Activity Overview

In this activity, students will perform trigonometric proofs and use the graphing capabilities of the calculator for verification.

Topic: Trigonometric Identities

- Use fundamental trigonometric identities to prove more complex trigonometric identities.
- Verify trigonometric identities by graphing.

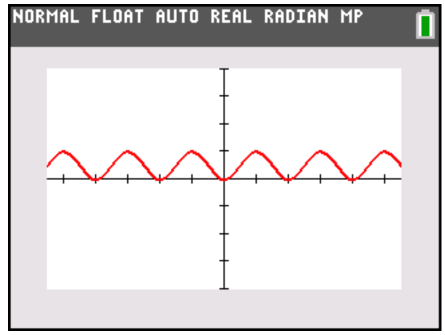
Teacher Preparation and Notes

- Students should already be familiar with the Pythagorean trigonometric identities as well the fact that tangent = sine/cosine, cosecant = 1/sine, secant = 1/cosine, and cotangent = 1/tangent.
- **To download the student worksheet, go to education.ti.com/exchange and enter "9776" in the keyword search box.**

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- An Interesting Circle (TI-Nspire™ technology) — 11176
- Graphs of Sine, Cosine, and Tangent (TI-Nspire™ technology) — 8314
- Trigonometric Patterns (TI-84 Plus family) — 12434
- Ferris Wheel Ride (TI-Nspire™ technology) — 10088
- Trigonometric Ratios (TI-84 Plus family) — 9534



This activity utilizes MathPrint™ functionality and includes screen captures taken from the TI-84 Plus C Silver Edition. It is also appropriate for use with the TI-83 Plus, TI-84 Plus, and TI-84 Plus Silver Edition but slight variances may be found within the directions.

Compatible Devices:
- TI-84 Plus Family
- TI-84 Plus C Silver Edition

Lesson Files:
- TrigProofs_Student.pdf
- TrigProofs_Student.doc

Click HERE for Graphing Calculator Tutorials.

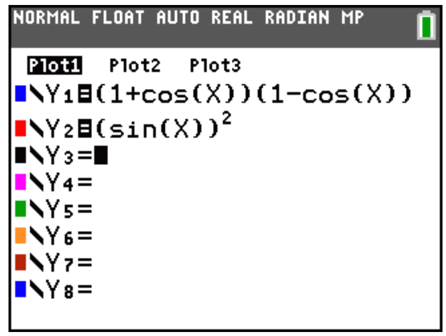
Problem 1 – Using the Calculator for Verification

Prove: $(1 + \cos x)(1 - \cos x) = \sin^2 x$.

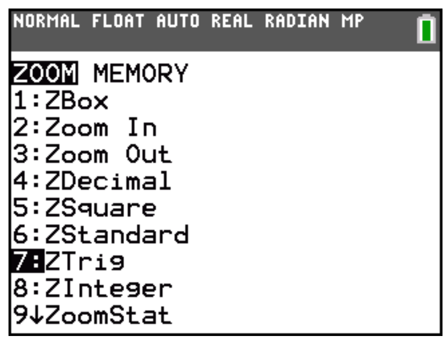
$$(1 + \cos(x))(1 - \cos(x)) = 1 - \cos^2(x)$$
$$= [\sin^2(x) + \cos^2(x)] - \cos^2(x)$$
$$= \sin^2 x$$

To verify this proof graphically, you will determine if the graph of the expression on the left side of the equation coincides with the graph of the expression on the right side of the equation.

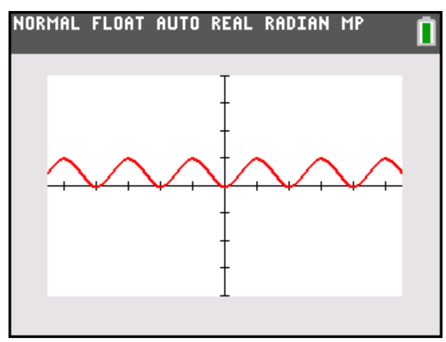
Enter the left side of the equation $(1 + \cos x)\ (1 - \cos x)$ in **Y1**. Enter the right side of the equation $(\sin x)^2$ in **Y2**.



Press WINDOW and select **ZTrig** to set the window size.



The second graph (red graph) covers the first graph (blue graph), so the two sides of the equation are equal, as proved. Note that the calculator is only **verifying** what has been proven. The graph by itself does NOT constitute a proof.



For problems 2 through 5, prove the equation given, and then verify it graphically. For $\cot x$, type $(1/\tan x)$. For $\sec x$, type $(1/\cos x)$.

2. $\sin x \cdot \cot x \cdot \sec x = 1$

3. $\dfrac{\sec^2 x - 1}{\sec^2 x} = \sin^2 x$

4. $\tan x + \cot x = \sec x(\csc x)$

5. $\dfrac{\sin^2 x - 49}{\sin^2 x + 14\sin x + 49} = \dfrac{\sin x - 7}{\sin x + 7}$

Solutions

2.

$$\begin{aligned}\sin(x)\cdot\cot(x)\cdot\sec(x) &= \sin(x)\cdot\tfrac{\cos(x)}{\sin(x)}\cdot\tfrac{1}{\cos(x)}\\ &= 1\end{aligned}$$

3.

$$\begin{aligned}\frac{\sec^2(x)-1}{\sec^2(x)} &= \frac{\left[1+\tan^2 x\right]-1}{\sec^2(x)}\\ &= \frac{\tan^2(x)}{\sec^2(x)}\\ &= \frac{\left(\frac{\sin(x)}{\cos(x)}\right)^2}{\frac{1}{\cos^2(x)}}\\ &= \sin^2(x)\end{aligned}$$

4.

$$\begin{aligned}\tan(x)+\cot(x) &= \frac{\sin(x)}{\cos(x)}+\frac{\cos(x)}{\sin(x)}\\ &= \frac{\sin^2(x)}{\cos(x)\cdot\sin(x)}+\frac{\cos^2(x)}{\cos(x)\cdot\sin(x)}\\ &= \frac{\sin^2(x)+\cos^2(x)}{\cos(x)\cdot\sin(x)}\\ &= \frac{1}{\cos(x)\cdot\sin(x)}\\ &= \sec(x)\cdot\csc(x)\end{aligned}$$

5.

$$\begin{aligned}\frac{\sin^2(x)-49}{\sin^2(x)+14\sin(x)+49} &= \frac{(\sin(x)-7)\cdot(\sin(x)+7)}{(\sin(x)+7)\cdot(\sin(x)+7)}\\ &= \frac{\sin(x)-7}{\sin(x)+7}\end{aligned}$$