28 Lesson Plan: Trigonometric Identities

Name_____

Due: Thursday, 11/13/03

Why?

Trigonometric identities are useful in transforming expressions.

Overview

We have studied the unit circle as it applies to trigonometric functions. From the unit circle we have developed the Pythagorean identities and the simple relations ships between the tangent, cotangent, secant and cosecant functions and the sine and cosine functions. In this section, we will develop many more identities that are useful in the applications of trigonometry in real world situations. In calculus, you will use these transformations in integrating functions near the end of the first semester.

Prerequisites

1. You should possess knowledge of the unit circle definition of sine and cosine.
2. You should know the Pythagorean theorem.
3. You should know SOHCAHTOA.
4. You should know about similarity in right triangles.

Learning Objectives

1. You will learn what a (trigonometric) identity is and how to solve trigonometric equations.
2. You will learn and memorize the basic identities involving sine and cosine that are result of the definitions of tangent, cotangent, secant, and cosecant.
3. You will learn the double angle formulas.
4. You will learn the sine and cosine of the negative of an angle measure.
5. You will learn identities that involve only the sine and cosine and a horizontal translations of $\frac{\pi}{2}$).

Performance Criteria

1. You will be able to write down the Pythagorean identities from memory.
2. You will be able to write down the double angle formulas for the sine, cosine and tangent functions.
3. You will be able to use these identities in simplifying trigonometric expressions.
4. You will be able to solve a trigonometric equation using these identities.
5. You will be able to use your graphing calculator to determine if an equation is an identity.

Vocabulary

1. Double angle formulas.
2. Pythagorean identities.
3. Negative angle identities.
4. Tangent identity
5. Solving a trigonometric equation.

Resources

1. The Pythagorean theorem as it applies to the unit circle and right triangles.
2. You knowledge of function notation.
3. Your graphing calculator.
4. Section 7.2.

Plan

1. Read the Critical Thinking Questions
2. Develop the double angle identities in class.
3. Solve trigonometric equations in class.
4. Read Section 7.2.
5. Answer the Critical Thinking Questions.
6. Complete the Applications exercises.
7. Complete the Problem Solving problems.

Model

1. The trigonometric identities developed by the instructor.
2. The equations solved by the instructor.
3. Examples in Section 7.2.

Critical Thinking Questions

1. What is a trigonometric identity? What is an algebraic identity? Give examples of each.

2. Why is $\cos^2(t) + \sin^2(t) = 1$ called a Pythagorean identity?

3. What law is used to prove the double angle identity for the sine function? What laws or identities are used to prove the double angle identities for cosine?

4. State the tangent double angle identity. Could this identity be transformed using the $\tan(t) = \dfrac{\sin(t)}{\cos(t)}$ identity? Do so.

5. Can you give three reasons why $\sin(2t) \neq 2\sin(t)$? Do so.

6. For what values of t is $\sin(2t) = 2\sin(t)$? Hint: Graphs might help.

7. Can you write $\sin 3t$ in terms of cosine alone? Hint: Will a translation work?

Applications
In Section 7.2: exercises #2-9 all

Problem Solving
In Section 7.2: problems #13, 14, 15, 17, 16, 23, 27, 28b, 29b, 31b,33*, 1*

Self-Assessment
- Can you use the cosine double angle formula to transform the expression $\cot(\theta)\sin(2\theta) + 2$?
- Can you write the cotangent function in terms of sine and cosine?
- Can you determine if $\tan(t) = \dfrac{\sin^2(t)}{\sin(2t)}$?

Extensions
- Is there a secant double angle identity? Should you memorize it? Why or why not?
- Do any of these new identities help in solving triangles?
- We know that $\ln(ab) = \ln(a) + \ln(b)$. Is this an identity? Might there be similar identities for sine and cosine?