Unit #3 Graphs of Trigonometric Functions

Content Area: **Mathematics**
Course(s): **Honors Pre-Calculus**
Time Period: **January**
Length: **number of days 30**
Status: **Published**

Unit Overview

This unit will review graphs of trigonometric functions using radian measure, students will also learn about amplitude,period,phase shift and vertical shift. Combination of selected graphs will create compound curves. applications include linear and angular velocity and writing trigonometric equations to model real-life situations. The students will also learn about trigonometric functions and their inverses.

Enduring Understandings

• Patterns, functions and relationships can be represented graphically, numerically, symbollically or verbally.

• Students will understand how to model real-life problems and situations using sinusoidal models, examples waves and heartbeats.

• Students will understand the characteristics of the sine and cosine functions and how to translate those functions by stretching, shrinking, shifting vertically and horizontally

Essential Questions

• How can mathematical models be used to describe physical relationships?

• How do mathematical representations model real-life situations?

• How do you graph trigonometric functions and find the amplitude and period of variation of the sine and cosine graph?

Standards

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.4	Model with mathematics.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.F-LE.B	Interpret expressions for functions in terms of the situation they model
MA.F-TF.A	Extend the domain of trigonometric functions using the unit circle
MA.F-TF.B	Model periodic phenomena with trigonometric functions

Indicators

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.4	Use the unit circle to explain symmetry (odd and even) and periodicity of 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.

Student Learning Objectives

- SWBAT change from radian measure to degree measure and vice versa
- SWBAT find principal values of inverse trigonometric functions
- SWBAT find the amplitude and period for sine and cosine functions
- SWBAT find the area of a sector
- SWBAT find the linear and angular velocity
- SWBAT find the phase shift and vertical translation for sine and cosine functions
- SWBAT graph compound functions
- SWBAT graph inverse functions
- SWBAT graph the remaining four functions and identify their characteristics
- SWBAT model real-world data using harmonic motion
- SWBAT use the graphs of sine and cosine functions
- SWBAT write equations of sine and cosine functions given the amplitude and period

Lesson Titles

- Amplitude and Period of Sine and Cosine Functions
- Angles and Radian Measure
- Angular and Linear Velocity
- Graphing Other Trigonometric Functions
- Graphing Sine and Cosine Functions
- Modeling Real World Data Sinusoidal Functions
- Translations of Sine and Cosine Functions
- Trigonometric Inverses and Their Graphs

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.6	Model integrity, ethical leadership and effective management.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Inter-Disciplinary Connections

LA.RL.11-12.4	Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (e.g., Shakespeare as well as other authors.)
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.RI.11-12.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.WHST.11-12.1.E	Provide a concluding paragraph or section that supports the argument presented.
9-12.HS-ETS1-4.5	Using Mathematics and Computational Thinking

Instructional Strategies/Learning Activities/Levels of Blooms/DOK

- demonstrate 3 models for graphing trig functions, use power point unwrap circle, plot y = sin x, y = cos x, extend both graphs discuss periodic functions and properties

- develop concept of aradian, convert radians to degrees and vice versa, take unit circle and replace degree measure with radians, redo circle,

- explain compound curves set up chart for each example add ordinates, complete graph

- explain phase shift and vertcal translation

- graph sin and cos extend period in both directions, discuss values at selected radians, use graphing calculator, to apply amplitude and period, do selected examples sketch on board, check on calculator

- hand out graphing project instructions, show examples ,explain rubric

- hand out notes on angular and linear velocity, classwork 1-8 on board

- identify amplitude and period andd sketch various sin and cos curves, worksheet from homework for examples

- introduce horology, explain use of clock to find angle of rotation, how far the minute travels, use worksheet for examples

- review conversions, use graphing calculator to check conversions, find arc length, central angle measure and area of a sector, use examples in text, include guided practice

- review homework

- review study guide

- study guide , conversions, arc length, area of a sector, clock arithmetic, angular/linear velocity,geography

- to analize and apply harmonic motion

- to develop and write inverse relations, go over hw, write inverse relations, develop principle value apply, show sketches and discuss properties

- to evaluate inverse trig relations using principle value, go over hw, finish worksheet using calculator and work thru selected examples on combinations,

- to graph tan x, cot x, sec x, csc x, use graphing calculator overhead to graph the remaining 4 functions, analyze characteristics of each one

- to model real-life data with harmonic motion, use practice worksheet to solve 3 different types of word problems, explain strategies, show graphs work thru worksheet, include pendulums, waves, springloaded systems

- to modell real-life data with harmonic motion, go over Bay of fundy assignment, use a power point presentation to show enormous tide fluctuation, worksheet to explain how to write equations for harmonic motion

- tutoring during Delsea One

- use ditto #76 for reinforcement of sketching functions and identifying characteristics, explain phase shift and vertical shift

MODIFICATIONS

ELL Modifications

- 1:1 testing

- Create planned opportunities for interaction between individuals in the classroom: skits, cooperative and collaborative learning, student generated stories based on personal experience

- Digital translators

- Establish a framework allowing ELL students to understand and assimilate new ideas and information

- Intentional scheduling/grouping with student/teacher who speaks the same language if possible

- Offer resources for specific topics in primary language (Youtube web resources)

- Provide formal and informal verbal interaction to provide practice, increase motivation, and self-monitoring

IEP & 504 Modifications

- allowing co-teaching with general education and special education teachers in the same classroom so that the special education teacher can re-teach students with special needs in a different way in a smaller group (pulled to the side)

- allowing student to take notes in class for reinforcement but also providing a copy of completed/correct notes to study from

- for testing - allowing student to correct mistakes or answer wrong questions correctly for additional credit if failed the first test (another way to re-teach material)

• for testing - rewording questions so that there are not higher level vocabulary within the question (you are testing for understanding of the content not the ability to understand the question)

• if not in a co-teaching setting allowing time in the schedule for a special education teacher to consult with general education teachers on what specifically can be modified or how to paraphrase things in a different way specific to that lesson

• math tests could have formula's available on the test and/or sample problems

• providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides

• students could use calculator and/or other math tools (x grids, chips, ect)

• teaching the main ideas/concepts (limiting not needed details)to be taught and repeating them in several different ways over several different days

• tutoring during Delsea One

G & T Modifications

• Ask students' higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning.

• Avoid drill and practice activities.

• Effective questioning techniques (focus on what's important, provide processing time, require higher order thinking

• Encourage students to explore concepts in depth and encourage independent studies or investigations.

• Math- provide additional rigorous challenge problems for advanced students

• Refrain from having them complete more work in the same manner.

At Risk Modifications

• additional help during tutoring/Delsea One/Academic Enrichment

• allowing student to take notes in class for reinforcement but also providing a copy of completed/correct notes to study from

• guided notes and study guides

• modeling and showing lots of examples

• testing modifications and retesting

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessments

Skills-based assessment- math practice

Formative Assessment

- anticipatory set
- closure
- groupwork
- homework
- participation
- pop quizes
- Quiz on graphing sine and cosine functions
- Quiz on Principal Value
- Quiz on radian measure
- teacher observation
- warm up

Summative Assessment

- Alternate Assessment
- benchmark assessment
- graphing project
- Marking period assessment
- midchapter test Graphing Sine and Cosine Functions
- midchapter test Principal value and Inverse trig functions

Resources & Materials

- Advanced Mathematical Concepts Precalculus with Applications textbook
- cooperative learning exploration
- evoke student participation from their seats and at the board
- google classroom
- mathpower4u math videos
- PowerPoint lessons
- Teacher generated worksheets
- Use youtube videos to demonstrate concepts in real-life situations

Technology

- Chromebook
- Desmos graphing calculator
- equatio
- graphing calculator
- Promethean board
- Quizizz

TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.