Course: PreCalculus **Unit #: Trigonometry**	**Year of Implementation:** 2025-2026

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:
{provide all applicable links to standards here}
https://www.nj.gov/education/standards/

- **Unit Standards:** *(keep each of the following headings in place)*
  - ***Content Standards***

Standard: F-IF.B Interpret functions that arise in applications in terms of the context

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

5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes

Standard: F-IF. C Analyze functions using different representations

7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude

Standard: F-TF.A Extend the domain of trigonometric functions using the unit circle.

1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

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.

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.

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.

Standard: F-TF.C Prove and apply trigonometric identities

8 Prove the Pythagorean identity sin2 (θ) + cos2 (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.

9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

Standard: F-BF.B Build new functions from existing functions

4 Find inverse functions

Standard: G-SRT.C Define trigonometric ratios and solve problems involving right triangles

8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems

Standard: G-SRT.D Apply trigonometry to general triangles

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.

10 Prove the Laws of Sines and Cosines and use them to solve problems.

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).

- ***21st Century Life & Career Standards***
  - All curriculum writers/revisionists need to include standards that apply to “Career Readiness, Life Literacies,

and Key Skills". This should include a brief description of the standard and the standard number. Document only those standards and practices that apply to each unit. Use the following link to assist you [see pages of 31-36; 41-42; 53-56 for specific standard #'s and strands]
https://www.state.nj.us/education/cccs/2020/2020%20NJSLS-CLKS.pdf

- 9.4.12.CT.2 Explain the potential benefits of collaborating to enhance critical thinking and problem solving.
- 9.4.12.CI.1 Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
- 9.4.12.TL.3 Analyze the effectiveness of the process and quality of collaborative environments.

- ***Interdisciplinary Content Standards***
  - HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency,wavelength, and speed of waves traveling in various media

- ***NJ Statutes:*** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

  Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

  Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

  LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall

have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: ***https://www.nj.gov/education/amistad/about/***

Diversity and Inclusion: ***https://www.nj.gov/education/standards/dei/index.shtml***

- *(Sample Activities/ Lessons):* ***https://www.nj.gov/education/standards/dei/samples/index.shtml***

Asian American and Pacific Islanders:

- ***Asian American and Pacific Islander Heritage and History in the U.S.***
  A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to cultivate critical thinking skills essential for analyzing periodic phenomena, interpreting data, and making informed decisions across various disciplines.

As aligned with LRHSD Long Term Learning Goal(s):https://www.lrhsd.org/academics/program-of-studies/curriculum

1. Problem-Solving: apply and transfer autonomously and collaboratively mathematical concepts and problem- solving

techniques to unfamiliar, varied and real-world situations
2. Reasoning: reason abstractly and quantitatively by applying mathematical representations, symbols and estimation techniques when engaging in problem-solving
3. Critical Thinking: construct and effectively communicate valid conclusions and critique the reasoning of others
4. Modeling: demonstrate mastery of concepts by evaluating models that others have constructed or by creating appropriate models of their own
5. Tools: identify the correct tools to solve problems, if applicable
6. Precision: determine an answer's appropriateness as a means of determining its validity, while using proper mathematical notation and units
7. Structure: use multiple representations, critical thinking skills, and prior knowledge to solve problems in new situations
8. Patterns: analyze data and recognize patterns in a variety of situations
9. Habits of Mind: approach new situations with curiosity, persistence, resourcefulness, and confidence; take risks, monitor their progress, accept and learn from setbacks, make adjustments, and reflect on their performance.

Enduring Understandings	*Essential Questions*
Students will understand that. . . *EU 1* verifying the correctness of solutions through a variety of methods provides a better understanding of the real-world context. *EU 2* graphs help us describe and interpret real-world phenomena.	● How do trigonometric identities help simplify expressions and reveal relationships between angles and functions? ● How can trigonometric functions be used to model and solve real-world problems involving angles, distances, and periodic phenomena?
Knowledge *Students will know . . .* *EU 1*	*Skills* *Students will be able to. . .* *EU 1*

• degree and radian measurement of an angle are used in different contexts of trigonometry. (F-TF.A.1, 2, 3, G-SRT.C. 8) • trigonometric identities help simplify and verify expressions and reveal relationships between angles and functions. (F-TF.C,8-9) • identities help solve trigonometric equations. (F-TF.C. 8) • the laws of sines and cosines can be used together to solve real-world problems involving triangles. (G-SRT.D. 9, 10, 11) • compositions of trigonometric functions and their inverses can be evaluated with precision. (F-BF.B. 4) *EU 2* • interpreting the key components of the graph of a trigonometric function (amplitude, period, phase shift, and vertical shift) affects the shape and position of the graph. (F-IF.B.4, 5. 7e) • domain restrictions of trigonometric functions are needed to determine the inverse functions. (F-IF.B.5, F-TF.A.7, F-BF.B.4) • the graphs of polar functions in the polar graphing system are used in real life when describing movement or position in terms of angle and distance from a central point. (enrichment) (N-CN.B.4)	• convert given angles between radians and degrees and vice versa. (F-TF.A.1) • determine exact values of trigonometric functions of unit circle angles. (F-TF.A.2,3) • use right triangles to construct trigonometric ratios. (G-SRT.C,8) • construct trig equations to evaluate applications involving angles of elevation, depression and bearing. (G-SRT.C,8) • justify, evaluate and construct sum and difference, half angle, and double angle formulas. (F-TF.C,8-9) • apply Pythagorean, reciprocal, even and odd, and quotient identities to simplify expressions, verify identities and solve trig equations. (F-TF.C, 8-9) • choose law of sines and law of cosines based on given information to solve problems. (G-SRT.D,9-11) *EU 2* • identify and graph period, amplitude, vertical and horizontal shift for all six trigonometric functions. (F-IF.B.4-5, F-IF. C.7e) • formulate the domain and range, in interval notation, of the six trigonometric functions (F-IF.B.4-5, F-IF. C.7e) • analyze the graphs of inverse trig functions. (F-TF.B.7)

Stage Two - Assessment

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Stage Three - Instruction

Learning Plan: **Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer.** *{place A, M and/or T along with the applicable EU number in parentheses after each statement} All knowledge and skills must be addressed in this section with a corresponding lesson/activity which teaches each concept. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection*

For example:

- Discovering Radians Activity (A, M,EU1) https://teacher.desmos.com/activitybuilder/custom/6266d428e368b105211a29de
- Deriving the Unit Circle Foldable (A,M, EU1) Deriving-the-Unit-Circle-Foldable.pdf https://mathequalslove.net/deriving-the-unit-circle-foldable/
- The Alley Oop Challenge (M,T, EU2) https://teacher.desmos.com/activitybuilder/custom/6260232437e60914dc7e3543?collections=5e9f7242c811f40298cac1cf
- Trigonometry Identities Introduction (A, EU1) https://teacher.desmos.com/activitybuilder/custom/61b7413e12999d0a29d9637a
- Law of Sines and Cosines Diorama Activity (T, EU 1) Copy of Shadow Box - Diorama Project for Law of Sines and Cosines.pdf
- Sine Waverunner 3 ACT Math (T, EU2) https://whenmathhappens.com/2016/03/04/sine-waverunner/
- Spaghetti Graphing Activity (T, EU 2) Copy of 1 - Spaghetti Graphing Lab

Suggested Sequence of Learning Activities

- Discovering Radians Activity (A, M,EU1)

- Convert radians to degrees and degrees to radians (A, M, EU 1)
- Find coterminal and reference angles (A, EU1)
- Deriving the Unit Circle Foldable (T, EU1)
- Label special angles in Unit Circle in radians and degrees (A, EU 1)
- Derive the ordered pairs in the Unit Circle using right triangles (M, T EU 1)
- Find all six trig values of any angle in the coordinate plane and unit circle (A, EU 11)
- Find the angle given the trig value (special angles) (A, EU 1)
- Spaghetti Graphing Activity (T, EU2)
- Graph sine and cosine functions (A, EU 2)
- Sine Waverunner 3 ACT Math (T, EU2)
- Graph cosecant and secant (T, EU 2)
- Graph tangent and cotangent (A, EU 2)
- Evaluate inverse trig functions (A, EU 2)
- The Alley Oop Challenge (M,T, EU2)
- Solve right triangle trig word problems involving angle elevation, angle of depression, and bearing angle (M,T, EU 1)
- Trigonometry Identities Introduction linked above (A, EU1)
- Simplify trig expressions (A, EU 1)
- Verify using trig identities (M EU 1)
- Solve trig equations using trig identities (T, EU 1)
- Use sum and difference identities to verify and solve trig equations (A,M,T EU 1)
- Use double angle identities to verify and solve trig equations (A, M, T EU 1)
- Use half angle identities to verify and solve trig equations (A, M, T EU 1)
- Apply Law of Sines to solve oblique triangles (A, M, EU 1)
- Apply Law of Cosines to solve oblique triangles (A, M, EU 1)
- Law of Sines and Cosines Diorama Activity linked above (T, EU 1)
- Plot polar coordinate in the polar graphing system and analyze the graphs of polar functions (enrichment) (A, M, T EU 2)

Pacing Guide

{This chart will be identical in all of the units for this course.}

Unit #	*Title of Unit*	*Approximate # of teaching days*
1	Conics	12
2	Trigonometry	56
3	Functions	57
4	Limits	10

Instructional Materials

TI-Nspire Calculator
DESMOS online graphing calculator and activities
Khan Academy
Kuta Infinite Software

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.
Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.
English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.
Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.
Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.