MATH 112 : Trigonometry **(4-0-4)** 4/30/25

Catalog Description: The trigonometric functions and their applications. Topics include graphs, identities, trigonometric equations, vectors, and complex numbers.

Course Objectives: After completing this course, students will be able to

1. Find arc-length and angles in both degrees and radians.
2. Define the six trigonometric function and use them to solve problems.
3. Graph trigonometric functions.
4. Use basic identities to prove additional identities.
5. Solve trigonometric equations.
6. Use the of law of sines, law of cosines, and vectors to solve applied problems.
7. Compute with complex numbers.
8. Communicate mathematical ideas using correct and appropriate notation.

Learning Outcomes and Performance Criteria

1. Find arc-length and angles in both degrees and radians.
   Core Criteria:
   (a) Draw an angle in standard position.
   (b) Determine a reference angle.
   (c) Determine a coterminal angle of a given angle.
   (d) Find the arc-length, given the radius and an angle.
   (e) Find the angular and linear velocity given sufficient information and vice versa.
   (f) Convert between radians and degrees.

   Additional Criteria:
   (a) Find the area of a sector of a circle.
2. Define the six trigonometric function and use them to solve problems.
   Core Criteria:
   (a) Define the six trigonometric functions in terms of a right triangle.
   (b) Solve applied right triangle problems.
   (c) Given a point on the terminal side of an angle, compute the six trigonometric functions.
   (d) Given a quadrant and the value of a trigonometric function, determine the other five.
   (e) State (without a calculator) the values of the six trigonometric functions for all angles which have a reference angle that is a special angle.
   (f) Use a calculator to approximate trigonometric values of a real number.

3. Graph trigonometric functions.

   Core Criteria:

   (a) Identify and graph sine, cosine, and tangent without transformations.
   (b) Find the amplitude, period, and phase shift given an equation or graph.
   (c) Given an equation of a sine or cosine draw a graph and label both the graph and the axes appropriately.
   (d) Given the graph of a sine or cosine curve determine an equation.

   Additional Criteria:

   (a) Given an equation of a tangent, secant, cosecant, or cotangent, draw a graph and label both the graph and the axes appropriately.

4. Use basic identities to prove additional identities.

   Core Criteria:

   (a) Use the half-angle and double-angle identities for sine and cosine to verify other identities.
   (b) Memorize the fundamental eight identities.
   (c) Use the sum and difference formulas for sine and cosine to verify other identities or find exact values of trigonometric functions.
   (d) Use the reduction formula $a\sin(x) + b\cos(x) = \sqrt{a^2 + b^2}\cos(x - \alpha)$ to verify other identities and combine waveforms.
   (e) Students will prove a trigonometric identity by writing in a logical manner with the appropriate format ("left-right-down").

5. Solve trigonometric equations.

   Core Criteria:

   (a) Find the exact values of expressions with inverse trigonometric ($\sin^{-1}(x)$, $\cos^{-1}(x)$, and $\tan^{-1}(x)$) functions.
   (b) Use the range of inverse trig. functions appropriately to find a solution to a trigonometric function.
   (c) Find the solutions to a trigonometric equation on a prescribed domain.
   (d) Use an identity to solve an trigonometric equation .

6. Use the of law of sines, law of cosines, and vectors to solve applied problems.

   Core Criteria:

   (a) Solve triangles with the law of sines and the law of cosines.
   (b) Solve applied problems using the law of sines and law of cosines.
   (c) Combine vectors geometrically and algebraically.
   (d) Convert vectors from cartesian to trigonometric form.

(e) Solve applied problems using vectors.

Additional Criteria:

(a) Use the dot product and projections to solve applied problems.

7. Compute with complex numbers.
   Core Criteria:

   (a) Convert complex numbers from cartesian to polar.
   (b) Perform complex arithmetic in the rectangular and polar form.
   (c) Find powers using De Moivre's Theorem.

Last modified by : Pake Melland, Dibyajyoti Deb, Randall Paul, Kenneth Davis.