

9th Grade American Online School

MATHEMATICS CURRICULUM

Laying the Foundation for Algebraic Thinking, Geometric Reasoning, and Mathematical Literacy

Version Apr/2025

1. Introduction

The Role of Mathematics Education in 9th Grade

The 9th Grade Mathematics curriculum strengthens foundational knowledge in algebra, geometry, functions, and data analysis. It supports the transition from middle school arithmetic to high school algebraic reasoning and equips students with tools for real-world application and abstract thinking. Emphasis is placed on problem-solving strategies, conceptual understanding, and mathematical communication across multiple representations.

By the end of this course, students will:

- ✓ Simplify algebraic expressions and solve linear and quadratic equations.
- ✓ Analyze and graph functions, identifying key features and modeling real-world situations.
- ✓ Apply geometric theorems and formulas to 2D and 3D problems.
- ✓ Represent and interpret data using statistics and probability models.
- ✓ Use logical reasoning and proof strategies in mathematical argumentation.

2. Core Competence Areas

MTH.1 Algebraic Thinking and Expressions

Learning Outcomes

By the end of this course, students will be able to:

- ✓ Simplify and evaluate algebraic expressions.
- ✓ Solve linear equations and inequalities.
- ✓ Factor polynomials and use them to solve equations.
- ✓ Apply exponent rules and work with radicals.

Competencies

MTH.1.A.1 – Simplifying Algebraic Expressions.

- Use the distributive property, combine like terms, and apply exponent rules.

MTH.1.A.2 – Solving Equations and Inequalities.

- Solve one-step, multi-step, and absolute value equations and represent solutions graphically.

MTH.1.A.3 – Factoring Polynomials.

- Factor trinomials and special cases to solve quadratic equations.

MTH.1.A.4 – Working with Exponents and Radicals.

- Simplify and evaluate expressions involving rational exponents and roots.

MTH.2 Functions and Relations

Learning Outcomes

By the end of this unit, students will be able to:

- ✓ Identify and represent functions using notation and graphs.
- ✓ Analyze and graph linear, quadratic, and exponential functions.
- ✓ Model real-world scenarios using appropriate functions.
- ✓ Transform and compare functions.

Competencies

MTH.2.A.1 – Defining Functions.

- Determine if a relation is a function and use function notation correctly.

MTH.2.A.2 – Graphing and Interpreting Functions.

- Graph various function types and identify features such as intercepts, vertex, and asymptotes.

MTH.2.A.3 – Comparing Function Types.

- Differentiate between linear, exponential, and quadratic functions and apply them to contexts.

MTH.2.A.4 – Transforming Functions.

- Apply shifts, reflections, and stretches/compressions to function graphs.

MTH.3 Linear Equations and Systems

Learning Outcomes

By the end of this unit, students will be able to:

- ✓ Determine slope and intercepts from various representations.
- ✓ Write and graph linear equations in multiple forms.
- ✓ Solve systems of equations and inequalities using different methods.

Competencies

MTH.3.A.1 – Understanding Slope and Intercepts.

- Calculate and interpret slope and y-intercept from graphs or coordinates.

MTH.3.A.2 – Writing and Graphing Equations.

- Write equations in slope-intercept, point-slope, and standard forms and graph them accurately.

MTH.3.A.3 – Solving Systems of Equations.

- Use graphing, substitution, and elimination to solve and interpret systems..

MTH.3.A.4 – Graphing Systems of Inequalities.

- Identify solution regions and interpret real-world implications.
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MTH.4 Geometry and Spatial Reasoning

Learning Outcomes

By the end of this unit, students will be able to:

- ✓ Analyze relationships among angles, triangles, and circles.
- ✓ Apply geometric formulas to compute measurements.
- ✓ Describe and perform transformations on the coordinate plane.

Competencies

MTH.4.A.1 – Understanding Geometric Properties.

- Classify angles, triangles, and quadrilaterals and analyze angle relationships.

MTH.4.A.2 – Applying Geometric Theorems.

- Use the Pythagorean Theorem and triangle inequality to solve problems.

MTH.4.A.3 – Calculating Area and Volume.

- Apply formulas to compute area, surface area, and volume of 2D and 3D figures.

MTH.4.A.4 – Performing Transformations.

- Translate, reflect, rotate, and dilate figures on the coordinate plane and analyze congruence/similarity.
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MTH.5 Data Analysis and Statistics

Learning Outcomes

By the end of this unit, students will be able to:

- ✓ **Collect and represent data graphically.**
- ✓ **Calculate and interpret measures of central tendency and variability.**
- ✓ **Analyze distributions using statistical tools.**

Competencies

MTH.5.A.1 – Organizing and Representing Data.

- Use histograms, box plots, and scatter plots to represent data.

MTH.5.A.2 – Computing Central Tendency.

- Find mean, median, mode, and range, and apply them contextually.

MTH.5.A.3 – Interpreting Distributions.

- Describe shape, spread, and center using standard deviation and quartiles.

MTH.5.A.4 – Evaluating Data Validity.

- Assess sample size, bias, and data reliability in studies.

MTH.6 Probability and Mathematical Reasoning

Learning Outcomes

By the end of this unit, students will be able to:

- ✓ **Calculate theoretical and experimental probabilities.**
- ✓ **Model compound events using probability tools.**
- ✓ **Apply logical reasoning to analyze mathematical statements.**

Competencies

MTH.6.A.1 – Calculating Probability.

- Find probabilities of single and compound events using appropriate methods.

MTH.6.A.2 – Modeling Probability Events.

- Use tables, trees, and area models to calculate multi-step probabilities.

MTH.6.A.3 – Comparing Probability Types.

- Interpret differences between expected and observed results.

MTH.6.A.4 – Reasoning with Logic.

- Use basic proof structures to evaluate statements and justify conclusions.
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3. Assessment and Evaluation

Formative Assessments – Checking Progress Through Interactive Learning

- ✓ Skills practice, journaling, collaborative problem-solving tasks.
- ✓ Exit slips and quick checks for understanding.
- ✓ Think-pair-share and teacher-led questioning strategies.

Summative Assessments – Final Projects and Exams

- ✓ Unit tests, semester exams, and structured performance tasks.
- ✓ Extended response questions and multiple representation problems.
- ✓ Projects applying functions, data, or geometry to real-world scenarios.

Authentic Assessment – Real-World Applications

- ✓ Financial modeling and statistical investigations.
 - ✓ Geometry-based design or architecture projects.
 - ✓ Probability experiments and analysis.
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4. Instructional Strategies for Online Learning

Spiral and Scaffolded Learning

- ✓ Revisit key concepts with increasing complexity across units.
- ✓ Scaffold problem-solving with modeling, guided practice, and independence.

Concrete-to-Abstract Instruction

- ✓ Begin with manipulatives and visual models before introducing symbols and formulas.

Technology-Integrated Learning

- ✓ Use Desmos, GeoGebra, and Google Sheets for dynamic visualization.
- ✓ Integrate graphing calculators and interactive simulations.

Inclusive Learning Environment

- ✓ Foster a growth mindset around mistakes and perseverance.
- ✓ Encourage multiple solution paths and justification of reasoning.
- ✓ Build mathematical confidence through mastery-based practice.