

Math 29
Solving Trigonometric Equations

Find all solutions for each of the following.

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

2. $\tan x - 1 = 0$

3. $\cos^2 x + \cos x = 0$

4. $2\sin^2 x - \sin x = 1$

Solve each equation for solutions in the interval specified. When possible, state exact solutions. Otherwise, state solutions to the nearest hundredth.

5. $\sin x = \frac{1}{2}$, $x \in [0, 6\pi)$

6. $\cot x = -\frac{1}{\sqrt{3}}$, $x \in [-2\pi, 2\pi)$

7. $2\cos x + 5 = 4$, $x \in [0, 4\pi)$

8. $2\csc x + 5 = 0$, $x \in [0, \pi)$

9. $\csc^2 x = 6\csc x + 7$, $x \in [-2\pi, 0)$

10. $5\cot^2 x + 2\cot x = 3$, $x \in [-\pi, \pi)$

Find all solutions in the interval $[0, 2\pi)$. When possible, state exact solutions. Otherwise, state solutions to the nearest hundredth.

11. $22\sin x - 2 = -17$

12. $5\csc x - 7 = 6$

13. $17\sin^2 x - 9 = 0$

14. $\tan^2 x - \tan x - 20 = 0$

15. $6\sin 2x + 7\cos x = 0$

16. $10\cos x + 1 = -3$

17. $\cos 2x + \sin x = -2$

18. $2\cos^2 x - 7\sin x + 2 = 0$

19. $3\sec x + 8 = 1$

20. $1 + 4\sin x = 12$

21. $\sin^2 x - 1 = 0$

22. $2\cos^2 x - \cos x = 0$

23. $\tan^2 x - 3 = 0$

24. $\sec^2 x - 5 = 0$

25. $\tan x \sin x - \sin x = 0$

26. $\csc^2 x + \csc x - 12 = 0$

27. $\tan^2 x = \sec x + 1$

28. $\sec x = \pi$

Find all solutions in the interval $[0, 2\pi)$. When possible, state exact solutions. Otherwise, state solutions to the nearest hundredth.

29. $\tan 3x = \sqrt{3}$

30. $\cos \frac{1}{2}x = \frac{\sqrt{3}}{2}$

31. $\cot 2x = 0$

32. $2\sin 3x = -1$

Answers

1. $\frac{5\pi}{4} + 2k\pi, k \in Z$
 $\frac{7\pi}{4} + 2k\pi, k \in Z$

2. $\frac{\pi}{4} + k\pi, k \in Z$

3. $\frac{\pi}{2} + k\pi, k \in Z$
 $\pi + 2k\pi, k \in Z$

$\frac{\pi}{2} + 2k\pi, k \in Z$
 4. $\frac{7\pi}{6} + 2k\pi, k \in Z$
 $\frac{11\pi}{6} + 2k\pi, k \in Z$

5. $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{13\pi}{6}, \frac{17\pi}{6}, \frac{25\pi}{6}, \frac{29\pi}{6}$

6. $-\frac{4\pi}{3}, -\frac{\pi}{3}, \frac{2\pi}{3}, \frac{5\pi}{3}$

7. $\frac{2\pi}{3}, \frac{4\pi}{3}, \frac{8\pi}{3}, \frac{10\pi}{3}$

8. no solution

9. $-6.14, -3.28, -\frac{\pi}{2}$

10. $-2.11, -\frac{\pi}{4}, 1.03, \frac{3\pi}{4}$

11. 3.89, 5.53

12. 0.39, 2.75

13. 0.81, 2.33, 3.95, 5.47

14. 1.37, 1.81, 4.51, 4.95

15. $\frac{\pi}{2}, 3.76, \frac{3\pi}{2}, 5.66$

16. 1.98, 4.30

17. $\frac{3\pi}{2}$

18. $\frac{\pi}{6}, \frac{5\pi}{6}$

19. 2.01, 4.27

20. no solution

21. $\frac{\pi}{2}, \frac{3\pi}{2}$

22. $\frac{\pi}{3}, \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{3}$

23. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

24. 1.11, 2.03, 4.25, 5.17

25. $0, \frac{\pi}{4}, \pi, \frac{5\pi}{4}$

26. 0.34, 2.80, 3.39, 6.03

27. $\frac{\pi}{3}, \pi, \frac{5\pi}{3}$

28. 1.25, 5.03

29. $\frac{\pi}{9}, \frac{4\pi}{9}, \frac{7\pi}{9}, \frac{10\pi}{9}, \frac{13\pi}{9}, \frac{16\pi}{9}$

30. $\frac{\pi}{3}$

31. $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

32. $\frac{7\pi}{18}, \frac{11\pi}{18}, \frac{19\pi}{18}, \frac{23\pi}{18}, \frac{31\pi}{18}, \frac{35\pi}{18}$