

Solving Trig Equations with Multiple Angles WS

Solve each of the following equations over $[0, 2\pi)$.

1. $\sin 3x = 1$

$3x = \frac{\pi}{2}, \frac{5\pi}{2}, \frac{9\pi}{2}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$

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

$2x = \frac{\pi}{6}, \frac{11\pi}{6}, \frac{13\pi}{6}, \frac{23\pi}{6}$

$x = \frac{\pi}{12}, \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{23\pi}{12}$

3. $\tan 2x = -1$

$2x = \frac{3\pi}{4}, \frac{7\pi}{4}, \frac{11\pi}{4}, \frac{15\pi}{4}$

$x = \frac{3\pi}{8}, \frac{7\pi}{8}, \frac{11\pi}{8}, \frac{15\pi}{8}$

4. $\sec 3x = 2$

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

$3x = \frac{\pi}{3}, \frac{5\pi}{3}, \frac{7\pi}{3}, \frac{11\pi}{3}, \frac{13\pi}{3}, \frac{17\pi}{3}$

$x = \frac{\pi}{9}, \frac{5\pi}{9}, \frac{7\pi}{9}, \frac{11\pi}{9}, \frac{13\pi}{9}, \frac{17\pi}{9}$

5. $3 \cot 3x - 3 = 0$

$3 \cot 3x = 3$

$\cot 3x = 1$

$3x = \frac{\pi}{4}, \frac{5\pi}{4}, \frac{9\pi}{4}, \frac{13\pi}{4}, \frac{17\pi}{4}, \frac{21\pi}{4}$

$x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{3\pi}{4}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{7\pi}{4}$

6. $2 \sin 2x + \sqrt{3} = 0$

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

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

$2x = \frac{4\pi}{3}, \frac{5\pi}{3}, \frac{10\pi}{3}, \frac{11\pi}{3}$

$x = \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{5\pi}{3}, \frac{11\pi}{6}$

7. $2 \cos 3x + 1 = 0$

$2 \cos 3x = -1$

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

$3x = \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{8\pi}{3}, \frac{10\pi}{3}, \frac{14\pi}{3}, \frac{16\pi}{3}$

$x = \frac{2\pi}{9}, \frac{4\pi}{9}, \frac{8\pi}{9}, \frac{10\pi}{9}, \frac{14\pi}{9}, \frac{16\pi}{9}$

8. $\csc 2x + \sqrt{2} = 0$

$\csc 2x = -\sqrt{2}$

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

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

$2x = \frac{5\pi}{4}, \frac{7\pi}{4}, \frac{13\pi}{4}, \frac{15\pi}{4}$

$x = \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}$

9. $2 \cos^2 2x = 1$

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

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

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

$2x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}, \frac{9\pi}{4}, \frac{11\pi}{4}, \frac{13\pi}{4}, \frac{15\pi}{4}$

$x = \frac{\pi}{8}, \frac{3\pi}{8}, \frac{5\pi}{8}, \frac{7\pi}{8}, \frac{9\pi}{8}, \frac{11\pi}{8}, \frac{13\pi}{8}, \frac{15\pi}{8}$

10. $3 \tan^2 2x - 1 = 0$

$3 \tan^2 2x = 1$

$\sqrt{\tan^2 2x} = \sqrt{\frac{1}{3}}$

$\tan 2x = \pm \frac{1}{\sqrt{3}}$

$\tan 2x = \pm \frac{\sqrt{3}}{3}$

$2x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}, \frac{19\pi}{6}, \frac{23\pi}{6}$

$x = \frac{\pi}{12}, \frac{5\pi}{12}, \frac{7\pi}{12}, \frac{11\pi}{12}, \frac{13\pi}{12}, \frac{17\pi}{12}, \frac{19\pi}{12}, \frac{23\pi}{12}$