Trigonometric Identities

VERITRIG.8xp

Name ________________________

Class ________________________

Problem 1 – Proving $\cos^2\theta + \sin^2\theta = 1$.

Choose the **VERITRIG** program and select **PROVE ID 1**. Label the triangle with 1, *x*, *y*, and θ in their respective places using the **Text** tool.

To prove: $\cos^2\theta + \sin^2\theta = 1$

1. Apply the Pythagorean Theorem to the right triangle:

2. Define the right triangle trig ratios for the triangle in terms of sine and cosine for θ:

3. Substitute $x = \cos\theta$ and $y = \sin\theta$ into your equation from step 1:

Problem 2 - Proving $\sec^2\theta = 1 + \tan^2\theta$.

Select **PROVE ID 2**. Label the smaller triangle.

For the large triangle, the length of its base is 1. Let *Y* be the height and *X* be the hypotenuse. Label the large similar triangle accordingly.

Using our similar triangles, we can now set up proportional ratios. First, let's start by stating what we know: the ratio of the hypotenuse to the base is $\frac{1}{\cos\theta}$ (small △) = $\frac{X}{1}$ (large △)

And the ratio of the two sides of the small and large triangles:

$$\frac{Y \text{ (large } \triangle)}{\sin\theta \text{ (small } \triangle)} = \frac{1 \text{ (large } \triangle)}{\cos\theta \text{ (small } \triangle)}$$

- Cross multiply and state what *X* and *Y* are equal to:

- Now substitute these values into the Pythagorean Theorem:

Problem 3 – Numerical verification

Now that we have proved the two identities using our algebra skills, it is always nice to use the power of the calculator lists to numerically verify the two identities.

Select **NUM EXPLORE**. Trace to see the *x*-values for cosine and the *y*-values for sine for each angle measurement.

- As you move the cursor around the circle, state what patterns you notice between the *x*- and *y*-values.

These values are stored in the lists of the calculator with the angle measurements in L_1, the cosine values in L_2, and the sine values in L_3. To numerically verify $\cos^2\theta + \sin^2\theta = 1$, you will use the lists of the calculator.

- What would you type into the top of a list (a formula) to numerically verify this Pythagorean Identity?

- Enter this in to the top of L_4. State your results:

Again, to numerically verify $\sec^2\theta = 1 + \tan^2\theta$, you are going to use the lists of the calculator.

- What would you type into the top of a list to numerically verify this Pythagorean Identity?

- Enter these in to the top of L_5 and L_6. State your results:

- Explain why you cannot verify this identity numerically using the lists of the calculator.

- What alternative method can you use to verify the identity?

Problem 4 – Verifying trig identities using graphing

Verify the identity $\sin^2 x = 1 - \cos^2 x$ by graphing the two sides of the equation together.

You can check any identity with this method.