Mathematics II, Semester A

Credits: 0.5

Course Overview and Goals

Mathematics II, Semester A, is a single-semester course designed to present mathematics as a coherent, useful, and logical subject that makes use of problem-solving skills. The focus is on quadratic expressions, equations, and functions. You will compare their characteristics and behavior to those of linear and exponential relationships and solve quadratic equations that have real and complex solutions. Finally, you will investigate and prove theorems about lines, angles, and triangles.

By the end of this course, you will be able to do the following:

- Determine the sums, differences, and products of polynomials.
- Apply factoring techniques and distribution to rewrite quadratic expressions.
- Rewrite and simplify expressions with radicals and rational exponents.
- Solve quadratic equations in one variable by inspection, taking square roots, factoring, completing the square, and using the quadratic formula.
- Graph and transform quadratic functions on the coordinate plane.
- Solve systems of linear and quadratic equations graphically and algebraically.
- Identify and apply a quadratic data model to make predictions and solve problems.
- Write and apply exponential functions to model situations in the real world.
- Identify and analyze key features of piecewise and absolute value functions.
- Prove geometric theorems using a variety of proof methods.

Scope and Sequence

This document outlines the design of Mathematics II, Semester A, as well as the coverage of the Common Core State Standards: Mathematics within the course.

Common Core State Standards: Mathematics

UNIT 1: POLYNOMIAL EXPRESSIONS (DAYS 1 – 14)

In this unit, you will develop the tools you need to solve and model complex problems using polynomials.

Lesson/*CCSS Standards*	Lesson Objective
Syllabus and Orientation	Review the Student Orientation and Course Syllabus at the beginning of this course.
Properties of Exponents *CCSS.Math.Practice.MP.2,* *CCSS.Math.Practice.MP.7*	Use the laws of exponents to rewrite monomial expressions and ratios of monomial expressions.
Adding and Subtracting Polynomials *CCSS.Math.Practice.MP.7,* *CCSS.Math.Content.HSA-APR.A.1*	Determine sums and differences of polynomials.
Multiplying Polynomials *CCSS.Math.Practice.MP.4,* *CCSS.Math.Content.HSA-APR.A.1*	Determine the products of polynomials.
Clarifying Big Ideas: Variables	Explore the different ways variables can be used.
Factoring Polynomials, Part 1 *CCSS.Math.Practice.MP.7,* *CCSS.Math.Content.HSA-APR.A.1,* *CCSS.Math.Content.HSA-SSE.A.2,* *CCSS.Math.Content.HSA-SSE.B.3.a*	Apply factoring techniques and distribution to rewrite quadratic expressions.
Factoring Polynomials, Part 2 *CCSS.Math.Practice.MP.7,* *CCSS.Math.Content.HSA-SSE.A.2,* *CCSS.Math.Content.HSA-SSE.B.3.a*	Apply factoring techniques and distribution to rewrite quadratic expressions.

UNIT 2: EXTENDING THE NUMBER SYSTEM (DAYS 15 – 25)

In this unit, you will explore the properties of exponents, radicals, and complex numbers and use them to rewrite and simplify expressions.

Lesson/*CCSS Standards*	Lesson Objective
Performing Operations on Radicals *CCSS.Math.Practice.MP.2,* *CCSS.Math.Practice.MP.7*	Use mathematical operations to rewrite radical expressions.
Clarifying Big Ideas: Algebra and Reasoning	Consider ways to justify solutions. Explore the difference between showing a procedure and showing your thinking.
Radicals and Exponents *CCSS.Math.Practice.MP.2,* *CCSS.Math.Practice.MP.3,* *CCSS.Math.Practice.MP.7,* *CCSS.Math.Content.HSN-RN.A.1,* *CCSS.Math.Content.HSN-RN.A.2*	Use the laws of exponents to rewrite expressions with radicals and rational exponents.
Relationships Between Real Numbers *CCSS.Math.Content.HSN-RN.B.3*	Explain the result of adding or multiplying rational and irrational numbers.
Operations with Complex Numbers *CCSS.Math.Content.HSN-CN.A.1,* *CCSS.Math.Content.HSN-CN.A.2*	Identify complex numbers and apply properties of arithmetic to simplify expressions that contain complex numbers.

UNIT 3: QUADRATIC EQUATIONS AND FUNCTIONS (DAYS 26 – 42)

In this unit, you will solve quadratic equations by inspection, taking square roots, and factoring. You will also identify key attributes of quadratic relationships, explore transformations, and apply quadratic functions to model real-world situations.

Lesson/*CCSS Standards*	Lesson Objective
Solving Quadratic Equations with Square Roots *CCSS.Math.Practice.MP.2, CCSS.Math.Content.HSA-CED.A.1, CCSS.Math.Content.HSA-CED.A.4, CCSS.Math.Content.HSA-REI.B.4.b*	Solve quadratic equations in one variable by inspection and by taking square roots.
Solving Quadratic Equations by Factoring *CCSS.Math.Content.HSA-CED.A.1, CCSS.Math.Content.HSA-REI.B.4.b*	Solve quadratic equations in one variable by factoring.
Clarifying Big Ideas: Algebra Procedures	Create problems and find solutions, investigate a variety of solution methods, and re-evaluate misunderstandings about "the right way" to solve problems.
Quadratic Relationships *CCSS.Math.Content.HSA-SSE.B.3.a, CCSS.Math.Content.HSA-CED.A.2, CCSS.Math.Content.HSF-IF.B.4, CCSS.Math.Content.HSF-IF.B.5, CCSS.Math.Content.HSF-IF.C.7.a, CCSS.Math.Content.HSF-IF.C.8.a*	Explore quadratic relationships and use their graphs to identify key attributes.
Graphs of Quadratic Relationships *CCSS.Math.Content.HSA-CED.A.2, CCSS.Math.Content.HSF-IF.C.7.a, CCSS.Math.Content.HSF-BF.B.3*	Graph and transform quadratic functions on the coordinate plane.

Lesson/*CCSS Standards*	Lesson Objective
Forms of Quadratic Equations *CCSS.Math.Practice.MP.7, CCSS.Math.Content.HSA-SSE.A.1.b, CCSS.Math.Content.HSA-SSE.B.3.a, CCSS.Math.Content.HSA-CED.A.2, CCSS.Math.Content.HSF-IF.C.7.a, CCSS.Math.Content.HSF-IF.C.8.a*	Identify and use the three forms of quadratic equations.
Writing Quadratic Functions and Equations *CCSS.Math.Practice.MP.4, CCSS.Math.Content.HSA-SSE.A.1.a, CCSS.Math.Content.HSA-SSE.A.1.b, CCSS.Math.Content.HSA-SSE.B.3.a, CCSS.Math.Content.HSA-CED.A.2, CCSS.Math.Content.HSF-IF.C.8.a, CCSS.Math.Content.HSF-BF.A.1.a, CCSS.Math.Content.HSF-BF.A.1.b*	Write quadratic equations in two variables.
Unit Activity: Quadratic Equations and Functions *CCSS.Math.Practice.MP.1, CCSS.Math.Practice.MP.5, CCSS.Math.Content.HSA-SSE.B.3.a, CCSS.Math.Content.HSA-CED.A.1, CCSS.Math.Content.HSF-IF.C.8.a, CCSS.Math.Content.HSF-BF.A.1.a, CCSS.Math.Content.HSF-BF.A.1.b, CCSS.Math.Content.HSF-BF.B.3*	Use quadratic functions to model real-world situations.

UNIT 4: EXTENDING QUADRATIC RELATIONSHIPS (DAYS 43 – 56)

In this unit, you will solve quadratic equations by using the most appropriate method, including completing the square and applying the quadratic formula. You will solve equations that have non-real solutions and write these solutions as complex numbers.

Lesson/*CCSS Standards*	Lesson Objective
Solving Quadratic Equations by Completing the Square *CCSS.Math.Content.HSA-SSE.B.3.b, CCSS.Math.Content.HSA-CED.A.1, CCSS.Math.Content.HSA-REI.B.4.a, CCSS.Math.Content.HSA-REI.B.4.b, CCSS.Math.Content.HSF-IF.C.8.a*	Solve quadratic equations in one variable by completing the square.
Clarifying Big Ideas: Equal Sign and Balance	Evaluate misunderstandings about the equal sign and balance.
The Quadratic Formula *CCSS.Math.Content.HSA-CED.A.1, CCSS.Math.Content.HSA-REI.B.4.a, CCSS.Math.Content.HSA-REI.B.4.b, CCSS.Math.Content.HSF-IF.C.8.a*	Solve quadratic equations in one variable and categorize the solutions using the quadratic formula.
Solving and Reasoning with Complex Numbers *CCSS.Math.Practice.MP.2, CCSS.Math.Content.HSN-CN.C.7, CCSS.Math.Content.HSN-CN.C.8, CCSS.Math.Content.HSN-CN.C.9, CCSS.Math.Content.HSA-CED.A.1*	Apply properties of complex numbers to quadratic solutions and polynomial identities.
Unit Activity: Extending Quadratic Relationships *CCSS.Math.Practice.MP.3, CCSS.Math.Practice.MP.5, CCSS.Math.Practice.MP.7, CCSS.Math.Content.HSA-CED.A.1, CCSS.Math.Content.HSA-REI.B.4.a, CCSS.Math.Content.HSA-REI.B.4.b*	Solve quadratic equations using the method appropriate to the initial form of the equation.

UNIT 5: COMPARING AND MODELING WITH FUNCTIONS (DAYS 57 – 72)

In this unit, you will become familiar with how functions can describe relationships between quantities and model real-world situations. You will compare different function types and apply them to solve mathematical and real-world problems.

Lesson/*CCSS Standards*	Lesson Objective
Inverse Functions *CCSS.Math.Content.HSA-CED.A.4,* *CCSS.Math.Content.HSF-BF.B.4.a*	Determine inverses of functions.
Piecewise and Absolute Value Functions *CCSS.Math.Content.HSF-IF.C.7.b,* *CCSS.Math.Content.HSF-BF.B.3*	Analyze key features of piecewise and absolute value functions algebraically and graphically.
Solving Systems of Linear and Quadratic Equations *CCSS.Math.Content.HSA-REI.C.7,* *CCSS.Math.Content.HSF-IF.C.7.a*	Solve systems of linear and quadratic equations using algebraic and graphical methods.
Modeling with Quadratic Functions *CCSS.Math.Content.HSA-CED.A.2,* *CCSS.Math.Content.HSF-BF.A.1.a*	Determine and use a quadratic data model to make predictions and solve problems.
Exponential Curves of Best Fit *CCSS.Math.Content.HSA-CED.A.2,* *CCSS.Math.Content.HSF-IF.C.8.b,* *CCSS.Math.Content.HSF-BF.A.1.a*	Determine exponential curves of best fit to make predictions.
Comparing Functions *CCSS.Math.Content.HSF-IF.B.4,* *CCSS.Math.Content.HSF-IF.B.6,* *CCSS.Math.Content.HSF-IF.C.7.a,* *CCSS.Math.Content.HSF-IF.C.9,* *CCSS.Math.Content.HSF-LE.A.3*	Compare and translate representations of linear, exponential, and quadratic functions.

UNIT 6: CONGRUENCE AND PROOFS (DAYS 73 – 90)

In this unit, you will explore the origins of geometry and complete mathematical proofs to prove theorems. You will study properties of line segments, lines, and angles and explore relationships among them.

Lesson/*CCSS Standards*	Lesson Objective
Introduction to Geometry *CCSS.Math.Practice.MP.6, CCSS.Math.Practice.MP.7*	Examine the history, career applications, and logical structure and development of geometry.
Mathematical Proofs *CCSS.Math.Practice.MP.3, CCSS.Math.Practice.MP.7, CCSS.Math.Content.HSG-CO.C.9*	Construct mathematical proofs and apply proof techniques to simple geometric relationships.
Proving Theorems about Lines and Angles *CCSS.Math.Practice.MP.8, CCSS.Math.Content.HSG-CO.C.9*	Prove theorems about lines and angles including angles formed by a transversal crossing parallel lines and points on a perpendicular bisector.
Dividing a Line Segment *CCSS.Math.Content.HSG-GPE.B.6*	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
Clarifying Big Ideas: Plane Shapes and Orientation	Identify plane shapes in different orientations.
Proving Theorems about Triangles *CCSS.Math.Practice.MP.3, CCSS.Math.Content.HSG-CO.C.10*	Prove theorems about angles, sides, and special segments of triangles.
Unit Activity: Congruence and Proofs *CCSS.Math.Practice.MP.3, CCSS.Math.Practice.MP.6*	Employ the structure of geometry as an axiomatic system to analyze statements and write proofs.

Course Map

You will achieve course level objectives by completing each lesson's instruction, assignments, and assessments. For a detailed look at how the materials meet these objectives, review the course map for Semester A.