Unit 1 Polynomial and Rational Functions

Content Area: **Mathematics**
Course(s):
Time Period: **September**
Length: **8 weeks**
Status: **Published**

Unit Overview:

In Unit 1, students develop understanding of two key function concepts while exploring polynomial and rational functions. The first concept is covariation, or how output values change in tandem with changing input values. The second concept is rates of change, including average rate of change, rate of change at a point, and changing rates of change. The central idea of a function as a rule for relating two simultaneously changing sets of values provides students with a vital tool that has many applications, in nature, human society, and business and industry. For example, the idea of crop yield increasing but at a decreasing rate or the efficacy of a medicine decreasing but at an increasing rate are important understandings that inform critical decisions.

Enduring Understandings:

- Relations and functions can be represented numerically, graphically, algebraically, and/or verbally.
- The characteristics of rational functions and their representations are useful in solving real-world problems
- The properties of functions and function operations are used to model and analyze real-world applications and quantitative relationships.

Career Education Connection

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Essential Questions:

- How can I use data and graphs to figure out the best time to purchase event tickets?
- How can we adjust known projectile motion models to account for changes in conditions?
- How do we model the intensity of light from its source?

Standards/Indicators/Student Learning Objectives (SLOs):

MA.F-IF.A	Understand the concept of a function and use function notation
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
MA.F-IF.B.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.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
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.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
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.F-IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.F-BF.A	Build a function that models a relationship between two quantities
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-LE.A	Construct and compare linear and exponential models and solve problems

Lesson Titles:

- 1.1 Change in Tandem
- 1.10 Rational Functions and Holes
- 1.11 Equivalent Representations of Polynomial and Rational Expressions
- 1.12 Transformations of Functions
- 1.13 Function Model Selection and Assumption Articulation
- 1.14 Function Model Construction and Application
- 1.2 Rates of Change
- 1.3 Rates of Change in Linear and Quadratic Functions
- 1.4 Polynomial Functions and Rates of Change
- 1.5 Polynomial Functions and Complex Zeros
- 1.6 Polynomial Functions and End Behavior

- 1.7 Rational Functions and End Behavior
- 1.8 Rational Functions and Zeros
- 1.9 Rational Functions and Vertical Asymptotes

Career Readiness, Life Literacies, & Key Skills:

WRK.9.2.12.CAP.4	Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
WRK.9.2.12.CAP.5	Assess and modify a personal plan to support current interests and post-secondary plans.

Computer Science and Design Thinking Standards

CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.CS.2	Model interactions between application software, system software, and hardware.

Assessments

Summative Assessment:

- Alternate Assessment
- Benchmark
- Marking Period Assessment
- Sample AP Test

Benchmark Assessments

Writing Prompt

Skills Based Assessment

Reading Response

Alternative Assessment

Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Portfolios

Formative Assessment:

- Anticipatory Set
- Closure
- Warm-Up

Inter-Disciplinary Connections:

9-12.HS-ETS1-4.5.1	Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems.
9-12.HS-ETS1-2.6.1	Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Diversity, Equity, and Inclusion

Amistad Mandate

Topic:

Materials Used:

Addresses the Following Component of the Mandate:

- African Slave Trade
- Amistad
- Contributions of African Americans to our Society
- Slavery in America
- Vestiges of Slavery in this Country

Holocaust Mandate

Topic:

Materials Used:

Addresses the Following Component of the Mandate:

- Bias
- Bigotry
- Bullying
- Holocaust Studies
- Prejudice

LGBTQ and Disabilities Mandate

Topic (Person and Contribution Addresses):

Materials Used:

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Climate Change

Students analyze the melting of the polar ice caps and its effects on the Earth and humanity

How fast are the polar ice caps melting, and why is this rate important to human life on Earth?

What type of function is best to predict the rate of melting of the polar ice caps?

Asian American Pacific Islander Mandate

Topic (Person and Contribution Addresses):

Materials Used:

Addresses the Following Component of the Mandate:

- Economic
- Political
- Social

Materials:

Core Instructional Materials

- AP Classroom
- Course and Exam Description Book

Supplemental Materials

- Bryan Passwater Materials
- Calc Medic
- Collegeboard
- Flamingo Math
- Flipped Math

Texts at Various Levels

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Analysis of Graphs
- Circuits
- Define Change of Tandem
- Define end behavior
- Define holes and asymptotes
- Define Rates of Change
- Demonstrate how to find holes
- Demonstrate how to find horizontal asymptote(s)
- Demonstrate how to find the end behavior of Polynomial functions
- Demonstrate how to find the end behavior of rational functions
- Demonstrate how to find vertical asymptote(s)
- Demonstrate Transformations of Functions using RST method
- Discuss and show students samples Unit 1 free response questions are scored
- Intro how to find Rates of Change of linear functions
- Intro how to find Rates of Change of Polynomial functions
- Intro how to find Rates of Change of quadratic functions
- Piecewise Function Lesson - intro and practice
- Progress checks in AP Classroom
- Provide group work activity
- Provide individual activity
- Provide real world examples
- Review homework
- Review Vocabulary of this Unit
- Students will work in groups on the Vertical White Boards
- Thin slicing activity on white board
- Work through sample AP multiple choice questions
- Work through sample AP Unit 1 free response questions

Modifications

MLL Modifications:

- Choice of test format (multiple-choice, essay, true-false)
- Continue practicing vocabulary
- Provide study guides prior to tests
- Read directions to the student

- Read test passages aloud (for comprehension assessment)
- Vary test formats

G&T Modifications:

- Alternate assignments/enrichment assignments
- Enrichment projects
- Extension activities
- Higher-level cooperative learning activities
- Pairing direct instruction with coaching to promote self-directed learning
- Provide higher-order questioning and discussion opportunities
- Provide texts at a higher reading level
- Tiered assignments
- Tiered centers

At Risk Modifications

The possible list of modifications/accommodations identified for Special Education students can be utilized for At-Risk students. Teachers should utilize ongoing methods to provide instruction, assess student needs, and utilize modifications specific to the needs of individual students. In addition, the following may be considered:

- Additional time for assignments
- Adjusted assignment timelines
- Agenda book and checklists
- Answers to be dictated
- Assistance in maintaining uncluttered space
- Books on tape
- Concrete examples
- Extra visual and verbal cues and prompts
- Follow a routine/schedule
- Graphic organizers
- Have students restate information
- No penalty for spelling errors or sloppy handwriting
- Peer or scribe note-taking
- Personalized examples
- Preferential seating
- Provision of notes or outlines
- Reduction of distractions
- Review of directions

- Review sessions
- Space for movement or breaks
- Support auditory presentations with visuals
- Teach time management skills
- Use of a study carrel
- Use of mnemonics
- Varied reinforcement procedures
- Work in progress check

IEP & 504 Modifications:

*All teachers of students with special needs must review each student's IEP. Teachers must then select the appropriate modifications and/or accommodations necessary to enable the student to appropriately progress in the general curriculum.

Possible Modifications/Accommodations: (See listed items below):

- Allow for redos/retakes
- Assign fewer problems at one time (e.g., assign only odds or evens)
- Differentiated center-based small group instruction
- Extra time on assessments
- Highlight key directions
- If a manipulative is used during instruction, allow its use on a test
- Opportunities for cooperative partner work
- Provide reteach pages if necessary
- Provide several ways to solve a problem if possible
- Provide visual aids and anchor charts
- Test in alternative site
- Tiered lessons and assignments
- Use of a graphic organizer
- Use of concrete materials and objects (manipulatives)
- Use of word processor

Technology Materials and Standards

- AP Classroom site
- Calc Medic videos
- Flipped Math videos
- Google Classroom
- Google Slides
- Graphing Calculator

- IXL

TECH.8.1.12.A.3	Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.F.1	Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.1.12.F.CS4	Use multiple processes and diverse perspectives to explore alternative solutions.