Unit 02: The Nature of Graphs

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

Unit Overview

This unit reviews the concepts of symmetry of graphs. Students identify and sketch families of graphs that include polynomials, absolute value functions, greatest integer functions, rational functions, and square root functions. Students also find inverses of functions and identify asymptotes associated with rational functions.

Enduring Understandings

- One representation may sometimes be more helpful than another; and used together, multiple representations give a fuller understanding of a problem.
- Shape and area can be conserved during mathematical transformations.
- Understand and perform transformations on commonly used functions.

Essential Questions

- How do you compare and analyze the properties of classes of functions including exponential, polynomial, and rational?
- What do the affects of the various types of transformations have on the original polynomial functions?
- What situations can be analyzed using transformations and symmetry?

Standards

MA.G-CO.A	Experiment with transformations in the plane
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.A-REI.B	Solve equations and inequalities in one variable
MA.F-LE.A	Construct and compare linear and exponential models and solve problems
MA.A-REI.D	Represent and solve equations and inequalities graphically

Indicators

MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.F-IF.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
MA.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.A-REI.D.10	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).
MA.A-REI.D.12	Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.
MA.F-TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

Student Learning Objectives

- SWBAT classify functions as even or odd
- SWBAT determine inverses of relations and functions
- SWBAT determine vertical, horizontal, and slant asymptotes
- SWBAT graph functions and their inverses
- SWBAT graph polynomial, absolute value, and radical inequalities
- SWBAT graph rational functions
- SWBAT identify transformations of simple graphs
- SWBAT sketch graphs of related functions
- SWBAT solve absolute value inequalities
- SWBAT use algebraic tests to determine whether the graph of a relation is symmetrical

Lesson Titles

- Continuity and End Behavior
- Critical Points and Extrema
- Families of Graphs
- Graphs of Nonlinear Inequalities
- Graphs of Rational Functions
- Inverse Functions and Relations
- Symmetry and Coordinate 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.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

- Algebraically determine even/odd functions and describe graphically even/odd functions
- Algebraically develop inverses
- Demonstrate how to complete graphs by using symmetry
- Demonstrate how to to translate, reflect, and dilate
- Desmos Activity on exploring parent graphs and their transformations
- Determine if inverse is still a function
- Explain reflections, translations and dilations
- Graphically sketch inverses
- Group activity
- Guided Practice
- Homework Review
- Identify asymptotes algebraically as well as graphically using the table function on the graphing calculator
- Independent Practice
- List parent graphs using pg. 137
- Notes and examples will be completed together

- Notes will be given and examples done together and then independently on how to determine types of asymptotes including horizontal and vertical
- Pair and share activity
- Set up and list types of symmetry include x axis, y-axis, y = x, y = -x
- Student volunteers will place answers on the board with explanations
- Students will complete a worksheet that reinforces how to find slant asymptotes using long or synthetic division, then they will verify results using the graphing calculator
- tutoring during Delsea One
- Use long division to find equations representing slant asymptotes

MODIFICATIONS

ELL Modfications

- 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 support as ELL students move through all levels of language acquisition: scaffold learning, processing time, as well as other modifications mentioned above

IEP & 504 Modifications

- 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
- 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)
- 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
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- 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.
- 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
- speaking to students privately when redirecting behaviors
- testing modifications

Benchmark Assessments

Skill-based assessments - math practice

Alternative Assessments

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Formative Assessment

- Anticipatory Set

- Closure
- Group Work
- Guided Practice
- Homework
- Mini Quiz-Immediate Feedback
- Observation
- Oral Responses
- Quiz on Families of Graphs
- Warm Up

Summative Assessment

- Alternate Assessment
- Benchmark assessment
- Marking Period Assessment
- Mid-Chapter Test Families of Graphs

Resources & Materials

- Advanced Mathematical Concepts Textbook
- amc.glencoe.com
- Cooperative learning exploration
- Google Classroom
- Mathpower4u math videos
- Power Point
- 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.