Advanced Functions – Trigonometric Equations WS Name : Key

I. Solve each trigonometric equation. Keep answer(s) in degrees where $0° \le x < 360°$. Show work!!

1.) $2\cos x - \sqrt{3} = 0$

$+\sqrt{3}\ +\sqrt{3}$

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

$\cos x = \frac{\sqrt{3}}{2}$ → $x = \cos^{-1}\left(\frac{\sqrt{3}}{2}\right)$

$x = 30°, 330°$

2.) $2\sin x + 1 = 4\sin x$

$-2\sin x \quad -2\sin x$

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

$\sin x = \frac{1}{2}$ → $x = \sin^{-1}\left(\frac{1}{2}\right)$

$x = 30°, 150°$

3.) $\tan x + \sqrt{3} = 0$

$-\sqrt{3} \quad -\sqrt{3}$

$\tan x = -\sqrt{3}$

$x = \tan^{-1}(-\sqrt{3})$

$x = -60 + 360$

$x = 300°, 120°$

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

$\tan x - 1 = 0$ $\quad \cos x + 2 = 0$

$\tan x = 1$ $\quad -2 \quad -2$

$x = \tan^{-1}(1)$ $\quad \cos x = -2$

$x = 45°, 225°$ $\quad x = \cos^{-1}(-2)$

$\varnothing$

5.) $4\sin\left(\frac{x}{5}\right) - 4 = 0$

$4\sin\left(\frac{x}{5}\right) = 4$

$\sin\left(\frac{x}{5}\right) = 1$

$\frac{x}{5} = \sin^{-1}(1)$

$5\left(\frac{x}{5} = 90°\right)5$

$x = 450°$

$\varnothing$

no solution

6.) $3\tan 3x - \sqrt{3} = 0$

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

$3x = \tan^{-1}\left(\frac{\sqrt{3}}{3}\right)$

$\frac{3x}{3} = \frac{30°}{3}, \frac{210°}{3}$

$x = 10°, 70°$

7.) $2\cos\left(\frac{3x}{5}\right) + \sqrt{2} = 0$

$\frac{2\cos\left(\frac{3x}{5}\right)}{2} = \frac{-\sqrt{2}}{2}$

$\cos\left(\frac{3x}{5}\right) = -\frac{\sqrt{2}}{2}$

$\frac{3x}{5} = \cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

$5\left(\frac{3x}{5} = 135°, 225°\right)5$

$3x = 675°, 1125°$

$\frac{3}{3} \quad \frac{3}{3}$

$x = 225°, 375°$

$\varnothing$

8.) $\sin x(1 - \sin x) = 0$

$\sin x = 0$ $\quad 1 - \sin x = 0$

$x = \sin^{-1}(0)$ $\quad -\sin x = -1$

$\sin x = 1$

$x = \sin^{-1}(1)$

$x = 0°, 180°$ $\quad x = 90°$

9.) $3\cos x + 8 = 3 - 2\cos x$

$+2\cos x \quad -8 \quad +2\cos x$

$\frac{5\cos x}{5} = \frac{-5}{5}$

$\cos x = -1$

$x = \cos^{-1}(-1)$

$x = 180°$

10.) $\frac{-2\sin(2x + 30°)}{-2} = \frac{1}{-2}$

$\sin(2x + 30°) = -\frac{1}{2}$

$2x + 30° = \sin^{-1}\left(-\frac{1}{2}\right)$

$2x + 30° = 210°, 330°$

$-30 \quad -30$

$\frac{2x}{2} = \frac{180°}{2}, \frac{300°}{2}$

$x = 90°, 150°$

11.) $(2\sin x + 1)(\sqrt{3} + 3\tan x) = 0$

$2\sin x + 1 = 0$ $\quad \sqrt{3} + 3\tan x = 0$

$2\sin x = -1$ $\quad 3\tan x = -\sqrt{3}$

$\sin x = -\frac{1}{2}$ $\quad x = \tan^{-1}\left(-\frac{\sqrt{3}}{3}\right)$

$x = \sin^{-1}\left(-\frac{1}{2}\right)$ $\quad x = -30 + 360$

$x = -30 + 360$ $\quad x = 330°, 150°$

$x = 330°, 210°$

12.) $\frac{1}{\cos x} = -\frac{2}{\sqrt{3}}$

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

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

$x = \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

$x = 150°, 210°$

13.) $\cos x(\cos x + 1)(\sqrt{3}\tan x - 1) = 0$

$\cos x = 0$ $\quad \cos x + 1 = 0$

$x = \cos^{-1}(0)$ $\quad \cos x = -1$

$x = 90°, 270°$ $\quad x = \cos^{-1}(-1)$

$x = 180°$

$\sqrt{3}\tan x - 1 = 0$

$\sqrt{3}\tan x = 1$

$\tan x = \frac{1}{\sqrt{3}}$ → $x = \tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$

$x = 30°, 210°$

14.) $\frac{1}{2\sin x - 3} = \frac{2}{3\sin x}$

$2(2\sin x - 3) = 3\sin x$

$4\sin x - 6 = 3\sin x$

$-4\sin x \quad -4\sin x$

$-6 = -\sin x$

$\sin x = 6$

$x = \sin^{-1}(6)$

$\varnothing$

no solution

15.) $4\sin^2 x - 3 = 0$

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

$\sqrt{\sin^2 x} = \pm\sqrt{\frac{3}{4}}$

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

$x = \sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ $\quad x = \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

$x = -60 + 360$

$x = 60°, 120°$ $\quad x = 300°, 240°$

II. Complete each application problem involving a trigonometric equation.

16.) A person's blood pressure can be represented by $p = 20\sin(360°t) + 100$. What is a person's blood pressure after 10 seconds?

$p = 20\sin(360 \cdot 10) + 100$

$p = 100$

17.) The population of owls can be represented by $p = 150 + 30\sin(18°t)$. After how many years will the owl population reach its maximum amount?

max amt $= 150 + 30 = 180$

$180 = 150 + 30\sin(18t)$

$30 = 30\sin(18t)$

$1 = \sin(18t)$

$18t = \sin^{-1}(1)$

$18t = 90$

$t = 5$ years

18.) Gene gets onto a 28 diameter Ferris wheel that is 4 feet above the ground. It takes the wheel 12 seconds to complete one cycle. How long does it take for Gene to be 32 feet above the ground?

$a = \frac{28}{2} = 14$

$b = \frac{2\pi}{12} = \frac{\pi}{6} = 30°$

$d = 4 + 14 = 18$

$h = 14\sin(30t) + 18$

$32 = 14\sin(30t) + 18$

$14 = 14\sin(30t)$

$1 = \sin(30t)$

$30t = \sin^{-1}(1)$

$30t = 90$

$t = 3$ seconds