Unit 3 - Expressions and Equations

Content Area: **Mathematics**
Course(s): **Honors Algebra I 8**
Time Period: **January**
Length: **1**
Status: **Published**

Unit Overview

The standards included in unit 3 blend the conceptual understandings of expressions and equations with procedural fluency and problem solving. The students will not encounter solutions of quadratic equations that are complex.

In this unit students will learn how to factor a variety of polynomials

In this unit students will learn how to manipulate variables with exponents

It is important to the study of math for students to be able to use the language of Algebra in a natural way to express mathematical ideas.

Simplifying polynomials and finding the quotient of monomials make algebraic expressions easier to work with, making complex higher-math problems more comprehensible and manageable.

Students need to be able to find and factor out a greatest common factor.

Students need to be able to factor a polynomial into a product of two binomials.

Students need to be able to check their answer using FOIL multiplication.

Students need to be able to manipulate polynomials and work with exponents.

Enduring Understandings

- Identify when the quadratic formula gives complex solutions.
- Represent a quantity in terms of an expression, such as terms, factors, and coefficients by viewing one or more of their parts as a single entity.
- Understand the relationship between quantities of two or more variables through graphing on a coordinate plane system.
- A quadratic function can be factored by breaking it down into two binomials in parentheses, or by removing the greatest common factor.
- Apply rules so that polynomials form a system analogous to integers.
- Factoring is essential to solving quadratic equations.
- Represent equations and inequalities in one variable in various ways and use them to solve problems.
- Solve systems of linear equations in two variables algebraically and graphically.
- There are simple rules for multiplying and dividing exponential expressions. When adding and subtracting monomials, you can only combine like terms.

- Transform quadratic equations using the method of completing the square to derive a solution.
- Working with polynomials is an essential algebra skill.
- Write in equivalent forms to find solutions that reveal and explain properties of quadratic expressions from completing the square, factoring, and using properties of exponents.

Essential Questions

- How are exponential functions used in real life?
- How are the laws of exponents applied in solving real-world problems?
- How are the methods of solving a quadratic equation related?
- How can factoring help us to solve equations?
- How can the GCF for a set of monomials and integers be found?
- How can the properties of exponents be extended to rational exponents?
- How do students know which is the most efficient ways to solve a quadratic equation?
- How do you graph exponential functions?
- How do you solve quadratic equations?
- What is the quadratic formula and how is it used to solve quadratic equations?
- What must students understand in order to create equations that describe numbers or relationships?
- Why are the methods of solving quadratic equations not learned in isolation?
- Why is it important to solve and produce equivalent forms of an expression?
- How can an exponential expression be simplified?
- How can equations be solved for different variables?
- How can equations involving the addition and subtraction of polynomials be simplified and solved?
- How can general quadratic trinomials be factored?
- How can problems be solved by factoring quadratic equations?
- How can students analyze algebraic equations/inequalities to solve problems?
- How do students know when the roots of a quadratic equation are real or complex?
- How do students know which method to use in solving quadratic equations?
- How do you graph quadratic functions?
- How do you perform operations on polynomials?
- What is the importance of identifying the structure of an expression and ways to rewrite it?
- When is completing the square useful to reveal the maximum or minimum value of the function it defines?
- When is factoring the best method to solve a quadratic equation?
- Why is it important to know the operations of integers to understand the properties of polynomials?
- Why is it important to understand solving a system of linear and quadratic equations in two variables algebraically and graphically?

Student Learning Objectives (SLOs)

- Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, simple rational and exponential functions and highlighting a quantity of interest in a formula.
- Create linear and quadratic equations that represent a relationship between two or more variables. Graph equations on the coordinate axes with labels and scale.
- Derive the quadratic formula by completing the square and recognize when there are no real solutions.
- Interpret parts of expressions in terms of context including those that represent square and cube roots; use the structure of an expression to identify ways to rewrite it.
- 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 maximum or minimum value of the function.
- Perform addition, subtraction and multiplication with polynomials and relate it to arithmetic operations with integers.
- Solve quadratic equations in one variable using a variety of methods [including inspection (e.g. x2 = 81), factoring, completing the square, and the quadratic formula].
- Write linear and exponential functions (e.g. growth/decay and arithmetic and geometric sequences) from graphs, tables, or a description of the relationship, recursively and with an explicit formula, and describe how quantities increase linearly and exponentially over equal intervals.

Standards/Indicators

MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.A-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.
MA.K-12.5	Use appropriate tools strategically.
MA.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.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.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.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.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.
MA.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
MA.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in

	solving equations.
MA.A-REI.B.4	Solve quadratic equations in one variable.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

Lesson Titles

- Adding and Subtracting Polynomials
- Differences of Two Squares
- Differences of Two Squares
- Dividing Monomials
- Exponents
- Factoring by Grouping
- Factoring Patterns
- Factoring Patterns (for all c)
- Monomial Factors of Polynomials
- Multiplying Monomials
- Multiplying Polynomials
- Multipying Polynomials by Monomials
- Negative Exponents
- Powers of Monomials
- Rate-Time-Distance Problems
- Scientific Notation
- Solving Equations by Factoring
- Squares of Binomials
- Tranforming Formulas
- Using Factoring to Solve Problems
- Using Several Methods of Factoring

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.1	Act as a responsible and contributing community members and employee.
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

Science

Social studies

Language arts

Health/ Physical education

Music

LA.RL.8	Reading Literature
LA.RH.6-8.1	Cite specific textual evidence to support analysis of primary and secondary sources.
LA.RH.6-8.5	Describe how a text presents information (e.g., sequentially, comparatively, causally).
LA.RH.6-8.7	Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
	Vocabulary Acquisition and Use
HPE.2.1.8	All students will acquire health promotion concepts and skills to support a healthy, active lifestyle.
HPE.2.1.8.A	Personal Growth and Development
SCI.7-8.5.1.8	All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
SOC.6.1.8	U.S. History: America in the World: All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.

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

- Adding and subtracting polynomials Draw a series of pictures to represent addition or subtraction problems then have a partner write the variable expression and then solve the problem.
- Apply operations with polynomials to find area and perimeter
- Apply the rules of exponents and distributive property to multiply polynomials
- Factor perfect square trinomials

- Factor polynomials completely
- Factor trinomials
- Factor using the difference of two squares
- Formulate solutions to real world quadratic problems
- Manipulate standard formulas (area, Perimeter, distance etc) to be solved for different variables. See how this can make solving word problems easier.
- Multiplying a polynomial by a monomial
- Multiplying polynomials
- Recognizing problems that do not have solutions
- Simplify expressions with exponents
- Solve open ended questions dealing with factoring and quadratics
- Solve quadratic equations by graphing Graph quadratic equations on Big paper with a partner; discuss results as a class to make connections with graphs and solutions
- Solve quadratic equations using quadratic formula
- Solve quadratic expressions
- Solving quadratic equations involving area and perimeter
- Solving uniform motion problems Have students write their own D = RT problem and pass to a partner to solve
- Students will be able to compare and contrast the various methods of solving a quadratic equation.
- Students will be able to read a word problem and identify the language need to create an algebraic representation in order to solve the problem.
- Transforming formulas
- Use GCF and prime factorization

Modifications

ELL Modifications

Content specific vocabulary important for ELL students to understand include:

Expression, equation, coefficient, constant, inverse, opposite, combine, distribute, solution, infinite, each, every, per, altogether, fractions, numerator, denominator, least common denominator (LCD), cross simplify

- reducing or omitting lengthy outside reading assignments
- allowing the use of note cards or open-book during testing
- Content specific vocabulary important for ELL students to understand include: Expression, equation, coefficient, constant, inverse, opposite, combine, distribute, solution, infinite, each, every, per, altogether, fractions, numerator, denominator, least common denominator (LCD), cross simplify
- decreasing the amount of workpresented or required

- Digital translators
- Graphic Organizers
- modify assessments
- repeat, reword, clarify
- teaching key aspects of a topic
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

IEP & 504 Modifications

- allow students to correct errors for additional credit
- break larger assignments into smaller sections
- Draw a large vertical line through the equal sign in a multi-step equation to represent a"wall" that students must use inverse operations in order to move a term to the other side of the "wall"
- Have students use technology, such as graphing calculator, graphing apps, and other software to graph both a linear function and quadratic function on the same plane.
- less questions per page
- make formulas available
- model/show lots of examples
- Provide personal handout for integer rules
- reduce homework length to most important for review
- reducing the number of answer choices on a multiple choice test

G&T Modifications

- avoid drill and practice
- Create a real world problem where factoring is the best method to solve a quadratic expression. Have students apply their math knowledge of quadratic equations to solve a word problem they have created.
- Provide additional rigorous challenge problems
- Take students through the process of designing word problems involving quadratic equations and functions. Have students write a scenario and explain the process needed to solve a system of linear and quadratic equations with two variables.
- Provide the students with a problem (either quadratic equation or system of linear equations), ask them to solve it by different methods (for system: algebraic methods – elimination, substitution, addition, etc. and graphing; for quadratics – factoring, completing by square, quadratic formula, graphing), then have them write an explanation of which method was most relevant to the problem type

At Risk Modifications

- additional help during Academic Enrichment
- allow student to correct errors for partial credit
- reduce homework length

- Review, restate, reword directions
- study guides
- testing modifications

Formative Assessment

- 5 Questions
- challenge problem
- current events
- math history
- Pair share
- relate to prior knowledge
- senteo
- Stand up
- Thumbs up
- video clips

Summative Assessment

- Quiz - Factoring
- Quiz - Factoring to Solve Word Problems
- Quiz - Powers of Monomials and Polynomials
- Unit Test - Factoring Polynomials to solve problems

Alternative Assessments

Performance tasks
Project-based assignments
Problem-based assignments
Presentations

Benchmark Assessments

Skills-based assessment- math practice

Resources & Materials

- Multimedia clips
- PMI - Expressions and Equations
- PMI - Polynomials
- Structure and Method Book 1

Technology

- Chromebook
- desmos.com
- Difference of squares https://www.youtube.com/watch?v=0yBDsZvfT0g
- Equatio
- Factoring a perfect square https://www.youtube.com/watch?v=1_kxLXFtqHg
- Factoring https://www.youtube.com/watch?v=6SACul2TFEM
- Factoring https://www.youtube.com/watch?v=ghwtmpSvm9w
- Factoring with common factors https://www.youtube.com/watch?v=hMAImz2BuPc
- https://www.youtube.com/watch?v=IgDlSSMVo9o
- Interactive Promethean Board
- IXL
- MathXL
- peardeck
- PMI - Expressions and Equations
- PMI - Factoring

TECH.8.1.8	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools.
TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.
TECH.8.2.8	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.