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TRIGONOMETRY

Grades 9-12

Units: 5 high school credits

UC Requirement Category: c

General Description:

Trigonometry is a one semester course that is designed to help prepare the student to succeed at higher levels of mathematics such as pre-calculus, calculus as well as physics by building a strong foundation. Trigonometry is the study of problems involving angles, triangles and objects that move in circular motion, or orbits. Topics will include; angle measure in degrees and radians, trigonometric and circular functions and their graphs, right triangles, oblique triangles, inverse trigonometric functions and vectors.

- Course goals expect the student to:
- Demonstrate the definitions of the trigonometric and circular function
- Demonstrate the relationship between an angle, its reference angle, and a co-terminal angle
- Determine the graph of a trigonometric or circular function.
- Use trigonometric identities to simplify or verify trigonometric expressions/equations
- Demonstrate the definitions of the inverse trigonometric functions
- Solve trigonometric equations
- Solve right triangles and oblique triangles
- Demonstrate the definitions of a vector and determine its horizontal/vertical components
- Determine the magnitude of the resultant formed by the sum of two vectors.

Trigonometry Course Syllabus:

Course Outcomes:

1. Students will be able to relate geometric ideas that evolve into trigonometric functions.
2. Students will be able to use trigonometric ideas to solve application problems.
3. Students will be able to generate and interpret graphs of trigonometric functions.
4. Students will be able to use logic and trigonometric identities to prove the validity of other identities.
5. Students will be able to integrate algebraic properties and trigonometric concepts to solve equations involving trigonometric functions.

Unit 1: The Trigonometric Functions

Subject Matter

1. Basic concepts
2. Angles

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3. Angle relationships and similar triangles
4. Definitions of the trigonometric functions
5. Using the definitions of the trigonometric functions

Outcomes

1. Students will be able to determine the distance between two points.
2. Students will be able to use interval notation.
3. Students will be able to determine the domain and range of a relation.
4. Students will be able to identify a function.
5. Students will be able to express an angle measure in Degrees, Minutes, Seconds, or Decimal Degrees.
6. Students will be able to determine an angle coterminal with a given angle.
7. Students will be able to use the properties of similar triangles to determine missing sides or angles.
8. Students will be able to demonstrate the definitions of the trigonometric functions.
9. Students will be able to demonstrate the reciprocal, Pythagorean, and quotient identities.
10. Students will be able to, given the quadrant and value of one of the trigonometric functions, determine the values of the other trigonometric functions.

Unit 2: Acute Angles and Right Triangles

Subject Matter

1. Trigonometric functions of acute angles
2. Trigonometric functions of non-acute angles
3. Finding trigonometric function values using a calculator
4. Solving right triangles
5. Further applications of right triangles

Outcomes

1. Students will be able to state and apply the properties of cofunctions.
2. Students will be able to determine exact values of the trigonometric ratios for special angles.
3. Students will be able to determine the reference angle for a given angle.
4. Students will be able to determine the approximate values of the trigonometric ratios for any angle, using a calculator.
5. Students will be able to use the definition of trigonometric ratios to solve a right triangle problem.

Unit 3: Radian Measure and Circular Functions

Subject Matter

1. Radian measure

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2. Applications of radian measure
3. Circular functions of real numbers
4. Linear and angular velocity

Outcomes

1. Students will be able to convert degrees to radians and radians to degrees.
2. Students will be able to determine the trigonometric ratios of special angles given in radian measure.
3. Students will be able to state and apply the formula to determine the length of an arc.
4. Students will be able to state and apply the formula to determine the area of a sector.
5. Students will be able to determine the reference number (angle) for rotation given in radian measure.
6. Students will be able to determine the values of circular functions using a calculator.
7. Students will be able to state and apply the formula to determine angular velocity.
8. Students will be able to state and apply the formula to determine linear velocity.

Unit 4: Graphs of the Circular Functions

Subject Matter

1. Graphs of the sine and cosine functions
2. Translating graphs of the sine and cosine functions
3. Graphs of the other circular functions

Outcomes

1. Students will be able to determine the amplitude, period, and phase shift for the trigonometric functions.
2. Students will be able to sketch a graph of the trigonometric functions.
3. Students will be able to determine a sine or cosine function, given its amplitude, period, and phase shift.
4. Students will be able to match a trigonometric function with a given graph.

Unit 5: Trigonometric Identities

Subject Matter

1. Fundamental identities
2. Verifying trigonometric identities
3. Sum and difference identities for cosine
4. Sum and difference identities for sine and tangent
5. Double-angle identities
6. Half-angle identities

Outcomes

1. Students will be able to, given the value of the trigonometric functions and the quadrant, find the values of the other trigonometric functions.

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2. Students will be able to demonstrate the fundamental identities.
3. Students will be able to verify a trigonometric identity using the fundamental identities.
4. Students will be able to determine the exact value of a trigonometric expression using:
 - a. The cosine sum and difference identities.
 - b. The sine sum and difference identities.
 - c. The cosine double-angle identity.
 - d. The sine double-angle identity.
 - e. The cosine half-angle identity.
 - f. The sine half-angle identity.
5. Students will be able to verify a trigonometric identity using the special identities referenced in objective.

Unit 6: Inverse Trigonometric Functions and Trigonometric Equations

Subject Matter

1. Inverse trigonometric functions
2. Trigonometric equations
3. Trigonometric equations with multiple angles
4. Equations with inverse trigonometric functions

Outcomes

1. Students will be able to determine exact values of an inverse trigonometric function.
2. Students will be able to use a calculator to evaluate an inverse trigonometric function.
3. Students will be able to evaluate an expression involving trigonometric functions and inverse trigonometric functions.
4. Students will be able to solve a trigonometric equation over a specified domain.
5. Students will be able to solve a trigonometric equation involving multiple of half-angles over a specified domain.
6. Students will be able to solve an equation involving inverse trigonometric functions.

Unit 7: Application of Trigonometry and Vectors

Subject Matter

1. Oblique triangles and the law of sines
2. The ambiguous case of the law of sines
3. The law of cosines
4. Introduction to vectors
5. Applications of vectors

Outcomes

1. Students will be able to state and demonstrate the law of sines to solve triangles.
2. Students will be able to determine the area of a triangle using $K = (1/2)bc\sin A$, etc.

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3. Students will be able to recognize and solve triangles given in the ambiguous case.
4. Students will be able to state and demonstrate the law of cosines to solve triangles.
5. Students will be able to determine the area of a triangle using Heron's formula.
6. Students will be able to represent two vectors and their sum, the resultant, graphically using the parallelogram rule.
7. Students will be able to solve for the resultant between two given vectors given the angle between them.
8. Student will be able to determine the horizontal and vertical components of a given vector.
9. Students will be able to determine the sum and dot product of two vectors.
10. Students will be able to use vector diagrams and the law of sines and the law of cosines to solve word problems.