



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

1. $\sin x \tan x = -\tan x$
 $\sin x \tan x + \tan x = 0$
 $\tan x (\sin x + 1) = 0$
 $\tan x = 0$ $\sin x = -1$
 $x = 0\pi, \pi$ ~~$x = \frac{3\pi}{2}$~~

2. $\cos x - \cot x = 0$
 $\cos x - \frac{\cos x}{\sin x} = 0$
 $\cos x (1 - \frac{1}{\sin x}) = 0$
 $\cos x = 0$
 $x = \frac{\pi}{2}, \frac{3\pi}{2}$

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

3. $(\cos^2 x - 1)(\cot x + 1) = 0$
 $\cos^2 x = 1$ $\cot x = -1$
 $\cos x = \pm 1$ $x = \frac{3\pi}{4}, \frac{7\pi}{4}$
 ~~$x = 0\pi, \pi$~~

4. $\cos x (\sec x - 2) = 0$
 $\cos x = 0$ $\sec x = 2$
 $\cos x = \frac{1}{2}$
 ~~$x = \frac{\pi}{2}, \frac{3\pi}{2}$~~
 $x = \frac{\pi}{3}, \frac{5\pi}{3}$

5. $\sin^2 x \tan x = \tan x$
 $\sin^2 x \tan x - \tan x = 0$
 $\tan x (\sin^2 x - 1) = 0$
 $\tan x = 0$ $\sin^2 x = 1$
 $x = 0\pi, \pi$ $\sin x = \pm 1$
 ~~$x = \frac{\pi}{2}, \frac{3\pi}{2}$~~

6. $\tan^2 x - 2 \tan x + 1 = 0$
 $(\tan x - 1)(\tan x - 1) = 0$
 $\tan x = 1$
 $x = \frac{\pi}{4}, \frac{5\pi}{4}$

7. $\cos x \tan x = \sqrt{3} \cos x$
 $\cos x \tan x - \sqrt{3} \cos x = 0$
 $\cos x (\tan x - \sqrt{3}) = 0$
 $\cos x = 0$ $\tan x = \sqrt{3}$
 ~~$x = \frac{\pi}{2}, \frac{3\pi}{2}$~~
 $x = \frac{\pi}{3}, \frac{4\pi}{3}$

8. $\cos x \sec x + 2 \cos x = 0$
 $\cos x (\sec x + 2) = 0$
 $\cos x = 0$ $\sec x = -2$
 $\cos x = -\frac{1}{2}$
 ~~$x = \frac{\pi}{2}, \frac{3\pi}{2}$~~
 $x = \frac{2\pi}{3}, \frac{4\pi}{3}$

9. $\sec x \csc x = \csc x$
 $\sec x \csc x - \csc x = 0$
 $\csc x (\sec x - 1) = 0$
 $\csc x = 0$ $\sec x = 1$
 $\sin x = 0$ $\cos x = 1$
 not possible ~~$x = \pi$~~ \emptyset

10. $(\sin x + 1)(\sec x - 2) = 0$
 $\sin x = -1$ $\sec x = 2$
 $\cos x = \frac{1}{2}$
 ~~$x = \frac{3\pi}{2}$~~
 $x = \frac{\pi}{3}, \frac{5\pi}{3}$

11. $\cot x \tan x = -\sqrt{3} \cot x$
 $\cot x \tan x + \sqrt{3} \cot x = 0$
 $\cot x (\tan x + \sqrt{3}) = 0$
 $\cot x = 0$ $\tan x = -\sqrt{3}$
 ~~$x = \frac{\pi}{2}, \frac{3\pi}{2}$~~
 $x = \frac{2\pi}{3}, \frac{5\pi}{3}$

12. $3 \cot x \cos x - \sqrt{3} \cos x = 0$
 $\cos x (3 \cot x - \sqrt{3}) = 0$
 $\cos x = 0$ $3 \cot x = \sqrt{3}$
 $\cot x = \frac{\sqrt{3}}{3}$
 $x = \frac{\pi}{2}, \frac{3\pi}{2}$
 $x = \frac{\pi}{3}, \frac{4\pi}{3}$