



Solving Trigonometric Equations

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Learning Objectives

- Solve basic trigonometric equations using algebraic principles
- Use the unit circle and table of special angle values to find solutions
- Find all solutions of trig equations on the interval $[0, 2\pi)$

Solve each trigonometric equation for x on the interval $[0, 2\pi)$ using the unit circle or table of special values.

1. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\cos x - 1 = 0$$

Answer: _____

2. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

Answer: _____

3. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

Answer: _____

4. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$\tan x - 1 = 0$$

Answer: _____

5. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\cos^2 x - 1 = 0$$

Answer: _____

6. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

Answer: _____

7. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\sin x - 1 = 0$$

Answer: _____



8. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$\cos^2 x - \frac{1}{4} = 0$$

Answer: _____

9. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

Answer: _____

10. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\cos x + \sqrt{2} = 0$$

Answer: _____





Encourage students to first isolate the trig function as they would a variable in an algebraic equation, then reference the unit circle for all valid angle solutions.

Solutions

1. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\cos x - 1 = 0$$

- Add 1 to both sides to get 2 cosine x equals 1.
- Divide both sides by 2 so cosine x equals one half.
- Use the unit circle to find angles where cosine equals one half.
- The solutions are π over 3 and five π over 3.

Answer: $x = \frac{\pi}{3}, \frac{5\pi}{3}$

2. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

- Add 1 to both sides to get sine squared x equals 1.
- Take the square root of both sides so sine x equals plus or minus 1.
- From the unit circle, sine equals 1 at π over 2 and sine equals negative 1 at three π over 2.
- The solutions are π over 2 and three π over 2.

Answer: $x = \frac{\pi}{2}, \frac{3\pi}{2}$

3. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

- Subtract square root of 3 from both sides.
- Divide both sides by 2 to get sine x equals negative square root of 3 over 2.
- Identify the angles in the unit circle where sine has this value.
- The solutions are four π over 3 and five π over 3.

Answer: $x = \frac{4\pi}{3}, \frac{5\pi}{3}$

4. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$\tan x - 1 = 0$$

- Add 1 to both sides so tangent x equals 1.
- Find angles on the unit circle where tangent equals 1.
- Tangent equals 1 in the first and third quadrants.
- The solutions are π over 4 and five π over 4.

Answer: $x = \frac{\pi}{4}, \frac{5\pi}{4}$



5. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\cos^2 x - 1 = 0$$

- Add 1 to both sides and divide by 2 to get cosine squared x equals one half.
- Take the square root of both sides so cosine x equals plus or minus square root of 2 over 2.
- Find all four angles where cosine has these values.
- The solutions are π over 4, three π over 4, five π over 4, and seven π over 4.

Answer: $x = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

6. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

- Add 1 to both sides and divide by square root of 3.
- Rationalize to get tangent x equals square root of 3 over 3.
- Find the reference angle on the unit circle where tangent equals this value.
- The solutions are π over 6 and seven π over 6.

Answer: $x = \frac{\pi}{6}, \frac{7\pi}{6}$

7. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\sin x - 1 = 0$$

- Add 1 to both sides to get 2 sine x equals 1.
- Divide both sides by 2 so sine x equals one half.
- Identify angles on the unit circle where sine equals one half.
- The solutions are π over 6 and five π over 6.

Answer: $x = \frac{\pi}{6}, \frac{5\pi}{6}$

8. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$\cos^2 x - \frac{1}{4} = 0$$

- Add one fourth to both sides to isolate cosine squared x .
- Take the square root of both sides so cosine x equals plus or minus one half.
- Use the unit circle to find all four angles with these cosine values.
- The solutions are π over 3, two π over 3, four π over 3, and five π over 3.

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

9. Solve the trigonometric equation for x on $[0, 2\pi)$.

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

- Add 3 to both sides to get tangent squared x equals 3.
- Take the square root of both sides so tangent x equals plus or minus square root of 3.
- Identify angles on the unit circle where tangent has these values.
- The solutions are π over 3, two π over 3, four π over 3, and five π over 3.

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



10. Solve the trigonometric equation for x on $[0, 2\pi)$.

$$2\cos x + \sqrt{2} = 0$$

→ Subtract square root of 2 from both sides.

→ Divide both sides by 2 to get cosine x equals negative square root of 2 over 2.

→ Identify the quadrants where cosine is negative.

→ The solutions are three pi over 4 and five pi over 4.

Answer: $x = \frac{3\pi}{4}, \frac{5\pi}{4}$

