

Examples on Solving Trig Equations

Find all solutions on the interval $0 \leq x < 2\pi$

Ex 1 $10 \sin(x) \cos(x) = 6 \cos(x)$

$10 \sin(x) \cos(x) - 6 \cos(x) = 0$ ← set equal to 0

$\cos(x) \cdot (10 \sin(x) - 6) = 0$ ← factor out $\cos(x)$

| $\cos(x) = 0$ | $10 \sin(x) - 6 = 0$ |
|----------------------|-------------------------|
| $\cos(x) = 0$ | $10 \sin(x) - 6 = 0$ |
| $x = \frac{\pi}{2}$ | $10 \sin(x) = 6$ |
| | $\sin(x) = \frac{3}{5}$ |
| $x = \frac{3\pi}{2}$ | $Q_1 = .644$ |
| | $Q_2 = 2.5$ |

Solutions

$.644, 2.5, \frac{\pi}{2}, \frac{3\pi}{2}$


Ex 2 $4 \cos^2 x - 4 = 15 \cos x$

$4 \cos^2 x - 15 \cos x - 4 = 0$ ← set equal to zero

$4u^2 - 15u - 4 = 0$ ← u substitution; $u = \cos x$

$4u^2 - 16u + u - 4$
 $4u(u-4) + 1(u-4)$ ← factor to two binomials

$(u-4)(4u+1)$ ← undo the u and solve ☺

| $\cos(x) - 4 = 0$ | $4 \cos(x) + 1$ |
|---|--------------------------|
| $\cos(x) = 4$  | $4 \cos(x) = -1$ |
| | $\cos(x) = -\frac{1}{4}$ |
| | $Q_2 = 1.823$ |
| | $Q_3 = 4.46$ |

Solutions

1.823 and 4.46

Ex 3 $2\sin^2(x) + 3\sin(x) + 1 = 0$ ← u substitution
 $u = \sin(x)$

$$2u^2 + 3u + 1 = 0$$

$$2u^2 + 2u + u + 1 = 0$$

$$2u(u+1) + (u+1) = 0 \rightarrow (u+1)(2u+1)$$

$$\sin(x) + 1 = 0 \quad | \quad 2\sin(x) + 1 = 0$$

$$\sin(x) = -1$$

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

$$2\sin(x) = -1$$

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

$$x = \frac{7\pi}{6}; \frac{11\pi}{6}$$

Solutions

$$x = \frac{3\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$$