Unit 3 - Polynomial Expressions and Equations (Expressions and Equations)

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **Full Year**
Status: **Published**

Unit Overview

In this unit students will begin working with polynomials. After classifying and evaluating polynomial expressions, students will perform the basic operations such as adding, subtracting, and multiplying two or more polynomials. Students will also being to manipulate expressions using factoring, completing the square and properties of exponents to produce equivalent forms that highlight particular properties such as the zeros or the solutions of the function.

Enduring Understandings

Algebraic and numeric procedures are interconnected and build on one another to produce a coherent whole.
Rules of arithmetic and algebra can be used to transform and manipulate equations and inequalities so solutions can be found to solve problems.
Quadratic equations can be solved by a variety of methods including graphing, taking square roots, factoring, or using the quadratic formula.
Quadratic functions can model real-world situations such as falling objects, vertical motion, and area.

Essential Questions

What are the characteristics of quadratic functions?
How can we model real world situations using quadratics?
How are the properties of real numbers related to polynomials?
Can two algebraic expressions that appear to be different be equivalent?
What different methods can be used to solve quadratic equations?
How many solutions does a quadratic have?

Learning Objectives

Be able to describe and identify monomials, polynomials, and degrees.
Be able to perform arithmetic operations with polynomials.
Be able to factor recognize and factor monomials out of a polynomial.
Be able to factor quadratic equations.
Be able to solve equations using factoring, completing the square and the quadratic formula.

Standards: Content

A.APR.A	Perform arithmetic operations on polynomials
N.RN.A	Extend the properties of exponents to rational exponents
N.RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
A.APR.A.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
N.RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
N.Q.A	Reason quantitatively and use units to solve problems
N.Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
N.Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
N.Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
F.BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k(both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
A.CED.A	Create equations that describe numbers or relationships
A.CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
A.CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
A.CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
F.IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
A.REI.B	Solve equations and inequalities in one variable
A.REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.B.4	Solve quadratic equations in one variable.
A.REI.B.4.a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
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.
F.IF.C.7.a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
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.
A.SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
A.SSE.A.1.a	Interpret parts of an expression, such as terms, factors, and coefficients.
F.LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.
A.SSE.A.2	Use the structure of an expression to identify ways to rewrite it.
F.LE.A.1.a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
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).
A.SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
F.LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
A.SSE.B.3.a	Factor a quadratic expression to reveal the zeros of the function it defines.

Standards: Interdisciplinary

9.1.8.CDM.4	Evaluate the application process for different types of loans (e.g., credit card, mortgage, student loans).
9.1.8.CP.1	Compare prices for the same goods or services.
8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.4	Transform data to remove errors and improve the accuracy of the data for analysis.
8.1.8.DA.5	Test, analyze, and refine computational models.
8.1.8.AP.1	Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode.
8.1.8.AP.2	Create clearly named variables that represent different data types and perform operations on their values.

Assessment Evidence

Formative	Collaborative Activities, Homework, Classwork, Discussion, Independent Class Assignment, Informal Observations of Students, Games, Exit Slips, Pre-Assessments, Math Message – Warm up, Questioning, Teacher Made Pages, Learning Centers, LinkIt, Problem of the Day, Problem of the Week, Entrance Slips, Pre-Assessments
Summative	LinkIt Benchmark Assessments, Tests, Pre-Assessments, Quizzes, Written Responses
Alternative & Benchmark	Alternative – Reteaching, One on One Conferencing, Learning Centers, Levels Homework, Higher Order Thinking Problems, Additional leveled practice Benchmark - LinkIt Benchmark Assessments, Totowa TPA
Assessment Evidence Resource	

Instructional Resources

Smartboard, Computers, iPads, websites and digital interactives/models, multi-media presentations, video streaming, Brain Pop, Microsoft 365, Primary and Secondary Source Documents, Assorted Manipulatives, Khan Academy, Crosswalk Coach for the Common Core Standards, Ready Common Core Mathematics Instruction and Practice, Common Core Coach, Calculators, Reveal Math Resources.

Instructional Resource List

Curricular Mandates

Below are the curricular requirements as defined in NJ Administrative Code and Statute

	Amistad		Diversity, Equity, and Inclusion
	Holocaust		LGBT and Disabilities (Grades 6-12)
	Climate Change		Asian American & Pacific Islander

Social Emotional Learning (SEL) Competencies

NJ Social and Emotional Learning Competencies & Sub-Competencies

	Self-Awareness	X	Relationship Skills
X	Responsible Decision-Making		Social Awareness
X	Self-Management		

21st Century Skills & Themes

	Global and Cultural Awareness	X	Technology Literacy		Planning and Budgeting

X	Creativity and Innovation		Financial Institutions		Risk Management and Insurance
X	Information and Media Literacy		Digital Citizenship		Economic and Government Influences
	Critical Thinking and Problem Solving		Credit Profile		Career Awareness and Planning
	Civic Financial Responsibility		Financial Psychology		