11. Trigonometric Equations

Exercise 11.1

1 A. Question

Find the general solutions of the following equations :

i.
$$\sin x = \frac{1}{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = \pi + y$, where $n \in Z$.

we have,

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

We know that $\sin 30^{\circ} = \sin \pi/6 = 0.5$

$$\therefore \sin x = \sin \frac{\pi}{6}$$

 \because it matches with the form $\sin x = \sin y$

Hence,

$$x = n\pi + (-1)^n \frac{\pi}{3}$$
, where n \in Z

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- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in \mathbb{Z}$.
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$$\therefore \sin x = \sin \frac{\pi}{6}$$

 \because it matches with the form $\sin x = \sin y$



Hence,

 $x = n\pi + (-1)^n \frac{\pi}{3}$, where n \in Z

1 B. Question

Find the general solutions of the following equations :

$$\cos x = -\frac{\sqrt{3}}{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = \pi + y$, where $n \in Z$.

Given,

$$\cos x = -\frac{\sqrt{3}}{2}$$

We know that, $\cos 150^\circ = \left(-\frac{\sqrt{3}}{2}\right) = \cos \frac{5\pi}{6}$

$$\therefore \cos x = \cos \frac{5\pi}{6}$$

If $\cos x = \cos y$ then $x = 2n\pi \pm y$, where $n \in Z$.

For above equation $y = 5\pi / 6$

$$\therefore$$
 x = 2n π ± 5 π / 6 ,where n \in Z

Thus, x gives the required general solution for the given trigonometric equation.

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- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$\cos x = -\frac{\sqrt{3}}{2}$$

We know that, $\cos 150^\circ = \left(-\frac{\sqrt{3}}{2}\right) = \cos \frac{5\pi}{6}$





$$cos x = cos \frac{5\pi}{6}$$

If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$.

For above equation $y = 5\pi / 6$

$$\therefore x = 2n\pi \pm 5\pi / 6$$
, where $n \in Z$

Thus, x gives the required general solution for the given trigonometric equation.

1 C. Question

Find the general solutions of the following equations:

$$cosecx = -\sqrt{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = \pi + y$, where $n \in Z$.

Given,

$$cosecx = -\sqrt{2}$$

We know that $\sin x$, and $\csc x$ have negative values in the 3^{rd} and 4^{th} quadrant.

While giving a solution, we always try to take the least value of y

The fourth quadrant will give the least magnitude of y as we are taking an angle in a clockwise sense (i.e., negative angle)

$$-\sqrt{2} = -\csc(\pi/4) = \csc(-\pi/4) \{ \because \sin \theta = -\sin \theta \}$$

$$\because cosec \ x = cosec \ \left(-\frac{\pi}{4}\right)$$

$$\Rightarrow \sin x = \sin \left(\frac{-\pi}{4}\right)$$

If $\sin x = \sin y$, then $x = n\pi + (-1)^n y$, where $n \in Z$.

For above equation $y = -\frac{\pi}{4}$

$$\therefore$$
 x = n π + (-1)ⁿ $\left(-\frac{\pi}{4}\right)$, where n \in Z

Or
$$x = n\pi + (-1)^{n+1} \left(\frac{\pi}{4}\right)$$
, where $n \in Z$

Thus, x gives the required general solution for given trigonometric equation.

1 C. Question

Find the general solutions of the following equations :

$$cosecx = -\sqrt{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -







• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

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• tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$cosecx = -\sqrt{2}$$

We know that $\sin x$, and $\csc x$ have negative values in the 3^{rd} and 4^{th} quadrant.

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$$\because cosec \ x = cosec \ \left(-\frac{\pi}{4}\right)$$

$$\Rightarrow \sin x = \sin \left(\frac{-\pi}{4}\right)$$

If $\sin x = \sin y$, then $x = n\pi + (-1)^n y$, where $n \in Z$.

For above equation $y = -\frac{\pi}{4}$

$$\therefore x = n\pi + (-1)^n \left(-\frac{\pi}{4}\right)$$
, where $n \in Z$

Or
$$x = n\pi + (-1)^{n+1} \left(\frac{\pi}{4}\right)$$
, where $n \in Z$

Thus, x gives the required general solution for given trigonometric equation.

1 D. Question

Find the general solutions of the following equations:

$$\sec x = \sqrt{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

• $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,

$$sec x = \sqrt{2}$$

We know that sec x and $\cos x$ have positive values in the 1st and 4th quadrant.

While giving a solution, we always try to take the least value of y

both quadrants will give the least magnitude of y.

We can choose any one, in this solution we are assuming a positive value.

$$\sec x = \sec \frac{\pi}{4}$$

$$\Rightarrow \cos x = \cos \frac{\pi}{4}$$







If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$.

For above equation $y = \pi / 4$

$$\therefore \mathbf{x} = 2\mathbf{n}\pi \pm \frac{\pi}{4}$$
, where $\mathbf{n} \in \mathbf{Z}$

Thus, x gives the required general solution for the given trigonometric equation.

1 D. Question

Find the general solutions of the following equations :

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- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$sec x = \sqrt{2}$$

We know that sec x and $\cos x$ have positive values in the 1st and 4th quadrant.

While giving a solution, we always try to take the least value of y

both quadrants will give the least magnitude of y.

We can choose any one, in this solution we are assuming a positive value.

$$\sec x = \sec \frac{\pi}{4}$$

$$\Rightarrow \cos x = \cos \frac{\pi}{4}$$

If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$.

For above equation $y = \pi / 4$

$$\therefore x = 2n\pi \pm \frac{\pi}{4}$$
, where $n \in Z$

Thus, x gives the required general solution for the given trigonometric equation.

1 E. Question

Find the general solutions of the following equations :

$$\tan x = -\frac{1}{\sqrt{3}}$$

Answer

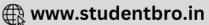
Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.







Given,

$$\tan x = -\frac{1}{\sqrt{3}}$$

We know that tan x and cot x have negative values in the 2^{nd} and 4^{th} quadrant.

While giving solution, we always try to take the least value of y.

The fourth quadrant will give the least magnitude of y as we are taking an angle in a clockwise sense (i.e. negative angle)

$$\tan x = \tan \left(-\frac{\pi}{6}\right)$$

If $\tan x = \tan y$ then x = m + y, where $n \in Z$.

For above equation $y = -\frac{\pi}{6}$

$$\therefore x = n\pi + (-\frac{\pi}{6})$$
, where $n \in Z$

Or
$$x = n\pi - \frac{\pi}{6}$$
, where $n \in Z$

Thus, x gives the required general solution for the given trigonometric equation.

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Answer

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- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$\tan x = -\frac{1}{\sqrt{3}}$$

We know that tan x and cot x have negative values in the 2^{nd} and 4^{th} quadrant.

While giving solution, we always try to take the least value of y.

The fourth quadrant will give the least magnitude of y as we are taking an angle in a clockwise sense (i.e. negative angle)

$$\tan x = \tan \left(-\frac{\pi}{6}\right)$$

If tan $x = \tan y$ then x = m + y, where $n \in Z$.

For above equation $y = -\frac{\pi}{6}$

$$\therefore x = n\pi + (-\frac{\pi}{6})$$
, where $n \in Z$

Or $x = n\pi - \frac{\pi}{6}$, where $n \in Z$







Thus, x gives the required general solution for the given trigonometric equation.

1 F. Question

Find the general solutions of the following equations :

$$\sqrt{3}$$
 sec x = 2

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\sqrt{3} \sec x = 2$$

$$\Rightarrow$$
 sec $x = \frac{2}{\sqrt{3}}$

We know that sec x and $\cos x$ have positive values in the 1st and 4th quadrant.

While giving solution, we always try to take the least value of y

both quadrants will give the least magnitude of y.

We can choose any one, in this solution we are assuming a positive value.

$$\sec x = \sec \frac{\pi}{6}$$

$$\Rightarrow \cos x = \cos \frac{\pi}{6}$$

If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$.

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$$\therefore x = 2n\pi \pm \frac{\pi}{6}$$
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Thus, x gives the required general solution for the given trigonometric equation.

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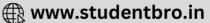
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If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$.

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Thus, x gives the required general solution for the given trigonometric equation.

2 A. Question

Find the general solutions of the following equations :

$$\sin 2x = \frac{\sqrt{3}}{2}$$

Answer

Ideas required to solve the problem:

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- tan $x = \tan y$, implies $x = \pi + y$, where $n \in Z$.

Given,

$$\sin 2x = \frac{\sqrt{3}}{2}$$

We know that $\sin x$, and $\cos x$ have positive values in the 1st and 2nd quadrant.

While giving solution, we always try to take the least value of y

The first quadrant will give the least magnitude of y.

$$\therefore \sin 2x = \sin \frac{\pi}{3}$$

If $\sin x = \sin y$ then $x = n\pi + (-1)^n y$, where $n \in Z$

Clearly on comparing we have $y = \pi/3$

$$\therefore 2x = n\pi + (-1)^n \frac{\pi}{3}$$

$$\Rightarrow x = \frac{n\pi}{2} + (-1)^n \frac{\pi}{6}$$
, where n \in Zans

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- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given.

$$\sin 2x = \frac{\sqrt{3}}{2}$$

We know that $\sin x$, and $\cos x$ have positive values in the 1st and 2nd quadrant.

While giving solution, we always try to take the least value of y

The first quadrant will give the least magnitude of y.

$$\therefore \sin 2x = \sin \frac{\pi}{3}$$

If $\sin x = \sin y$ then $x = n\pi + (-1)^n y$, where $n \in Z$

Clearly on comparing we have $y = \pi/3$

$$\therefore 2x = n\pi + (-1)^n \frac{\pi}{3}$$

$$\Rightarrow x = \frac{n\pi}{2} + (-1)^n \frac{\pi}{6}$$
, where n \in Zans

2 B. Question

Find the general solutions of the following equations:

$$\cos 3x = \frac{1}{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,

$$\cos 3x = \frac{1}{2}$$

We know that $\cos x$ and $\sec x$ have positive values in the 1st and 4th quadrant.

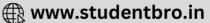
While giving solution, we always try to take the least value of y

both quadrant will give the least magnitude of y. We prefer the first quadrant.

$$\therefore \cos 3x = \cos \frac{\pi}{3}$$







If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$

Clearly on comparing we have $y = \pi/3$

$$\therefore 3x = 2n\pi \pm \frac{\pi}{3}$$

$$\Rightarrow \chi = \frac{2n\pi}{3} \pm \frac{\pi}{9}$$
, where n \in Zans

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Given,

$$\cos 3x = \frac{1}{2}$$

We know that $\cos x$ and $\sec x$ have positive values in the 1st and 4th quadrant.

While giving solution, we always try to take the least value of y

both quadrant will give the least magnitude of y. We prefer the first quadrant.

$$\therefore \cos 3x = \cos \frac{\pi}{2}$$

If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$

Clearly on comparing we have $y = \pi/3$

$$\therefore 3x = 2n\pi \pm \frac{\pi}{3}$$

$$\Rightarrow \chi = \frac{2n\pi}{3} \pm \frac{\pi}{9}$$
, where n \in Zans

2 C. Question

Find the general solutions of the following equations :

$$\sin 9x = \sin x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,





$$\sin 9x = \sin x$$

$$\Rightarrow \sin 9x - \sin x = 0$$

Using transformation formula: $\sin A - \sin B = 2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}$

$$\therefore 2\cos\frac{9x+x}{2}\sin\frac{9x-x}{2} = 0$$

$$\Rightarrow \cos 5x \sin 4x = 0$$

$$\therefore$$
 cos 5x = 0 or sin 4x = 0

If either of the equation is satisfied, the result will be 0

So we will find the solution individually and then finally combined the solution.

$$\therefore$$
 cos 5x = 0

$$\Rightarrow$$
 cos 5x = cos $\pi/2$

$$\therefore 5x = (2n+1)^{\frac{\pi}{2}}$$

$$x = (2n+1)\frac{\pi}{10}$$
, where n \in Zeqn 1

Also,

$$\sin 4x = \sin 0$$

$$4x = n\pi$$

Or
$$x = \frac{n\pi}{4}$$
, where n \in Zeqn 2

From equation 1 and eqn 2,

$$x=(2n+1)rac{\pi}{10}$$
 or $x=rac{n\pi}{4}$,where n \in Z ...ans

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Find the general solutions of the following equations :

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Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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$$\sin x = \sin y$$
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$$\cos x = \cos y$$
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• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

Given,

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Using transformation formula: $\sin A - \sin B = 2 \cos \frac{A+B}{2} \sin \frac{A-B}{2}$

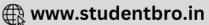
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$$\therefore \cos 5x = 0$$

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$$\therefore 5x = (2n+1)^{\frac{\pi}{2}}$$

$$x = (2n+1)\frac{\pi}{10}$$
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$$\sin 4x = \sin 0$$

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Or
$$x = \frac{n\pi}{4}$$
, where $n \in Z$ eqn 2

From equation 1 and eqn 2,

$$x=(2n+1)rac{\pi}{10}$$
 or $x=rac{n\pi}{4}$,where n \in Z ...ans

2 D. Question

Find the general solutions of the following equations:

$$\sin 2x = \cos 3x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

Given.

$$\sin 2x = \cos 3x$$

$$\Rightarrow \cos(\frac{\pi}{2} - 2x) = \cos 3x \, \{\because \sin \theta = \cos (\pi/2 - \theta) \, \}$$

If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$

Clearly on comparing we have y = 3x

$$\therefore \frac{\pi}{2} - 2x = 2n\pi \pm 3x$$

$$\frac{\pi}{2} - 2x = 2n\pi + 3x \text{ or } \frac{\pi}{2} - 2x = 2n\pi - 3x$$

$$5x = \frac{\pi}{2} - 2n\pi = \frac{\pi}{2} (1 - 4n) \text{ or } x = 2n\pi - \frac{\pi}{2} = \frac{\pi}{2} (4n - 1)$$

$$x = \frac{\pi}{10} (1 - 4n)$$
, where $n \in \mathbb{Z}$

Hence,

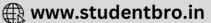
$$x = \frac{\pi}{10} (1 - 4n) \ or \ \frac{\pi}{2} (4n - 1)$$
 , where $n \in \mathbb{Z}$...ans

2 D. Question

Find the general solutions of the following equations:







Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

 $\sin 2x = \cos 3x$

$$\Rightarrow \cos(\frac{\pi}{2} - 2x) = \cos 3x \, \{\because \sin \theta = \cos (\pi/2 - \theta) \, \}$$

If $\cos x = \cos y$ then $x = 2m \pm y$, where $n \in Z$

Clearly on comparing we have y = 3x

$$\therefore \frac{\pi}{2} - 2x = 2n\pi \pm 3x$$

$$\frac{\pi}{2} - 2x = 2n\pi + 3x \text{ or } \frac{\pi}{2} - 2x = 2n\pi - 3x$$

$$5x = \frac{\pi}{2} - 2n\pi = \frac{\pi}{2} (1 - 4n) \text{ or } x = 2n\pi - \frac{\pi}{2} = \frac{\pi}{2} (4n - 1)$$

$$x = \frac{\pi}{10} (1 - 4n)$$
, where $n \in Z$

Hence,

$$x = \frac{\pi}{10} (1 - 4n)$$
 or $\frac{\pi}{2} (4n - 1)$, where $n \in \mathbb{Z}$...ans

2 E. Question

Find the general solutions of the following equations :

$$tan x + cot 2x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$\tan x + \cot 2x = 0$$

$$\Rightarrow \tan x = -\cot 2x$$

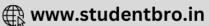
We know that: $\cot \theta = \tan (\pi/2 - \theta)$

$$\tan x = -\tan \left(\frac{\pi}{2} - 2x\right)$$

$$\Rightarrow \tan x = \tan(2x - \frac{\pi}{2}) \{ \because - \tan \theta = \tan -\theta \}$$

If tan $x = \tan y$, then x is given by $x = \pi + y$, where $n \in Z$.





From above expression, on comparison with standard equation we have

$$y = (2x - \frac{\pi}{2})$$

$$\therefore x = n\pi + 2x - \frac{\pi}{2}$$

$$\Rightarrow$$
 $x=rac{\pi}{2}-n\pi=rac{\pi}{2}$ $(1-2n)$,where n \in Z ...ans

2 E. Question

Find the general solutions of the following equations:

$$tan x + cot 2x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\tan x + \cot 2x = 0$$

$$\Rightarrow \tan x = -\cot 2x$$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

$$\tan x = -\tan \left(\frac{\pi}{2} - 2x\right)$$

$$\Rightarrow \tan x = \tan(2x - \frac{\pi}{2}) \{ \because - \tan \theta = \tan -\theta \}$$

If tan $x = \tan y$, then x is given by $x = \pi + y$, where $n \in Z$.

From above expression, on comparison with standard equation we have

$$y=(2x-\frac{\pi}{2})$$

$$\therefore x = n\pi + 2x - \frac{\pi}{2}$$

$$\Rightarrow x = \frac{\pi}{2} - n\pi = \frac{\pi}{2} (1 - 2n)$$
 ,where n \in Z ...ans

2 F. Question

Find the general solutions of the following equations :

$$tan 3x = cot x$$

Answer

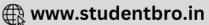
Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,





 $\tan 3x = \cot x$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

$$\tan 3x = \tan \left(\frac{\pi}{2} - x\right)$$

If tan $x = \tan y$, then x is given by $x = \pi + y$, where $n \in Z$.

From above expression, on comparison with standard equation we have

$$y = (\frac{\pi}{2} - x)$$

$$\therefore 3x = n\pi + \frac{\pi}{2} - x$$

$$\Rightarrow 4x = n\pi + \frac{\pi}{2}$$

$$\therefore \chi = \frac{n\pi}{4} + \frac{\pi}{8}$$
, where n \in Zans

2 F. Question

Find the general solutions of the following equations:

$$tan 3x = cot x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,

 $\tan 3x = \cot x$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

If tan $x = \tan y$, then x is given by $x = \pi + y$, where $n \in Z$.

From above expression, on comparison with standard equation we have

$$y = (\frac{\pi}{2} - x)$$

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, where n \in Zans

2 G. Question

Find the general solutions of the following equations :

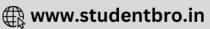
tan 2x tan x = 1

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -





• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

• $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

 $\tan 2x \tan x = 1$

$$\Rightarrow \tan 2x = \frac{1}{\tan x}$$

$$\Rightarrow \tan 2x = \cot x$$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

If tan $x = \tan y$, then x is given by $x = \pi + y$, where $n \in Z$.

From above expression, on comparison with standard equation we have

$$y = (\frac{\pi}{2} - x)$$

$$\therefore 2x = n\pi + \frac{\pi}{2} - x$$

$$\Rightarrow 3x = n\pi + \frac{\pi}{2}$$

$$\Rightarrow x = \frac{n\pi}{3} + \frac{\pi}{6}$$
, where $n \in \mathbb{Z}$ ans

2 G. Question

Find the general solutions of the following equations:

tan 2x tan x = 1

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

Given,

 $\tan 2x \tan x = 1$

$$\Rightarrow \tan 2x = \frac{1}{\tan x}$$

$$\Rightarrow \tan 2x = \cot x$$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

If tan $x = \tan y$, then x is given by x = m + y, where $n \in Z$.

From above expression, on comparison with standard equation we have

$$y = (\frac{\pi}{2} - x)$$





$$\therefore 2x = n\pi + \frac{\pi}{2} - x$$

$$\Rightarrow 3x = n\pi + \frac{\pi}{2}$$

$$\Rightarrow x = \frac{n\pi}{3} + \frac{\pi}{6}$$
, where $n \in \mathbb{Z}$ ans

2 H. Question

Find the general solutions of the following equations :

$$tan mx + cot nx = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = \pi + y$, where $n \in Z$.

Given,

tan mx + cot nx = 0

$$\Rightarrow \tan mx = -\cot nx$$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

$$\therefore \tan mx = -\tan \left(\frac{\pi}{2} - nx\right)$$

$$\Rightarrow \tan mx = \tan(nx - \frac{\pi}{2}) \{ \because - \tan \theta = \tan -\theta \}$$

If tan $x = \tan y$, then x is given by $x = k\pi + y$, where $k \in Z$.

From above expression, on comparison with standard equation we have

$$y = (nx - \frac{\pi}{2})$$

$$\therefore mx = k\pi + nx - \frac{\pi}{2}$$

$$\Rightarrow (m-n)x = k\pi - \frac{\pi}{2}$$

$$\Rightarrow x = \frac{\pi}{2} \left(\frac{2k-1}{m-n} \right)$$
, where k \in Z ...ans

2 H. Question

Find the general solutions of the following equations:

$$tan mx + cot nx = 0$$

Answer

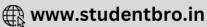
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- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,





tan mx + cot nx = 0

 $\Rightarrow \tan mx = -\cot nx$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

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, where k \in Z ...ans

2 I. Question

Find the general solutions of the following equations:

$$tan px = cot qx$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given.

 $\tan px = \cot qx$

We know that: $\cot \theta = \tan (\pi/2 - \theta)$

If tan $x = \tan y$, then x is given by $x = \pi + y$, where $n \in Z$.

From above expression, on comparison with standard equation we have

$$y = (\frac{\pi}{2} - qx)$$

$$\therefore px = n\pi + \frac{\pi}{2} - qx$$

$$\Rightarrow (p+q)x = n\pi + \frac{\pi}{2}$$

$$\therefore \chi = \frac{n\pi}{(p+q)} + \frac{\pi}{2(p+q)}$$
, where $n \in Z$

2 I. Question

Find the general solutions of the following equations:

$$tan px = cot qx$$





Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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 ,where $n \in Z$

2 J. Question

Find the general solutions of the following equations :

$$\sin 2x + \cos x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$\sin 2x + \cos x = 0$$

We know that: $\sin \theta = \cos (\pi/2 - \theta)$

$$\cos x = -\sin 2x$$

$$\Rightarrow \cos x = -\cos(\frac{\pi}{2} - 2x)$$

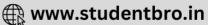
We know that: $-\cos \theta = \cos (\pi - \theta)$

$$\cos x = \cos(\pi - (\frac{\pi}{2} - 2x))$$

$$\Rightarrow \cos x = \cos\left(\frac{\pi}{2} + 2x\right)$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.





From above expression and on comparison with standard equation we have:

$$y = (\frac{\pi}{2} + 2x)$$

$$\therefore x = 2n\pi \pm (\frac{\pi}{2} + 2x)$$

Hence,

$$x = 2n\pi + \frac{\pi}{2} + 2x$$
 or $x = 2n\pi - \frac{\pi}{2} - 2x$

$$\therefore x = -\frac{\pi}{2} - 2n\pi \text{ or } 3x = 2n\pi - \frac{\pi}{2}$$

$$\Rightarrow x = -\frac{\pi}{2} (1 + 4n) \text{ or } x = \frac{\pi}{6} (4n - 1)$$

$$\therefore x = -rac{\pi}{2} (4n+1) \ or rac{\pi}{6} (4n-1)$$
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Given,

$$\sin 2x + \cos x = 0$$

We know that: $\sin \theta = \cos (\pi/2 - \theta)$

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 ,where n \in Z

2 K. Question

Find the general solutions of the following equations :

$$\sin x = \tan x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

 $\sin x = \tan x$

$$\Rightarrow \sin x = \frac{\sin x}{\cos x}$$

 $\Rightarrow \sin x \cos x = \sin x$

$$\Rightarrow \sin x (\cos x - 1) = 0$$

either.

$$\sin x = 0 \text{ or } \cos x = 1$$

$$\Rightarrow$$
 sin x = sin 0 or cos x = cos 0

We know that,

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$

$$:: \sin x = \sin 0$$

And hence,

$x = n\pi$ where $n \in Z$

Also,

If $\cos x = \cos y$, implies $x = 2m\pi \pm y$, where $m \in Z$

$$\because \cos x = \cos 0$$

Hence, x is given by

 $x = 2m\pi$ where $m \in Z$

 $\therefore x = n\pi$ or $2m\pi$, where $m, n \in Z$...ans

2 K. Question

Find the general solutions of the following equations :

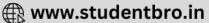
$$\sin x = \tan x$$

Answer

Ideas required to solve the problem:







The general solution of any trigonometric equation is given as -

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- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Given,

 $\sin x = \tan x$

$$\Rightarrow \sin x = \frac{\sin x}{\cos x}$$

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$$:: \sin x = \sin 0$$

$$\therefore y = 0$$

And hence.

$x = n\pi$ where $n \in Z$

Also,

If $\cos x = \cos y$, implies $x = 2m\pi \pm y$, where $m \in Z$

$$\because \cos x = \cos 0$$

Hence, x is given by

$x = 2m\pi$ where $m \in Z$

 $\therefore x = n\pi$ or $2m\pi$, where m,n $\in Z$...ans

2 L. Question

Find the general solutions of the following equations :

$$\sin 3x + \cos 2x = 0$$

Answer

Ideas required to solve the problem:

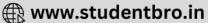
The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,

 $\sin 3x + \cos 2x = 0$





We know that: $\sin \theta = \cos (\pi/2 - \theta)$

$$\cos 2x = -\sin 3x$$

$$\Rightarrow \cos 2x = -\cos(\frac{\pi}{2} - 3x)$$

We know that: $-\cos \theta = \cos (\pi - \theta)$

$$\cos 2x = \cos(\pi - (\frac{\pi}{2} - 3x))$$

$$\Rightarrow \cos 2x = \cos \left(\frac{\pi}{2} + 3x\right)$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

From above expression and on comparison with standard equation we have:

$$y = (\frac{\pi}{2} + 3x)$$

$$\therefore 2x = 2n\pi \pm (\frac{\pi}{2} + 3x)$$

Hence,

$$2x = 2n\pi + \frac{\pi}{2} + 3x$$
 or $2x = 2n\pi - \frac{\pi}{2} - 3x$

$$x = -\frac{\pi}{2} - 2n\pi \text{ or } 5x = 2n\pi - \frac{\pi}{2}$$

$$\Rightarrow x = -\frac{\pi}{2} (1+4n) \text{ or } x = \frac{\pi}{10} (4n-1)$$

$$\therefore x = -\frac{\pi}{2} (4n+1) \ or \ \frac{\pi}{10} (4n-1)$$
 , where n \in Z

2 L. Question

Find the general solutions of the following equations:

$$\sin 3x + \cos 2x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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Given,

$$\sin 3x + \cos 2x = 0$$

We know that: $\sin \theta = \cos (\pi/2 - \theta)$

$$\cos 2x = -\sin 3x$$

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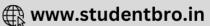
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From above expression and on comparison with standard equation we have:

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Hence,

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ight)$$
 , where n \in Z

3 A. Question

Solve the following equations:

$$\sin^2 x - \cos x = \frac{1}{4}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

given,

$$\sin^2 x - \cos x = \frac{1}{4}$$

As the equation is of 2nd degree, so we need to solve a quadratic equation.

First we will substitute trigonometric ratio with some variable k and we will solve for k

As,
$$\sin^2 x = 1 - \cos^2 x$$

∴ we have,

$$1 - \cos^2 x - \cos x = \frac{1}{4}$$

$$\Rightarrow$$
 4 - 4 cos² x - 4 cos x = 1

$$\Rightarrow 4\cos^2 x + 4\cos x - 3 = 0$$

Let,
$$\cos x = k$$

$$4k^2 + 4k - 3 = 0$$

$$\Rightarrow$$
 4k² -2k + 6k - 3

$$\Rightarrow$$
 2k(2k - 1) +3(2k - 1) = 0

$$\Rightarrow (2k - 1)(2k + 3) = 0$$

$$k = 1/2 \text{ or } k = -3/2$$





$$\Rightarrow$$
 cos x = \clubsuit or cos x = -3/2

As cos x lies between -1 and 1

$$\therefore$$
 cos x can't be -3/2

So we ignore that value.

$$\therefore \cos x = \mathbf{\hat{v}}$$

$$\Rightarrow$$
 cos x = cos 60° = cos $\pi/3$

If
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

On comparing our equation with standard form, we have

$$y = \pi/3$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where n \in Z ...ans

3 A. Question

Solve the following equations:

$$\sin^2 x - \cos x = \frac{1}{4}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

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• tan
$$x = \tan y$$
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given,

$$\sin^2 x - \cos x = \frac{1}{4}$$

As the equation is of 2nd degree, so we need to solve a quadratic equation.

First we will substitute trigonometric ratio with some variable k and we will solve for k

As,
$$\sin^2 x = 1 - \cos^2 x$$

∴ we have,

$$1 - \cos^2 x - \cos x = \frac{1}{4}$$

$$\Rightarrow 4 - 4\cos^2 x - 4\cos x = 1$$

$$\Rightarrow 4\cos^2 x + 4\cos x - 3 = 0$$

Let, $\cos x = k$

$$4k^2 + 4k - 3 = 0$$

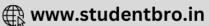
$$\Rightarrow$$
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$$\Rightarrow 2k(2k-1) + 3(2k-1) = 0$$

$$\Rightarrow (2k - 1)(2k + 3) = 0$$

$$k = 1/2 \text{ or } k = -3/2$$





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$$\Rightarrow$$
 cos x = cos 60° = cos $\pi/3$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

On comparing our equation with standard form, we have

$$y = \pi/3$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where n \in Z ..ans

3 B. Question

Solve the following equations:

$$2 \cos^2 x - 5 \cos x + 2 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = m + y$, where $n \in Z$.

given,

$$2 \cos^2 x - 5 \cos x + 2 = 0$$

As the equation is of 2nd degree, so we need to solve a quadratic equation.

First we will substitute trigonometric ratio with some variable k and we will solve for k

Let,
$$\cos x = k$$

$$\therefore 2k^2 - 5k + 2 = 0$$

$$\Rightarrow 2k^2 - 4k - k + 2 = 0$$

$$\Rightarrow$$
 2k(k - 2) -1(k -2) = 0

$$\Rightarrow (k-2)(2k-1) = 0$$

$$\therefore$$
 k = 2 or k = **?**

 \Rightarrow cos x = 2 {which is not possible} or cos x = � (acceptable)

$$\therefore \cos x = \mathbf{\hat{v}}$$

$$\Rightarrow$$
 cos x = cos 60° = cos $\pi/3$

If
$$\cos x = \cos y$$
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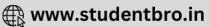
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On comparing our equation with standard form, we have

$$y = \pi/3$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where n \in Z ...ans

3 C. Question

Solve the following equations :

$$2\sin^2 x + \sqrt{3}\cos x + 1 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

given,





$$2\sin^2 x + \sqrt{3}\cos x + 1 = 0$$

As the equation is of 2nd degree, so we need to solve a quadratic equation.

First we will substitute trigonometric ratio with some variable k and we will solve for k

As,
$$\sin^2 x = 1 - \cos^2 x$$

∴ we have,

$$2(1 - \cos^2 x) + \sqrt{3}\cos x + 1 = 0$$

$$\Rightarrow 2 - 2\cos^2 x + \sqrt{3}\cos x + 1 = 0$$

$$\Rightarrow 2\cos^2 x - \sqrt{3}\cos x - 3 = 0$$

Let,
$$\cos x = k$$

$$\therefore 2k^2 - \sqrt{3} k - 3 = 0$$

$$\Rightarrow 2k^2 - 2\sqrt{3} k + \sqrt{3} k - 3 = 0$$

$$\Rightarrow 2k(k - \sqrt{3}) + \sqrt{3}(k - \sqrt{3}) = 0$$

$$\Rightarrow (2k + \sqrt{3})(k - \sqrt{3}) = 0$$

$$\therefore$$
 k = $\sqrt{3}$ or k = $-\sqrt{3/2}$

$$\Rightarrow$$
 cos x = $\sqrt{3}$ or cos x = $-\sqrt{3}/2$

As cos x lies between -1 and 1

So we ignore that value.

$$\therefore \cos x = -\sqrt{3/2}$$

$$\Rightarrow$$
 cos x = cos 150° = cos 5 π /6

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

On comparing our equation with standard form, we have

$$y = 5\pi/6$$

$$\dot{x} = 2n\pi \pm \frac{5\pi}{6}$$
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3 C. Question

Solve the following equations :

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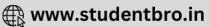
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- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

given,

$$2\sin^2 x + \sqrt{3}\cos x + 1 = 0$$





As the equation is of 2nd degree, so we need to solve a quadratic equation.

First we will substitute trigonometric ratio with some variable k and we will solve for k

As,
$$\sin^2 x = 1 - \cos^2 x$$

∴ we have,

$$2(1-\cos^2 x) + \sqrt{3}\cos x + 1 = 0$$

$$\Rightarrow 2 - 2\cos^2 x + \sqrt{3}\cos x + 1 = 0$$

$$\Rightarrow 2\cos^2 x - \sqrt{3}\cos x - 3 = 0$$

Let, $\cos x = k$

$$\therefore 2k^2 - \sqrt{3} k - 3 = 0$$

$$\Rightarrow 2k^2 - 2\sqrt{3} k + \sqrt{3} k - 3 = 0$$

$$\Rightarrow 2k(k - \sqrt{3}) + \sqrt{3}(k - \sqrt{3}) = 0$$

$$\Rightarrow (2k + \sqrt{3})(k - \sqrt{3}) = 0$$

$$\therefore$$
 k = $\sqrt{3}$ or k = $-\sqrt{3/2}$

$$\Rightarrow$$
 cos x = $\sqrt{3}$ or cos x = $-\sqrt{3}/2$

As cos x lies between -1 and 1

∴ cos x can't be √3

So we ignore that value.

$$\therefore$$
 cos x = $-\sqrt{3/2}$

$$\Rightarrow$$
 cos x = cos 150° = cos 5 π /6

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

On comparing our equation with standard form, we have

$$y = 5\pi/6$$

$$\dot{x} = 2n\pi \pm \frac{5\pi}{6}$$
 where n \in Z ...ans

3 D. Question

Solve the following equations:

$$4 \sin^2 x - 8 \cos x + 1 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

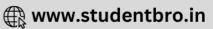
given,

$$4\sin^2 x - 8\cos x + 1 = 0$$

As the equation is of 2nd degree, so we need to solve a quadratic equation.

First we will substitute trigonometric ratio with some variable k and we will solve for k





As,
$$\sin^2 x = 1 - \cos^2 x$$

∴ we have,

$$4(1-\cos^2 x) - 8\cos x + 1 = 0$$

$$\Rightarrow 4 - 4\cos^2 x - 8\cos x + 1 = 0$$

$$\Rightarrow 4\cos^2 x + 8\cos x - 5 = 0$$

Let. $\cos x = k$

$$4k^2 + 8k - 5 = 0$$

$$\Rightarrow 4k^2 - 2k + 10k - 5 = 0$$

$$\Rightarrow$$
 2k(2k - 1) +5(2k - 1) = 0

$$\Rightarrow (2k + 5)(2k - 1) = 0$$

$$\therefore k = -5/2 = -2.5 \text{ or } k = 1/2$$

$$\Rightarrow$$
 cos x = -2.5 or cos x = 1/2

As cos x lies between -1 and 1

∴ cos x can't be -2.5

So we ignore that value.

$$\therefore$$
 cos x = 1/2

$$\Rightarrow$$
 cos x = cos 60° = cos $\pi/3$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

On comparing our equation with standard form, we have

$$y = \pi/3$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where n \in Z ..ans

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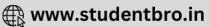
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$$4(1 - \cos^2 x) - 8\cos x + 1 = 0$$

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$$\Rightarrow 4\cos^2 x + 8\cos x - 5 = 0$$

Let,
$$\cos x = k$$

$$4k^2 + 8k - 5 = 0$$

$$\Rightarrow 4k^2 - 2k + 10k - 5 = 0$$

$$\Rightarrow$$
 2k(2k - 1) +5(2k - 1) = 0

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$$\therefore k = -5/2 = -2.5 \text{ or } k = 1/2$$

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 cos x = -2.5 or cos x = 1/2

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$$\therefore$$
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$$\Rightarrow$$
 cos x = cos 60° = cos $\pi/3$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

On comparing our equation with standard form, we have

$$y = \pi/3$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where n \in Z ...ans

3 E. Question

Solve the following equations:

$$\tan^2 x + \left(1 - \sqrt{3}\right) \tan x - \sqrt{3} = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

Given,

$$\tan^2 x + \left(1 - \sqrt{3}\right) \tan x - \sqrt{3} = 0$$

$$\Rightarrow \tan^2 x + \tan x - \sqrt{3} \tan x - \sqrt{3} = 0$$

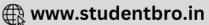
$$\Rightarrow \tan x (\tan x + 1) - \sqrt{3}(\tan x + 1) = 0$$

$$\Rightarrow (\tan x + 1)(\tan x - \sqrt{3}) = 0$$

$$\therefore$$
 tan x = -1 or tan x = $\sqrt{3}$

As, $\tan x \in (-\infty, \infty)$ so both values are valid and acceptable.





$$\Rightarrow$$
 tan x = tan (- π /4) or tan x = tan (π /3)

If
$$\tan x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

Clearly by comparing standard form with obtained equation we have

$$y = -\pi/4 \text{ or } y = \pi/3$$

$$\therefore x = m\pi - \frac{\pi}{4} \text{ or } x = n\pi + \frac{\pi}{3}$$

Hence,

$$x=m\pi-rac{\pi}{4}$$
 or $n\pi+rac{\pi}{3}$,where m,n \in Z

3 E. Question

Solve the following equations:

$$\tan^2 x + \left(1 - \sqrt{3}\right) \tan x - \sqrt{3} = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

Given,

$$\tan^2 x + (1 - \sqrt{3}) \tan x - \sqrt{3} = 0$$

$$\Rightarrow \tan^2 x + \tan x - \sqrt{3} \tan x - \sqrt{3} = 0$$

$$\Rightarrow$$
 tan x (tan x + 1) - $\sqrt{3}$ (tan x + 1) = 0

$$\Rightarrow$$
 $(\tan x + 1)(\tan x - \sqrt{3}) = 0$

$$\therefore$$
 tan x = -1 or tan x = $\sqrt{3}$

As, $\tan x \in (-\infty, \infty)$ so both values are valid and acceptable.

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 tan x = tan (- π /4) or tan x = tan (π /3)

If
$$\tan x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

Clearly by comparing standard form with obtained equation we have

$$y = -\pi/4 \text{ or } y = \pi/3$$

$$\therefore x = m\pi - \frac{\pi}{4} \text{ or } x = n\pi + \frac{\pi}{3}$$

Hence,

$$\emph{x} = \emph{m} \pi - rac{\pi}{4} \ \emph{or} \ \emph{n} \pi + rac{\pi}{3}$$
 ,where m,n \in Z

3 F. Question

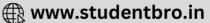
Solve the following equations:

$$3\cos^2 x - 2\sqrt{3}\sin x \cos x - 3\sin^2 x = 0$$

Answer







Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

given,

$$3\cos^2 x - 2\sqrt{3}\sin x \cos x - 3\sin^2 x = 0$$

$$\Rightarrow 3\cos^2 x - 3\sqrt{3}\sin x \cos x + \sqrt{3}\sin x \cos x - 3\sin^2 x = 0$$

$$\Rightarrow 3\cos x (\cos x - \sqrt{3}\sin x) + \sqrt{3}\sin x (\cos x - \sqrt{3}\sin x) = 0$$

$$\Rightarrow \sqrt{3} (\cos x - \sqrt{3} \sin x)(\sqrt{3} \cos x + \sin x) = 0$$

$$\therefore$$
 either, $\cos x - \sqrt{3} \sin x = 0$ or $\sin x + \sqrt{3} \cos x = 0$

$$\Rightarrow \cos x = \sqrt{3} \sin x \text{ or } \sin x = -\sqrt{3} \cos x$$

$$\Rightarrow \tan x = \frac{1}{\sqrt{3}} \text{ or } \tan x = -\sqrt{3}$$

$$\Rightarrow \tan x = \tan \frac{\pi}{6} \text{ or } \tan x = \tan(-\frac{\pi}{3})$$

If $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Clearly by comparing standard form with obtained equation we have:

$$y = \pi/6 \text{ or } y = -\pi/3$$

$$\therefore x = m\pi + \frac{\pi}{6} \text{ or } x = n\pi - \frac{\pi}{3}$$

Hence,

$$x=m\pi+rac{\pi}{6}\ or\ n\pi-rac{\pi}{3}$$
 ,where m,n \in Z

3 F. Question

Solve the following equations:

$$3\cos^2 x - 2\sqrt{3}\sin x \cos x - 3\sin^2 x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

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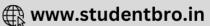
$$3\cos^2 x - 2\sqrt{3}\sin x \cos x - 3\sin^2 x = 0$$

$$\Rightarrow 3\cos^2 x - 3\sqrt{3}\sin x \cos x + \sqrt{3}\sin x \cos x - 3\sin^2 x = 0$$

$$\Rightarrow 3\cos x (\cos x - \sqrt{3}\sin x) + \sqrt{3}\sin x (\cos x - \sqrt{3}\sin x) = 0$$

$$\Rightarrow \sqrt{3} (\cos x - \sqrt{3} \sin x)(\sqrt{3} \cos x + \sin x) = 0$$





 \therefore either, $\cos x - \sqrt{3} \sin x = 0$ or $\sin x + \sqrt{3} \cos x = 0$

 $\Rightarrow \cos x = \sqrt{3} \sin x \text{ or } \sin x = -\sqrt{3} \cos x$

 $\Rightarrow \tan x = \frac{1}{\sqrt{3}} \text{ or } \tan x = -\sqrt{3}$

 $\Rightarrow \tan x = \tan \frac{\pi}{6} \text{ or } \tan x = \tan(-\frac{\pi}{3})$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Clearly by comparing standard form with obtained equation we have:

$$y = \pi/6 \text{ or } y = -\pi/3$$

$$\therefore x = m\pi + \frac{\pi}{6} \text{ or } x = n\pi - \frac{\pi}{3}$$

Hence,

$$x=m\pi+rac{\pi}{6}~or~n\pi-rac{\pi}{3}$$
 ,where m,n \in Z

3 G. Question

Solve the following equations:

$$\cos 4x = \cos 2x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

• $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given.

 $\cos 4x = \cos 2x$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

From above expression and on comparison with standard equation we have:

$$y = 2x$$

$$4x = 2n\pi + 2x$$

Hence,

$$4x = 2n\pi + 2x$$
 or $4x = 2m\pi - 2x$

$$\therefore 2x = 2n\pi \text{ or } 6x = 2m\pi$$

$$\Rightarrow$$
 x = n π or $x = \frac{2m\pi}{6} = \frac{m\pi}{3}$

$$\therefore x = n\pi \ or \ \frac{m\pi}{3}$$
 where m, n \in Z ...ans

3 G. Question

Solve the following equations :

$$\cos 4x = \cos 2x$$

Answer







Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
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- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,

 $\cos 4x = \cos 2x$

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 where m, n \in Z ...ans

4 A. Question

Solve the following equations:

$$\cos x + \cos 2x + \cos 3x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$\cos x + \cos 2x + \cos 3x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

to transform.

As,
$$\cos x + \cos 2x + \cos 3x = 0$$

 \therefore we will use cos x and cos 2x for transformation as after transformation it will give cos 2x term which can be taken common.

$$\therefore \cos x + \cos 2x + \cos 3x = 0$$

$$\Rightarrow$$
 cos 2x + (cos x + cos 3x) = 0







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

$$\Rightarrow \cos 2x + 2 \cos(\frac{3x+x}{2}) \cos \frac{3x-x}{2} = 0$$

$$\Rightarrow$$
 cos 2x + 2cos 2x cos x = 0

$$\Rightarrow$$
 cos 2x (1 + 2 cos x) = 0

$$\therefore$$
 cos 2x = 0 or 1 + 2cos x = 0

$$\Rightarrow$$
 cos 2x = cos $\pi/2$ or cos x = -1/2

$$\Rightarrow$$
 cos 2x = cos $\pi/2$ or cos x = cos $(\pi - \pi/3)$ = cos $(2\pi/3)$

If $\cos x = \cos y$ implies $x = 2m \pm y$, where $n \in Z$.

From above expression and on comparison with standard equation we have:

$$y = \pi/2 \text{ or } y = 2\pi/3$$

$$\therefore 2x = 2n\pi \pm \pi/2 \text{ or } x = 2m\pi \pm 2\pi/3$$

$$\dot{x} = n\pi \pm rac{\pi}{4} \ or \ x = \ 2m\pi \pm rac{2\pi}{3}$$
 where m, n \in Z

4 A. Question

Solve the following equations:

$$\cos x + \cos 2x + \cos 3x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

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As,
$$\cos x + \cos 2x + \cos 3x = 0$$

 \therefore we will use cos x and cos 2x for transformation as after transformation it will give cos 2x term which can be taken common.

$$\therefore$$
 cos x + cos 2x + cos 3x = 0

$$\Rightarrow$$
 cos 2x + (cos x + cos 3x) = 0

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

$$\Rightarrow \cos 2x + 2 \cos(\frac{3x+x}{2}) \cos \frac{3x-x}{2} = 0$$

$$\Rightarrow$$
 cos 2x + 2cos 2x cos x = 0

$$\Rightarrow$$
 cos 2x (1 + 2 cos x) = 0







 $\therefore \cos 2x = 0 \text{ or } 1 + 2\cos x = 0$

 \Rightarrow cos 2x = cos $\pi/2$ or cos x = -1/2

 \Rightarrow cos 2x = cos $\pi/2$ or cos x = cos $(\pi - \pi/3)$ = cos $(2\pi/3)$

If $\cos x = \cos y$ implies $x = 2m \pm y$, where $n \in Z$.

From above expression and on comparison with standard equation we have:

$$y = \pi/2 \text{ or } y = 2\pi/3$$

$$\therefore 2x = 2n\pi \pm \pi/2 \text{ or } x = 2m\pi \pm 2\pi/3$$

$$\dot{x} = n\pi \pm rac{\pi}{4} \ or \ x = \ 2m\pi \pm rac{2\pi}{3}$$
 where m, n \in Z

4 B. Question

Solve the following equations :

$$\cos x + \cos 3x - \cos 2x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given.

$$\cos x - \cos 2x + \cos 3x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

to transform.

As,
$$\cos x - \cos 2x + \cos 3x = 0$$

 \therefore we will use cos x and cos 2x for transformation as after transformation it will give cos 2x term which can be taken common.

$$\therefore \cos x - \cos 2x + \cos 3x = 0$$

$$\Rightarrow$$
 -cos 2x + (cos x + cos 3x) = 0

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

$$\Rightarrow -\cos 2x + 2\cos(\frac{3x+x}{2})\cos\frac{3x-x}{2} = 0$$

$$\Rightarrow$$
 -cos 2x + 2cos 2x cos x = 0

$$\Rightarrow$$
 cos 2x (-1 + 2 cos x) = 0

$$\therefore$$
 cos 2x = 0 or 1 + 2cos x = 0

$$\Rightarrow$$
 cos 2x = cos $\pi/2$ or cos x = $1/2$

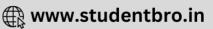
$$\Rightarrow$$
 cos 2x = cos $\pi/2$ or cos x = cos $(\pi/3)$ = cos $(\pi/3)$

If
$$\cos x = \cos y$$
 implies $x = 2m \pm y$, where $n \in Z$.

From above expression and on comparison with standard equation we have:







$$y = \pi/2 \text{ or } y = \pi/3$$

$$\therefore 2x = 2n\pi \pm \pi/2 \text{ or } x = 2m\pi \pm \pi/3$$

$$\therefore x = n\pi \pm \frac{\pi}{4} \text{ or } x = 2m\pi \pm \frac{\pi}{3} \text{ where m, n } \in Z$$

4 B. Question

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Answer

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- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,

$$\cos x - \cos 2x + \cos 3x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

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Transformation formula we need to select the terms wisely which we want

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As,
$$\cos x - \cos 2x + \cos 3x = 0$$

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$$\therefore \cos x - \cos 2x + \cos 3x = 0$$

$$\Rightarrow -\cos 2x + (\cos x + \cos 3x) = 0$$

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

$$\Rightarrow -\cos 2x + 2\cos(\frac{3x+x}{2})\cos\frac{3x-x}{2} = 0$$

$$\Rightarrow$$
 -cos 2x + 2cos 2x cos x = 0

$$\Rightarrow \cos 2x (-1 + 2 \cos x) = 0$$

$$\therefore \cos 2x = 0 \text{ or } 1 + 2\cos x = 0$$

$$\Rightarrow$$
 cos 2x = cos $\pi/2$ or cos x = 1/2

$$\Rightarrow$$
 cos 2x = cos $\pi/2$ or cos x = cos $(\pi/3)$ = cos $(\pi/3)$

If $\cos x = \cos y$ implies $x = 2m \pm y$, where $n \in Z$.

From above expression and on comparison with standard equation we have:

$$y = \pi/2 \text{ or } y = \pi/3$$

$$\therefore 2x = 2n\pi \pm \pi/2 \text{ or } x = 2m\pi \pm \pi/3$$

$$\therefore x = n\pi \pm \frac{\pi}{4} \text{ or } x = 2m\pi \pm \frac{\pi}{3} \text{ where m, n } \in Z$$

4 C. Question







Solve the following equations:

$$\sin x + \sin 5x = \sin 3x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\sin x + \sin 5x = \sin 3x$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

to transform.

As,
$$\sin x + \sin 5x = \sin 3x$$

$$\therefore \sin x + \sin 5x - \sin 3x = 0$$

... we will use sin x and sin 5x for transformation as after transformation it will give sin 3x term which can be taken common.

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

$$\Rightarrow -\sin 3x + 2\sin(\frac{5x+x}{2})\cos\frac{5x-x}{2} = 0$$

$$\Rightarrow$$
 2sin 3x cos 2x - sin 3x = 0

$$\Rightarrow \sin 3x (2\cos 2x - 1) = 0$$

$$\therefore$$
 either, $\sin 3x = 0$ or $2\cos 2x - 1 = 0$

If
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

If
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

Comparing obtained equation with standard equation, we have:

$$3x = n\pi$$
 or $2x = 2m\pi \pm \pi/3$

$$\therefore x = \frac{n\pi}{3} \text{ or } x = m\pi \pm \frac{\pi}{6} \text{ where m,n } \in \mathsf{Z} \text{ ...ans}$$

4 C. Question

Solve the following equations:

$$\sin x + \sin 5x = \sin 3x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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• $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,

$$\sin x + \sin 5x = \sin 3x$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

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As,
$$\sin x + \sin 5x = \sin 3x$$

$$\therefore \sin x + \sin 5x - \sin 3x = 0$$

 \therefore we will use sin x and sin 5x for transformation as after transformation it will give sin 3x term which can be taken common.

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

$$\Rightarrow -\sin 3x + 2\sin(\frac{5x+x}{2})\cos\frac{5x-x}{2} = 0$$

$$\Rightarrow$$
 2sin 3x cos 2x - sin 3x = 0

$$\Rightarrow$$
 sin 3x (2cos 2x - 1) = 0

$$\therefore$$
 either, $\sin 3x = 0$ or $2\cos 2x - 1 = 0$

If
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

Comparing obtained equation with standard equation, we have:

$$3x = n\pi \text{ or } 2x = 2m\pi \pm \pi/3$$

$$\therefore x = \frac{n\pi}{3}$$
 or $x = m\pi \pm \frac{\pi}{6}$ where m,n \in Z ...ans

4 D. Question

Solve the following equations:

$$\cos x \cos 2x \cos 3x = \mathbf{\hat{v}}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

Given,

$$\cos x \cos 2x \cos 3x =$$

$$\Rightarrow$$
 4cos x cos 2x cos 3x - 1 = 0

$$\{\because 2 \cos A \cos B = \cos (A + B) + \cos (A - B)\}$$

$$\therefore 2(2\cos x \cos 3x)\cos 2x - 1 = 0$$







 $\Rightarrow 2(\cos 4x + \cos 2x)\cos 2x - 1 = 0$

⇒ $2(2\cos^2 2x - 1 + \cos 2x)\cos 2x - 1 = 0$ {using $\cos 2\theta = 2\cos^2 \theta - 1$ }

 $\Rightarrow 4\cos^3 2x - 2\cos 2x + 2\cos^2 2x - 1 = 0$

 $\Rightarrow 2\cos^2 2x (2\cos 2x + 1) -1(2\cos 2x + 1) = 0$

 \Rightarrow (2cos² 2x - 1)(2 cos 2x + 1) = 0

: either, $2\cos 2x + 1 = 0$ or $(2\cos^2 2x - 1) = 0$

 \Rightarrow cos 2x = -1/2 or cos 4x = 0 {using cos 2 θ = 2cos² θ - 1}

 \Rightarrow cos 2x = cos (π - π /3) = cos 2 π /3 or cos 4x = cos π /2

If $\cos x = \cos y$ implies $x = 2n\pi \pm y$, where $n \in Z$.

In case of cos x = 0 we can give solution directly as $\cos x = 0$ is true for x = odd multiple of $\pi/2$

Comparing obtained equation with standard equation, we have:

$$y = 2\pi / 3 \text{ or } y = \pi/2$$

$$\therefore 2x = 2m\pi \pm 2\pi/3 \text{ or } 4x = (2n+1)\pi/2$$

$$\therefore x = m\pi \pm \frac{\pi}{3} \text{ or } x = (2n+1)\frac{\pi}{8} \text{ where m,n } \in Z \text{ans}$$

4 D. Question

Solve the following equations :

$$\cos x \cos 2x \cos 3x =$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

 $\cos x \cos 2x \cos 3x =$

 \Rightarrow 4cos x cos 2x cos 3x - 1 = 0

 $\{\because 2 \cos A \cos B = \cos (A + B) + \cos (A - B)\}$

 $\therefore 2(2\cos x \cos 3x)\cos 2x - 1 = 0$

 $\Rightarrow 2(\cos 4x + \cos 2x)\cos 2x - 1 = 0$

⇒ $2(2\cos^2 2x - 1 + \cos 2x)\cos 2x - 1 = 0$ {using $\cos 2\theta = 2\cos^2 \theta - 1$ }

 $\Rightarrow 4\cos^3 2x - 2\cos 2x + 2\cos^2 2x - 1 = 0$

 $\Rightarrow 2\cos^2 2x (2\cos 2x + 1) -1(2\cos 2x + 1) = 0$

 \Rightarrow (2cos² 2x - 1)(2 cos 2x + 1) = 0

: either, $2\cos 2x + 1 = 0$ or $(2\cos^2 2x - 1) = 0$

 \Rightarrow cos 2x = -1/2 or cos 4x = 0 {using cos 2 θ = 2cos² θ - 1}

 \Rightarrow cos 2x = cos (π - π /3) = cos 2 π /3 or cos 4x = cos π /2







If $\cos x = \cos y$ implies $x = 2m \pm y$, where $n \in Z$.

In case of cos x = 0 we can give solution directly as cos x = 0 is true for x = 0 and multiple of $\pi/2$

Comparing obtained equation with standard equation, we have:

$$y = 2\pi / 3 \text{ or } y = \pi/2$$

$$\therefore 2x = 2m\pi \pm 2\pi/3 \text{ or } 4x = (2n+1)\pi/2$$

$$\therefore x = m\pi \pm \frac{\pi}{3} \text{ or } x = (2n+1)\frac{\pi}{8} \text{ where m,n } \in \mathsf{Z} \text{ans}$$

4 E. Question

Solve the following equations:

$$\cos x + \sin x = \cos 2x + \sin 2x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

$$\cos x + \sin x = \cos 2x + \sin 2x$$

$$\cos x - \cos 2x = \sin 2x - \sin x$$

{:
$$\sin A - \sin B = 2\cos(\frac{A+B}{2})\sin(\frac{A-B}{2}) & \cos A - \cos B = -2\sin(\frac{A+B}{2})\sin(\frac{A-B}{2})}$$

$$\therefore -2\sin\left(\frac{x+2x}{2}\right)\sin\left(\frac{x-2x}{2}\right) = 2\cos\left(\frac{2x+x}{2}\right)\sin\left(\frac{2x-x}{2}\right)$$

$$\Rightarrow 2\sin\frac{3x}{2}\sin\frac{x}{2} = 2\cos\frac{3x}{2}\sin\frac{x}{2}$$

$$\sin \frac{x}{2} \left(\sin \frac{3x}{2} - \cos \frac{3x}{2} \right) = 0$$

Hence,

Either,
$$\sin \frac{x}{2} = 0$$
 or $\sin \frac{3x}{2} = \cos \frac{3x}{2}$

$$\Rightarrow \sin\frac{x}{2} = \sin m\pi \text{ or } \tan\frac{3x}{2} = 1 = \tan\frac{\pi}{4}$$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore \frac{x}{2} = m\pi \text{ or } \frac{3x}{2} = n\pi + \frac{\pi}{4}$$

$$\Rightarrow x = 2m\pi \text{ or } x = \frac{2n\pi}{3} + \frac{\pi}{6} \text{ where m,n } \in \mathbb{Z} \text{ans}$$

4 E. Question

Solve the following equations:

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Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -







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• tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

 $\cos x + \sin x = \cos 2x + \sin 2x$

 $\cos x - \cos 2x = \sin 2x - \sin x$

{:
$$\sin A - \sin B = 2\cos(\frac{A+B}{2})\sin(\frac{A-B}{2}) & \cos A - \cos B = -2\sin(\frac{A+B}{2})\sin(\frac{A-B}{2})}$$

$$\div -2\sin\left(\frac{x+2x}{2}\right)\sin\left(\frac{x-2x}{2}\right) = 2\cos\left(\frac{2x+x}{2}\right)\sin\left(\frac{2x-x}{2}\right)$$

$$\Rightarrow 2\sin\frac{3x}{2}\sin\frac{x}{2} = 2\cos\frac{3x}{2}\sin\frac{x}{2}$$

$$\sin \frac{x}{2} \left(\sin \frac{3x}{2} - \cos \frac{3x}{2} \right) = 0$$

Hence,

Either,
$$\sin\frac{x}{2} = 0$$
 or $\sin\frac{3x}{2} = \cos\frac{3x}{2}$

$$\Rightarrow \sin\frac{x}{2} = \sin m\pi \text{ or } \tan\frac{3x}{2} = 1 = \tan\frac{\pi}{4}$$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore \frac{x}{2} = m\pi \text{ or } \frac{3x}{2} = n\pi + \frac{\pi}{4}$$

$$\Rightarrow x = 2m\pi \text{ or } x = \frac{2n\pi}{3} + \frac{\pi}{6} \text{ where m,n } \in \mathbb{Z} \text{ans}$$

4 F. Question

Solve the following equations:

$$\sin x + \sin 2x + \sin 3x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\sin x + \sin 2x + \sin 3x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

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Transformation formula we need to select the terms wisely which we want

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As,
$$\sin x + \sin 2x + \sin 3x = 0$$

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

$$\Rightarrow \sin 2x + 2 \sin(\frac{3x+x}{2}) \cos(\frac{3x-x}{2}) = 0$$

$$\Rightarrow$$
 2sin 2x cos x + sin 2x = 0

$$\Rightarrow \sin 2x (2\cos x + 1) = 0$$

$$\therefore$$
 either, $\sin 2x = 0$ or $2\cos x + 1 = 0$

$$\Rightarrow$$
 sin 2x = sin 0 or cos x = - \diamondsuit = cos (π - π /3) = cos 2 π /3

If
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

If
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

Comparing obtained equation with standard equation, we have:

$$2x = n\pi$$
 or $x = 2m\pi \pm 2\pi/3$

$$\dot{x} = \frac{n\pi}{2}$$
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$$\{\because \sin A + \sin B = 2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)\}$$

$$\Rightarrow \sin 2x + 2 \sin(\frac{3x+x}{2}) \cos(\frac{3x-x}{2}) = 0$$

$$\Rightarrow$$
 2sin 2x cos x + sin 2x = 0

$$\Rightarrow \sin 2x (2\cos x + 1) = 0$$

$$\therefore$$
 either, $\sin 2x = 0$ or $2\cos x + 1 = 0$

$$\Rightarrow$$
 sin 2x = sin 0 or cos x = - \diamondsuit = cos (π - π /3) = cos 2 π /3

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.







If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

Comparing obtained equation with standard equation, we have:

$$2x = n\pi$$
 or $x = 2m\pi \pm 2\pi/3$

$$\dot{x} = \frac{n\pi}{2}$$
 or $x = 2m\pi \pm \frac{2\pi}{3}$ where m,n \in Z ...ans

4 G. Question

Solve the following equations:

$$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given.

$$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

to transform.

As,
$$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$$

 \therefore we will use sin x and sin 3x together in 1 group for transformation and sin 4x and sin 2x common in other group as after transformation both will give cos x term which can be taken common.

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

$$(\sin x + \sin 3x) + (\sin 2x + \sin 4x) = 0$$

$$\Rightarrow 2 \sin(\frac{4x+2x}{2}) \cos(\frac{4x-2x}{2}) + 2 \sin(\frac{3x+x}{2}) \cos(\frac{3x-x}{2}) = 0$$

$$\Rightarrow$$
 2sin 2x cos x + 2sin 3x cos x= 0

$$\Rightarrow$$
 2cos x (sin 2x + sin 3x) = 0

Again using transformation formula, we have:

$$\Rightarrow 2 \cos x \, 2\sin \frac{3x+2x}{2} \cos \frac{3x-2x}{2} = 0$$

$$\Rightarrow 4\cos x \sin \frac{5x}{2} \cos \frac{x}{2} = 0$$

$$\therefore$$
 either, $\cos x = 0$ or $\sin \frac{5x}{2} = 0$ or $\cos \frac{x}{2} = 0$

In case of cos x = 0 we can give solution directly as cos x = 0 is true for x = 0 and multiple of $\pi/2$

In case of sin x = 0 we can give solution directly as sin x = 0 is true for x = integral multiple of π

$$\therefore x = (2n+1)^{\frac{\pi}{2}} \text{ or } \frac{5x}{2} = k\pi \text{ or } \frac{x}{2} = (2p+1)^{\frac{\pi}{2}}$$

$$\Rightarrow x = (2n+1)\frac{\pi}{2}$$
 or $x = \frac{2k\pi}{5}$ or $x = (2p+1)\pi$ where n,p,m \in Z







4 G. Question

Solve the following equations:

$$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

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As,
$$\sin x + \sin 2x + \sin 3x + \sin 4x = 0$$

 \therefore we will use sin x and sin 3x together in 1 group for transformation and sin 4x and sin 2x common in other group as after transformation both will give cos x term which can be taken common.

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

$$(\sin x + \sin 3x) + (\sin 2x + \sin 4x) = 0$$

$$\Rightarrow 2 \sin(\frac{4x+2x}{2}) \cos \frac{4x-2x}{2} + 2 \sin(\frac{3x+x}{2}) \cos \frac{3x-x}{2} = 0$$

$$\Rightarrow$$
 2sin 2x cos x + 2sin 3x cos x= 0

$$\Rightarrow$$
 2cos x (sin 2x + sin 3x) = 0

Again using transformation formula, we have:

$$\Rightarrow 2 \cos x \cdot 2\sin \frac{3x+2x}{2} \cos \frac{3x-2x}{2} = 0$$

$$\Rightarrow 4\cos x \sin \frac{5x}{2} \cos \frac{x}{2} = 0$$

$$\therefore$$
 either, $\cos x = 0$ or $\sin \frac{5x}{2} = 0$ or $\cos \frac{x}{2} = 0$

In case of cos x = 0 we can give solution directly as cos x = 0 is true for x = 0 and multiple of $\pi/2$

In case of sin x = 0 we can give solution directly as sin x = 0 is true for x = integral multiple of π

$$\therefore x = (2n+1)^{\frac{\pi}{2}} \text{ or } \frac{5x}{2} = k\pi \text{ or } \frac{x}{2} = (2p+1)^{\frac{\pi}{2}}$$

$$\Rightarrow x=(2n+1)rac{\pi}{2} \ or \ x=rac{2k\pi}{5} \ or \ x=(2p+1)\pi \ ext{where n,p,m} \in Z$$

4 H. Question

Solve the following equations:

$$\sin 3x - \sin x = 4 \cos^2 x - 2$$

Answer





Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,

$$\sin 3x - \sin x = 4 \cos^2 x - 2$$

$$\Rightarrow \sin 3x - \sin x = 2(2\cos^2 x - 1)$$

$$\Rightarrow \sin 3x - \sin x = 2 \cos 2x \{ \because \cos 2\theta = 2\cos^2 \theta - 1 \}$$

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

$$\Rightarrow 2\cos\left(\frac{3x+x}{2}\right)\sin\left(\frac{3x-x}{2}\right) = 2\cos 2x$$

$$\Rightarrow 2\cos 2x\sin x - 2\cos 2x = 0$$

$$\Rightarrow 2\cos 2x \left(\sin x - 1\right) = 0$$

$$\therefore$$
 either, cos 2x = 0 or sin x = 1 = sin $\pi/2$

In case of cos x = 0 we can give solution directly as cos x = 0 is true for x = 0 and multiple of $\pi/2$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

$$\therefore 2x = (2n+1)^{\frac{\pi}{2}} \text{ or } x = m\pi + (-1)^{\frac{\pi}{2}}$$

$$\Rightarrow$$
 $x=(2n+1)rac{\pi}{4}$ or $x=m\pi+(-1)^mrac{\pi}{2}$ where m, n \in Z

4 H. Question

Solve the following equations:

$$\sin 3x - \sin x = 4 \cos^2 x - 2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given.

$$\sin 3x - \sin x = 4 \cos^2 x - 2$$

$$\Rightarrow \sin 3x - \sin x = 2(2\cos^2 x - 1)$$

$$\Rightarrow \sin 3x - \sin x = 2 \cos 2x \{\because \cos 2\theta = 2\cos^2 \theta - 1\}$$

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

$$\Rightarrow 2\cos\left(\frac{3x+x}{2}\right)\sin\left(\frac{3x-x}{2}\right) = 2\cos 2x$$

$$\Rightarrow 2\cos 2x\sin x - 2\cos 2x = 0$$







$$\Rightarrow 2\cos 2x \left(\sin x - 1\right) = 0$$

$$\therefore$$
 either, $\cos 2x = 0$ or $\sin x = 1 = \sin \pi/2$

In case of cos x = 0 we can give solution directly as cos x = 0 is true for x = 0 and multiple of $\pi/2$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

$$\therefore 2x = (2n+1)^{\frac{\pi}{2}} \text{ or } x = m\pi + (-1)^{\frac{\pi}{2}}$$

$$\Rightarrow$$
 $x=(2n+1)rac{\pi}{4}$ or $x=m\pi+(-1)^{m}rac{\pi}{2}$ where m, n \in Z

4 I. Question

Solve the following equations:

$$\sin 2x - \sin 4x + \sin 6x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan
$$x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\sin 2x - \sin 4x + \sin 6x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

to transform.

we have,
$$\sin 2x - \sin 4x + \sin 6x = 0$$

 \therefore we will use sin 6x and sin 2x for transformation as after transformation it will give sin 4x term which can be taken common.

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

$$\Rightarrow -\sin 4x + 2\sin\left(\frac{2x+6x}{2}\right)\cos\frac{6x-2x}{2} = 0$$

$$\Rightarrow$$
 2sin 4x cos 2x - sin 4x = 0

$$\Rightarrow$$
 sin 4x (2cos 2x - 1) = 0

$$\therefore$$
 either, $\sin 4x = 0$ or $2\cos 2x - 1 = 0$

$$\Rightarrow$$
 sin 4x = sin 0 or cos 2x = $\mathbf{\hat{v}}$ = cos $\pi/3$

If
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

If
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

Comparing obtained equation with standard equation, we have:

$$4x = n\pi \text{ or } 2x = 2m\pi \pm \pi/3$$

$$\therefore x = \frac{n\pi}{4} \text{ or } x = m\pi \pm \frac{\pi}{6} \text{ where m,n } \in \mathsf{Z} \text{ ..ans}$$

4 I. Ouestion







Solve the following equations:

$$\sin 2x - \sin 4x + \sin 6x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$\sin 2x - \sin 4x + \sin 6x = 0$$

To solve the equation we need to change its form so that we can equate the t-ratios individually.

For this we will be applying transformation formulae. While applying the

Transformation formula we need to select the terms wisely which we want

to transform.

we have, $\sin 2x - \sin 4x + \sin 6x = 0$

 $\dot{}$ we will use sin 6x and sin 2x for transformation as after transformation it will give sin 4x term which can be taken common.

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

⇒ -sin 4x + 2 sin(
$$\frac{2x+6x}{2}$$
) cos $\frac{6x-2x}{2}$ = 0

$$\Rightarrow$$
 2sin 4x cos 2x - sin 4x = 0

$$\Rightarrow$$
 sin 4x (2cos 2x - 1) = 0

$$\therefore$$
 either, sin $4x = 0$ or $2\cos 2x - 1 = 0$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

Comparing obtained equation with standard equation, we have:

$$4x = n\pi \text{ or } 2x = 2m\pi \pm \pi/3$$

$$\therefore x = \frac{n\pi}{4} \ or \ x = m\pi \ \pm \frac{\pi}{6} \ \text{where m,n} \ \in Z \ ..$$
ans

5 A. Question

Solve the following equations:

$$tan x + tan 2x + tan 3x = 0$$

Answer

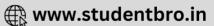
Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.







• tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

given,

$$tan x + tan 2x + tan 3x = 0$$

In order to solve the equation we need to reduce the equation into factor form so that we can equate the ratios with 0 and can solve the equation easily

As if we expand $\tan 3x = \tan (x + 2x)$ we will get $\tan x + \tan 2x$ common.

$$\therefore$$
 tan x + tan 2x + tan 3x = 0

$$\Rightarrow$$
 tan x + tan 2x + tan (x + 2x) = 0

As,
$$tan (A + B) = \frac{tan A + tan B}{1 - tan A tan B}$$

$$\therefore \tan x + \tan 2x + \frac{\tan x + \tan 2x}{1 - \tan x \tan 2x} = 0$$

$$\Rightarrow (\tan x + \tan 2x)(1 + \frac{1}{1 - \tan x \tan 2x}) = 0$$

$$\Rightarrow (\tan x + \tan 2x)(\frac{2-\tan x \tan 2x}{1-\tan x \tan 2x}) = 0$$

$$\therefore \tan x + \tan 2x = 0 \text{ or } 2 - \tan x \tan 2x = 0$$

Using,
$$\tan 2x = \frac{2\tan x}{1-\tan^2 x}$$
 we have,

⇒ tan x = tan (-2x) or 2
$$-\frac{2 \tan^2 x}{1 - \tan^2 x} = 0$$

$$\Rightarrow$$
 tan x = tan(-2x) or 2 - 4tan² x = 0 \Rightarrow tan x = 1/ $\sqrt{2}$

Let $1/\sqrt{2} = \tan \alpha$ and if $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$

$$\therefore x = n\pi + (-2x)$$
 or $\tan x = \tan \alpha \Rightarrow x = m\pi + \alpha$

$$\Rightarrow$$
 3x = n π or x = m π + α

$$\therefore x = \frac{n\pi}{3} \text{ or } x = m\pi + \alpha \text{ where } \tan \alpha = \frac{1}{\sqrt{2}} \text{ and } m \text{ , } n \in Z$$

5 A. Question

Solve the following equations:

$$tan x + tan 2x + tan 3x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in \mathbb{Z}$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

given,

$$tan x + tan 2x + tan 3x = 0$$

In order to solve the equation we need to reduce the equation into factor form so that we can equate the ratios with 0 and can solve the equation easily

As if we expand $\tan 3x = \tan (x + 2x)$ we will get $\tan x + \tan 2x$ common.

$$\therefore$$
 tan x + tan 2x + tan 3x = 0





$$\Rightarrow$$
 tan x + tan 2x + tan (x + 2x) = 0

As,
$$tan (A + B) = \frac{tan A + tan B}{1 - tan A tan B}$$

$$\therefore \tan x + \tan 2x + \frac{\tan x + \tan 2x}{1 - \tan x \tan 2x} = 0$$

$$\Rightarrow (\tan x + \tan 2x)(1 + \frac{1}{1 - \tan x \tan 2x}) = 0$$

$$\Rightarrow (\tan x + \tan 2x)(\frac{2-\tan x \tan 2x}{1-\tan x \tan 2x}) = 0$$

$$\therefore \tan x + \tan 2x = 0 \text{ or } 2 - \tan x \tan 2x = 0$$

Using,
$$\tan 2x = \frac{2\tan x}{1-\tan^2 x}$$
 we have,

⇒ tan x = tan (-2x) or 2
$$-\frac{2 \tan^2 x}{1 - \tan^2 x} = 0$$

$$\Rightarrow$$
 tan x = tan(-2x) or 2 - 4tan² x = 0 \Rightarrow tan x = 1/ $\sqrt{2}$

Let
$$1/\sqrt{2} = \tan \alpha$$
 and if $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$

$$\therefore x = n\pi + (-2x)$$
 or $\tan x = \tan \alpha \Rightarrow x = m\pi + \alpha$

$$\Rightarrow$$
 3x = n π or x = m π + α

$$\therefore x = rac{n\pi}{3} \ or \ x = m\pi + lpha \ where \ tan \ lpha = rac{1}{\sqrt{2}} \ and \ m$$
 , $n \in Z$

5 B. Question

Solve the following equations :

$$tan x + tan 2x = tan 3x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

given,

$$tan x + tan 2x - tan 3x = 0$$

In order to solve the equation we need to reduce the equation into factor form so that we can equate the ratios with 0 and can solve the equation easily

As if we expand $\tan 3x = \tan (x + 2x)$ we will get $\tan x + \tan 2x$ common.

$$\therefore \tan x + \tan 2x - \tan 3x = 0$$

$$\Rightarrow$$
 tan x + tan 2x - tan (x + 2x) = 0

As,
$$tan (A + B) = \frac{tan A + tan B}{1 - tan A tan B}$$

$$\therefore \tan x + \tan 2x - \frac{\tan x + \tan 2x}{1 - \tan x \tan 2x} = 0$$

$$\Rightarrow (\tan x + \tan 2x)(1 - \frac{1}{1 - \tan x \tan 2x}) = 0$$

$$\Rightarrow (\tan x + \tan 2x)(\frac{-\tan x \tan 2x}{1-\tan x \tan 2x}) = 0$$







 \therefore tan x + tan 2x = 0 or - tan x tan 2x = 0

Using,
$$\tan 2x = \frac{2\tan x}{1-\tan^2 x}$$
 we have,

$$\Rightarrow \tan x = \tan (-2x) \text{ or } \frac{2 \tan^2 x}{1 - \tan^2 x} = 0$$

$$\Rightarrow$$
 tan x = tan(-2x) or tan x = 0 = tan 0

if tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$

$$\therefore x = n\pi + (-2x) \text{ or } x = m\pi + 0$$

$$\Rightarrow$$
 3x = n π or x = m π

$$\therefore x = \frac{n\pi}{3} \ or \ x = m\pi \ where \ m$$
 , $n \in \mathbb{Z}$ ans

5 B. Ouestion

Solve the following equations:

$$tan x + tan 2x = tan 3x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan
$$x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

given,

$$tan x + tan 2x - tan 3x = 0$$

In order to solve the equation we need to reduce the equation into factor form so that we can equate the ratios with 0 and can solve the equation easily

As if we expand $\tan 3x = \tan (x + 2x)$ we will get $\tan x + \tan 2x$ common.

$$\therefore$$
 tan x + tan 2x - tan 3x = 0

$$\Rightarrow$$
 tan x + tan 2x - tan (x + 2x) = 0

As,
$$tan (A + B) = \frac{tan A + tan B}{1 - tan A tan B}$$

$$\therefore \tan x + \tan 2x - \frac{\tan x + \tan 2x}{1 - \tan x \tan 2x} = 0$$

$$\Rightarrow (\tan x + \tan 2x)(1 - \frac{1}{1 - \tan x \tan 2x}) = 0$$

$$\Rightarrow (\tan x + \tan 2x)(\frac{-\tan x \tan 2x}{1 - \tan x \tan 2x}) = 0$$

$$\therefore$$
 tan x + tan 2x = 0 or - tan x tan 2x = 0

Using,
$$\tan 2x = \frac{2\tan x}{1-\tan^2 x}$$
 we have,

$$\Rightarrow \tan x = \tan (-2x) \text{ or } \frac{2 \tan^2 x}{1 - \tan^2 x} = 0$$

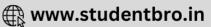
$$\Rightarrow$$
 tan x = tan(-2x) or tan x = 0 = tan 0

if
$$\tan x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$

$$\therefore x = n\pi + (-2x) \text{ or } x = m\pi + 0$$







$$\Rightarrow$$
 3x = n π or x = m π

$$\therefore x = \frac{n\pi}{3} \text{ or } x = m\pi \text{ where } m$$
 , $n \in \mathbb{Z}$ ans

5 C. Question

Solve the following equations:

$$tan 3x + tan x = 2 tan 2x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

given,

$$tan x + tan 3x = 2tan 2x$$

$$\Rightarrow$$
 tan x + tan 3x = tan 2x + tan 2x

$$\Rightarrow$$
 tan 3x - tan 2x = tan 2x - tan x

$$\Rightarrow \frac{(\tan 3x - \tan 2x)(1 + \tan 3x \tan 2x)}{1 + \tan 3x \tan 2x} = \frac{(\tan 2x - \tan x)(1 + \tan x \tan 2x)}{1 + \tan 2x \tan x}$$

As,
$$\tan (A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

$$\tan(3x - 2x)(1 + \tan 3x \tan 2x) = \tan(2x - x)(1 + \tan x \tan 2x)$$

$$\Rightarrow \tan x \{1 + \tan 3x \tan 2x - 1 - \tan 2x \tan x\} = 0$$

$$\Rightarrow \tan x \tan 2x (\tan 3x - \tan x) = 0$$

$$\therefore$$
 tan x = 0 or tan 2x = 0 or tan 3x = tan x

if tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$

$$\therefore x = n\pi \text{ or } 2x = m\pi \text{ or } 3x = k\pi + x$$

$$\therefore x = n\pi \text{ or } x = \frac{m\pi}{2} \text{ or } x = \frac{k\pi}{2}$$

$$x = n\pi \text{ or } x = \frac{m\pi}{2} \text{ where } m, n \in \mathbb{Z} \text{ ans}$$

5 C. Question

Solve the following equations:

$$tan 3x + tan x = 2 tan 2x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan
$$x = tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

given,





tan x + tan 3x = 2tan 2x

 \Rightarrow tan x + tan 3x = tan 2x + tan 2x

 \Rightarrow tan 3x - tan 2x = tan 2x - tan x

$$\Rightarrow \frac{(\tan 3x - \tan 2x)(1 + \tan 3x \tan 2x)}{1 + \tan 3x \tan 2x} = \frac{(\tan 2x - \tan x)(1 + \tan x \tan 2x)}{1 + \tan 2x \tan x}$$

As,
$$tan (A - B) = \frac{tan A - tan B}{1 + tan A tan B}$$

$$\tan(3x-2x)(1+\tan 3x\tan 2x)=\tan(2x-x)(1+\tan x\tan 2x)$$

$$\Rightarrow \tan x \{1 + \tan 3x \tan 2x - 1 - \tan 2x \tan x\} = 0$$

$$\Rightarrow \tan x \tan 2x (\tan 3x - \tan x) = 0$$

$$\therefore$$
 tan x = 0 or tan 2x = 0 or tan 3x = tan x

if $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$

$$\therefore x = n\pi \text{ or } 2x = m\pi \text{ or } 3x = k\pi + x$$

$$x = n\pi \text{ or } x = \frac{m\pi}{2} \text{ or } x = \frac{k\pi}{2}$$

$$\therefore x = n\pi \text{ or } x = \frac{m\pi}{2} \text{ where } m, n \in \mathbb{Z} \text{ ans}$$

6 A. Question

Solve the following equations:

$$\sin x + \cos x = \sqrt{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

given,

$$\sin x + \cos x = \sqrt{2}$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.

$$\therefore \frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x = 1$$

$$\Rightarrow \sin x \cos \frac{\pi}{4} + \sin \frac{\pi}{4} \cos x = 1 \{ : \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} \}$$

$$\Rightarrow \sin\left(\frac{\pi}{4} + x\right) = 1 \{ \because \sin A \cos B + \cos A \sin B = \sin (A + B) \}$$

$$\Rightarrow \sin\left(\frac{\pi}{4} + x\right) = \sin\frac{\pi}{2}$$

NOTE: We can also make the ratio of cos instead of sin, the answer remains same but the form of answer may look different, when you put values of n you will get same values with both forms

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$

$$\therefore \frac{\pi}{4} + x = n\pi + (-1)^n \frac{\pi}{2}$$







$$\therefore x = n\pi + (-1)^n \frac{\pi}{2} - \frac{\pi}{4} \text{ where } n \in \mathbb{Z} \text{ ans}$$

6 A. Question

Solve the following equations :

$$\sin x + \cos x = \sqrt{2}$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = m + y, where $n \in Z$.

given,

$$\sin x + \cos x = \sqrt{2}$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.

$$\therefore \frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x = 1$$

$$\Rightarrow \sin x \cos \frac{\pi}{4} + \sin \frac{\pi}{4} \cos x = 1 \ \{ \because \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} \ \}$$

$$\Rightarrow \sin\left(\frac{\pi}{A} + x\right) = 1 \{ \because \sin A \cos B + \cos A \sin B = \sin (A + B) \}$$

$$\Rightarrow \sin\left(\frac{\pi}{4} + x\right) = \sin\frac{\pi}{2}$$

NOTE: We can also make the ratio of cos instead of sin, the answer remains same but the form of answer may look different, when you put values of n you will get same values with both forms

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$

$$\frac{\pi}{4} + x = n\pi + (-1)^n \frac{\pi}{2}$$

$$\therefore x = n\pi + (-1)^n \frac{\pi}{2} - \frac{\pi}{4} \text{ where } n \in \mathbb{Z} \text{ ans}$$

6 B. Question

Solve the following equations:

$$\sqrt{3}\cos x + \sin x = 1$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in \mathbb{Z}$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

given,

$$\sqrt{3}\cos x + \sin x = 1$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.





$$\frac{1}{2} \frac{\sqrt{3}}{2} \cos x + \frac{1}{2} \sin x = \frac{1}{2}$$

$$\Rightarrow \sin x \sin \frac{\pi}{6} + \cos \frac{\pi}{6} \cos x = \frac{1}{2} \left\{ \because \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2} \ and \sin \frac{\pi}{6} = \frac{1}{2} \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{6}\right) = \frac{1}{2} \left\{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{6}\right) = \cos\frac{\pi}{3}$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore x - \frac{\pi}{6} = 2n\pi \pm \frac{\pi}{3}$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3} + \frac{\pi}{6} \text{ where } n \in \mathbb{Z}$$

$$\therefore x = 2n\pi + \frac{\pi}{2} \text{ or } 2n\pi - \frac{\pi}{6} \text{ where } n \in Z \text{ ans}$$

6 B. Question

Solve the following equations:

$$\sqrt{3}\cos x + \sin x = 1$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

given,

$$\sqrt{3}\cos x + \sin x = 1$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.

$$\therefore \frac{\sqrt{3}}{2}\cos x + \frac{1}{2}\sin x = \frac{1}{2}$$

$$\Rightarrow \sin x \sin \frac{\pi}{6} + \cos \frac{\pi}{6} \cos x = \frac{1}{2} \{ \because \cos \frac{\pi}{6} = \frac{\sqrt{3}}{2} \text{ and } \sin \frac{\pi}{6} = \frac{1}{2} \}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{6}\right) = \frac{1}{2} \left\{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{6}\right) = \cos\frac{\pi}{3}$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore x - \frac{\pi}{6} = 2n\pi \pm \frac{\pi}{3}$$

$$\therefore x = 2n\pi \pm \frac{\pi}{3} + \frac{\pi}{6} \text{ where } n \in \mathbb{Z}$$

$$\therefore x = 2n\pi + \frac{\pi}{2} \text{ or } 2n\pi - \frac{\pi}{6} \text{ where } n \in \mathbb{Z} \text{ ans}$$

6 C. Ouestion

Solve the following equations:

$$\sin x + \cos x = 1$$







Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

given,

$$\sin x + \cos x = 1$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.

$$\therefore \frac{1}{\sqrt{2}} \sin x + \frac{1}{\sqrt{2}} \cos x = \frac{1}{\sqrt{2}}$$
 { dividing by $\sqrt{2}$ both sides}

$$\Rightarrow \sin x \sin \frac{\pi}{4} + \cos \frac{\pi}{4} \cos x = \cos \frac{\pi}{4} \left\{ \because \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{4}\right) = \cos\frac{\pi}{4} \left\{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \right\}$$

NOTE: We can also make the ratio of sin instead of cos , the answer remains same but the form of answer may look different, when you put values of n you will get same values with both forms

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore s_{X} - \frac{\pi}{4} = \left(2n\pi \pm \frac{\pi}{4}\right)$$

$$\therefore x = \left(2n\pi \pm \frac{\pi}{4}\right) + \frac{\pi}{4} \text{ where } n \in Z.$$

$$x = 2n\pi \text{ or } x = 2n\pi + \frac{\pi}{2} \text{ where n } \epsilon Z \dots \text{ans}$$

6 C. Question

Solve the following equations:

$$\sin x + \cos x = 1$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

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$$\therefore \frac{1}{\sqrt{2}} \sin x + \frac{1}{\sqrt{2}} \cos x = \frac{1}{\sqrt{2}}$$
 { dividing by $\sqrt{2}$ both sides}

$$\Rightarrow \sin x \sin \frac{\pi}{4} + \cos \frac{\pi}{4} \cos x = \cos \frac{\pi}{4} \left\{ \because \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{4}\right) = \cos\frac{\pi}{4} \left\{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \right\}$$

NOTE: We can also make the ratio of sin instead of cos , the answer remains same but the form of answer may look different, when you put values of n you will get same values with both forms

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore sx - \frac{\pi}{4} = \left(2n\pi \pm \frac{\pi}{4}\right)$$

$$\therefore x = \left(2n\pi \pm \frac{\pi}{4}\right) + \frac{\pi}{4} \text{ where } n \in Z.$$

$$x = 2n\pi \text{ or } x = 2n\pi + \frac{\pi}{2} \text{ where n } \epsilon Z \dots \text{ans}$$

6 D. Question

Solve the following equations:

$$cosec x = 1 + cot x$$

Answer

deas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = m + y, where $n \in Z$.

given,

cosec x = 1 + cot x

$$\Rightarrow \frac{1}{\sin x} = 1 + \frac{\cos x}{\sin x}$$

$$\Rightarrow \sin x + \cos x = 1$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.

$$\therefore s \frac{1}{\sqrt{2}} \sin x + \frac{1}{\sqrt{2}} \cos x = \frac{1}{\sqrt{2}} \text{ {dividing by } $\sqrt{2}$ both sides}}$$

$$\Rightarrow \sin x \sin \frac{\pi}{4} + \cos \frac{\pi}{4} \cos x = \cos \frac{\pi}{4} \cdot \{ \because \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} . \}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{4}\right) = \cos\frac{\pi}{4}. \{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \}$$

NE: We can also make the ratio of sin instead of cos , the answer remains same but the form of answer may







look different, when you put values of n you will get same values with both forms

If $\cos x = \cos y$, impls $x = 2n\pi \pm y$, where $n \in Z$

$$\cdots x - \frac{\pi}{4} = \left(2n\pi \pm \frac{\pi}{4}\right).$$

$$\therefore x = \left(2n\pi \pm \frac{\pi}{4}\right) + \frac{\pi}{4} \text{ where } n \in \mathbb{Z}$$

$$x = 2n\pi \text{ or } x = 2n\pi + \frac{\pi}{2} \text{ where n } \epsilon Z \dots \text{ans}$$

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given,

cosec x = 1 + cot x

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$$\Rightarrow \sin x + \cos x = 1$$

In all such problems we try to reduce the equation in an equation involving single trigonometric expression.

$$\therefore s \frac{1}{\sqrt{2}} \sin x + \frac{1}{\sqrt{2}} \cos x = \frac{1}{\sqrt{2}}$$
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$$\Rightarrow \cos\left(x - \frac{\pi}{4}\right) = \cos\frac{\pi}{4}. \{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \}$$

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If $\cos x = \cos y$, impls $x = 2n\pi \pm y$, where $n \in Z$

$$x - \frac{\pi}{4} = \left(2n\pi \pm \frac{\pi}{4}\right)$$

$$\therefore x = \left(2n\pi \pm \frac{\pi}{4}\right) + \frac{\pi}{4} \text{ where } n \in \mathbb{Z}$$





$$x = 2n\pi \text{ or } x = 2n\pi + \frac{\pi}{2} \text{ where n } \epsilon Z \dots \text{ans}$$

6 E. Question

Solve the following equations:

$$\left(\sqrt{3}-1\right)\cos x + \left(\sqrt{3}+1\right)\sin x = 2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

 $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given.

$$\left(\sqrt{3}-1\right)\cos x + \left(\sqrt{3}+1\right)\sin x = 2$$

Dividing both sides by $2\sqrt{2}$:

We have,

.

$$\Rightarrow \cos\alpha\cos x + \sin\alpha\sin x = \cos\frac{\pi}{4} \text{ where } \cos\alpha = \pi/4$$

$$\Rightarrow \cos(x - \alpha) = \cos\frac{\pi}{4} \{ \cos \pi/4 = 1/\sqrt{2} \}$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\dot{x} - \alpha = 2n\pi \pm \frac{\pi}{4} \frac{\left(\sqrt{3} - 1\right)}{2\sqrt{2}} \cos x + \frac{\left(\sqrt{3} + 1\right)}{2\sqrt{2}} \sin x = \frac{1}{\sqrt{2}}$$

$$x = 2n\pi \pm \frac{\pi}{4} + \alpha$$
 where $\cos \alpha = \frac{(\sqrt{3} - 1)}{2\sqrt{2}}$ and $n \in \mathbb{Z}$

6 E. Question

Solve the following equations:

$$\left(\sqrt{3}-1\right)\cos x + \left(\sqrt{3}+1\right)\sin x = 2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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$$\left(\sqrt{3}-1\right)\cos x + \left(\sqrt{3}+1\right)\sin x = 2$$

Dividing both sides by $2\sqrt{2}$:

We have,

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$$\Rightarrow \cos\alpha\cos x + \sin\alpha\sin x = \cos\frac{\pi}{4} \text{ where } \cos\alpha = \pi/4$$

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If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore x - \alpha = 2n\pi \pm \frac{\pi}{4} \frac{\left(\sqrt{3} - 1\right)}{2\sqrt{2}} \cos x + \frac{\left(\sqrt{3} + 1\right)}{2\sqrt{2}} \sin x = \frac{1}{\sqrt{2}}$$

$$x = 2n\pi \pm \frac{\pi}{4} + \alpha$$
 where $\cos \alpha = \frac{\left(\sqrt{3} - 1\right)}{2\sqrt{2}}$ and $n \in \mathbb{Z}$

7. Question

Solve the following equations :

$$\cot x + \tan x = 2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = \pi + y$, where $n \in Z$.

given,

$$\cot x + \tan x = 2$$

$$\frac{1}{\tan x} + \tan x = 2$$

$$\Rightarrow \tan^2 x - 2\tan x + 1 = 0$$

$$\Rightarrow (\tan x - 1)^2 = 0$$

$$\therefore$$
 tan x = 1 \Rightarrow tan x = tan $\pi/4$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$\therefore x = n\pi + \pi/4$ where $n \in Z$ans

7. Question

Solve the following equations:

$$\cot x + \tan x = 2$$





Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

given,

 $\cot x + \tan x = 2$

$$\frac{1}{\tan x} + \tan x = 2$$

- $\Rightarrow \tan^2 x 2\tan x + 1 = 0$
- $\Rightarrow (\tan x 1)^2 = 0$
- ∴ tan $x = 1 \Rightarrow \tan x = \tan \pi/4$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

 $\therefore x = n\pi + \pi/4$ where $n \in Z$ ans

7 B. Question

Solve the following equations:

$$2 \sin^2 x = 3 \cos x, 0 \le x \le 2\pi$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = m + y, where $n \in Z$.

given,

$$2 \sin^2 x = 3 \cos x \cdot 0 \le x \le 2\pi$$

$$\Rightarrow$$
 2 (1 - cos² x) = 3 cos x

$$\Rightarrow 2\cos^2 x + 3\cos x - 2 = 0$$

$$\Rightarrow 2 \cos^2 x + 4 \cos x - \cos x - 2 = 0$$

$$\Rightarrow 2\cos x(\cos x + 2) - 1(\cos x + 2) = 0$$

$$\Rightarrow (2\cos x - 1)(\cos x + 2) = 0$$

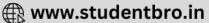
or $\cos x = -2$ { as $\cos x$ lies between -1 and 1 so this value is rejected }

$$\therefore \cos x = \mathbf{\hat{v}} = \cos \pi/3$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore x = 2n\pi \pm \pi/3$$





But, $0 \le x \le 2\pi$

 $\therefore x = \pi/3$ and $x = 2\pi - \pi/3 = 5\pi/3$ ans

7 B. Question

Solve the following equations:

 $2\sin^2 x = 3\cos x, 0 \le x \le 2\pi$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

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- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

given,

 $2 \sin^2 x = 3 \cos x$, $0 \le x \le 2\pi$

$$\Rightarrow$$
 2 (1 - cos² x) = 3 cos x

$$\Rightarrow 2 \cos^2 x + 3\cos x - 2 = 0$$

$$\Rightarrow 2\cos^2 x + 4\cos x - \cos x - 2 = 0$$

$$\Rightarrow 2 \cos x(\cos x + 2) - 1(\cos x + 2) = 0$$

$$\Rightarrow (2\cos x - 1)(\cos x + 2) = 0$$

or $\cos x = -2$ { as $\cos x$ lies between -1 and 1 so this value is rejected }

$$\therefore \cos x = \mathbf{\hat{v}} = \cos \pi/3$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$

$$\therefore x = 2n\pi \pm \pi/3$$

But,
$$0 \le x \le 2\pi$$

$$\therefore$$
 x = $\pi/3$ and x = $2\pi - \pi/3 = 5\pi/3$ ans

7 C. Question

Solve the following equations:

$$\sec x \cos 5x + 1 = 0, 0 < x < \pi/2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

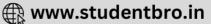
- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

given,

 $\sec x \cos 5x + 1 = 0, 0 < x < \pi/2$

 \Rightarrow sec x cos 5x = -1





$$\Rightarrow$$
 cos 5x = - cos x

$$\because$$
 - cos x = cos (π - x)

$$\therefore$$
 cos 5x = cos (π - x)

If $\cos x = \cos y$, implies $2n\pi \pm y$, where $n \in Z$.

$$\therefore 5x = 2n\pi \pm (\pi - x)$$

$$\Rightarrow 5x = 2n\pi + (\pi - x) \text{ or } 5x = 2n\pi - (\pi - x)$$

$$\Rightarrow 6x = (2n+1)\pi \text{ or } 4x = (2n-1)\pi$$

$$\therefore$$
 x = $(2n+1)\frac{\pi}{6}$ or x = $(2n-1)\frac{\pi}{4}$ where $n \in \mathbb{Z}$

But,
$$0 < x < \pi/2$$

$$\therefore x = \frac{\pi}{6}$$
 and $x = \frac{\pi}{4}$...ans

7 C. Question

Solve the following equations:

$$\sec x \cos 5x + 1 = 0, 0 < x < \pi/2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x =
$$n\pi$$
 + y, where $n \in Z$.

given,

$$\sec x \cos 5x + 1 = 0, 0 < x < \pi/2$$

$$\Rightarrow$$
 sec x cos $5x = -1$

$$\Rightarrow$$
 cos 5x = - cos x

$$\because$$
 - cos x = cos (π - x)

$$\therefore$$
 cos 5x = cos (π - x)

If $\cos x = \cos y$, implies $2n\pi \pm y$, where $n \in Z$.

$$\therefore 5x = 2n\pi \pm (\pi - x)$$

$$\Rightarrow$$
 5x = 2n π + (π - x) or 5x = 2n π - (π - x)

$$\Rightarrow$$
 6x = $(2n+1)\pi$ or 4x = $(2n-1)\pi$

$$\therefore$$
 x = $(2n+1)\frac{\pi}{6}$ or x = $(2n-1)\frac{\pi}{4}$ where $n \in \mathbb{Z}$

But,
$$0 < x < \pi/2$$

$$\therefore x = \frac{\pi}{6} \text{ and } x = \frac{\pi}{4} \dots \text{ans}$$

7 D. Question





Solve the following equations:

$$5\cos^2 x + 7\sin^2 x - 6 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

given,

$$5 \cos^2 x + 7 \sin^2 x - 6 = 0$$

$$\Rightarrow 5 \cos^2 x + 5 \sin^2 x + 2\sin^2 x - 6 = 0$$

$$\Rightarrow 2 \sin^2 x - 6 + 5 = 0 \{ : \sin^2 x + \cos^2 x = 1 \}$$

$$\Rightarrow 2 \sin^2 x - 1 = 0$$

$$\Rightarrow \sin^2 x = (1/2)$$

$$\therefore \sin x = \pm (1/\sqrt{2})$$

$$\Rightarrow$$
 sin x = \pm sin $\pi/4$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

$$\therefore x = n\pi + (-1)^n (\pm (\pi / 4))$$
 where $n \in Z$

$$\therefore x = n\pi \pm \frac{\pi}{4}$$
 where $n \in \mathbb{Z}$ ans

7 D. Question

Solve the following equations:

$$5\cos^2 x + 7\sin^2 x - 6 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in \mathbb{Z}$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan
$$x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

given,

$$5 \cos^2 x + 7 \sin^2 x - 6 = 0$$

$$\Rightarrow 5 \cos^2 x + 5 \sin^2 x + 2\sin^2 x - 6 = 0$$

$$\Rightarrow 2 \sin^2 x - 6 + 5 = 0 \{ : \sin^2 x + \cos^2 x = 1 \}$$

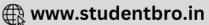
$$\Rightarrow 2 \sin^2 x - 1 = 0$$

$$\Rightarrow \sin^2 x = (1/2)$$

$$\therefore \sin x = \pm (1/\sqrt{2})$$







 \Rightarrow sin x = \pm sin $\pi/4$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

 $\therefore x = n\pi + (-1)^n (\pm (\pi / 4))$ where $n \in Z$

$$\therefore x = n\pi \pm \frac{\pi}{4}$$
 where $n \in \mathbb{Z}$ ans

7 E. Question

Solve the following equations:

$$\sin x - 3 \sin 2x + \sin 3x = \cos x - 3 \cos 2x + \cos 3x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies $x = n\pi + y$, where $n \in Z$.

given,

 $\sin x - 3 \sin 2x + \sin 3x = \cos x - 3 \cos 2x + \cos 3x$

$$\Rightarrow (\sin x + \sin 3x) - 3\sin 2x - (\cos x + \cos 3x) + 3\cos 2x = 0$$

$$\because \sin A + \sin B = 2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right) \text{and } \cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$\div 2\sin\left(\frac{x+3x}{2}\right)\cos\left(\frac{3x-x}{2}\right) - 3\sin 2x - 2\cos\left(\frac{3x+x}{2}\right)\cos\left(\frac{3x-x}{2}\right) + 3\cos 2x = 0$$

$$\Rightarrow$$
 2 sin 2x cos x - 3 sin 2x - 2 cos 2x cos x + 3 cos 2x = 0

$$\Rightarrow$$
 sin 2x (2cos x - 3) - cos 2x (2cos x - 3) = 0

$$\Rightarrow (2\cos x - 3)(\sin 2x - \cos 2x) = 0$$

$$\therefore$$
 cos x = 3/2 = 1.5 (not accepted as cos x lies between - 1 and 1)

Or $\sin 2x = \cos 2x$

$$\therefore$$
 tan $2x = 1 = \tan \pi/4$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore 2x = n\pi + \pi/4$$

$$x = \frac{n\pi}{2} + \frac{\pi}{8} \text{ where } n \in \mathbb{Z}....ans$$

7 E. Question

Solve the following equations:

$$\sin x - 3 \sin 2x + \sin 3x = \cos x - 3 \cos 2x + \cos 3x$$

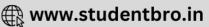
Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -







• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

• $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

given,

 $\sin x - 3 \sin 2x + \sin 3x = \cos x - 3 \cos 2x + \cos 3x$

 $\Rightarrow (\sin x + \sin 3x) - 3\sin 2x - (\cos x + \cos 3x) + 3\cos 2x = 0$

$$\because \sin A + \sin B = 2\sin\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right) \text{and } \cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$\div 2\sin\left(\frac{x+3x}{2}\right)\cos\left(\frac{3x-x}{2}\right) - 3\sin 2x - 2\cos\left(\frac{3x+x}{2}\right)\cos\left(\frac{3x-x}{2}\right) + 3\cos 2x = 0$$

 \Rightarrow 2 sin 2x cos x - 3 sin 2x - 2 cos 2x cos x + 3 cos 2x = 0

$$\Rightarrow$$
 sin 2x (2cos x - 3) - cos 2x (2cos x - 3) = 0

$$\Rightarrow (2\cos x - 3)(\sin 2x - \cos 2x) = 0$$

 \therefore cos x = 3/2 = 1.5 (not accepted as cos x lies between - 1 and 1)

Or $\sin 2x = \cos 2x$

 \therefore tan $2x = 1 = \tan \pi/4$

If $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore 2x = n\pi + \pi/4$$

$$\therefore x = \frac{n\pi}{2} + \frac{\pi}{8} \text{ where } n \in \mathbb{Z}....ans$$

7 F. Question

Solve the following equations:

$$4 \sin x \cos x + 2 \sin x + 2 \cos x + 1 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

• $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

• $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

given,

 $4 \sin x \cos x + 2 \sin x + 2 \cos x + 1 = 0$

 \Rightarrow 2sin x (2cos x + 1) + 1(2cos x + 1) = 0

 $\Rightarrow (2\cos x + 1)(2\sin x + 1) = 0$

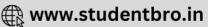
 \therefore cos x = -1/2 or sin x = -1/2

 \Rightarrow cos x = cos (π - π /3) or sin x = sin (- π /6)

 \Rightarrow cos x = cos $2\pi/3$ or sin x = sin $(-\pi/6)$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.





And $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

$$\therefore x = 2n\pi \pm 2\pi/3 \text{ or } x = m\pi + (-1)^m (-\pi/6)$$

Hence,

$$x = 2n\pi \pm \frac{2\pi}{3}$$
 or $x = m\pi + (-1)^m \left(-\frac{\pi}{6}\right)$ where $m, n \in \mathbb{Z}$...ans

7 F. Question

Solve the following equations:

$$4 \sin x \cos x + 2 \sin x + 2 \cos x + 1 = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- $\tan x = \tan y$, implies x = m + y, where $n \in Z$.

given,

$$4 \sin x \cos x + 2 \sin x + 2 \cos x + 1 = 0$$

$$\Rightarrow$$
 2sin x (2cos x + 1) + 1(2cos x + 1) = 0

$$\Rightarrow (2\cos x + 1)(2\sin x + 1) = 0$$

$$\therefore$$
 cos x = -1/2 or sin x = -1/2

$$\Rightarrow$$
 cos x = cos (π - π /3) or sin x = sin (- π /6)

$$\Rightarrow$$
 cos x = cos $2\pi/3$ or sin x = sin $(-\pi/6)$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

And $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

$$\therefore x = 2n\pi \pm 2\pi/3 \text{ or } x = m\pi + (-1)^m (-\pi/6)$$

Hence,

$$x = 2n\pi \pm \frac{2\pi}{3}$$
 or $x = m\pi + (-1)^m \left(-\frac{\pi}{6}\right)$ where $m, n \in \mathbb{Z}$...ans

7 G. Question

Solve the following equations :

$$\cos x + \sin x = \cos 2x + \sin 2x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.

Given,







$$\cos x + \sin x = \cos 2x + \sin 2x$$

$$\cos x - \cos 2x = \sin 2x - \sin x$$

$$\{\because \sin A - \sin B = 2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right) & \cos A - \cos B = -2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)\}$$

$$\therefore -2\sin\left(\frac{x+2x}{2}\right)\sin\left(\frac{x-2x}{2}\right) = 2\cos\left(\frac{2x+x}{2}\right)\sin\left(\frac{2x-x}{2}\right)$$

$$\Rightarrow 2\sin\frac{3x}{2}\sin\frac{x}{2} = 2\cos\frac{3x}{2}\sin\frac{x}{2}$$

$$\sin \frac{x}{2} \left(\sin \frac{3x}{2} - \cos \frac{3x}{2} \right) = 0$$

Hence,

Either,
$$\sin \frac{x}{2} = 0$$
 or $\sin \frac{3x}{2} = \cos \frac{3x}{2}$

$$\Rightarrow \sin \frac{x}{2} = \sin m\pi \text{ or } \tan \frac{3x}{2} = 1 = \tan \frac{\pi}{4}$$

If tan $x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\frac{x}{2} = m\pi \text{ or } \frac{3x}{2} = n\pi + \frac{\pi}{4}$$

$$\Rightarrow x = 2m\pi \text{ or } x = \frac{2n\pi}{3} + \frac{\pi}{6} \text{ where m,n } \in \mathbb{Z} \text{ans}$$

7 G. Question

Solve the following equations:

$$\cos x + \sin x = \cos 2x + \sin 2x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = m + y, where $n \in Z$.

Given,

$$\cos x + \sin x = \cos 2x + \sin 2x$$

$$\cos x - \cos 2x = \sin 2x - \sin x$$

$$\{\because \sin A - \sin B = 2\cos\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right) & \cos A - \cos B = -2\sin\left(\frac{A+B}{2}\right)\sin\left(\frac{A-B}{2}\right)\}$$

$$\therefore -2\sin\left(\frac{x+2x}{2}\right)\sin\left(\frac{x-2x}{2}\right) = 2\cos\left(\frac{2x+x}{2}\right)\sin\left(\frac{2x-x}{2}\right)$$





$$\Rightarrow 2\sin\frac{3x}{2}\sin\frac{x}{2} = 2\cos\frac{3x}{2}\sin\frac{x}{2}.$$

$$\sin \frac{x}{2} \left(\sin \frac{3x}{2} - \cos \frac{3x}{2} \right) = 0$$

Hence,

Either,
$$\sin \frac{x}{2} = 0$$
 or $\sin \frac{3x}{2} = \cos \frac{3x}{2}$

$$\Rightarrow \sin \frac{x}{2} = \sin m\pi \text{ or } \tan \frac{3x}{2} = 1 = \tan \frac{\pi}{4}$$

If $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore \frac{x}{2} = m\pi \text{ or } \frac{3x}{2} = n\pi + \frac{\pi}{4}$$

$$\Rightarrow x = 2m\pi \text{ or } x = \frac{2n\pi}{3} + \frac{\pi}{6} \text{ where m,n } \in Z \text{ans}$$

7 H. Question

Solve the following equations:

$$\sin x \tan x - 1 = \tan x - \sin x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = π + y, where n \in Z.

given,

$$\sin x \tan x - 1 = \tan x - \sin x$$

$$\Rightarrow$$
 sin x tan x - tan x + sin x - 1 = 0

$$\Rightarrow \tan x(\sin x - 1) + (\sin x - 1) = 0$$

$$\Rightarrow (\sin x - 1)(\tan x + 1) = 0$$

$$\therefore$$
 sin x = 1 or tan x = -1

$$\Rightarrow$$
 sin x = sin $\pi/2$ or tan x = tan (- $\pi/4$)

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

and $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore x = n\pi + (-1)^n (\pi/2) \text{ or } x = m\pi + (-\pi/4)$$

$$\therefore x = n\pi + (-1)^n \left(\frac{\pi}{2}\right) \text{ or } x = m\pi - \frac{\pi}{4} \text{ where } n, m \in \mathbb{Z}....ans$$

7 H. Question

Solve the following equations:





Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = m + y, where $n \in Z$.

given,

 $\sin x \tan x - 1 = \tan x - \sin x$

$$\Rightarrow$$
 sin x tan x - tan x + sin x - 1 = 0

$$\Rightarrow \tan x(\sin x - 1) + (\sin x - 1) = 0$$

$$\Rightarrow (\sin x - 1)(\tan x + 1) = 0$$

$$\therefore$$
 sin x = 1 or tan x = -1

$$\Rightarrow$$
 sin x = sin $\pi/2$ or tan x = tan (- $\pi/4$)

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

and $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore x = n\pi + (-1)^n (\pi/2) \text{ or } x = m\pi + (-\pi/4)$$

$$\therefore x = n\pi + (-1)^n \left(\frac{\pi}{2}\right) \text{ or } x = m\pi - \frac{\pi}{4} \text{ where } n, m \in \mathbb{Z}....ans$$

7 I. Question

Solve the following equations:

$$3 \tan x + \cot x = 5 \csc x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = $n\pi$ + y, where $n \in Z$.

Given,

 $3\tan x + \cot x = 5\csc x$

$$\Rightarrow 3\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x} = \frac{5}{\sin x}$$

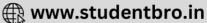
$$\Rightarrow 3 \frac{\sin x}{\cos x} = \frac{5}{\sin x} - \frac{\cos x}{\sin x}$$

$$\Rightarrow 3\sin^2 x = (5 - \cos x)\cos x$$

$$\Rightarrow 3\sin^2 x + \cos^2 x = 5\cos x$$







$$\Rightarrow 2\sin^2 x - 5\cos x + 1 = 0 \{ \because \sin^2 x + \cos^2 x = 1 \}$$

$$2(1-\cos^2 x) - 5\cos x + 1 = 0$$

$$\Rightarrow 2\cos^2 x + 5\cos x - 3 = 0$$

$$\Rightarrow 2\cos^2 x + 6\cos x - \cos x - 3 = 0$$

$$\Rightarrow 2\cos x(\cos x + 3) - 1(\cos x + 3) = 0$$

$$\Rightarrow (\cos x + 3)(2\cos x - 1) = 0$$

$$\therefore$$
 cos x = -3 (neglected as cos x lies between -1 and 1)

or $\cos x =$ (accepted value)

$$\cos x = \cos \frac{\pi}{3}$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where $n \in \mathbb{Z}$ans

7 I. Question

Solve the following equations:

$$3 \tan x + \cot x = 5 \csc x$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = n\pi + y$, where $n \in Z$.

Given,

 $3\tan x + \cot x = 5\csc x$

$$\Rightarrow 3\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x} = \frac{5}{\sin x}$$

$$\Rightarrow 3\frac{\sin x}{\cos x} = \frac{5}{\sin x} - \frac{\cos x}{\sin x}$$

$$\Rightarrow 3\sin^2 x = (5 - \cos x)\cos x$$

$$\Rightarrow 3\sin^2 x + \cos^2 x = 5\cos x$$

$$\Rightarrow 2\sin^2 x - 5\cos x + 1 = 0 \{ \because \sin^2 x + \cos^2 x = 1 \}$$

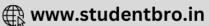
$$2(1-\cos^2 x) - 5\cos x + 1 = 0$$

$$\Rightarrow 2\cos^2 x + 5\cos x - 3 = 0$$

$$\Rightarrow 2\cos^2 x + 6\cos x - \cos x - 3 = 0$$







$$\Rightarrow 2\cos x(\cos x + 3) - 1(\cos x + 3) = 0$$

$$\Rightarrow (\cos x + 3)(2\cos x - 1) = 0$$

 \therefore cos x = -3 (neglected as cos x lies between -1 and 1)

or $\cos x = \mathbf{\bullet}$ (accepted value)

$$\cos x = \cos \frac{\pi}{3}$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

$$\therefore x = 2n\pi \pm \frac{\pi}{3}$$
 where $n \in \mathbb{Z}$ans

8. Question

Solve:
$$3 - 2 \cos x - 4 \sin x - \cos 2x + \sin 2x = 0$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

• tan
$$x = \tan y$$
, implies $x = n\pi + y$, where $n \in Z$.

Given,

$$3 - 2 \cos x - 4 \sin x - \cos 2x + \sin 2x = 0$$

As,
$$\cos 2x = 1 - 2\sin^2 x$$
 and $\sin 2x = 2\sin x \cos x$

$$3 - 2\cos x - 4\sin x - (1 - 2\sin^2 x) + 2\sin x \cos x = 0$$

$$\Rightarrow 2\sin^2 x - 4\sin x + 2 - 2\cos x + 2\sin x \cos x = 0$$

$$\Rightarrow 2(\sin^2 x - 2\sin x + 1) + 2\cos x(\sin x - 1) = 0$$

$$\Rightarrow$$
 2(sin x - 1)² + 2cos x(sin x - 1) = 0

$$\Rightarrow (\sin x - 1)(2\cos x + 2\sin x - 2) = 0$$

$$\therefore$$
 sin x = 1 or sin x + cos x = 1

When,
$$\sin x = 1$$

We have,

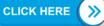
$$\sin x = \sin \pi/2$$

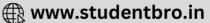
If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$

$$\therefore x = n\pi + (-1)^n \left(\frac{\pi}{2}\right) \text{ where } n \in \mathbb{Z}$$

When, $\sin x + \cos x = 1$

$$\therefore \frac{1}{\sqrt{2}} \sin x + \frac{1}{\sqrt{2}} \cos x = \frac{1}{\sqrt{2}}$$
 { dividing by $\sqrt{2}$ both sides}





$$\Rightarrow \sin x \sin \frac{\pi}{4} + \cos \frac{\pi}{4} \cos x = \cos \frac{\pi}{4} \left\{ \because \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{4}\right) = \cos\frac{\pi}{4} \left\{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \right\}$$

If $\cos x = \cos y$, implies $x = 2m\pi \pm y$, where $m \in Z$

$$\therefore x - \frac{\pi}{4} = \left(2m\pi \pm \frac{\pi}{4}\right)$$

$$\therefore x = \left(2m\pi \pm \frac{\pi}{4}\right) + \frac{\pi}{4} \text{ where } m \in Z$$

$$\Rightarrow$$
 x = 2m π or x = 2m π + $\frac{\pi}{2}$ where m ϵ Z

Hence,

$$x = n\pi + (-1)^n \left(\frac{\pi}{2}\right)$$
 or $x = 2m\pi$ or $x = 2m\pi + \frac{\pi}{2}$ where $m, n \in \mathbb{Z}$

8. Question

Solve : $3 - 2 \cos x - 4 \sin x - \cos 2x + \sin 2x = 0$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, implies x = m + y, where $n \in Z$.

Given,

$$3 - 2 \cos x - 4 \sin x - \cos 2x + \sin 2x = 0$$

As,
$$\cos 2x = 1 - 2\sin^2 x$$
 and $\sin 2x = 2\sin x \cos x$

$$\therefore$$
 3 - 2cos x - 4sin x - (1 - 2sin² x) + 2sin x cos x = 0

$$\Rightarrow 2\sin^2 x - 4\sin x + 2 - 2\cos x + 2\sin x \cos x = 0$$

$$\Rightarrow 2(\sin^2 x - 2\sin x + 1) + 2\cos x(\sin x - 1) = 0$$

$$\Rightarrow 2(\sin x - 1)^2 + 2\cos x(\sin x - 1) = 0$$

$$\Rightarrow (\sin x - 1)(2\cos x + 2\sin x - 2) = 0$$

$$\therefore$$
 sin x = 1 or sin x + cos x = 1

When, $\sin x = 1$

We have,

$$\sin x = \sin \pi/2$$

If $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$





$$\therefore x = n\pi + (-1)^n \left(\frac{\pi}{2}\right) \text{ where } n \in \mathbb{Z}$$

When, $\sin x + \cos x = 1$

$$\therefore \frac{1}{\sqrt{2}}\sin x + \frac{1}{\sqrt{2}}\cos x = \frac{1}{\sqrt{2}} \text{ {dividing by $\sqrt{2}$ both sides}}$$

$$\Rightarrow \sin x \sin \frac{\pi}{4} + \cos \frac{\pi}{4} \cos x = \cos \frac{\pi}{4} \left\{ \because \sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}} \right\}$$

$$\Rightarrow \cos\left(x - \frac{\pi}{4}\right) = \cos\frac{\pi}{4} \left\{ \because \cos A \cos B + \sin A \sin B = \cos (A - B) \right\}$$

If $\cos x = \cos y$, implies $x = 2m\pi \pm y$, where $m \in Z$

$$\therefore x - \frac{\pi}{4} = \left(2m\pi \pm \frac{\pi}{4}\right)$$

$$\therefore x = \left(2m\pi \pm \frac{\pi}{4}\right) + \frac{\pi}{4} \text{ where } m \in Z$$

$$\Rightarrow$$
 x = 2m π or x = 2m π + $\frac{\pi}{2}$ where m ϵ Z

Hence,

$$x = n\pi + (-1)^n \left(\frac{\pi}{2}\right) or \ x = 2m\pi or \ x = 2m\pi + \frac{\pi}{2} where \ m, \ n \in \mathbb{Z}$$

9. Question

$$3\sin^2 x - 5\sin x \cos x + 8\cos^2 x = 2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

•
$$\sin x = \sin y$$
, implies $x = n\pi + (-1)^n y$, where $n \in Z$.

•
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

•
$$tan x = tan y$$
, $implies x = m + y$, where $n \in Z$.

Given,

$$3\sin^2 x - 5\sin x \cos x + 8\cos^2 x = 2$$

$$\Rightarrow 3\sin^2 x + 3\cos^2 x - 5\sin x \cos x + 5\cos^2 x = 2$$

$$\Rightarrow$$
 3 - 5sin x cos x + 5 cos² x = 2 {:: sin² x + cos ²x = 1 }

$$\Rightarrow$$
 5cos² x + 1 = 5sin x cos x

Squaring both sides:

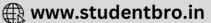
$$\Rightarrow$$
 (5cos² x + 1)² = (5sin x cos x)²

$$\Rightarrow 25\cos^4 x + 10\cos^2 x + 1 = 25\sin^2 x \cos^2 x$$

$$\Rightarrow 25\cos^4 x + 10\cos^2 x + 1 = 25 (1 - \cos^2 x) \cos^2 x$$







$$\Rightarrow 50\cos^4 x - 15\cos^2 x + 1 = 0$$

$$\Rightarrow 50\cos^4 x - 10\cos^2 x - 5\cos^2 x + 1 = 0$$

$$\Rightarrow$$
 10cos² x (5cos² x - 1) - (5cos² x - 1) = 0

$$\Rightarrow$$
 (10cos² x - 1)(5cos² x - 1) = 0

$$\cos^2 x = 1/10 \text{ or } \cos^2 x = 1/5$$

Hence, when $\cos^2 x = 1/10$

We have,
$$\cos x = \pm \frac{1}{\sqrt{10}}$$

If $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.

let $\cos \alpha = 1/\sqrt{10}$

$$\therefore \cos (\pi - \alpha) = -1/\sqrt{10}$$

$$\therefore x = 2n\pi \pm \alpha \text{ or } x = 2n\pi \pm (\pi - \alpha)$$

$$\therefore \text{ when, } \cos x = \pm \frac{1}{\sqrt{10}}$$

$$x = 2n\pi \pm \alpha$$
 or $x = 2n\pi \pm (\pi - \alpha)$ where $n \in Z$ and $\cos \alpha = \frac{1}{\sqrt{10}}$

When $\cos^2 x = 1/5$

We have,
$$\cos x = \pm \frac{1}{\sqrt{5}}$$
.

If $\cos x = \cos y$, implies $x = 2m\pi \pm y$, where $n \in Z$.

let $\cos \beta = 1/\sqrt{5}$

$$\therefore$$
 cos $(\pi - \beta) = -1/\sqrt{5}$

$$\therefore x = 2m\pi \pm \beta \text{ or } x = 2m\pi \pm (\pi - \beta)$$

$$\therefore \text{ when, } \cos x = \pm \frac{1}{\sqrt{5}}.$$

$$x = 2m\pi \pm \beta$$
 or $x = 2m\pi \pm (\pi - \beta)$ where $m \in Z$ and $\cos \beta = \frac{1}{\sqrt{5}}$

...ans

9. Question

$$3\sin^2 x - 5\sin x \cos x + 8\cos^2 x = 2$$

Answer

Ideas required to solve the problem:

The general solution of any trigonometric equation is given as -

- $\sin x = \sin y$, implies $x = n\pi + (-1)^n y$, where $n \in Z$.
- $\cos x = \cos y$, implies $x = 2n\pi \pm y$, where $n \in Z$.
- tan x = tan y, $implies x = n\pi + y$, where $n \in Z$.





$$3\sin^2 x - 5\sin x \cos x + 8\cos^2 x = 2$$

$$\Rightarrow 3\sin^2 x + 3\cos^2 x - 5\sin x \cos x + 5\cos^2 x = 2$$

$$\Rightarrow$$
 3 - 5sin x cos x + 5 cos² x = 2 {:: sin² x + cos ²x = 1 }

$$\Rightarrow$$
 5cos² x + 1 = 5sin x cos x

Squaring both sides:

$$\Rightarrow (5\cos^2 x + 1)^2 = (5\sin x \cos x)^2$$

$$\Rightarrow 25\cos^4 x + 10\cos^2 x + 1 = 25\sin^2 x \cos^2 x$$

$$\Rightarrow 25\cos^4 x + 10\cos^2 x + 1 = 25 (1 - \cos^2 x) \cos^2 x$$

$$\Rightarrow 50\cos^4 x - 15\cos^2 x + 1 = 0$$

$$\Rightarrow 50\cos^4 x - 10\cos^2 x - 5\cos^2 x + 1 = 0$$

$$\Rightarrow$$
 10cos² x (5cos² x - 1) - (5cos² x - 1) = 0

$$\Rightarrow$$
 (10cos² x - 1)(5cos² x - 1) = 0

$$\cos^2 x = 1/10 \text{ or } \cos^2 x = 1/5$$

Hence, when
$$\cos^2 x = 1/10$$

We have,
$$\cos x = \pm \frac{1}{\sqrt{10}}$$

If
$$\cos x = \cos y$$
, implies $x = 2n\pi \pm y$, where $n \in Z$.

let
$$\cos \alpha = 1/\sqrt{10}$$

$$\therefore$$
 cos $(\pi - \alpha) = -1/\sqrt{10}$

$$\therefore x = 2n\pi \pm \alpha \text{ or } x = 2n\pi \pm (\pi - \alpha)$$

$$\therefore$$
 when, $\cos x = \pm \frac{1}{\sqrt{10}}$

$$x = 2n\pi \pm \alpha$$
 or $x = 2n\pi \pm (\pi - \alpha)$ where $n \in Z$ and $\cos \alpha = \frac{1}{\sqrt{10}}$

When
$$\cos^2 x = 1/5$$

We have,
$$\cos x = \pm \frac{1}{\sqrt{5}}$$
.

If
$$\cos x = \cos y$$
, implies $x = 2m\pi \pm y$, where $n \in Z$.

let cos
$$\beta = 1/\sqrt{5}$$

$$\therefore$$
 cos $(\pi - \beta) = -1/\sqrt{5}$

$$\therefore x = 2m\pi \pm \beta \text{ or } x = 2m\pi \pm (\pi - \beta)$$

$$\therefore$$
 when, $\cos x = \pm \frac{1}{\sqrt{5}}$.

$$x = 2m\pi \pm \beta$$
 or $x = 2m\pi \pm (\pi - \beta)$ where $m \in Z$ and $\cos \beta = \frac{1}{\sqrt{5}}$



...ans

10. Question

Solve:
$$2^{\sin^2 x} + 2^{\cos^2 x} = 2\sqrt{2}$$

Answer

Given,

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

On comparing both sides, we have

$$\sin^2 x = \cos^2 x =$$

Note: If we want to give solution using above two equations then task will become tedious as sin x can be positive at that time cos will be negative and similar 4-5 cases will arise. So inspite of combining all solutions at the end, we proceed as follows

combining both we can say that,

all the solutions of first 2 equations combined will satisy this single equation

$$tan^2 x = 1$$

$$\tan x = \pm 1 = \tan \left(\pm \frac{\pi}{4} \right)$$

 $\tan x = \tan y$, implies $x = n\pi + y$, where $n \in Z$.

$$\therefore X = n\pi + \frac{\pi}{4} \text{ or } X = m\pi - \frac{\pi}{4} \text{ where } m, n \in \mathbb{Z}... \text{ ans}$$

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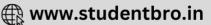
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$$\therefore X = n\pi + \frac{\pi}{4} \text{ or } X = m\pi - \frac{\pi}{4} \text{ where } m, n \in \mathbb{Z}...$$
 ans

Very Short Answer

1. Question

Write the number of solutions of the equation $\tan x + \sec x = 2 \cos x$ in the interval $[0, 2\pi]$.

Answer

$$\frac{\sin x}{\cos x} + \frac{1}{\cos x} = 2 \times \cos x$$

$$\sin x + 1 = 2 \times (\cos x)^2$$

$$\sin x + 1 = 2 \times (1 - (\sin x)^2)$$

$$\sin x + 1 = 2 - 2(\sin x)^2$$

$$2(\sin x)^2 + \sin x - 1 = 0$$

So, the equation will be

$$2a^2+a-1=0$$

From the equation a=0.5 or -1

Which implies

Sin
$$x=0.5$$
 or $\sin x=(-1)$

Therefore
$$x=30^{\circ}$$
 or 270°

But for $x=270^{\circ}$ our equation will not be defined as $\cos (270^{\circ})=0$

So, the solution for $x=30^{\circ}$

According to trigonometric equations

If sin x=sin a

Then $x=n\pi$ - na

Here sin x=sin30

So,
$$x=n\pi + (-1)^n \times 30$$

For n=0, x=30 and $n=1, x=150^{\circ}$ and for n=2, x=390

Hence between 0 to 2π there are only 2 possible solutions.

2. Question

Write the number of solutions of the equation $4 \sin x - 3 \cos x = 7$.

Answer

$$4\sin x - 3\cos x = 7$$

$$4\sin x - 7 = 3\cos x$$

Squaring both sides

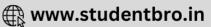
$$16(\sin x)^2 + 49 - 56\sin x = 9(\cos x)^2$$

$$16(\sin x)^2 + 49 - 56\sin x = 9((\sin x)^2 - 1)$$

$$16(\sin x)^2 - 9(\sin x)^2 - 56\sin x + 49 + 9 = 0$$







$$7(\sin x)^2$$
-56sin x+58=0

Solving the quadratic equation

Sin
$$x = 6.7774$$
 or 1.2225

But we know that $sin\theta$ lies between [-1,1]

So there are no solutions for this given equation

3. Question

Write the general solution of $tan^2 2x = 1$.

Answer

$$\frac{\sin^2 2x}{\cos^2 2x} = 1$$

$$\sin^2 2x = \cos^2 2x$$

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

$$2 \sin^2 2x = 1$$

$$\sin 2x = \frac{1}{\sqrt{2}}$$

sin 2x=sin45

So

$$2x=n\pi+\frac{\pi}{4}$$

$$x = \frac{n\pi}{2} + \frac{\pi}{8}$$

4. Question

Write the set of values of a for which the equation $\sqrt{3} \sin x - \cos x = a$ has no solution.

Answer

$$\frac{\sqrt{3}}{2}\sin x - \frac{\cos x}{2} = a$$

cos30°sin x - sin30°cos x = a

$$\sin (x-30) = a$$

As the range of sin function is from [-1,1]

So the value of a can be R-[-1,1]

i.e.
$$a \in (-\infty, -2) \cup (2, \infty)$$

5. Question

If $\cos x = k$ has exactly one solution in [0, 2 π], then write the value(s) of k.

Answer

As $\cos x = \cos \theta$

Then $x=2n\pi \pm \theta$

And it is said that it has exactly one solution.

So $\theta=0$ and





$$x=\frac{2n\pi}{2}$$

 $=n\pi$

In the given interval taking $n=1, x=\pi$ {n=0 is not possible as $\cos 0 = 1$ not -1 but $\cos \pi$ is -1}

6. Question

Write the number of points of intersection of the curves 2y = 1 and $y = \cos x$, $0 \le x \le 2\pi$.

Answer

$$2y=1$$

i.e.
$$y = \frac{1}{2}$$

and $y = \cos x$

so, to get the intersection points we must equate both the equations

i.e.
$$\cos x = \frac{1}{2}$$

so, $\cos x = \cos 60^{\circ}$

and we know if $\cos x = \cos a$

then $x=2n\pi \pm a$ where $a \in [0, \pi]$

so here

$$x=2n\pi\,\pm\frac{\pi}{3}$$

So the possible values which belong [0,2 π] are $\frac{\pi}{3}$ and $\frac{5\pi}{3}$.

There are a total of 2 points of intersection.

7. Question

Write the values of x in $[0, \pi]$ for which $\sin 2x, \frac{1}{2}$ and $\cos 2x$ are in A.P.

Answer

so
$$A_1 + A_3 = 2A_2$$

here $\sin 2x + \cos 2x = 1$

 $2\sin x \cos x + 1-2\sin^2 x = 1$

 $\sin x \cos x - \sin^2 x = 0$

 $\sin x (\cos x - \sin x) = 0$

if $\sin x = 0$

then x = 0. π

if $\sin x = \cos x$

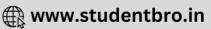
then $x = \pi/4$

So, all possible values are $0, \frac{\pi}{4}, \pi$

8. Question

Write the number of points of intersection of the curves 2y = -1 and $y = \csc x$.





Answer

Y=cosec x and
$$y = -\frac{1}{2}$$

So

$$\frac{1}{\sin x} = \frac{-1}{2}$$

$$Sin x = -2$$

Which is not possible

So

There are 0 points of intersection.

9. Question

Write the solution set of the equation $(2 \cos x + 1) (4 \cos x + 5) = 0$ in the interval $(0, 2 \pi]$.

Answer

$$8 \cos^2 x + 10 \cos x + 4 \cos x + 5 = 0$$

$$8 \cos^2 x + 14 \cos x + 5 = 0$$

Solving the quadratic equation, we get,

$$\cos x = -0.5$$

$$\cos x = \cos 120^{\circ}$$

$$x=2n\pi\,\pm\,\frac{2\pi}{3}$$

So
$$x = \frac{2\pi}{3}$$
 when $n = 0$,

And when n=1
$$\chi = \frac{4\pi}{3}$$

10. Question

Write the number of values of x in [0, 2 π] that satisfy the equation $\sin^2 x - \cos x = \frac{1}{4}$.

Answer

$$1-\cos^2 x - \cos x = 0.25$$

$$\cos x^2x + \cos x - 0.75 = 0$$

Solving the quadratic equation we get

$$\cos x = 0.5$$

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

$$x = 2n\pi \pm \frac{\pi}{3}$$

$$x=60^{\circ}$$
 when $n=0$

And
$$x=300^{\circ}$$
 when $n=1$

11. Question

If 3 tan
$$(x - 15^{\circ}) = \tan (x + 15^{\circ})$$
, $0 \le x \le 90^{\circ}$, find x.





Let $tan (15^\circ) = tan(45^\circ-30^\circ)$

We know that

$$tan(A - B) = \frac{(tanA - tanB)}{1 + tanA tanB}$$

$$\tan(45^{\circ} - 30^{\circ}) = \frac{(\tan 45^{\circ} - \tan 30^{\circ})}{1 + \tan 45^{\circ} \tan 30^{\circ}}$$

$$\tan(45-30) = \frac{1-\frac{1}{\sqrt{3}}}{1+\frac{1}{\sqrt{3}}}$$

$$\tan 15 = \frac{\sqrt{3} - 1}{\sqrt{3} + 1}$$

We now

$$\tan(a+b) = \frac{\tan a + \tan b}{1 - \tan a \times \tan b}$$

And

$$\tan(a-b) = \frac{\tan a - \tan b}{1 + \tan a \times \tan b}$$

So, 3 tan $(x - 15^{\circ}) = \tan (x + 15^{\circ})$ can be written as follows

$$3 \times \frac{\tan x - \tan 15}{1 + \tan x \times \tan 15} = \frac{\tan x + \tan 15}{1 - \tan x \times \tan 15}$$

 $(3 \tan x - 3\tan 15)(1-\tan x \times \tan 15) = (1+\tan x \times \tan 15)(\tan x + \tan 15)$

3 $\tan x - 3 \tan 15$ -3 $\tan^2 x \tan (15$ -3) $\tan x \tan^2 15 = \tan x + \tan 15 + \tan^2 x \tan 15 + \tan x \tan^2 15$ Solving the equation,

And putting

$$\tan 15 = \frac{\sqrt{3} - 1}{\sqrt{3} + 1}$$

We get $\tan x - 1 = 0$

Therefore, tan x = 1

So, $x=45^{\circ}$

Or

$$x=\frac{\pi}{4}$$

12. Question

If $2 \sin^2 x = 3 \cos x$, where $0 \le x \le 2 \pi$, then find the value of x.

Answer

$$2\sin^2 x = 3\cos x$$

$$2-2\cos^2 x = 3\cos x$$

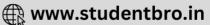
Solving the quadratic equation, we get

$$\cos x = 1/2$$

Therefore $x=60^{\circ}$ and 300°







i.e.

$$\theta = \frac{\pi}{3} \text{ and } \frac{5\pi}{3}$$

13. Question

If sec x cos 5x + 1 = 0, where $0 < x \le \frac{\pi}{2}$, find the value of x.

Answer

$$\frac{\cos 5x}{\cos x} = -1$$

$$\cos 5x = -\cos x$$

$$\cos 5x + \cos x = 0$$

We know

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

Here

$$cos5x + cosx = 2\cos\Bigl(\frac{5x+x}{2}\Bigr)\cos\Bigl(\frac{5x-x}{2}\Bigr)$$

Now from the above equation it would be,

$$2\cos 3x\cos 2x=0$$

$$\cos 3x \cos 2x=0$$

$$\cos 3x=0$$
 or $\cos 2x=0$

for cos3x=0

$$3x = (2n+1)\left(\frac{\pi}{2}\right)$$

$$x = (2n+1)\left(\frac{\pi}{6}\right)$$

for cos2x=0

$$2x = (2n+1)\left(\frac{\pi}{2}\right)$$

$$x = (2n+1) \left(\frac{\pi}{4}\right)$$

so the values of the x less than equal to 90° are $\frac{\pi}{6}$, $\frac{\pi}{4}$, $\frac{\pi}{2}$

MCQ

1. Question

Mark the Correct alternative in the following:

The smallest value of x satisfying the equation $\sqrt{3}$ (cot x + tan x) = 4 is

- A. $2 \pi / 3$
- B. π /3
- C. π /6
- D. π/12

Answer

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

$$\sqrt{3} \left(\frac{1 + \tan^2 x}{\tan x} \right) = 4$$

$$\sqrt{3} + \sqrt{3} \tan^2 x = 4 \tan x$$

$$\sqrt{3} \tan^2 x - 4 \tan x + \sqrt{3} = 0$$

Therefore

$$\tan x = \sqrt{3} \text{ or } \tan x = \frac{1}{\sqrt{3}}$$

Therefore
$$x = \frac{\pi}{3}$$
 or $\frac{\pi}{6}$

But here the smallest angle is π /6

Option C

2. Question

Mark the Correct alternative in the following:

If
$$\cos x + \sqrt{3} \sin x = 2$$
, then $x =$

A.
$$\pi/3$$

C.
$$4 \pi / 3$$

D.
$$5 \pi / 3$$

Answer

$$\cos^2 x = (2-\sqrt{3} \sin x)^2$$

$$1-\sin^2 x = 4+3 \sin^2 x - 4\sqrt{3} \sin x$$

$$4 \sin^2 x - 4\sqrt{3} \sin x + 3 = 0$$

$$sinx = \frac{\sqrt{3}}{2}$$

$$x = \frac{\pi}{3}$$

Option A

3. Question

Mark the Correct alternative in the following:

If tan px - tan qx = 0, then the values of θ form a series in

- A. AP
- B. GP
- C. HP
- D. None of these

Answer

Tan x=tana





 $X=n\pi+a$

So tan px - tan qx = 0

tan px = tan qx

 $px = n\pi + qx$

 $(p-q)x=n\pi$

$$x=\frac{n\pi}{p-q}$$

$$x=\frac{\pi}{p-q},\frac{2\pi}{p-q},\frac{3\pi}{p-q}$$

Here in this series $a = r = \frac{\pi}{p-q}$

So, this is in AP.

Option A

4. Question

Mark the Correct alternative in the following:

If a is any real number, the number of roots of cot x – tan x = a in the first quadrant is (are).

- A. 2
- B. 0
- C. 1
- D. None of these

Answer

$$\frac{1}{\tan x} - \tan x = a$$

$$\frac{1 - \tan^2 x}{\tan x} = a$$

 $1-\tan^2 x = a \tan x$

 $tan^2x + a tan x - 1 = 0$

$$tanx = \frac{-a \, \pm \sqrt{a^2-4(-1)}}{2}$$

$$tanx = \frac{-a \pm \sqrt{a^2 + 4}}{2}$$

As it is given a be any real number take a=0,

For a=0

$$tanx = \frac{\pm\sqrt{0+4}}{2}$$

Tan x = +1 or -1

In first quadrant only $tan(\pi/4)=1$

So, there is only one root that lies in the first quadrant.

Option C

5. Question





Mark the Correct alternative in the following:

The general solution of the equation $7 \cos^2 x + 3 \sin^2 x = 4$ is

A.
$$x = 2n\pi \pm \frac{\pi}{6}, n \in Z$$

$$\text{B. } x=2n\pi\pm\frac{2\pi}{3}, n\in Z$$

$$\text{C. } x=2\,n\pi\pm\frac{\pi}{3}, n\in Z$$

D. none of these

Answer

$$7\cos^2 x + 3(1-\cos^2 x) = 4$$

$$7 \cos^2 x + 3 - 3 \cos^2 x = 4$$

$$4 \cos^2 x - 1 = 0$$

$$cosx = \frac{1}{2}$$

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

Then

$$x = 2n\pi \pm \frac{\pi}{3}$$
, $n \in Z$

6. Question

Mark the Correct alternative in the following:

A solution of the equation $\cos^2 x + \sin x + 1 = 0$, lies in the interval

A.
$$(-\pi/4, \pi/4)$$

B.
$$(\pi /4, 3 \pi /4)$$

C.
$$(3 \pi /4, 5 \pi /4)$$

D.
$$(5 \pi/4, 7 \pi/4)$$

Answer

$$1-\sin^2 x + \sin x + 1 = 0$$

$$\sin^2 x - \sin x - 2 = 0$$

$$\sin x=-1$$

$$x = \frac{3\pi}{2}$$

Option D

7. Question

Mark the Correct alternative in the following:

The number of solution in $[0, \pi/2]$ of the equation $\cos 3x \tan 5x = \sin 7x$ is

- A. 5
- B. 7



D. None of these

Answer

 $\cos 3x \tan 5x = \sin 7x$

$$\cos 3x \left(\frac{\sin 5x}{\cos 5x} \right) = \sin 7x$$

 $2 \cos 3x \sin 5x = 2 \cos 5x \sin 7x$

$$\sin 8x + \sin 2x = \sin 12x + \sin 2x$$

$$\sin 8x = \sin 12x$$

$$\sin 12x - \sin 8x = 0$$

$$2 \sin 2x \cos 10x = 0$$

If
$$sin2x=0$$

Then,
$$x=0$$

If
$$cos10x = 0$$

Then
$$10x = \frac{\pi}{2}$$

$$x = \frac{\pi}{20}, \frac{3\pi}{20}, \frac{5\pi}{20}, \frac{7\pi}{20}, \frac{9\pi}{20}$$

and x=0 (from above equation $\sin 2x=0$)

So, there are 6 possible solutions.

Option C

8. Question

Mark the Correct alternative in the following:

The general value of x satisfying the equation $\sqrt{3}\sin x + \cos x = \sqrt{3}$ is given by

$$\text{A. } x=n\pi+\left(-1\right)^n\frac{\pi}{4}+\frac{\pi}{3}, n\in Z$$

$$\mathsf{B.}\ x = n\pi + \left(-1\right)^n \frac{\pi}{3} - \frac{\pi}{6}, n \in Z$$

$$\mathsf{C.}\ x = n\pi \pm \frac{\pi}{6}, n \in Z$$

$$\text{D. } x=n\pi\pm\frac{\pi}{3}, n\in Z$$

$$\cos^2 x = (\sqrt{3} - \sqrt{3} \sin x)^2$$

$$1-\sin^2 x = 3+3\sin^2 x-6\sin x$$

$$4\sin^2 x$$
- $6\sin x+2=0$

$$2\sin^2 x$$
- $3\sin x+1=0$

$$\sin x = 1 \text{ or } 0.5$$



We know,

$$x = n\pi + (-1)^n \theta$$

$$x = n\pi + (-1)^n \left(\frac{\pi}{2}\right) \text{ or } x = n\pi + (-1)^n \left(\frac{\pi}{6}\right)$$

Therefore, the values of x are

$$\frac{\pi}{6}$$
, $\frac{\pi}{2}$, $\frac{5\pi}{6}$, π , $\frac{13\pi}{6}$

So, these values are obtained for different value of n from the equation

$$x = n\pi + (-1)^n \frac{\pi}{3} - \frac{\pi}{6}, n \in Z$$

So, Option B

9. Question

Mark the Correct alternative in the following:

The smallest positive angle which satisfies the equation $2\sin^2 x + \sqrt{3}\cos x + 1 = 0$ is

A.
$$\frac{5\pi}{6}$$

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

c.
$$\frac{\pi}{3}$$

D.
$$\frac{\pi}{6}$$

Answer

$$2(1-\cos^2 x) + \sqrt{3}\cos x + 1 = 0$$

$$2 - 2 \cos^2 x + \sqrt{3} \cos x + 1 = 0$$

$$2 \cos^2 x - \sqrt{3} \cos x - 3 = 0$$

$$\cos x = \sqrt{3} \text{ or } \frac{-\sqrt{3}}{2}$$

$$x=\pi-\frac{\pi}{6}$$

$$x = \frac{5\pi}{6}$$

Option A

10. Question

Mark the Correct alternative in the following:

If $4 \sin^2 x = 1$, then the values of x are

A.
$$2n\pi \pm \frac{\pi}{3}, n \in Z$$





$$\text{B. } n\pi\pm\frac{\pi}{3}, n\in Z$$

$$\text{C. } n\pi\pm\frac{\pi}{6}, n\in Z$$

D.
$$2n\pi \pm \frac{\pi}{6}, n \in Z$$

Answer

$$sinx = \frac{1}{2} or \frac{-1}{2}$$

$$\sin x = \sin a$$

Here
$$a = 30^{\circ}$$
 or -30°

$$X=n\pi + (-1)^n$$
 a

So, the values of x are

$$n\pi \pm \frac{\pi}{6}$$
, $n \in Z$

Option C

11. Question

Mark the Correct alternative in the following:

If $\cot x - \tan x = \sec x$, then x is equal to

A.
$$2n\pi + \frac{3\pi}{2}, n \in \mathbb{Z}$$

$$\text{B. } n\pi + \left(-1\right)^n \frac{\pi}{6}, n \in Z$$

C.
$$n\pi + \frac{\pi}{2}, n \in Z$$

D. None of these

Answer

$$\frac{\cos x}{\sin x} - \frac{\sin x}{\cos x} = \frac{1}{\cos x}$$

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

$$\frac{1-\sin^2 x - \sin^2 x}{\sin x} = 1$$

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

$$2\sin^2 x + \sin x - 1 = 0$$

Sin
$$x = 0.5 \text{ or } -1$$

But the equation is invalid for $\sin x=-1$

So,
$$\sin x = 0.5 = \sin(\pi/6)$$



Hence
$$x=n\pi+\left(-1\right)^{n}\frac{\pi}{6}, n\in Z$$

Option B

12. Question

Mark the Correct alternative in the following:

A value of x satisfying is

A.
$$\frac{5\pi}{3}$$

B.
$$\frac{4\pi}{3}$$

c.
$$\frac{2\pi}{3}$$

D.
$$\frac{\pi}{3}$$

Answer

$$\frac{1}{2}\cos x + \frac{\sqrt{3}}{2}\sin x = 1$$

 $\cos 60 \cos x + \sin 60 \sin x = 1$

$$\cos (60-x)=1$$

$$cos (60-x)=cos 0^{\circ}$$

x=60°

Option D

13. Question

Mark the Correct alternative in the following:

In $(0, \pi)$, the number of solutions of the equation $\tan x + \tan 2x + \tan 3x = \tan x \tan 2x \tan 3x$ is

- A. 7
- B. 5
- C. 4
- D. 2

Answer

tan x+tan2x+tan3x -tan xtan2xtan3x=0

$$tan x + tan2x + tan3x (1-tan xtan2x) = 0$$

$$tan x + tan2x = -tan3x (1-tan xtan2x)$$

$$\frac{tanx + tan2x}{1 - tanx \ tan2x} = -tan3x$$

tan 3x = -tan 3x

$$2 \tan 3x = 0$$

 $\tan 3x=0$





 $3x=2n\pi$

$$X=\frac{2n\pi}{3}$$

For

$$n=0, x=0$$

n=1,

$$x = \frac{2\pi}{3}$$

$$n=2$$
,

$$x=\frac{4\pi}{3}>\pi$$

so, there are only two possible solutions

Option D

14. Question

Mark the Correct alternative in the following:

The number of values of x in [0, 2π] that satisfy the equation $\sin^2 x - \cos x = \frac{1}{4}$

- A. 1
- B. 2
- C. 3
- D. 4

Answer

$$1-\cos^2 x - \cos x - 0.25 = 0$$

$$\cos^2 x + \cos x - \frac{3}{4} = 0$$

Solving the quadratic equation, we get

 $\cos x = 0.5$

So
$$x = 60^{\circ}$$
 or 300°

Hence there are 2 values

Option B

15. Question

Mark the Correct alternative in the following:

If
$$e^{\sin x} - e^{-\sin x} - 4 = 0$$
, then $x =$

- A. 0
- B. $\sin^{-1} \{ \log_e (2 \sqrt{5}) \}$
- C. 1
- D. None of these





 $Log_e (e^{sin x}-e^{-sin x}) = log_e(4)$

$$\frac{log_e e^{sinx}}{log_e e^{-sinx}} = log_e 4$$

$$\frac{\sin x}{-\sin x} = \log_e 4$$

$$-1 = \log_e 4$$

But the above equation is not true so there are no possible values of x for this given equation

Option D

16. Question

Mark the Correct alternative in the following:

The equation $3 \cos x + 4 \sin x = 6 \text{ has } \dots$ Solution

A. finite

B. infinite

C. one

D. no

Answer

$$4\sin x = 6-3\cos x$$

$$16\sin^2 x = 36 + 9\cos^2 x - 36\cos x$$

$$16-16 \cos^2 x = 36+9\cos^2 x-36\cos x$$

$$25\cos^2 x - 36\cos x + 20 = 0$$

As both the roots are imaginary there exists no value of x satisfying this given equation.

No Solution

Option D

17. Question

Mark the Correct alternative in the following:

If
$$\sqrt{3}\cos x + \sin x = \sqrt{2}$$
, then general value of θ is

A.
$$n \pi + (-1)^n \frac{\pi}{4}, n \in \mathbb{Z}$$

B.
$$(-1)^n \frac{\pi}{4} - \frac{\pi}{3}, n \in \mathbb{Z}$$

C.
$$n \pi + \frac{\pi}{4} - \frac{\pi}{3}, n \in \mathbb{Z}$$

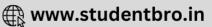
D.
$$n \pi + (-1)^n \frac{\pi}{4} - \frac{\pi}{3}, n \in \mathbb{Z}$$

$$3\cos^2 x = (\sqrt{2} - \sin x)^2$$

$$3 - 3\sin^2 x = 2 + \sin^2 x - 2\sqrt{2}\sin x$$







$$4 \sin^2 x - 2\sqrt{2} \sin x - 1 = 0$$

$$\sin x = \frac{\sqrt{3} + 1}{2\sqrt{2}} \text{ or } \frac{-\sqrt{3} + 1}{2\sqrt{2}}$$

So,
$$x=15^{\circ}$$
 or 345°

And these values are obtained by the following equation

$$n\pi+(-1)^n\frac{\pi}{4}-\frac{\pi}{3}, n\in Z$$

Option D

18. Question

Mark the Correct alternative in the following:

General solution of $\tan 5x = \cot 2x$ is

A.
$$\frac{n\pi}{7} + \frac{\pi}{2}, n \in \mathbb{Z}$$

B.
$$x = \frac{n\pi}{7} + \frac{\pi}{3}, n \in \mathbb{Z}$$

C.
$$x = \frac{n\pi}{7} + \frac{\pi}{14}, n \in Z$$

D.
$$x = \frac{n\pi}{7} - \frac{\pi}{14}, n \in Z$$

$$\tan 5x = \tan(\frac{\pi}{2} - 2x)$$

$$\tan 5x - \tan(\frac{\pi}{2} - 2x) = 0$$

$$\frac{sin5x}{cos5x} - \frac{sin\left(\frac{\pi}{2} - 2x\right)}{cos\left(\frac{\pi}{2} - 2x\right)} = 0$$

$$\frac{sin5x cos\left(\frac{\pi}{2}-2x\right)-sin\left(\frac{\pi}{2}-2x\right)cos5x}{cos5x cos\left(\frac{\pi}{2}-2x\right)}=0$$

$$\frac{\sin(5x - \frac{\pi}{2} + 2x)}{\cos 5x \cos\left(\frac{\pi}{2} - 2x\right)} = 0$$

This implies
$$\sin\left(7x - \frac{\pi}{2}\right) = 0$$

But
$$\cos 5x \cos \left(\frac{\pi}{2} - 2x\right) \neq 0$$

So
$$\sin\left(7x - \frac{\pi}{2}\right) = 0$$

$$\sin\left(7x - \frac{\pi}{2}\right) = \sin 0$$

$$7x - \frac{\pi}{2} \, = \, n\pi$$



$$x=\frac{n\pi}{7}+\frac{\pi}{14}$$

Option C

19. Question

Mark the Correct alternative in the following:

The solution of the equation $\cos^2 x + \sin x + 1 = 0$ lies in the interval

A.
$$(-\pi/4, \pi/4)$$

B.
$$(-\pi/3, \pi/4)$$

C.
$$(3\pi/4, 5\pi/4)$$

D.
$$(5\pi/4, 7\pi/4)$$

Answer

$$1-\sin^2 x + \sin x + 1 = 0$$

$$\sin^2 x - \sin x - 2 = 0$$

$$\sin x = -1$$

so,
$$x = 3\pi/2$$

and it lies between $(5\pi/4, 7\pi/4)$

Option D

20. Question

Mark the Correct alternative in the following:

If and $0 < x < 2 \pi$, then the solution are

A.
$$x = \frac{\pi}{3}, \frac{4\pi}{3}$$

B.
$$x = \frac{2\pi}{3}, \frac{4\pi}{3}$$

C.
$$x = \frac{2\pi}{3}, \frac{7\pi}{6}$$

D.
$$\theta = \frac{2\pi}{3}, \frac{5\pi}{3}$$

Answer

We know if cos x=cos a

Then

$$x = 2n\pi \pm a$$

here
$$\cos x = \cos\left(\frac{2\pi}{3}\right)$$

when n=0,

$$x = \frac{2\pi}{3}$$

when n=1,





$$x=2\pi-\frac{2\pi}{3}=\frac{4\pi}{3}$$

$$x=\frac{2\pi}{3},\frac{4\pi}{3}$$

Option B

21. Question

Mark the Correct alternative in the following:

The number of values of x in the interval [0. 5 π] satisfying the equation 3 $\sin^2 x - 7 \sin x + 2 = 0$ is

- A. 0
- B. 5
- C. 6
- D. 10

Answer

$$3\sin^2 x - 7\sin x + 2 = 0$$

Solving the equation, we get

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

$$a=\text{Sin}^{-1}\left(\frac{1}{3}\right)$$

$$x = n\pi + (-1)^n a$$

For

$$n=0$$
, $x=a$

$$n=1, x = \pi - a$$

$$n=2, x = 2\pi + a$$

$$n=3, x = 3\pi - a$$

$$n=4$$
, $x = 4\pi + a$

$$n=5, x = 5\pi + a$$

So, there are 6 values less then 5π .

Option C.



