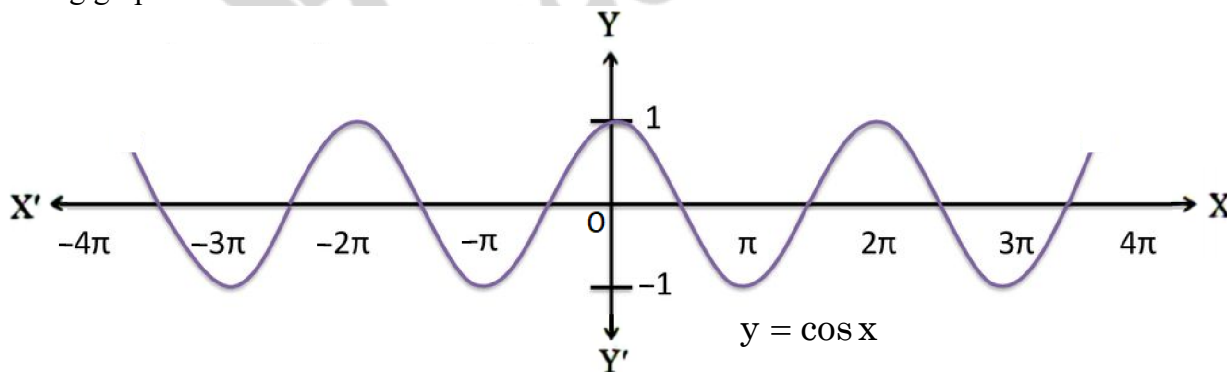
OR

Simplify : $\cos^{-1} x + \cos^{-1}\left[\frac{x}{2} + \frac{\sqrt{3-3x^2}}{2}\right]$; $\frac{1}{2} \leq x \leq 1$. [3 × 2 = 6]

Following is of 4 Marks (Q08).

Q08. **PASSAGE BASED QUESTION :** If a function $f : X \rightarrow Y$ defined as $f(x) = y$ is one-one and onto, then we can define a unique function $g : Y \rightarrow X$ such that $g(y) = x$, where $x \in X$ and $y = f(x)$, $y \in Y$. Function g is called the inverse of f .

The domain of cosine function is $\mathbb{R}$ and function $\cosine : \mathbb{R} \rightarrow \mathbb{R}$ is neither one-one nor onto. The following graph shows the cosine function.



Let cosine function be defined from set A to $[-1, 1]$ such that inverse of cosine function exists, i.e., $\cos^{-1} x$ is defined from $[-1, 1]$ to A .

On the basis of above information, answer the following questions.

(i) If A is the interval other than principal value branch, give an example of one such interval.

(ii) If $\cos^{-1} x$ is defined from the interval $[-1, 1]$ to its principal value branch, then find the value of

$$\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) - \cos^{-1}(-1).$$

(iii) Find the domain of $f(x) = 2 \cos^{-1}(1-x)$.

(iv) Find the range of $f(x) = 2 \cos^{-1}(1-x)$, if $x \in [0, 1]$.

[1 × 4 = 4]

Followings are of 5 Marks each (Q09-10).

Q09. Find the interval, in which $\cos^{-1} x > \sin^{-1} x$.

Q10. If $\cos^{-1} x + \cos^{-1} y + \cos^{-1} z = \pi$, then prove that $x^2 + y^2 + z^2 + 2xyz = 1$.

OR

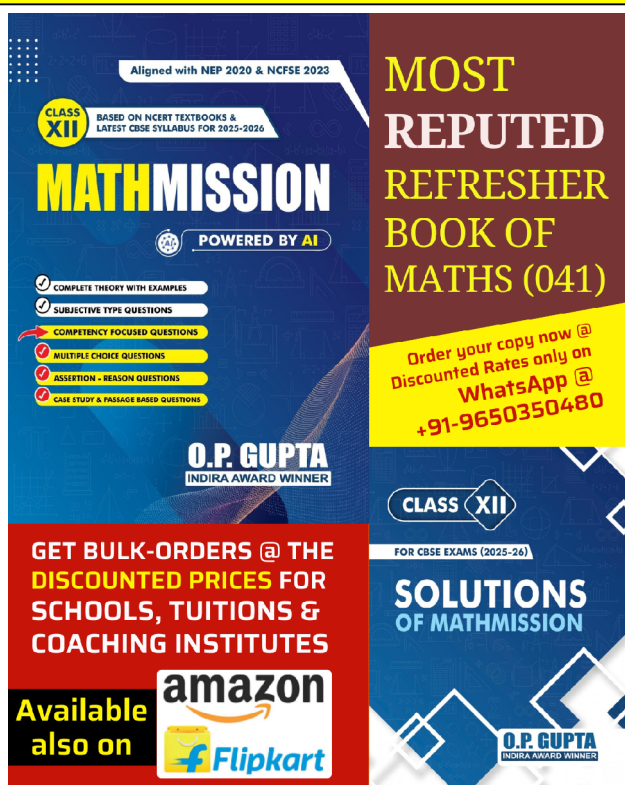
Simplify : $\cot^{-1} \left[\frac{1}{\sqrt{x^2 - 1}} \right]$, $x < -1$.

[5 × 2 = 10]

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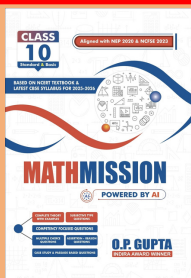
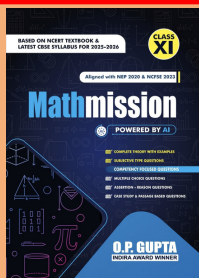
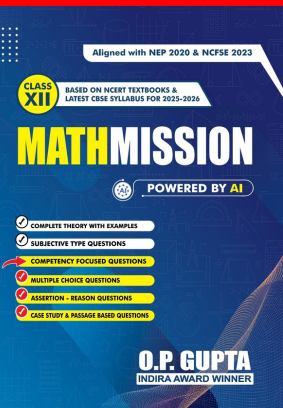
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