# Unit 2: Polynomial and Rational Functions

Content Area: **Math**
Course(s):
Time Period:
Length: **20 Days**
Status: **Published**

## State Mandated Topics Addressed in this Unit

| State Mandated Topics Addressed in this Unit | |
|---|---|
| N/A | N/A |

## Polynomial and Rational Functions

## Learning Objectives

- (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
- (+) Graph trigonometric functions, showing period, midline, and amplitude.
- (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression
- Add, subtract, multiply, and divide rational expressions.
- Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x)
- Find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations.
- 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.
- Graph exponential and logarithmic functions, showing intercepts and end behavior.
- Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.★
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- Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct

a rough graph of the function defined by the polynomial.

- Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.★
- Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.★
- Rewrite simple rational expressions in different forms; write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

## Essential Skills

- *Include f(x) & g(x) that are linear, polynomial, rational, absolute value, exponential, and logarithmic*
- Explain why the solution of f(x)=g(x) is the x coordinate of their intersection.
- Find the solutions approximately using technology to graph the function or create a table of values.
- Graph complicated functions using technology.
- Graph exponential & logarithmic functions showing intercepts and end behavior.
- Graph rational functions using asymptotes, holes, intercepts, and end behavior.
- Graph simple functions by hand showing key features of the graph.
- Graph square roots, cube root, absolute value, and piecewise functions showing key features of the graph.
- Graph trigonometric functions showing period, midline, and amplitude
- Identify zeros of polynomials using factoring.
- Interpret key features from a graph or a table of values.
- Key features include intercepts and extrema.
- Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
- Perform operations on rational expressions.
- Rewrite rational expressions in different forms.
- Sketch a graph using the key features of a function.
- Use inspections, long division, or synthetic division or CAS to rewrite rational expression.
- Use the zeros to construct a rough graph of a polynomial function.

## Standards

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| MATH.9-12.A.APR.B.3 | Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. |
| MATH.9-12.A.APR.D.6 | Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x)$ + $r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system. |
| MATH.9-12.A.APR.D.7 | Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational |

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| | expression; add, subtract, multiply, and divide rational expressions. |
| MATH.9-12.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.<br><br>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity. |
| MATH.9-12.F.IF.C.7.b | Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. |
| MATH.9-12.F.IF.C.7.d | Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. |
| MATH.9-12.F.IF.C.7.e | Graph exponential and logarithmic functions, showing intercepts and end behavior. |
| MATH.9-12.F.IF.C.7.f | Graph trigonometric functions, showing period, midline, and amplitude. |
| MATH.9-12.A.REI.D.11 | Explain why the $x$-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. |

## Instructional Tasks/Activities

- Topic #7: Simplifying Rational Expressions
- Lab: Exploration of the Values of Terms in a Polynomial
- Lab: Polynomials Discovery
- Topic #1: Factoring Polynomials Review
- Topic #10: Solving Rational Equations
- Topic #11: Applications of Rational Equations
- Topic #12: Graphing Rational Equations
- Topic #2: Dividing Polynomials
- Topic #3: Polynomial Functions
- Topic #4: Analyzing Graphs and Tables of Polynomials
- Topic #5: Zeros and Roots of Polynomial Functions
- Topic #6: Writing Polynomials from its Zeros
- Topic #8: Multiplying and Dividing Rational Expressions
- Topic #9: Adding and Subtracting Rational Expressions

## Assessment Procedure

- Class Discussions
- Classroom Total Participation Technique
- Classwork/homework
- Compare/Contrast Journals

- DBQ
- Electronic Active Responders
- Essay
- Exit Ticket/Entrance Ticket/Do Now
- Identify the Error Problems
- Journal / Student Reflection
- Kahoot
- Other named in lesson
- Peer Review
- Performance
- Problem Correction
- Project
- Quiz
- Quizzes/Tests
- Response and Analysis Questions
- Rubric
- Teacher Collected Data
- Teacher Observations
- Test
- Worksheet

## Recommended Technology Activities

- TI-Nspire CX-Cas activities throughout the unit as appropriate
- Appropriate Content Specific Online Resource
- Chromebook
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Desmos
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Forms
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson

- Quiziz
- Screencastify

## Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

## Special Education

- 1. Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)
- 2. Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- 3. Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- 4. Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- 5. Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

## Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share
- Tutorial Groups

## Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time

- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

## Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

## Honors Modifications

In this unit, honors students will be expected to move at a faster pace and students will have the expectation of analyzing and solving much higher level problems.

## Resources

- http://www.corestandards.org/the-standards/mathematics
- https://njctl.org/courses/math/pre-calculus/
- Infinite Pre-calculus

- www.geogebra.org