

Lesson 1 Solving Trig Equations Algebraically

Ex. 1) Solve $\sin x + \sqrt{2} = -\sin x$ where $0 \leq x \leq 2\pi$.

$$2\sin x = -\sqrt{2} \quad \text{radians}$$

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

$$x = \frac{5\pi}{4}, \frac{7\pi}{4}$$

Ex. 2) Solve.

a) $\sin x \cos x = 2 \cos x$ $0 \leq x < 2\pi$

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

$$\cos x (\sin x - 2) = 0$$

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

$$x = \frac{\pi}{2}, \frac{3\pi}{2}$$

$$\sin x = 2$$

No solution

$$-1 \leq \sin x \leq 1$$

b) Determine the general solution for the above equation.

$$\left. \begin{aligned} x &= \frac{\pi}{2} + 2k\pi \\ x &= \frac{3\pi}{2} + 2k\pi \end{aligned} \right\} k \in \mathbb{Z}$$

can be combined to
 $x = \frac{\pi}{2} + k\pi, k \in \mathbb{Z}$

Ex. 3) Solve $2\cos^2 x = 1$ for $0^\circ \leq x \leq 360^\circ$

$$\cos^2 x = \frac{1}{2} \quad \text{degrees}$$

$$\cos x = \pm \frac{1}{\sqrt{2}}$$

$$\cos x = \pm \frac{\sqrt{2}}{2}$$

$$x = 45^\circ, 135^\circ, 225^\circ, 315^\circ$$

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Ex. 4) Solve $6\sin^2 x - 5\sin x = 4$ for $0 \leq x < 2\pi$

$$6\sin^2 x - 5\sin x - 4 = 0$$

$P \quad -24$
 $S \quad -5$
 $F \quad \frac{-8, 3}{2, 3}$

$$(2\sin x + 1)(3\sin x - 4) = 0$$

$$2\sin x + 1 = 0 \qquad 3\sin x - 4 = 0$$

$$\sin x = -\frac{1}{2} \qquad \sin x = \frac{4}{3}$$

$$x = \frac{7\pi}{6}, \frac{11\pi}{6} \qquad \text{No solution}$$

Ex. 5) Solve $\tan^2 \theta - 5\tan \theta + 4 = 0$ for $\theta \in \mathbb{R}$ general sol'n

$$(\tan \theta - 4)(\tan \theta - 1) = 0$$

$$\tan \theta = 4 \quad \tan \theta = 1$$

calc in radians mode

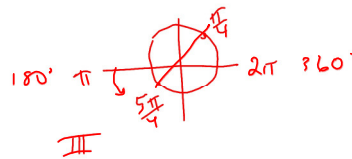
$$\theta_r = \tan^{-1}(4) \qquad \theta = \frac{\pi}{4}, \frac{5\pi}{4}$$

$$\theta_r = 1.32581\dots$$

$\tan \theta > 0$

QI
 $\theta = \theta_r = 1.326$

QIII
 $\theta = \pi + \theta_r = \pi + 1.32581\dots = 4.467$



Method 1

$$\left. \begin{aligned} \theta &= 1.326 + 2k\pi \\ \theta &= 4.467 + 2k\pi \\ \theta &= \frac{\pi}{4} + 2k\pi \\ \theta &= \frac{5\pi}{4} + 2k\pi \end{aligned} \right\} k \in \mathbb{Z}$$

Method 2 for $\tan \theta$ only

$$\left. \begin{aligned} \theta &= \frac{\pi}{4} + k\pi \\ \theta &= 1.326 + k\pi \end{aligned} \right\} k \in \mathbb{Z}$$

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 # 1a, c, h, j
 2b, g, i
 5b, d, e, g, k

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$$\text{QI} \quad \theta = \theta_r$$

$$\text{QII} \quad \theta = \pi - \theta_r$$

$$\text{QIII} \quad \theta = \pi + \theta_r$$

$$\text{QIV} \quad \theta = 2\pi - \theta_r$$