



Math Virtual Learning

Precalculus with Trigonometry

Students will solve basic trigonometric equations.

May 6th, 2020



Precalculus with Trigonometry

Lesson: May 6th, 2020

Objective/Learning Target:

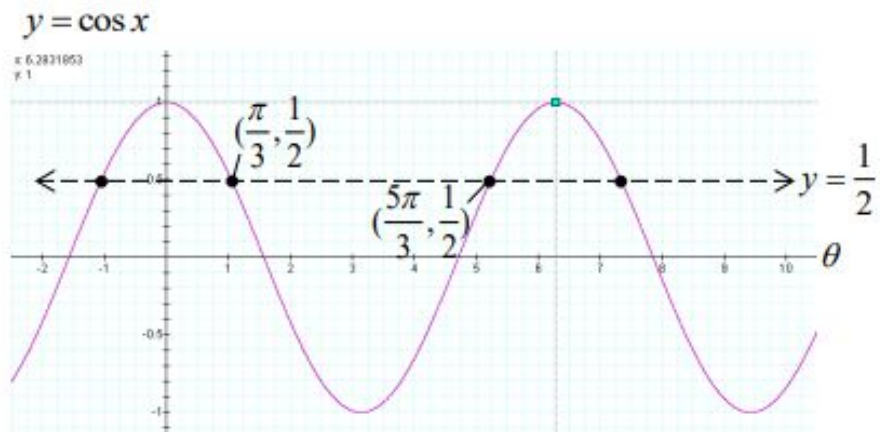
Students will solve basic trigonometric equations.

Let's Get Started!

Watch Video: [Solving Trigonometric Equations](#)

Example: Find all possible values of θ so that $\cos \theta = \frac{1}{2}$.

You can solve this equation by connecting what you know about the cosine graph as well as the unit circle



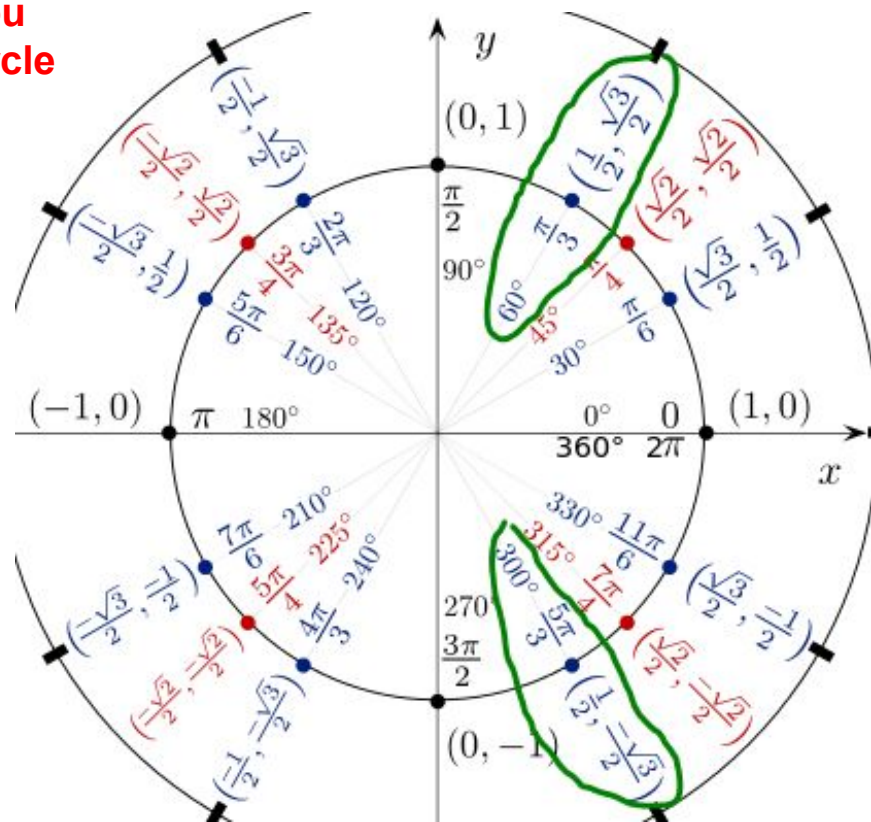
There are 3 ways to express your solution:

1. Degrees: $\square = 60, 300$

2. Radians: $\square = \frac{\pi}{3}, \frac{5\pi}{3}$

3. All solutions (because cosine is periodic)

$$\theta = \frac{\pi}{3} + 2\pi n, \quad \theta = \frac{5\pi}{3} + 2\pi n, \quad \text{where } n \text{ is an integer.}$$



Example: Solve $\sin x + \sqrt{2} = -\sin x$.

Begin by rewriting the equation so that $\sin x$ is isolated on one side of the equation.

$$\sin x + \sqrt{2} = -\sin x$$

Write original equation.

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

Add $\sin x$ to each side.

$$\sin x + \sin x = -\sqrt{2}$$

Subtract $\sqrt{2}$ from each side.

$$2 \sin x = -\sqrt{2}$$

Combine like terms.

$$\sin x = -\frac{\sqrt{2}}{2}$$

Divide each side by 2.

$$x = \frac{5\pi}{4} + 2n\pi \quad \text{and} \quad x = \frac{7\pi}{4} + 2n\pi \quad \text{General solution}$$

Example: Solve $3 \tan^2 x - 1 = 0$.

Solution

Begin by rewriting the equation so that $\tan x$ is isolated on one side of the equation.

$$3 \tan^2 x - 1 = 0$$

Write original equation.

$$3 \tan^2 x = 1$$

Add 1 to each side.

$$\tan^2 x = \frac{1}{3}$$

Divide each side by 3.

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

Extract square roots.

Because $\tan x$ has a period of π , first find all solutions in the interval $[0, \pi)$. These solutions are $x = \pi/6$ and $x = 5\pi/6$. Finally, add multiples of π to each of these solutions to get the general form

$$x = \frac{\pi}{6} + n\pi \quad \text{and} \quad x = \frac{5\pi}{6} + n\pi$$

General solution

Practice

Solve each equation for $0 \leq \theta < 360$.

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

$$3 \tan \theta = 3\sqrt{3}$$

Solve each equation for $0 \leq \theta < 2\pi$.

$$-8 \sin \theta = 4\sqrt{2}$$

$$4 = 5 + \tan \theta$$

Find all solutions to each equation in radians.

$$\frac{2}{5} \cdot \cos \theta = \frac{\sqrt{2}}{5}$$

$$\frac{1}{2} \cdot \sin \theta = -\frac{\sqrt{3}}{4}$$

Practice - ANSWERS

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

$$\{150, 210\}$$

$$-8\sin \theta = 4\sqrt{2}$$

$$\left\{ \frac{5\pi}{4}, \frac{7\pi}{4} \right\}$$

$$\frac{2}{5} \cdot \cos \theta = \frac{\sqrt{2}}{5}$$

$$\left\{ \frac{\pi}{4} + 2\pi n, \frac{7\pi}{4} + 2\pi n \right\}$$

$$3\tan \theta = 3\sqrt{3}$$

$$\{60, 240\}$$

$$4 = 5 + \tan \theta$$

$$\left\{ \frac{3\pi}{4}, \frac{7\pi}{4} \right\}$$

$$\frac{1}{2} \cdot \sin \theta = -\frac{\sqrt{3}}{4}$$

$$\left\{ \frac{5\pi}{3} + 2\pi n, \frac{4\pi}{3} + 2\pi n \right\}$$

Additional Practice and Resources:

Additional Resource Videos:

[Solving Trig Equations](#)

[Solving Cosine Equation - Khan Academy](#)

Additional Practice:

[Solving equations practice with answers](#)

[Solving basic trig equations practice](#)