

Algebra II

Course Overview and Syllabus

Course Number: MA3111 IC

Grade Level: 10–12

Prerequisite Courses: Algebra I, Geometry

Credits: 1.0

Course Description

This full-year course focuses on functions, polynomials, periodic phenomena, and collecting and analyzing data. Students will make connections between verbal, numeric, algebraic, and graphical representations of functions and apply this knowledge as they create equations and inequalities that can be used to model and solve mathematical and real-world problems. As students refine and expand their algebraic skills, they will draw analogies between the operations and field properties of real numbers and those of complex numbers and algebraic expressions. Process standards are embedded throughout the course, as students solve novel problems, reason abstractly, and think critically.

Course Objectives

Throughout the course, you will meet the following goals:

- Communicate effectively using graphic, numeric, symbolic, and verbal representations.
- Compare and connect the structure of the polynomial system and the system of integers.
- Use the coordinate plane to extend trigonometry to model periodic phenomena.
- Synthesize and generalize what you have learned about a variety of function families.
- Relate visual data displays and summary statistics to different types of data, including probability distributions.

Student Expectations

This course requires the same level of commitment from you as a traditional classroom course would. Throughout the course, you are expected to spend approximately 5–7 hours per week online on the following activities:

- Interactive lessons that include a mixture of instructional videos and tasks
- Assignments in which you apply and extend learning
- Assessments, including quizzes, tests, and cumulative exams

Communication

Your teacher will communicate with you regularly through discussions, e-mail, chat, and system announcements. You will also communicate with classmates, either via online tools or face to face, as you collaborate on projects, ask and answer questions in your peer group, and develop your speaking and listening skills.

Grading Policy

You will be graded on the work you do online and the work you submit electronically to your teacher. The weighting for each category of graded activity is listed below.

Grading Category	Weight
Quiz	20%
Test	30%
Exam	20%
Assignment	20%
Additional	0%
Project	10%

Scope and Sequence

When you log into Edgenuity, you can view the entire course map—an interactive scope and sequence of all topics you will study. The units of study are summarized below:

- Unit 1:** Relationships between Quantities
- Unit 2:** Quadratics and Complex Numbers
- Unit 3:** Polynomials
- Unit 4:** Rational Functions
- Unit 5:** Radical Functions

- Unit 6:** Exponential and Logarithmic Functions
- Unit 7:** Statistics and Probability
- Unit 8:** Trigonometric Functions
- Unit 9:** Mathematical Modeling

Unit	Lesson	Lesson Objectives
Relationships Between Quantities		
Real Numbers		
Classify real numbers.		
Identify the field properties of real numbers.		
Represent real numbers with variables.		
Inequalities		
Create one-variable linear inequalities in one variable and use them to solve problems.		
Solve one-variable linear inequalities, including compound inequalities, and represent the solution sets graphically and algebraically.		
Word Problems		
Create equations to solve a variety of word problems such as mixture, time-distance-rate, and work.		
Solve a variety of word problems, and interpret the solutions in context.		
Relations and Functions		
Determine if a relation is a function.		
Determine if the function is one-to-one.		
Determine the domain and range of a relation.		
Evaluate function rules.		
Represent a relation in multiple ways, including equations, graphs, words, and tables of values.		
Function Operations		
Combine functions using arithmetic operations, expressing the results both algebraically and graphically.		
Evaluate sums, differences, products, and quotients of functions.		
Composition of Functions		
Evaluate the composition of functions.		
Find the domain of the composition of functions.		
Write an expression for the composition of functions.		
Symmetry		
Determine the symmetry of a function algebraically.		
Determine the symmetry of a relation from a graph.		
Function Inverses		
Find the inverse of a function.		
Use composition to verify that functions are inverses.		
Rate of Change		
Calculate the average rate of change of a function over a specified interval.		
Interpret the average rate of change of a function over a specified interval.		
Solve problems involving direct variation.		

Unit	Lesson	Lesson Objectives
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Performance Task: Going on a Round Trip**Quadratics and Complex Numbers****Complex Numbers**

- Determine the absolute value of a complex number.
- Represent complex numbers in the form $a + bi$ or in the complex plane.
- Represent square roots of negative numbers as multiples of i .
- Simplify powers of i using their cyclic nature.

Operations with Complex Numbers

- Identify the field properties of complex numbers.
- Perform addition, subtraction, and multiplication of complex numbers.

Completing the Square

- Find complex solutions to quadratic equations by completing the square.
- Recognize the pattern of a perfect-square trinomial as the square of a binomial.
- Use the square root property to solve equations.

The Quadratic Formula

- Find real and complex solutions of quadratic equations using the quadratic formula.
- Use the discriminant to determine the number and type of roots of a quadratic equation.

Transformations of Quadratic Functions

- Describe the effects of changes in a , h , and k to the graph of a function in the form $y = a(x - h)^2 + k$.
- Use completing the square to write quadratic functions in the form $y = a(x - h)^2 + k$.

Square Root Functions

- Find the domain of a square root function.
- Find the inverse of a quadratic function.

Mixed Degree Systems

- Solve linear-quadratic systems of equations.
- Solve quadratic-quadratic systems of equations.

Polynomials**Factoring Polynomials Completely**

- Analyze polynomial expressions to factor them completely.

Division of Polynomials

- Use inverse operations to check the result of polynomial division
- Use long division to find quotients of polynomials

Unit	Lesson	Lesson Objectives
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The Binomial Theorem

- Use the Binomial theorem to expand binomials.
- Use the Binomial theorem to find a specific term in an expansion.

Synthetic Division and the Remainder Theorem

- Apply the remainder theorem.
- Use synthetic division to divide a polynomial by a linear factor.

The Rational Roots Theorem

- Determine the roots of and factor a polynomial function.
- Use the rational root theorem to determine possible roots of a polynomial function.

The Fundamental Theorem of Algebra

- Apply the fundamental theorem of algebra to determine the number of roots of a polynomial function.
- Use the complex conjugate theorem to factor and solve polynomial equations.

Writing Polynomial Functions from Complex Roots

- Write polynomial functions from complex roots.

Quadratic in Form Polynomials

- Identify fourth degree equations that are quadratic in form and use an appropriate u -substitution.
- Solve fourth degree equations that are quadratic in form.

Graphing Polynomial Functions

- Graph polynomial functions using key features.

Solving Polynomial Equations using Technology

- Use technology to solve or approximate solutions of one-variable polynomial equations.

Rational Functions

Negative Exponents

- Evaluate numeric expressions using laws of integer exponents.
- Simplify single-variable expressions using laws of integer exponents.

Simplifying Rational Expressions

- Simplify rational expressions using laws of integer exponents.

Multiplying and Dividing Rational Expressions

- Perform multiplication and division of rational expressions.

Adding and Subtracting Rational Expressions

- Perform addition and subtraction of rational expressions.
- Simplify complex rational expressions containing sums or differences.

Unit	Lesson	Lesson Objectives
		<p>Rational Equations</p> <p>Solve rational equations and determine extraneous solutions. Use rational equations to model and solve real-world problems.</p> <p>Vertical Asymptotes of Rational Functions</p> <p>Determine the vertical asymptotes and holes in the graph of a rational function having the x-axis as its only horizontal asymptote. Solve problems involving inverse variation.</p> <p>Graphing Rational Functions</p> <p>Determine the horizontal asymptotes of a rational function. Graph rational functions that have only vertical or horizontal asymptotes.</p> <p>Modeling with Rational Functions</p> <p>Model and solve real-world problems using rational functions.</p>
		<p>Radical Functions</p> <p>Graphing Radical Functions</p> <p>Determine the domain and range of square root and cube root functions. Relate transformations to the graphs of square root and cube root functions to their parent function.</p> <p>Simplifying Nonperfect Roots</p> <p>Simplify nonperfect roots without rationalizing.</p> <p>Rational Exponents</p> <p>Evaluate numeric expressions using properties of rational exponents. Simplify algebraic expressions using properties of rational exponents.</p> <p>Adding and Subtracting Radicals</p> <p>Add and subtract radical expressions. Identify like radicals.</p> <p>Multiplying Radicals</p> <p>Perform multiplication of radical expressions.</p> <p>Dividing Radicals</p> <p>Perform division of radical expressions, rationalizing the denominator when necessary.</p> <p>Radical Equations and Extraneous Roots</p> <p>Model and solve mathematical and real-world problems using radical equations, and determine extraneous roots.</p> <p>Performance Task: Roller Coaster Design</p> <p>Solve one-variable radical inequalities Write one-variable radical inequalities to model problems</p>

Unit	Lesson	Lesson Objectives
Exponential and Logarithmic Functions		
Graphing Exponential Functions		
Determine the domain and range of exponential functions.		
Graph exponential functions.		
Identify exponential functions.		
Solving Exponential Equations by Rewriting the Base		
Solve exponential equations by rewriting bases.		
Graphing Logarithmic Functions		
Determine the domain and range of logarithmic functions.		
Identify and analyze the graphs of logarithmic functions.		
Identify logarithmic functions.		
Evaluating Logarithmic Expressions		
Evaluate common logarithms using a calculator.		
Evaluate logarithmic expressions by converting between logarithmic and exponential forms.		
Solve logarithmic equations by converting between logarithmic and exponential forms.		
Solving Logarithmic Equations using Technology		
Rewrite logarithmic expressions using the change of base algorithm.		
Solve a one-variable equation containing logarithms by transforming it into a system of equations.		
Properties of Logarithms		
Evaluate, expand, and simplify logarithmic expressions using properties of logarithms.		
Solving Equations using Properties of Logarithms		
Apply properties of logarithms to solve logarithmic equations.		
Determine extraneous solutions of logarithmic equations.		
Base e		
Analyze exponential and logarithmic functions in base e to determine key features of the graph.		
Apply properties of logarithms and exponents to solve exponential and logarithmic equations having base e.		
Determine the domain and range of exponential and logarithmic functions in base e.		
Geometric Series		
Apply geometric series to solve mathematical and real-world problems.		
Find sums of finite and infinite geometric series.		

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Statistics and Probability**Designing a Study**

- Analyze study types and sampling methods.
- Classify sampling methods.
- Classify study types.
- Determine if a sample is biased.

Representing Data

- Describe a data set using measures of central tendency and range.
- Determine if a representation of data is misleading.

Standard Deviation

- Calculate variance and standard deviation of a sample or population.
- Determine if a value is within a given z-score.
- Interpret standard deviation as it pertains to the spread of a graph.

Properties of Probability Distributions

- Create probability distributions from a data set.
- Identify properties of a probability distribution.
- Solve problems using probability distributions.

Expected Value

- Calculate expected values.
- Use expected values to make decisions.

Binomial Distribution

- Calculate binomial probabilities.
- Identify a binomial experiment.
- Identify the probability of success, probability of failure, and number of trials for a binomial experiment.

Introduction to Normal Distributions

- Apply the z-score formula to solve problems.
- Describe normal distributions using the mean and standard deviation.
- Solve problems using the empirical rule.

Applications with Standard Normal Distribution

- Solve problems using the standard normal table.

Statistical Inferences

- Make inferences about a population from a sample.

Unit	Lesson	Lesson Objectives
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Hypothesis Testing

- Determine if a result is statistically significant.
- Perform hypothesis tests on normally distributed data.

Trigonometric Functions**Angles in Standard Position**

- Determine angles that are coterminal.
- Identify characteristics of angles in standard position.

Radian Measure

- Convert between degree and radian measure.
- Use the definition of radian measure to calculate arc lengths, radii, and angle measures.

Right Triangle Trigonometry

- Use special right triangle relationships to solve right triangles.
- Use the Pythagorean theorem, and the trigonometric functions and their inverses to solve right triangles.

The Unit Circle

- Compare sine, cosine, and tangent values for angles having the same reference angle.
- Find the sine, cosine, and tangent values of angle measures using the unit circle.

Reciprocal Trigonometric Functions

- Evaluate the six trigonometric functions for special angles.
- Simplify expressions involving the six trigonometric functions using reciprocal relationships.
- Solve right triangle trigonometry problems involving reciprocal trigonometric functions.

Evaluating the Six Trigonometric Functions

- Evaluate the six trigonometric functions for angles in degrees or radians based on one or more given trigonometric function values.
- Evaluate the six trigonometric functions for angles in degrees or radians given a point on the terminal ray.

Graphing Sine and Cosine

- Analyze key features of sine and cosine functions from equations and graphs.

Changes in Period and Phase Shift of Sine and Cosine Functions

- Relate transformations of the graphs of the sine and cosine functions to the equation.

Modeling with Periodic Functions

- Model and solve real-world problems using periodic functions.

Unit	Lesson	Lesson Objectives
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Mathematical Modeling**Linear Programming**

- Maximize a function given constraints.
- Represent and solve real-world problems using linear programming.

Modeling with Systems

- Model and solve real-world problems using linear-quadratic or quadratic-quadratic systems of equations.

Piecewise Defined Functions

- Determine the domain, range, and continuity of piecewise defined functions.
- Evaluate piecewise defined functions.
- Graph piecewise defined functions.

Joint and Combined Variation

- Find constants of variation.
- Model and solve problems involving joint and combined variation.

Transformations of Functions

- Analyze a function rule or graph to determine transformations of the parent function.
- Identify a function as belonging to a family of functions.

Modeling with Functions

- Find the equation of a function that best models a data set.
- Use function models to solve problems.

Performance Task: Production Schemes

- Determine the reasonableness of a function model.
- Use an appropriate function model to describe random data.
- Use function models to make predictions about situations.