CURRICULUM MAP for GRADE 11 Math

Algebra II with Trigonometry

ONGOING STANDARD: EFFECTIVE LEARNERS (HOWLs)

Students will consistently demonstrate college readiness and intellectual independence by engaging deeply with course content, being prepared, organizing time and materials, participating in class, and submitting work with attention to deadlines and craftsmanship.

LEARNING TARGETS

Effort, Perseverance, Independence, and Advocacy:
- I approach math with a growth mindset, try each question, and persevere in solving problems.
- I choose to challenge myself.
- I independently use resources (notes, models, charts, previous work, etc.) to help me make progress towards the target.
- I ask peers for help when needed.
- I let my teacher know when I am struggling and take advantage of extra help.
- I use my mistakes to grow as a learner.
- I revise my work when required or recommended.
- I reflect on my progress and areas for improvement.

Preparation:
- I come to class with all necessary materials.
- I arrive at class ready to participate in the class activity.
- I complete my homework on time.
- I am prepared to present work to the class.

Organization & Craftsmanship:
- I meet deadlines on longer assignments.
- I follow rubrics to create quality work.
- My work is clear and easy to read.
- I use labeled models and/or diagrams to represent my thinking, when appropriate.

Engagement and Participation:
- I contribute to small group and whole class discussions and collaborate with peers.
- I actively listen when others are speaking.
- I ask questions when I am confused or curious.
- I use class time effectively and stay on task.
- I contribute to a positive class environment that allows me and my classmates to learn.

ASSESSMENTS
Self-evaluations
Participation tracking
Homework completion
Rates of meeting deadlines
Attendance at extra help
Choice to try exceeding options

ONGOING STANDARD: COMMUNICATORS

MATHEMATICAL PRACTICES: Students can develop the habits and mindsets of mathematicians, communicating how they think through and solve problems.

LEARNING TARGETS

Investigator:
- I look for patterns, make predictions, and form conjectures.
- I try to find and make meaning with math.
- I generate and apply diverse problem solving strategies.
- I test new strategies for mathematical soundness and effectiveness.
- I use tools appropriately, strategically, and with precision.
- I persevere.
- I exercise curiosity (extending problems, posing new problems).

Critical Thinker:
- I compare alternative solutions and representations.
- I formalize and generalize.
- I model with mathematics.
- I use math to understand my community and the world, and seek multiple perspectives.
- I make connections across subject areas, within math, and to the real world.

Communicator:
- I put problems into my own words.
- I use multiple representations (diagrams, graphs, equations, tables, symbols and words) to communicate my thinking.
- I construct logical arguments with proper justification.
- I critique the reasoning of others.
- I attend to precision (notation, units, labels, accurate calculation, diagrams that convey meaning).
- I construct viable arguments and communicate my thinking to others so they understand “how” and “why”.

ASSESSMENTS

Partner/ group grapples
Seminars
Presentations
Reflections
Proofs
Ongoing observation and feedback
Specific assignments to each unit

SEMESTER 1: Trigonometry

COURSE OVERVIEW

The word trigonometry comes from the Greek words for "triangle" and "measure" but can be extended to the study of waves and oscillation. It is a branch of mathematics which grew out of demands from the fields of navigation and astronomy and is now used in robotics, animation, sound engineering, graphics, and neuroscience.

In trigonometry class, students will learn when, why, and how trigonometry can be used to solve practical problems and help us understand the natural world. Students will explore the relationships between the sides and angles of triangles, find missing parts of triangles, find patterns on the unit circle, solve notable historical problems, and use trigonometric functions and transformations to model periodic phenomena.

Students will learn these concepts and skills through class discussion, projects, mini-projects, activities, examples and problem sets. They will demonstrate their understanding through projects, seminars, presentations, quizzes, tests, and other assessments. They will be expected to participate in all daily activities and discussions and complete all homework assigned.

- Unit 1 → Triangle Trigonometry: In this unit, we define trigonometric ratios (sine, cosine, tangent, and their inverses) based on the discovery that by similarity, side ratios in a right triangle are dependent on the acute angles in the triangle.

- Unit 2 → Unit Circle Trigonometry: In this unit, we extend the domain of trigonometric functions using the unit circle. Our understanding of the relationships in the unit circle is built on our knowledge of triangle trigonometry.

- Unit 3 → Trigonometric Function Graphs: In this unit, we use the coordinate plane to graph the y-coordinates of points on the unit circle as a function of their corresponding central angles. Our understanding of trig function graphs is constructed using the unit circle.

Additional topics to explore, if time allows: Apparent Size/ Sectors, Polar Coordinates, Area of a Triangle, Law of Sines, Law of Cosines

Topics for exceeding options: Extensions of class topics, Trigonometric Equations and Identities, Applications to Navigation and Surveying

COURSE STANDARD: Knowledge Builders

Triangle Trigonometry

Students can use trigonometric ratios to solve for missing parts of a right triangle.

GUIDING QUESTIONS:

- ***What are sine, cosine, and tangent? Why does every angle have a unique corresponding ratio?***
- ***How can we use the trig functions to solve for unknown parts of a triangle?***
- *Practically, when would these methods be useful?*
- *What is the minimum information we need in order to figure out missing parts of a triangle?*
- *Why does it have to be a right triangle?*

LEARNING TARGETS	FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS

(MA Frameworks in parens)	(for learning)	(of learning)
● I can find a missing side of a right triangle given the two other sides. ● I can find a missing side of a right triangle given any side and any angle. ● I can find a missing angle of a right triangle given any two sides. ● I identify the appropriate function for any problem involving missing parts of a right triangle based on the information given and desired. ● I can use a trig table or calculator to solve problems. ● I can use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems. ● I can explain and use the relationship between the sine and cosine of complementary angles. (GEO.G-SRT C)	● Triangle on the floor kinesthetic activity ● Do nows ● Problem sets ● Class activities ● Homework ● Exit slips and written responses ● Trig mistakes role reversal ● Stations activity ● Trig table seminar	● Labeling and vocab quiz ● Triangle trig quiz ● Triangle trig Mini-project ● PT proofs presentation ● Create a word problem

Major texts/resources: trig table, word wall / bulletin board reference material, handouts, slideshows, class notes, online interactive websites (including geogebra1 and geogebra2)

Major learning experiences: Triangle on the floor activity, Discovering the ratios (cutting and measuring) activity, mini-project (see below)

Triangle Trig Mini-Project: HOW TALL IS THE SCHOOL?
Use triangle trig to calculate a dimension of something that is impossible to measure directly.

Guiding question: How can we use physical measurement tools, estimation skills, and the tangent function to find a reasonable answer to a tangible problem? How do I know if my answer is within the realm of possibility?

Description: Using an inclinometer, measuring tape, and calculator, students will figure out the height of the school building, flag pole, or tall tree.

COURSE STANDARD: Knowledge Builders

Circle Trigonometry

Students can solve problems based on the unit circle.

GUIDING QUESTIONS:

- ***How and why do the coordinates of a point on the unit circle correspond to its central angle?***
- *How would we need to modify if the circle's radius were not equal to 1?*
- *How does symmetry and repetition aid us in mapping the unit circle?*
- *What is the relationship between the quadrant and the sign of the function?*

LEARNING TARGETS	FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS

(MA Frameworks in parens)	(for learning)	(of learning)
● I can use triangle trigonometry to find the coordinates of points along the unit circle. ● I can use coterminal angles and reference angles to solve problems. ● I know the ratios associated with special angles. ● I can explain why the value and sign of the functions change as the central angle changes. ● I can extend my knowledge of the unit circle to solve problems involving sectors and polar coordinates. (F-TF A)	● Do nows ● Problem sets ● Class activities ● Homework ● Exit slips and written responses ● Unit circle jeopardy ● Unit circle seminar	● Completed Unit Circle ● Unit circle Quiz ● Unit circle Test

Major texts/resources: word wall / bulletin board reference material, handouts, slideshows, class notes, online interactive websites, completed unit circle

Major learning experiences: discovering how to find the coordinates by drawing in the x and y components, folding the unit circle to discover/emphasize the symmetry and relationship between coordinates

COURSE STANDARD: Knowledge Builders

Graphing Trigonometric Functions

Students can graph the parent sine function and variations of it as well as solve problems based on the graphs of trig functions.

GUIDING QUESTIONS:

- *How is the sine graph constructed? Why does it look the way it does?*
- ***How does the unit circle correspond to the graph of y=sinΘ?***
- ***How can it be transformed? How can we sketch variations on the graph of y=sinΘ?***
- *What is the relationship between frequency and period?*
- ***How do we use trigonometry to model the world around us?***

LEARNING TARGETS (MA Frameworks in parens)	FORMATIVE ASSESSMENTS (for learning)	SUMMATIVE ASSESSMENTS (of learning)
● I can use the unit circle to explain the characteristics of the sine, cosine, and tangent graphs. ● I understand how manipulating an equation transforms its graph. ● I can model periodic phenomena with trigonometric functions. I use multiple representations and explain their meaning in context. ● I can apply algebra and statistical regression with trigonometry. (F-TF B)	● Do nows ● Problem sets ● Class activities ● Homework ● Exit slips and written responses ● Spaghetti sine curve ● Sine graph seminar	● Sine graph variations quiz ● Graph paper sine graph ● Ferris Wheel Project ● Daylight Hours Project

Major texts/resources: word wall / bulletin board reference material, handouts, slideshows, class notes, online interactive websites, desmos online graphing software, sine graph reference

Major learning experiences: see projects below

Constructing the Sine Graph Mini-Project: SPAGHETTI SINE CURVE
Use the unit circle to construct the sine curve.

Guiding Question: How do we sketch the graph of y= sin(x)?

Description: Students will use spaghetti to measure the height of various points along a given unit circle (breaking it off to match the height) and will slide the spaghetti over to represent a height on the graph of sin(θ) vs. θ. They will map the y-values for two full rotations around the circle (0 – 720), thus discovering the periodic nature of the sine curve.

Transformations Project: THE FERRIS WHEEL
Apply trig modeling to a hypothetical (perfect) situation.

Guiding Question: How can we graph sine curves that correspond to situations?

Description: Students will graph the height of riders on a ferris wheel as a function of time. They will have to adjust the trajectory for a faster ride, a taller ferris wheel, a larger ferris wheel, a ferris wheel rotating in the opposite direction, and a ferris wheel with a different platform location. They will first draw a diagram of the ferris wheel and insert a right triangle to calculate the height versus time. After coming up with a formula, they will make a table of values and graph the new trajectory. Then they will design and model their own ferris wheel.

Modeling Project: MODELING FLUCTUATIONS IN DAYLIGHT HOURS
Apply trig regression to real life (messy) data.

Guiding Question: How can we use trigonometry to model natural phenomena and answer practical questions about the world?

Description: Students will explore the variation in the number of daylight hours in each day throughout the year for various locations around the world. They will record hours of daylight for 12 different times during a year in a table, make a scatter plot, and come up with a trigonometric equation to describe the relationship between day of the year and daylight hours, using their understanding of amplitude, frequency, period, phase, and midline. They will then fit these data points to a sine curve using regression, and reflect on the accuracy of their predicted equation and explain any differences. They will compare certain aspects of graphs and equations of classmates, make some conjectures about the nature of daylight in different locations around the world, research the astronomical cause of the observed phenomena, and finally describe changes based on latitude. After modeling the data, they will then make calculations and predictions based on trends in the data and using their function.

SEMESTER 2: Algebra II

COURSE OVERVIEW

A function describes a dependent relationship between quantities. Different types of functions, including polynomial functions, can be useful to model real world situations in various fields ranging from chemistry and physics to economics, ecology, and social science. Since functions are central to most fields of modern and applied mathematics, understanding functions is essential to speaking the language of mathematics.

In Algebra 2, students will build on their understanding of linear and quadratic functions from Algebra 1 as well as explore higher order polynomial functions. Students will graph, analyze, and interpret polynomial functions as well as make connections between multiple representations of the functions: graphs, tables, equations, and verbal descriptions. Building on algebraic and geometric concepts, this course will develop advanced algebra skills such as using various methods of finding vertices of parabolas and roots of polynomials, describing their behavior, and solving problems.

SEMESTER 1:

- Unit 1: Quadratic Expressions
- Unit 2: Quadratic Equations
- Unit 3: Quadratic Functions

Additional topics to explore, if time allows: Higher degree polynomial functions

Topics for exceeding options: Advanced Factoring, Extensions with complex numbers, Alternative Multiplication Algorithms, Conic Sections

COURSE STANDARD: Knowledge Builders

Quadratic Expressions

Students can solve problems involving quadratic expressions.

GUIDING QUESTIONS:
How can we multiply and factor algebraic expressions?
How can we represent algebraic multiplication and factoring visually, as area and dimensions?

LEARNING TARGETS (MA Frameworks in parens)	FORMATIVE ASSESSMENTS (for learning)	SUMMATIVE ASSESSMENTS (of learning)
• I can distribute ("FOIL"). • I can factor quadratic expressions. (A-SSE B3a/b; A-REI B4)	• Do nows • Problem sets • Class activities • Homework • Exit slips and written responses	• Quiz • Group poster

Major texts/resources: word wall / bulletin board reference material, handouts, slideshows, class notes, algebra tiles

Major learning experiences: using algebra tiles to represent relationships, operations and quantities visually

COURSE STANDARD: Knowledge Builders

Quadratic Equations

Students can solve problems involving quadratic equations.

GUIDING QUESTIONS:
What are the methods of solving quadratic equations? Why do they work?
How do I choose the best method?

LEARNING TARGETS	FORMATIVE ASSESSMENTS	SUMMATIVE ASSESSMENTS

(MA Frameworks in parens)	(for learning)	(of learning)
● I can solve quadratic equations by factoring. ● I can solve quadratic equations by completing the square. ● I can solve quadratic equations using the quadratic formula. ● I can identify the most appropriate method to solve any given quadratic equation. ● I can solve problems involving imaginary numbers. ● I can explain how and why the discriminant can be used to predict the kind of solution(s). (A-SSE B3a/b; A-REI B4)	● Do nows ● Problem sets ● Class activities ● Homework ● Exit slips and written responses	● Quiz ● Group poster

Major texts/resources: word wall / bulletin board reference material, handouts, slideshows, class notes, algebra tiles

Major learning experiences: discovering the zero product property, using algebra tiles to literally complete the square, deriving the quadratic formula + seminar, synthesizing knowledge in tri-fold comparing and annotating methods side by side, coming up with equations that have given kinds of solutions

COURSE STANDARD: Knowledge Builders

Quadratic Functions

Students can represent quadratic functions.

GUIDING QUESTIONS:
What makes a function “quadratic”?

How do the representations and applications of quadratic functions compare and contrast with those of linear functions?
What information do we need in order to sketch the graph of a parabola?
What do the characteristics of a parabola (roots, vertex, intercepts) or its equation represent?

LEARNING TARGETS (MA Frameworks in parens)	FORMATIVE ASSESSMENTS (for learning)	SUMMATIVE ASSESSMENTS (of learning)
● I can graph a parabola by making a table. ● I understand how manipulating the equation of a parabola will transform its graph. ● I know the 3 forms of a quadratic equation and what each can tell us about its graph. ● I can graph a parabola from an equation in vertex form. ● I can convert an equation into vertex form. ● I can find the intercepts and axis of symmetry from an equation in factored form. ● I can apply quadratic functions to model real life situations. (A-CED A1; F-IF B/C; F-BF A)	● Do nows ● Problem sets ● Class activities ● Homework ● Exit slips and written responses	● Quiz ● Test ● Project ● Group poster

Major texts/resources: word wall / bulletin board reference material, handouts, slideshows, class notes, desmos graphing calculator, desmos class activities

Major learning experiences: applying quadratic functions to a variety of disciplines including sports, business, physics and area e.g. Chicken pen project (modeling and optimizing with quadratic functions)