**CBSE Class–11 Mathematics**

**NCERT Solutions**

**Chapter - 3 Trigonometric Functions**

**Exercise 3.4**

**Find the principal and general solutions of the following equations:**

**1.** $\tan x = \sqrt{3}$

**Ans.** Given: $\tan x = \sqrt{3}$ Here $x$ lies in first or third quadrant.

$\therefore \tan x = \tan 60^\circ$ or $\tan x = \tan\left(180^\circ + 60^\circ\right)$

$\Rightarrow \tan x = \tan 60^\circ$ or $\tan x = \tan 240^\circ$

$\Rightarrow \tan x = \tan \frac{\pi}{3}$ or $\tan x = \tan \frac{4\pi}{3}$

Therefore, the principal solutions are $\frac{\pi}{3}, \frac{4\pi}{3}$.

Now, $\tan x = \tan \frac{\pi}{3}$

$\Rightarrow x = n\pi + \frac{\pi}{3}$ where $n \in$ Z

**2.** $\sec x = 2$

**Ans.** Given: $\sec x = 2 \Rightarrow \cos x = \frac{1}{2}$ Here $x$ lies in first or fourth quadrant.

$\therefore \cos x = \cos 60^\circ$ or $\cos x = \cos\left(360^\circ - 60^\circ\right)$

$\Rightarrow \cos x = \cos 60^\circ$ or $\cos x = \cos 300^\circ$

$\Rightarrow \cos x = \cos\frac{\pi}{3}$ or $\cos x = \cos\frac{5\pi}{3}$

Therefore, the principal solutions are $\frac{\pi}{3}, \frac{5\pi}{3}$.

Now, $\cos x = \cos\frac{\pi}{3}$

$\Rightarrow\ x = 2n\pi \pm \frac{\pi}{3}$ where $n \in$ Z

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**3.** $\cot x = -\sqrt{3}$

**Ans.** Given: $\cot x = -\sqrt{3} \Rightarrow \tan x = \frac{-1}{\sqrt{3}}$ Here $x$ lies in second or fourth quadrant.

$\therefore\ \tan x = -\tan 30^\circ = \tan\left(180^\circ - 30^\circ\right)$ or $\tan x = \tan\left(360^\circ - 60^\circ\right)$

$\Rightarrow \tan x = \tan 150^\circ$ or $\tan x = \tan 330^\circ$

$\Rightarrow \tan x = \tan\frac{5\pi}{6}$ or $\tan x = \tan\frac{11\pi}{6}$

Therefore, the principal solutions are $\frac{5\pi}{6}, \frac{11\pi}{6}$.

Now, $tanx = tan\frac{5\pi}{6}$

$\Rightarrow\ x = n\pi + \frac{5\pi}{6}$ where $n \in$ Z

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**4.** $\cos ec\ x = -2$

**Ans.** Given: $\cos ec\ x = -2 \Rightarrow \sin x = \frac{-1}{2}$ Here $x$ lies in third or fourth quadrant.

$\therefore \sin x = -\sin 30^\circ = \sin\left(180^\circ + 30^\circ\right)$ or $\sin x = \sin\left(360^\circ - 30^\circ\right)$

$\Rightarrow \sin x = \sin 210^\circ$ or $\sin x = \sin 330^\circ$

$\Rightarrow \sin x = \sin \frac{7\pi}{6}$ or $\sin x = \sin \frac{11\pi}{6}$

Therefore, the principal solutions are $\frac{7\pi}{6}, \frac{11\pi}{6}$.

Now, $\sin x = -\sin \frac{\pi}{6}$

$\Rightarrow x = n\pi + (-1)^n \left(\frac{7\pi}{6}\right)$ where $n \in$ Z

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**5.** $\cos 4x = \cos 2x$

**Ans.** Given: $\cos 4x = \cos 2x$

$\Rightarrow 4x = 2n\pi \pm 2x, n \in$ Z

$\Rightarrow 4x - 2x = 2n\pi$ or $4x + 2x = 2n\pi, n \in$ Z

$\Rightarrow 2x = 2n\pi$ or $6x = 2n\pi, n \in$ Z

$\Rightarrow x = n\pi$ or $x = \frac{n\pi}{3}, n \in$ Z

Therefore, the principal solutions are $n\pi, \frac{n\pi}{3} n \in$ Z

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**6.** $\cos 3x + \cos x - \cos 2x = 0$

**Ans.** Given: $\cos 3x + \cos x - \cos 2x = 0$

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

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

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

$\Rightarrow \cos 2x = 0$ or $2\cos x - 1 = 0$

$\Rightarrow 2x = (2n+1)\dfrac{\pi}{2}$ or $\cos x = \dfrac{1}{2} = \cos\dfrac{\pi}{3}, n \in \mathrm{Z}$

$\Rightarrow x = (2n+1)\dfrac{\pi}{4}$ or $x = 2n\pi \pm \dfrac{\pi}{3}, n \in \mathrm{Z}$

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

**Ans.** Given: $\sin 2x + \cos x = 0$

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

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

$\Rightarrow \cos x = 0$ or $2\sin x + 1 = 0$

$\Rightarrow x = (2n+1)\dfrac{\pi}{2}$ or $\sin x = \dfrac{-1}{2} = -\sin\dfrac{\pi}{6}, n \in \mathrm{Z}$

$\Rightarrow x = (2n+1)\dfrac{\pi}{2}$ or $x = n\pi + (-1)^n\left(\dfrac{-\pi}{6}\right), n \in \mathrm{Z}$

$\Rightarrow x = (2n+1)\dfrac{\pi}{2}$ or $x = n\pi + (-1)^n\dfrac{7\pi}{6}, n \in \mathrm{Z}$

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8. $\sec^2 2x = 1 - \tan 2x$

**Ans.** Given: $\sec^2 2x = 1 - \tan 2x$

$\Rightarrow 1 + \tan^2 2x = 1 - \tan 2x$

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

$\Rightarrow \tan 2x = 0$ or $\tan 2x + 1 = 0$

$\Rightarrow 2x = n\pi$ or $\tan 2x = -1 = -\tan\frac{\pi}{4}$

$\Rightarrow x = \frac{n\pi}{2}$ or $x = \frac{n\pi}{2} + \frac{3\pi}{8}, n \in Z$

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**9.** $\sin x + \sin 3x + \sin 5x = 0$

**Ans.** Given: $\sin x + \sin 3x + \sin 5x = 0$

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

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

$\Rightarrow \sin 3x\left(2\cos 2x + 1\right) = 0$

$\Rightarrow \sin 3x = 0$ or $2\cos 2x + 1 = 0$

$\Rightarrow 3x = n\pi$ or $\cos 2x = \frac{-1}{2} = \cos\frac{2\pi}{3}, n \in Z$

$\Rightarrow x = \frac{n\pi}{3}$ or $2x = 2n\pi \pm \frac{2\pi}{3}, n \in Z$

$\Rightarrow x = \frac{n\pi}{3}$ or $x = n\pi \pm \frac{\pi}{3}, n \in Z$