Unit 06 Polar Coordinates and Complex Numbers

Content Area: **Mathematics**
Course(s): **Trigonometry/Pre-Calculus**
Time Period: **March**
Length: **5 weeks**
Status: **Published**

Unit Overview

This unit introduces polar coordinates and continues concepts of complex numbers. Students will graph polar coordinates and equations, rectangular coordinates and polar forms of linear equations. Students will also investigate and apply complex numbers

Enduring Understandings

- Geometric relationships provide a means to make sense of a variety of phenomena
- Mathematics can give us tools that we can apply to complex problems that involve relationships
- One representation may sometimes be more helpful than another; and used together, multiple representations give a fuller understanding of a problem

Essential Questions

- How do geometric relationships help to solve problems and/or make sense of phenomena?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?
- what is the best solution to a complex problem? How can I know? How can I best defend and comunicate my thinking?

Standards

MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.G-MG.A	Apply geometric concepts in modeling situations

Indicators

MA.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.
MA.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).

Student Learning Objectives

- SWBAT Add, Subtract, multiply and Divide complex numbers
- SWBAT convert between polar and Rectangular coordinates
- SWBAT graph points in the polar coordinate system
- SWBAT graph simple polar equations
- SWBAT to identify and graph polar equations including the classical curves
- SWBAT write the polar form of a linear equation

Lesson Titles

- Graphs of Polar Equations
- Polar and Rectangular Coordinates
- Polar Coordinates
- Polar Form of a Linear Equation
- Simplifying Complex Numbers

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.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

- describe classical curves give examples and equations for each one, use graphing overhead to graph them,
- Desmos activity to investigate polar graphs
- have students work on design project
- polar graphing design project, go over hw, hand out graphing project requirements, give examples, set calculator, explain wow factor,
- polar to rectangular conversions, print out polar design projects, develop conversion formulas for rectangular to polar and reverse,do examples 1-5,
- review homework
- review study guide
- to apply complex numbers, go over hw, devlop imaginary numbers, simplify complex numbers, add,subtract, multiply and divide imaginary numbers, do selected examples from text
- to apply polar form of a linear equation,go over hw, discuss normal form of a line,work thru examples, guided practice
- to convert polar equations into rectangular,go over ws 9-3, classwork work on additional worksheet
- to find polar form of a line, go over hw, review normal form of a linear equation $p = r \cos(\theta - \phi)$, do examples
- to find the distance between 2 polar coordinates,
- to plot and identify polar coordinates and simple equations, go over test,hand out polar paper, do problems on board plot coordinates and draw equations
- tutoring during Delsea One
- use quizizz to review simplifying complex numbers

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
- 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 ELL students with multiple literacy strategies
- Provide formal and informal verbal interaction to provide practice, increase motivation, and self-monitoring

IEP & 504 Modifications

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

Benchmark Assessments

Skill-based assessment - math practice

Alternative Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Formative Assessment

- anticipatory set
- closure
- groupwork
- homework
- participation
- pop quizzes
- quiz on identifying classical curves
- Quiz on plotting polar coordinates
- student boardwork
- warm up

Summative Assessment

- Alternate Assessment
- Benchmark assessment
- Marking Period Assessment
- Midchapter test Polar Coordinates and Complex Numbers
- Polar Design Project

Resources & Materials

- Advanced Mathematical Concepts Precalculus with Applications textbook
- cooperative learning exploration
- evoke student particpation from their seats and at the board
- Google Classroom
- Mathpower4u math videos
- PowerPoint Lessons
- teacher generated worksheets

- Youtube videos to introduce/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.