

# Solving Trigonometric Equations

Find all solutions of the equation in the given interval.

| #   | Problem                                         | Interval                                     | Answers                                                                         |
|-----|-------------------------------------------------|----------------------------------------------|---------------------------------------------------------------------------------|
| 1.  | $1 + \cos x = 0$                                | $[0, 2\pi)$                                  | $\{\pi\}$                                                                       |
| 2.  | $\sqrt{3} - 2 \sin x = 0$                       | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{3}, \frac{2\pi}{3}\right\}$                                  |
| 3.  | $2 \sin x \cos x - \sin x = 0$                  | $[0, 2\pi)$                                  | $\left\{0, \pi, \frac{\pi}{3}, \frac{5\pi}{3}\right\}$                          |
| 4.  | $\cos x = 0$                                    | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{2}, \frac{3\pi}{2}\right\}$                                  |
| 5.  | $-\sin x = 0$                                   | $[0, 2\pi)$                                  | $\{0, \pi\}$                                                                    |
| 6.  | $\frac{1}{2} - \sin x = 0$                      | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{6}, \frac{5\pi}{6}\right\}$                                  |
| 7.  | $2 \sin x \cos x + \cos x = 0$                  | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{2}, \frac{3\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}\right\}$ |
| 8.  | $-\sin x - 1 = 0$                               | $[0, 4\pi)$                                  | $\left\{\frac{3\pi}{2}, \frac{7\pi}{2}\right\}$                                 |
| 9.  | $2 - \sec^2 x = 0$                              | $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ | $\left\{-\frac{\pi}{4}, \frac{\pi}{4}\right\}$                                  |
| 10. | $2 - \csc^2 x = 0$                              | $(0, \pi)$                                   | $\left\{\frac{\pi}{4}, \frac{3\pi}{4}\right\}$                                  |
| 11. | $1 - 2 \cos x = 1$                              | $[-\pi, \pi]$                                | $\left\{\frac{\pi}{2}, -\frac{\pi}{2}\right\}$                                  |
| 12. | $2 \sec^2 x = \frac{8}{\pi}$                    | $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$ | $\{\pm 0.4817\}$                                                                |
| 13. | $\cos x = \frac{3\sqrt{3}}{2\pi}$               | $\left[-\frac{\pi}{3}, \frac{\pi}{3}\right]$ | $\{\pm 0.5971\}$                                                                |
| 14. | $\sin x = \frac{2}{\pi}$                        | $[0, \pi]$                                   | $\{0.6901, 2.4515\}$                                                            |
| 15. | $\cos x = \frac{2}{\pi}$                        | $\left[0, \frac{\pi}{2}\right]$              | $\{0.8807\}$                                                                    |
| 16. | $2 \sec \theta \tan \theta + \sec^2 \theta = 0$ | $[0, 2\pi)$                                  | $\left\{\frac{7\pi}{6}, \frac{11\pi}{6}\right\}$                                |
| 17. | $\sec x \tan x = 0$                             | $\left[-\frac{\pi}{4}, \frac{\pi}{4}\right]$ | $\{0\}$                                                                         |
| 18. | $2 \cos x + 2 \cos 2x = 0$                      | $[0, \pi]$                                   | $\left\{\frac{\pi}{3}, \pi\right\}$                                             |

|     |                                                        |                                              |                                                                                |
|-----|--------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------|
| 19. | $2\cos x - 2\sin 2x = 0$                               | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{2}, \frac{3\pi}{2}, \frac{\pi}{6}, \frac{5\pi}{6}\right\}$  |
| 20. | $-2\sin x - 4\sin 2x = 0$                              | $[0, 2\pi)$                                  | $\{0, \pi, 1.8235, 4.4597\}$                                                   |
| 21. | $-\sin x + \sin 2x = 0$                                | $[0, 2\pi)$                                  | $\left\{0, \pi, \frac{\pi}{3}, \frac{5\pi}{3}\right\}$                         |
| 22. | $-\cos x + 2\cos 2x = 0$                               | $[0, 2\pi)$                                  | $\{0.5678, 2.2057, 4.0775, 5.7154\}$                                           |
| 23. | $2\csc^2 x \cot x = 0$                                 | $(0, \pi)$                                   | $\left\{\frac{\pi}{2}\right\}$                                                 |
| 24. | $2\sin x = \tan x$                                     | $\left[-\frac{\pi}{3}, \frac{\pi}{3}\right]$ | $\left\{\pm \frac{\pi}{3}, 0\right\}$                                          |
| 25. | $\sin 2x = \cos x$                                     | $\left[\frac{\pi}{6}, \frac{5\pi}{6}\right]$ | $\left\{\frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}\right\}$                  |
| 26. | $2\sin x + \sin 2x = 0$                                | $[0, \pi]$                                   | $\{0, \pi\}$                                                                   |
| 27. | $-\pi \sin \pi x = 0$                                  | $\left[0, \frac{1}{6}\right)$                | $\{0\}$                                                                        |
| 28. | $2\cos 2x = 0$                                         | $\left[\frac{\pi}{6}, \frac{\pi}{3}\right]$  | $\left\{\frac{\pi}{4}\right\}$                                                 |
| 29. | $4 - \pi \sec^2 \pi x = 0$                             | $\left[-\frac{1}{4}, \frac{1}{4}\right]$     | $\{\pm 0.1533\}$                                                               |
| 30. | $\frac{1}{2} - \frac{\pi}{6} \cos \frac{\pi}{6} x = 0$ | $[-1, 0]$                                    | $\{-0.5756\}$                                                                  |
| 31. | $\frac{6}{\pi} - 8\sin x \cos x = 0$                   | $\left[0, \frac{\pi}{6}\right]$              | $\{0.2489\}$                                                                   |
| 32. | $\cos^2 x - \sin^2 x = 0$                              | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}\right\}$ |
| 33. | $\frac{1}{2} \cos \frac{x}{2} = 0$                     | $[0, 4\pi)$                                  | $\{\pi, 3\pi\}$                                                                |
| 34. | $-\frac{1}{4} \sin \frac{x}{2} = 0$                    | $[0, 4\pi)$                                  | $\{0, 2\pi\}$                                                                  |
| 35. | $-3\csc \frac{3x}{2} \cot \frac{3x}{2} = 0$            | $(0, 2\pi)$                                  | $\left\{\frac{\pi}{3}, \pi, \frac{5\pi}{3}\right\}$                            |
| 36. | $\cos x - \sin x = 0$                                  | $[0, 2\pi)$                                  | $\left\{\frac{\pi}{4}, \frac{5\pi}{4}\right\}$                                 |
| 37. | $-\sin x - \cos x = 0$                                 | $[0, 2\pi)$                                  | $\left\{\frac{3\pi}{4}, \frac{7\pi}{4}\right\}$                                |