8th Grade American Online School

MATHEMATICS CURRICULUM

Mastering the Structure of Numbers, Algebraic Thinking, and Spatial Reasoning

Version May/2025

1. Introduction

The Role of Mathematics Education in 8th Grade

In 8th grade, students solidify their understanding of the number system, begin formal algebraic reasoning, and explore geometric principles through spatial analysis and transformations. This curriculum emphasizes conceptual understanding, procedural fluency, and real-world problem solving. Students are introduced to linear functions, systems of equations, and foundational statistics, laying the groundwork for success in high school algebra, geometry, and beyond.

By the end of this course, students will:

✓ **Analyze and compare rational and irrational numbers.**

✓ **Solve linear equations and systems using multiple methods.**

✓ **Apply the Pythagorean Theorem in real-world contexts.**

✓ **Model data using scatter plots and trend lines.**

✓ **Develop mathematical reasoning, precision, and communication skills.**

✓ **Use technology to explore, visualize, and validate mathematical concepts.**

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2. Core Competence Areas

MTH.1 Number Systems and Arithmetic Thinking

Learning Outcomes

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

✓ **Distinguish between rational and irrational numbers.**

✓ **Manipulate expressions with exponents and roots.**

✓ **Apply scientific notation and understand numerical scale.**

Competencies

MTH.1.A.1 – Classifying and locating rational and irrational numbers on the number line.

MTH.1.A.2 – Applying the laws of exponents to simplify expressions.

MTH.1.A.3 – Estimating square and cube roots in context.

MTH.1.A.4 – Using scientific notation for very large and small numbers.

MTH.1.A.5 – Understanding place value, orders of magnitude, and numerical scale.

MTH.2 Algebraic Thinking and Function

Learning Outcomes

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

✓ **Solve multi-step equations and systems.**

✓ **Understand the concept of functions and model relationships.**

✓ **Compare different representations of functional relationships.**

Competencies

MTH.2.A.1 – Solving multi-step linear equations with rational coefficients.

MTH.2.A.2 – Representing and solving systems of equations using multiple strategies.

MTH.2.A.3 – Defining and interpreting functions using graphs, tables, and rules.

MTH.2.A.4 – Constructing linear functions from contextual information.
MTH.2.A.5 – Comparing functional representations across formats.

MTH.3 Geometry and Spatial Reasoning

Learning Outcomes

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

✓ **Analyze geometric transformations and congruence.**
✓ **Apply the Pythagorean Theorem in problem-solving.**
✓ **Solve volume and angle-based problems using formulas and reasoning.**

Competencies

MTH.3.A.1 – Performing and describing transformations on the coordinate plane.
MTH.3.A.2 – Establishing triangle congruence and similarity through transformations.
MTH.3.A.3 – Applying the Pythagorean Theorem in two- and three-dimensional contexts.
MTH.3.A.4 – Solving volume problems for cones, cylinders, and spheres.
MTH.3.A.5 – Analyzing angle relationships formed by lines, angles, and transversals.

MTH.4 Data Analysis and Statistical Reasoning

Learning Outcomes

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

✓ **Collect, organize, and interpret bivariate data.**
✓ **Estimate and evaluate lines of best fit.**
✓ **Model data trends and interpret findings in context.**

Competencies

MTH.4.A.1 – Creating and interpreting scatter plots for trend analysis.
MTH.4.A.2 – Fitting and evaluating linear models for strength and accuracy.
MTH.4.A.3 – Using two-way tables to summarize categorical data.
MTH.4.A.4 – Interpreting slope and intercepts in real-world data models.

MTH.5 Mathematical Modeling and Practices

Learning Outcomes

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

✓ **Model and solve real-world mathematical problems.**
✓ **Justify and communicate reasoning with precision.**
✓ **Use structure, patterns, and digital tools effectively.**

Competencies

MTH.5.A.1 – Abstracting real-world situations into mathematical expressions and models.
MTH.5.A.2 – Applying logical reasoning to justify solutions.
MTH.5.A.3 – Communicating solutions using verbal, visual, and symbolic representation.
MTH.5.A.4 – Identifying and applying patterns to simplify problems.
MTH.5.A.5 – Using digital tools to explore and verify mathematical relationships.

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3. Assessment and Evaluation

Formative Assessments – Monitoring Understanding

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

Summative Assessments – Mastery Demonstration

✓ **Topic-based tests and real-world application tasks.**
✓ **Problem-solving portfolios.**
✓ **Final cumulative exam.**

Authentic Assessment – Application of Skills

✓ **Data analysis presentations and reports.**
✓ **Geometry construction and modeling projects.**
✓ **Function modeling tasks with real-life datasets.**

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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

✓ **Desmos and GeoGebra for dynamic graphing and geometry.**
✓ **Google Sheets for statistical analysis.**
✓ **PhET simulations for interactive concept exploration.**
✓ **Educational apps for targeted fluency development.**

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.**