Solving Trig Equations with Factoring WS
2020

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

1. $\csc^2 x + 2\csc x = 0$

$\csc x (\csc x + 2) = 0$

$\csc x = 0 \qquad \csc x = -2$

$\sin x = \frac{1}{0} \qquad \sin x = -\frac{1}{2}$

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

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

$(\cos x - 2)(\cos x + 1) = 0$

$\cos x = 2 \qquad \cos x = -1$

$\boxed{x = \pi}$

3. $2\cos x \sin x = \cos x$

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

$\cos x (2\sin x - 1) = 0$

$\cos x = 0 \qquad \sin x = \frac{1}{2}$

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

4. $2 = \sec x + \sec^2 x$

$\sec^2 x + \sec x - 2 = 0$

$(\sec x - 1)(\sec x + 2) = 0$

$\sec x = 1 \qquad \sec x = -2$

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

$\boxed{x = 0\pi, \frac{2\pi}{3}, \frac{4\pi}{3}}$

5. $2\sin^2 x + 5\sin x = 3$

$2\sin^2 x + 5\sin x - 3 = 0$

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

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

$\boxed{x = \frac{\pi}{6}, \frac{5\pi}{6}}$

6. $\tan^2 x \sin x = \sin x$

$\tan^2 x \sin x - \sin x = 0$

$\sin x (\tan^2 x - 1) = 0$

$\sin x = 0 \qquad \tan^2 x = 1$

$\tan x = \pm 1$

$\boxed{x = 0\pi, \pi \\ x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}}$

7. $\sin x + \sin x \tan x = 0$

$\sin x (1 + \tan x) = 0$

$\sin x = 0 \qquad \tan x = -1$

$\boxed{x = 0\pi, \pi, \frac{3\pi}{4}, \frac{7\pi}{4}}$

8. $\sec x \sin x - 2\sin x = 0$

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

$\sin x = 0 \qquad \sec x = 2$

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

$\boxed{x = 0\pi, \pi \\ x = \frac{\pi}{3}, \frac{5\pi}{3}}$

9. $\sin^2 x - \tan x \sin^2 x = 0$

$\cos^2 x (1 - \cot x) = 0$

$\cos^2 x = 0 \qquad \cot x = 1$

$\cos x = 0$

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

10. $2\tan^2 x - \tan x - 6 = 0$

$(3\csc x - 2)(\csc x + 2) = 0$

$\csc x = \frac{2}{3} \qquad \csc x = -2$

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

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

11. $4\cos^4 x - 5\cos^2 x + 1 = 0$

$(4\cos^2 x - 1)(\cos^2 x - 1) = 0$

$\cos^2 x = \frac{1}{4} \qquad \cos^2 x = 1$

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

$\boxed{x = \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}, 0\pi, \pi}$

12. $4\sin^4 x + \sin^2 x - 3 = 0$

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

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

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

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