



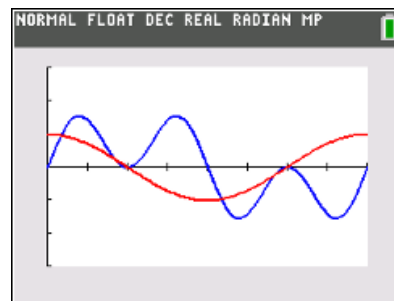
# Can You Solve a Trig Equation?

## Student Activity

Name \_\_\_\_\_

Class \_\_\_\_\_

In this activity, students will practice how to solve equations involving trigonometric functions within a finite interval. Starting with basic two-step equations and then progressing to equations involving the use of trigonometric identities, students will review how to solve these equations both analytically and graphically. By the end of the activity, students will then apply this trig equation solving knowledge to real world situations.



Before we start solving the trig equations, please know that students will be finding answers for this activity in radian measure and depending on the problem, students need to know how to find both exact answers or answers rounded to three significant figures.

### Problem 1 – Solving Basic Trig Equations

Solve the following equations for  $0 \leq x < 2\pi$ , algebraically, leaving the exact answers in radian measure.

1.  $2 \cdot \sin x + 1 = 0$

2.  $4 \cdot \cos^2 x - 3 = 0$

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

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

5. With a classmate, discuss how you might graphically solve the equations above. Verify your discussed method(s) by checking one or two of the problems above graphically.

### Problem 2 – Using Identities to Verify Trig Equations

Here are some Trig Identities that might be helpful to use in Problem 2:

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cos^2 \theta + \sin^2 \theta = 1$$

$$\sin 2\theta = 2 \sin \theta \cdot \cos \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2\cos^2 \theta - 1 = 1 - 2\sin^2 \theta$$



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Show that:

6.  $\cos x \cdot \tan x = \sin x$

7.  $\cos^2\theta - \sin^2\theta = 1 - 2\sin^2\theta$

8.  $\frac{\cos^2x-1}{\cos^2x} = -\tan^2x$

9. With a classmate, discuss how you can verify these trig expressions are equivalent on your handheld. Verify your discussed method(s) by checking one or two of the problems above.

### Problem 3 – Using Identities to Solve Trig Equations

Using Trig Identities, solve the following equations for  $0 \leq x < 2\pi$ , leaving the exact answers in radian measure. Use the methods discussed with a classmate above to check your answers.

10.  $\sin^2x + 1 = \cos x$

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

12.  $4 - \cos 2x = 3$

### Extension – Real World Scenario

Texas Instruments has designed a way to control a drone with your handheld. They wanted to test its flight path and height traveled. The function below represents the drone's altitude,  $h(t)$  in feet,  $t$  seconds after the beginning of its flight.

$$h(t) = 20 + 10 \sin^2\left(\frac{1}{3}t\right)$$

If the flight starts at  $t = 0$  seconds, find at what times the drone will achieve a height of 25 feet over the first 15 seconds. Round your answer(s) to three significant figures.



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### Further IB Application

(a) Show that  $\cos 2x + \sin^2 x = \frac{\sin 2x}{2 \tan x}$ .

For part (b), exact answer(s) should be in radian measure.

(b) Hence or otherwise, solve  $\cos 2x + \sin^2 x = \frac{1}{2}$ .