

Homework Pg. 389 #16

16. **Ferris wheel** A carnival Ferris wheel with a radius of 7 m makes one complete revolution every 16 s. The bottom of the wheel is 1.5 m above the ground.
- Draw a graph to show how a person's height above the ground varies with time for three revolutions, starting when the person gets onto the Ferris wheel at its lowest point.
 - Find an equation for the graph.
 - Predict how the graph and the equation will change if the Ferris wheel turns more slowly.
 - Test your predictions from part c) by drawing the graph for three revolutions and finding an equation, if the wheel completes one revolution every 20 s.

UNIT #6: Trigonometric Transformations Trigonometric Identities

Learning Goal:

I will learn how to prove complex trig identities using the fundamental trig identities.



Lesson: Trigonometric Identities

Trigonometric Identities are equations that are true for all values of a given angle.

To prove an equation is an identity, you must simplify one or both sides of the equation until the left side and right side are exactly the same.

We use fundamental trig identities to prove more complex identities.

Fundamental Trig Identities MEMORIZE!

1. The **Quotient Identity**: $\frac{\sin x}{\cos x} = \tan x$

2. The **Pythagorean Identity**: $\sin^2 x + \cos^2 x = 1$
 $\sin^2 x = 1 - \cos^2 x$
 $\cos^2 x = 1 - \sin^2 x$

3. The **Reciprocal Identities**: $\csc x = \frac{1}{\sin x}$
 $\sec x = \frac{1}{\cos x}$
 $\cot x = \frac{1}{\tan x} = \frac{\cos x}{\sin x}$

Trig Identities (Lesson Notes).notebook

Methods used to help prove:

1. Change ratios to sine and/or cosine
2. Use fundamental Identities
3. Find a common denominator
4. Expand and simplify
5. Factor (common, difference of squares, trinomial)

* Keep left side on left and right on right!

Don't move anything to other side of equals sign.

Example 1:

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

Expand: $1 - \sin x + \sin x - \sin^2 x = \cos^2 x$

Simplify: $1 - \sin^2 x = \cos^2 x$

Pythag Identity: $\cos^2 x = \cos^2 x$

Left side = Right side!

same as $\frac{\sin^2 x}{\cos^2 x}$

Example 2:

Prove: $\tan^2 x \cos^2 x = 1 - \cos^2 x$

Quot Ident: $\left(\frac{\sin x}{\cos x}\right)^2 \cos^2 x = 1 - \cos^2 x$

Simplify: $\sin^2 x = 1 - \cos^2 x$

Pythag Ident: $1 - \cos^2 x = 1 - \cos^2 x$

Example 3:

Prove: $\sin x \tan x = \cos x \tan^2 x$

Quot: $\sin x \left(\frac{\sin x}{\cos x}\right) = \cos x \left(\frac{\sin x}{\cos x}\right)^2$

Simplify: $\frac{\sin^2 x}{\cos x} = \frac{\sin^2 x}{\cos x}$

UNIT 6: Trigonometric Functions
Trig Identities

Example 4:

Prove: $\frac{1 + \cos x}{1 - \cos x} = \frac{\sec x + 1}{\sec x - 1}$

Reciprocal:

$$\frac{1 + \cos x}{1 - \cos x} = \frac{\frac{1}{\cos x} + 1}{\frac{1}{\cos x} - 1}$$

common den. of $\cos x$

Common Denominator:

$$\frac{1 + \cos x}{1 - \cos x} = \frac{1 + \cos x}{\frac{1 - \cos x}{\cos x}}$$

$$\frac{1 + \cos x}{1 - \cos x} = \frac{1 + \cos x}{\cos x} \div \frac{1 - \cos x}{\cos x}$$

$$\frac{1 + \cos x}{1 - \cos x} = \frac{1 + \cos x}{\cancel{\cos x}} \times \frac{\cancel{\cos x}}{1 - \cos x}$$

Simplify:

$$\frac{1 + \cos x}{1 - \cos x} = \frac{1 + \cos x}{1 - \cos x}$$

Learning Goal:

I will learn how to prove complex trig identities using the fundamental trig identities.

Success Criteria:

To be successful, I must be able to...

- prove an equation is an identity by showing the left side of the equation is equal to the right side.
- use the fundamental trig identities (Pythagorean, quotient, and reciprocal) to make both sides of the equation equal.

Practice Work

p. 398 #2, 4, p. 400 #7