Unit 04: Trigonometry (week 22-36)

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

MA.F-IF	Interpreting Functions
MA.F-IF.A	Understand the concept of a function and use function notation
MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.C	Analyze functions using different representations
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-TF	Trigonometric Functions
MA.F-TF.A	Extend the domain of trigonometric functions using the unit circle
MA.F-TF.A.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MA.F-TF.A.2	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
MA.F-TF.A.3	Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
MA.F-TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
MA.F-TF.B	Model periodic phenomena with trigonometric functions
MA.F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MA.F-TF.B.6	Understand that restricting a trigonometric function to a domain on which it is always

	increasing or always decreasing allows its inverse to be constructed.
MA.F-TF.B.7	Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
MA.F-TF.C	Prove and apply trigonometric identities
MA.F-TF.C.8	Prove the Pythagorean identity $sin^2(\theta) + cos^2(\theta) = 1$ and use it to find $sin(\theta)$, $cos(\theta)$, or $tan(\theta)$ given $sin(\theta)$, $cos(\theta)$, or $tan(\theta)$ and the quadrant of the angle.

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

Capacities of the Literate Individual
Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They respond to the varying demands of audience, task, purpose, and discipline.

They comprehend as well as critique.

They value evidence.

They use technology and digital media strategically and capably.

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.3	Construct viable arguments and critique the reasoning of others
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision
MATH.K-12.7	Look for and make use of structure
MATH.K-12.8	Look for and express regularity in repeated reasoning

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

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Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

The general topic of this unit is going to be about trigonometric ratios and problem solving with trigonometry. The definitions of sine, cosine, and tangent for acute angles are found on right triangles and similarity; in conjunction with the Pythagorean Theorem, these are fundamental in many real-world and theoretical problem situations. Since the Pythagorean Theorem can only be used with right triangles, and every geometrical problem we deal with is not so kind to give us a ninety degree angle with every triangle the Law of Cosines can be used to generalize to non-right triangles. Partnered with the Law of Sines, the Law of Cosines embodies the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle. By completely solving triangles I mean find every angle and side length. Students can use trigonometry to enrich their mind and expand there thinking, but more practically trigonometry can be used in surveying, engineering problems, heights of building or trees, stock market trends, or maybe business cycles.

Meaning

Essential Questions

Essential Questions

- How do trigonometric and circular functions model real world problems and their solutions?
- How does your perspective of a problem influence its solution?
- How are the circular functions related to the trigonometric functions?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- Trigonometric and circular functions can be represented through real-life problems.
- Connections among the six trigonometric functions are a result of their properties.
- Triangles are the basis of all geometric shapes, therefore trigonometry is powerful subject in terms of connections and applications.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- Radians / degrees
- Arc length
- Linear speed
- Area of a sector
- Trigonometric functions
- Harmonic motion
- Right triangle trigonometry
- Trigonometric identities
- Reference angles
- Graphs of trigonometric functions
- Translations of trigonometric graphs
- Inverse trigonometric functions
- Applications and models
- Fundamental trigonometric identities.
- Trigonometric equations.
- Standard algebra techniques involving the trigonometric identities.
- Inverse trigonometric functions.
- Law of Sines (AAS, ASA, SSA).
- Law of Cosines (SSS, SAS)
- Heron's Area Formula

Skills

Skills

Student will be skilled at …

- Section 4.1

Describe angles.

Use radian and degree measure.

Use angles to model and solve real world problems.

- Section 4.2

Evaluate trigonometric functions.

Characteristics sine and cosine functions.

Use technology to evaluate trigonometric functions.

- Section 4.3

Evaluate trigonometric functions of acute angles.

Use fundamental trigonometric identities.

Use angles to model and solve real world problems.

- Section 4.4

Evaluate trigonometric functions of any angle.

Use reference angles to evaluate trigonometric function.

- Section 4.5

Analyze graphs of sine and cosine functions.

Sketch translations of the sine and cosine functions.

Use sine and cosine functions to model real life problems.

- Section 4.7

Evaluate and graph inverse trigonometric functions.

- Section 4.8

Solve real life problems involving right triangles.

Solve real life problems involving directional variance.

Solve real life problems involving harmonic motion.

- Section 5.1

Recognize and write the fundamental trigonometric identities.

Use the fundamental trigonometric identities to:

1. evaluate trigonometric functions.

2. simplify trigonometric expressions.

3. rewrite trigonometric expressions.

- Section 5.2

Verify trigonometric identities.

- Section 5.3

Use standard algebraic techniques to solve trigonometric equations.

Solve trigonometric equations of quadratic type.

Solve trigonometric equations involving multiple angles.

Use inverse trigonometric functions to solve trigonometric equations.

- Section 6.1

Law of Sines.

Oblique Triangles (AAS, ASA, SSA).

Applications.

- Section 6.2

Law of Cosines.

Oblique Triangles (SSS & SAS).

Heron's Area Formula.

Applications.

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

- Textbook (Precalculus with Limits Larson and Hostetler)
- Teacher created materials
- -powerpoint games

-centers (review stations)

-worksheets

-scavenger hunts

-organizers

- Problems from the web and other textbook (Advanced Mathematics Precalculus with Discrete Mathematics and Data Analysis Richard G. Brown)

Formative Assessment Strategies

Formative Assessment Strategies

Discussion

Quizzes

Student Engagement sheet

Exit Tickets

Homework/Classwork

Learning Activities/Unit of Study

Learning Activities/Unit of Study

- Do Now--problem of the day related to previous learned skills or bellringers problems

- Review/Check Homework - (group check, partner check, whiteboard check)- Lecture

- Lecture

- Work together to understand and practice the skill - partner work/larger group work to read lesson, and practice skills through “On Your Own” problems incorporated throughout each lesson

- Stations - (Small group instruction, skills practice - scavenger hunts, online games, board work)

- Board/White Board Work - (solve problems/practice skills at board, or at seat with individual white boards)

- Kahoot to reinforce skills

- Review and practice skills using a variety of materials - (text, workbook, chromebook, games, activities, discussion)

- Thumbs up/down/sideways - quick formative assessment to gauge students level of understanding

- Scavenger hunts--self-checking, out of seats activity

- Jeopardy style review games

-Relay races--each student does one part of a problem, hands it to the next student to check then completes the next part, etc.

- Socrative--non-multiple choice technology option where students can either “race” or work at the teacher-pace

- Partner/Group investigation where students must create a formula, method, or strategy to solve a problem.

- Students “as teachers” where they present a method or formula they discovered through investigation

- Pear Deck--an interactive online powerpoint where students enter answers, watch videos, and record notes from the information shown on their own device as well as projected.

- Videos by Shmoop to introduce or reinforce concepts in an engaging and comical way

- Math created songs to help reinforce concepts

- Online games on chromebooks

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to

ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.