

K – 12 MATHEMATICS UNIFYING STANDARDS

- 1.0 Number Sense and Operations** – Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.
- 2.0 Patterns, Functions, and Algebra** – Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.
- 3.0 Measurement** – Students know and understand attributes, units and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.
- 4.0 Geometry and Spatial Sense** – Students know how to analyze characteristics and properties of two- and three- dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformations and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.
- 5.0 Data Analysis, Statistics, and Probability** – Students know how to pose questions and collect, organize, represent and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.
- 6.0 Problem Solving** – Students know that they learn basic skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, while demonstrating an attitude of persistence and reflection in their approaches.
- 7.0 Processes: Reasoning, Communication, and Connections** – Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas, as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

FOCUS GOALS TRIGONOMETRY

1.0 Number Sense and Operations

- 1.1 Compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.
- 1.2 Demonstrate an understanding of the addition formulas for sines and cosines and their proofs.
- 1.3 Demonstrate an understanding of half-angle and double-angle formulas for sines and cosines.

2.0 Patterns, Functions, and Algebra

- 2.1 Know the definition of sine and cosine as y - and x -coordinates of points on the unit circle and be familiar with the graphs of the sine and cosine functions.
- 2.2 Graph functions of the form $f(t) = A \sin (Bt + C) + D$ * or $f(t) = A \cos (Bt + C) + D$ and interpret A, B, C and D in terms of amplitude, frequency, period, phase shift, and vertical shift.
- 2.3 Know and apply definitions of the tangent and cotangent functions.
- 2.4 Know and apply definitions of the secant and cosecant functions.
- 2.5 Know and demonstrate how the tangent of the angle that a line makes with the x -axis is equal to the slope of the line.
- 2.6 Know and apply the definitions of inverse trigonometric functions.

3.0 Measurement

- 3.1 Measure angles, in both degrees and radians.
- 3.2 Understand the concept of coterminal and reference angle for a given angle.
- 3.3 Understand how to convert between decimal degrees and degrees, minutes, and seconds.

4.0 Geometry and Spatial Sense

- 4.1 Understand and apply polar coordinates.

5.0 Data Analysis, Statistics, and Probability

- 5.1 Organize, represent, and interpret data in graphs.

6.0 Problem Solving

- 6.1 Make decisions about how to approach problems.
- 6.2 Apply strategies, skills, and concepts in finding solutions.
- 6.3 Know how to use trigonometry in a variety of applications and word problems.
- 6.4 Apply the concept of angular velocity to solve problems.

7.0 Processes: Reasoning, Communication, and Connections

- 7.1 Communicate mathematics thinking and conclusions in words, graphs, and charts.
- 7.2 Prove, explain, and simplify trigonometric identities.
- 7.3 Apply literacy skills when making mathematical connections.

MATH STANDARDS TRIGONOMETRY

1.0 Number Sense and Operations – Students understand ways of representing numbers, relationships among numbers, and number systems. They understand the meaning of and relationships between operations and strategies, and they can estimate appropriately.

- 1.1 Compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.** (c/t9)
- o Find the exact value of the Trigonometric Functions of quadrangles, angles, and angles whose reference angles are 30° , 45° , 60° .
- 1.2 Demonstrate an understanding of the addition formulas for sines and cosines and their proofs.** (c/t10)
- o Use sum and difference formulas to find exact values.
 - o Use sum and difference formulas to simplify and prove identities.
- 1.3 Demonstrate an understanding of half-angle and double-angle formulas for sines and cosines.** (c/t11)
- o Use half-angle and double-angle formulas to find exact values.
 - o Use half-angle and double-angle formulas to simplify and prove identities.

2.0 Patterns, Functions, and Algebra – Students know and understand various types of patterns and functional relationships. They use symbolic forms and models to represent and analyze mathematical structures in both real and abstract contexts.

- 2.1 Know the definition of sine and cosine as y- and x-coordinates of points on the unit circle and be familiar with the graphs of the sine and cosine functions.** (c/t2)
- o Determine domain and range of the trigonometric functions.
 - o Determine the period of the trigonometric functions.
 - o Determine the sign of the trigonometric functions.
- 2.2 Graph functions of the form $f(t) = A \sin (Bt + C) + D$ * or $f(t) = A \cos (Bt + C) + D$ and interpret A, B, C and D in terms of amplitude, frequency, period, phase shift, and vertical shift.** (c/t4)
- o Graph transformations of the sine and cosine functions.
- 2.3 Know and apply definitions of the tangent and cotangent functions.** (c/t5)
- o Graph transformations of the tangent and cotangent functions.
- 2.4 Know and apply definitions of the secant and cosecant functions.** (c/t6)
- o Graph transformations of the secant and cosecant functions.
- 2.5 Know and demonstrate how the tangent of the angle that a line makes with the x-axis is equal to the slope of the line.** (c/t7)

2.6 Know and apply the definitions of inverse trigonometric functions. (c/t8)

- o Determine the domain and range of inverse functions.
- o Graph inverse trigonometric functions.

3.0 Measurement – Students know and understand attributes, units and systems of measurement. They apply a variety of techniques, tools, and formulas for determining measurements.

3.1 Measure angles, in both degrees and radians. (c/t1)

- o Convert angle measures between degrees and radians.

3.2 Understand the concept of coterminal and reference angle for a given angle. (p)*

- o Identify the reference angle for any positive or negative measured angle.
- o Identify an angle with various positive and negative rotations.

3.3 Understand how to convert between decimal degrees and degrees, minutes, and seconds. (p)

4.0 Geometry and Spatial Sense – Students know how to analyze characteristics and properties of two- and three- dimensional objects. They select and use different representational systems, including coordinate and graph theory. They understand the usefulness of transformations and symmetry in analyzing mathematical situations. They know how to visualize and to use spatial reasoning to solve problems that cross disciplines.

4.1 Understand and apply polar coordinates. (c/t15-18/ma1.0)

- o Plot points using polar coordinates. *
- o Convert from polar coordinates to rectangular coordinates. (c15)
- o Convert from rectangular coordinated to polar coordinates. (c15)
- o Represent complex numbers in polar form. (c18)
- o Be familiar with the proof of DeMoivre's theorem. (c18/ma2.0)

5.0 Data Analysis, Statistics, and Probability – Students know how to pose questions and collect, organize, represent and interpret data in order to answer those questions. They use methods of exploratory data analysis to develop and evaluate inferences, predictions, and arguments that are based on data. They understand and know how to apply the notions of chance and probability.

5.1 Organize, represent, and interpret data in graphs. (c/t5,6,8)

- o Find sinusoidal functions to fit data points in a scatter diagram. (c5)
- o Predict values using a trigonometric model. *

6.0 Problem Solving – Students know that they learn basic skills and concepts in order to use them to solve problems in and out of school. They solve routine and complex problems by drawing from a variety of strategies, including technology, while demonstrating an attitude of persistence and reflection in their approaches.

6.1 Make decisions about how to approach problems. (p9-12)

- o Analyze problems by identifying relationships, discriminating relevant from irrelevant information, identifying missing information, sequencing and prioritizing information, and observing patterns.
- o Identify and utilize appropriate tools.
- o Make generalizations based on prior knowledge and related examples.

6.2 Apply strategies, skills, and concepts in finding solutions. (c/p)

6.3 Know how to use trigonometry in a variety of applications and word problems. (c/t19)

- o Use trigonometry to determine unknown sides or angles in right triangles. (c/t14)
- o Know and use the law of sines and the law of cosines to solve oblique triangles. (c/t13)
- o Determine the area of a triangle, given one angle and the two adjacent sides. (c/t14)

6.4 Apply the concept of angular velocity to solve problems. *

- o Find the linear speed of an object traveling in circular motion.
- o Find arc length.

7.0 Processes: Reasoning, Communication, and Connections – Students use reasoning to develop, analyze, draw conclusions, and validate conjectures and arguments. As they reason, they recognize and understand multiple representations of the same concept. They see the interconnections among math ideas, as well as in other disciplines. They know how to communicate their math thinking clearly and coherently to others, orally, graphically, and in writing, using precise language and symbols.

7.1 Communicate mathematics thinking and conclusions in words, graphs, and charts. (p)

7.2 Prove, explain, and simplify trigonometric identities. (c/t3)

- o Use $\cos^2(x) + \sin^2(x) = 1$ and know that this identity is equivalent to the Pythagorean Theorem (i.e., students can prove this identity by using the Pythagorean Theorem and, conversely, they can prove the Pythagorean Theorem as a consequence of this identity). (c/t3.1)
- o Use the identity $\cos^2(x) + \sin^2(x) = 1$ to explain and simplify other trigonometric identities. (c3.2)

7.3 Apply literacy skills when making mathematical connections. (p-language arts)

- o Learn and use mathematics vocabulary encountered through reading. (R1.0)
- o Use strategies to comprehend, analyze, and evaluate mathematics reading materials. (R2.0)
- o Employ technology to organize and record mathematics information. (R3.0)
- o Write about mathematics to convey ideas logically and correctly. (W2.0)