Unit 03: Trigonometry (Weeks 13-18)

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

Standards Alignment

New Jersey Student Learning Standards

LA.K-12.NJSLSA.R2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.K-12.NJSLSA.R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
LA.K-12.NJSLSA.R4	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
LA.K-12.NJSLSA.R5	Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
LA.K-12.NJSLSA.R10	Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
LA.K-12.NJSLSA.W	Writing
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
MATH.9-12.F.IF	Interpreting Functions
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
MATH.9-12.F.IF.A	Understand the concept of a function and use function notation
LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
LA.K-12.NJSLSA.W2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
MATH.9-12.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 $y = f(x)$.
LA.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
LA.K-12.NJSLSA.W9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.1.D	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.11-12.1.E	Provide a concluding paragraph or section that supports the argument presented.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.2.D	Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
LA.WHST.11-12.2.E	Provide a concluding paragraph or section that supports the argument presented.
LA.WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.WHST.11-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
MATH.9-12.F.TF	Trigonometric Functions
MATH.9-12.F.TF.A	Extend the domain of trigonometric functions using the unit circle
MATH.9-12.F.TF.A.1	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
MATH.9-12.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.
MATH.9-12.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, cosine, and tangent for $\pi - x$, $\pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number.
MATH.9-12.F.TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.
MATH.9-12.F.TF.B	Model periodic phenomena with trigonometric functions
MATH.9-12.F.TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MATH.9-12.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.
MATH.9-12.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.
MATH.9-12.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

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 comprehend as well as critique.

They value evidence.

MATH.K-12.1	Make sense of problems and persevere in solving them
MATH.K-12.2	Reason abstractly and quantitatively
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision

MA.G-SRT	Similarity, Right Triangles, and Trigonometry
MA.G-SRT.C	Define trigonometric ratios and solve problems involving right triangles
MA.G-SRT.C.6	Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.
MA.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.
MA.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.
MA.G-SRT.D	Apply trigonometry to general triangles
MA.G-SRT.D.9	Derive the formula A = (1/2)$ab\ sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.
MA.G-SRT.D.10	Prove the Laws of Sines and Cosines and use them to solve problems.
MA.G-SRT.D.11	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).
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 π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosines, and tangent for π – x, π + x, and 2π – 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(θ) + cos^2(θ) = 1 and use it to find sin(θ), cos(θ), or tan(θ) given sin(θ), cos(θ), or tan(θ) and the quadrant of the angle.
MA.F-TF.C.9	Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

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

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale
Unit Rationale The purpose of this unit…

Meaning

Essential Questions

Essential Questions

- How do trigonometric and circular functions model real-world problems and their solutions?
- How are circular functions related to trigonometric functions?
- How are the six trigonometric functions related to each other?
- How do trigonometric functions model real world problems and their solutions?
- How does trigonometry apply to solving real world problems such as finding force on an inclined ramp or wind adjustment in navigation?
- How are the Law of Sines and Law of Cosines beneficial in solving real world problems?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- Trigonometric functions are used to model and analyze real world applications
- Triangles are the basis of all geometric shapes, therefore trigonometry is powerful subject in terms of

connections and applications.
- The patterns and relationships present in trigonometry make trigonometric relationships highly predictable and easily computed.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- Radians / degrees
- Unit circle
- 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 …

- Understand radian and degree measure
- Find the arc length
- Find the area of a sector of a circle
- Define trigonometric Functions.
- Domain and Period of Sine and Cosine.
- Evaluate Trigonometric Functions.
- Right triangle definitions of Trigonometric functions.
- Evaluate trigonometric functions and special angles.

- Discovering relationships among trigonometric Identities.
- Applications involving right triangles.
- Evaluate trigonometric functions of any angle.
- Analyze and graph characteristics of basic sine and cosine curves.
- Translations of sine and cosine curves.
- Evaluation of the inverse trigonometric functions.
- Use fundamental trigonometric identities to evaluate trigonometric functions.
- Use fundamental trigonometric identities to simplify trigonometric expression.
- Use fundamental trigonometric identities to rewrite trigonometric expressions.
- Prove trigonometric identities.
- 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.
- Use Law of Sines to solve oblique triangles.
- Find areas of oblique triangles.
- Use Law of Sines to model and solve real life problems.
- Use Law of Cosines to solve oblique triangles.
- Use Law of Cosines to model and solve real life problems.
- Use Heron's Area Formula to find area of triangles.
- Use advanced trigonometric identities to: evaluate trigonometric functions, verify identities, solve trigonometric equations

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

Larson, Ron and Robert Hostetler. *Precalculus*. Boston: Houghton Mifflin Company, 2007.

- Teacher created materials.
- Resources supplied by publisher.
- Resource from the Internet.

Formative Assessment Strategies

Formative Assessment Strategies

-Announced quizzes

-Short unannounced quizzes

-Homework quizzes

-Exit tickets

-Teacher observations

Learning Activities/Unit of Study

Learning Activities/Unit of Study

Chapter 4

4.1: Radian and Degree Measure

- notes/examples
- group activity: Introducing trigonometry (in notes)

4.3: Right Triangle Trigonometry

- notes/examples
- practice in groups

4.2: Trigonometric Functions: The Unit Circle

- notes/examples
- practice

4.4: Trigonometric Functions at Any Angle

- notes/examples
- practice in groups

4.5: Graphs of Sine and Cosine Functions

- notes/examples
- activity: graphing sine and cosine by plugging in values (in notes)
- group activity: using a calculator to investigate period and amplitude (in notes)

4.6: Graphs of Other Trigonometric Functions

- notes/examples

4.7: Inverse Trigonometric Functions

- notes/examples
- practice in groups

4.8: Applications and Models

- notes/examples
- practice in groups

Chapter 5

5.1: Using Fundamental Identities

- notes/examples
- activity: Discovering the Pythagorean identities
- practice in groups

5.2: Verifying Trigonometric Identities

- notes/examples
- practice in groups

5.3: Solving Trigonometric Equations

- notes/examples

5.4: Sum and Difference Formulas

- notes/examples

5.5: Multiple Angle Formulas

- notes/examples

Chapter 6

6.1: Law of Sines

- notes/examples
- practice in groups

6.2: Law of Cosines

- notes/examples
- practice in groups

trig ch 4 notes.pdf
trig ch 5 notes.pdf
trig ch 6 notes.pdf
trig 5.2 identity writing.docx
trig 12 04 13.doc
trig 12 16 13.doc
trig 1 07 14.doc
trig 1 15 14.doc
trig 1 28 14.doc
trig 2 06 14.doc
trig 2 18 14.doc
trig 2 26 14.doc
trig 3 7 14.doc
trig 3 14 14.doc
trig 3 26 14.doc

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

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.

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.