I CAN Learn®
EDUCATION SYSTEMS

NEW JERSEY

High School Mathematics Curriculum Framework

	Mathematics Curriculum Framework	I CAN L earn® Lesson Number	I CAN L earn® Lesson Title
Number and Numerical Operations			
4.1.11.A	Number Sense		
	1. Extend understanding of the number system to all real numbers.	MPA-124	Classifying Numbers in the Real Number System
	2. Compare and order rational and irrational numbers.	HA1-015	Graphing Real Numbers Using a Number Line
	3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.	HA1-020	Classifying Numbers into Subsets of Real Numbers
4.1.11.B	B. Numerical Operations		
	1. Extend understanding and use of operations to real numbers and algebraic procedures.	HA1-085	Simplifying Expressions Using the Properties of Real Numbers
		HA1-079	Using a Concrete Model to Simplify Algebraic Expressions
		HA1-090	Simplifying Expressions Using the Property of -1
		HA1-080	Simplifying and Evaluating Algebraic Expressions Containing Grouping Symbols
	2. Develop, apply, and explain methods for solving problems involving rational and negative exponents.	HA1-810	Simplifying Expressions Using the Multiplication Properties of Exponents
		HA1-815	Simplifying Expressions with Negative and Zero Exponents
		HA1-492	Simplifying Square and Cube Roots (Rational Exponents)
	3. Perform operations on matrices.		
	· Addition and subtraction	HA1-840	Introduction to Matrices
	· Scalar multiplication	HA1-845	Operations with Matrices
	4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers.	HA1-810	Simplifying Expressions Using the Multiplication Properties of Exponents
		HA1-815	Simplifying Expressions with Negative and Zero Exponents
		HA1-818	Simplifying Expressions Using the Division Properties of Exponents
4.1.11.C	C. Estimation		
	1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.	HA1-030	Using Opposites and Absolute Values (Journal)
Geometry and Measurement			
4.2.11.A	Geometric Properties		
	1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean Theorem to decide whether an object can fit through a doorway).	HA1-516	Applications of the Pythagorean Theorem
		HA1-889	Complementary and Supplementary Angles
		HA1-890	Using Models to Derive Formulas for Two-Dimensional Geometric Figures
		HA1-891	Using Models to Derive Formulas for Three-Dimensional Solids

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	2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).	HA1-893	Constructing Solids from Different Perspectives
	3. Apply the properties of geometric shapes.		
	· Parallel lines - transversal, alternate interior angles, corresponding angles	HGM-060	Examining Angle Relationships and Parallel Lines
		HGM-065	Proving Lines Parallel
		HGM-070	Identifying Relationships: Parallel Lines and Segments
	· Triangles	HGM-145	Classifying Triangles and Applying Angle Relationships
		HGM-215	Investigating Properties of the 30°-60°-90° Triangle
		HGM-220	Investigating Properties of the 45°-45°-90° Triangle
	a. Conditions for congruence	HGM-175	Identifying Corresponding Parts of Congruent Triangles (Future Release)
		HGM-180	Proving Triangles Congruent Using SSS and SAS (Future Release)
		HGM-190	Proving Triangles Congruent Using AAS and ASA (Future Release)
		HGM-195	Proving Triangles Congruent Using SSS, SAS, AAS and ASA (Future Release)
	b. Segment joining midpoints of two sides is parallel to and half the length of the third side	HGM-070	Identifying Relationships: Parallel Lines and Segments
	c. Triangle Inequality		
	· Verification or refutation of proposed proofs	HGM-160	Investigating Inequalities Involving One Triangle (Future Release)
	· Simple proofs involving congruent triangles	HGM-165	Investigating Inequalities Involving Two Triangles (Future Release)
	· Counterexamples to incorrect conjectures	HGM-027	Identifying Counterexamples and Using Proof by Contradiction
	4. Use reasoning and some form of proof to verify or refute conjectures and theorems.		
	· Verification or refutation of proposed proofs	HGM-020	Using Inductive Reasoning
	· Simple proofs involving congruent triangles	HGM-195	Proving Triangles Congruent Using SSS, SAS, AAS and ASA (Future Release)
	· Counterexamples to incorrect conjectures	HGM-027	Identifying Counterexamples and Using Proof by Contradiction
4.2.11.B	B. Transforming Shapes		
	1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.	HGM-100	Exploring Translations (Future Release)
		HGM-105	Exploring Reflections (Future Release)
		HGM-110	Exploring Rotations (Future Release)
		HGM-115	Exploring Dilations (Future Release)
		HGM-120	Exploring Composite Transformations (Future Release)
	2. Recognize three-dimensional figures obtained through transformations of two-dimensional figures (e.g., cone as rotating an isosceles triangle about an altitude), using software as an aid to visualization.	HA1-891	Using Models to Derive Formulas for Three-Dimensional Solids
	3. Determine whether two or more given shapes can be used to generate a tessellation.	HGM-140	Creating Tessellations
		HGM-142	Investigating Symmetry of Polygons (Future Release)
	4. Generate and analyze iterative geometric patterns.		
	· Fractals (e.g., Sierpinski's Triangle)	HA1-448	Finding the nth Term of a Pattern
	· Patterns in areas and perimeters of self-similar figures	HGM-310	Relating Perimeter and Area of Similar Polygons (Future Release)
	· Outcome of extending iterative process indefinitely	HA1-448	Finding the nth Term of a Pattern
4.2.11.C	C. Coordinate Geometry		
	1. Use coordinate geometry to represent and verify properties of lines.		
	· Distance between two points	HGM-085	Finding the Distance Between Two Points
	· Midpoint and slope of a line segment	HGM-080	Finding the Midpoint of a Segment
		HGM-090	Examining Slopes of Parallel and Perpendicular Lines
	· Finding the intersection of two lines	HGM-070	Identifying Relationships: Parallel Lines and Segments

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	· Lines with the same slope are parallel	HGM-090	Examining Slopes of Parallel and Perpendicular Lines
	· Lines that are perpendicular have slopes whose product is -1	HGM-090	Examining Slopes of Parallel and Perpendicular Lines
	2. Show position and represent motion in the coordinate plane using vectors.		
	· Addition and subtraction of vectors	HGM-122	Exploring Vectors and Vector Operations (Future Release)
4.2.11.D	D. Units of Measurement		
	1. Understand and use the concept of significant digits.	MPA-134	Calculating with Precision, Accuracy, and Significant Digits
	2. Choose appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation.	*Activity	
	· Degree of accuracy of a given measurement tool	MPA-134	Calculating with Precision, Accuracy, and Significant Digits
	· Finding the interval in which a computed measure (e.g., area or volume) lies, given the degree of precision of linear measurements	MPA-134	Calculating with Precision, Accuracy, and Significant Digits
4.2.11.E	E. Measuring Geometric Objects		
	1. Use techniques of indirect measurement to represent and solve problems.		
	· Similar triangles	HGM-305	Applying Properties of Similar Polygons
	· Pythagorean theorem	HA1-515	Using the Pythagorean Theorem
		HA1-516	Applications of the Pythagorean Theorem
	· Right triangle trigonometry (sine, cosine, tangent)	HGM-215	Investigating Properties of the 30°-60°-90° Triangle
		HGM-220	Investigating Properties of the 45°-45°-90° Triangle
	2. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures.		
	· Approximation of area using grids of different sizes	HA1-890	Using Models to Derive Formulas for Two-Dimensional Geometric Figures
		HA1-891	Using Models to Derive Formulas for Three-Dimensional Solids
	· Finding which shape has minimal (or maximal) area, perimeter, volume, or surface area under given conditions using graphing calculators, dynamic geometric software, and/or spreadsheets	*Activity	
	· Estimation of area, perimeter, volume, and surface area	MPA-160	Plotting Polygons and Finding the Area
		HA1-890	Using Models to Derive Formulas for Two-Dimensional Geometric Figures
		HA1-891	Using Models to Derive Formulas for Three-Dimensional Solids
Patterns and Algebra			
4.3.11.A	Patterns		
	1. Use models and algebraic formulas to represent and analyze sequences and series.		
	· Explicit formulas for n^{th} terms	HA1-448	Finding the nth Term of a Pattern
	· Sums of finite arithmetic series	Content under review	
	· Sums of finite and infinite geometric series	Content under review	
	2. Develop an informal notion of limit.	Content under review	
	3. Use inductive reasoning to form generalizations.	HA1-449	Applying Inductive and Deductive Reasoning
4.3.11.B	B. Functions and Relationships		
	1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.	HA1-436	Identifying Relations
		HA1-437	Identifying Relations as Functions
	2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.		
	· Slope of a line or curve	HA1-385	Finding the Slope of a Line from its Graph or from the Coordinates of Two Points
	· Domain and range	HA1-438	Finding the Domain and Range of Functions
	· Intercepts	HA1-398	Graphing Linear Equations Using Slope and y-Intercept or Slope and a Point
	· Continuity	HA1-887	Applications of Absolute Value, Step, and Constant Functions
	· Maximum/minimum	HA1-935	Analyzing Graphs of Quadratic Functions

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		HA1-945	Real-World Applications of Quadratic Functions
	· Estimating roots of equations	HA1-935	Analyzing Graphs of Quadratic Functions
	· Intersecting points as solutions of systems of equations	HA1-455	Solving Systems of Linear Equations by Graphing
		HA1-806	Solving Systems of Linear Equations Using the Graphing Calculator
	· Rates of change	HA1-955	Analyzing Linear Functions
	3. Understand and perform transformations on commonly-used functions.		
	· Translations, reflections, dilations	HA1-927	Graphing $f(x) = ax^2$ Using Dilations
		HA1-928	Graphing $f(x) = ax^2$ Using Dilations and Reflections
		HA1-929	Graphing $f(x) = ax^2 + c$ Using Dilations, Reflections, and Vertical Translations
	· Effects on linear and quadratic graphs of parameter changes in equations	HA1-401	How Variations of "m" and "b" Affect the Graph of $y = mx + b$
	· Using graphing calculators or computers for more complex functions	*Activity	
	4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.		
	· Linear vs. non-linear	HA1-892	Data Analysis Using the Graphing Calculator
	· Symmetry	HA1-935	Analyzing Graphs of Quadratic Functions
	· Increasing/decreasing on an interval	HA1-442	Interpreting Graphs of Functions in Real-Life Situations
4.3.11.C	C. Modeling		
	1. Use functions to model real-world phenomena and solve problems that involve varying quantities.		
	· Linear, quadratic, exponential, periodic (sine and cosine), and step functions (e.g., price of mailing a first-class letter over the past 200 years)	HA1-960	Real-World Applications of Linear Functions
		HA1-887	Applications of Absolute Value, Step, and Constant Functions
		HA1-945	Real-World Applications of Quadratic Functions
	· Direct and inverse variation	HA1-450	Solving Problems Involving Direct Variation
		HA1-453	Solving Problems Involving Inverse Variation
	· Absolute value	HA1-950	Graphing Absolute Value Functions
	· Expressions, equations and inequalities	Throughout	
	· Same function can model variety of phenomena	HA1-402	Translating Among Multiple Representations of Functions
	· Growth/decay and change in the natural world	HA1-855	Solving Exponential Equations
	· Applications in mathematics, biology, and economics (including compound interest)	Throughout	
	2. Analyze and describe how a change in an independent variable leads to change in a dependent one.	HA1-442	Interpreting Graphs of Functions in Real-Life Situations
	3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).	HA1-448	Finding the nth Term of a Pattern
4.3.11.D	D. Procedures		
	1. Evaluate and simplify expressions.		
	· Add and subtract polynomials	HA1-245	Adding and Subtracting Polynomials
	· Multiply a polynomial by a monomial or binomial	HA1-920	Simplifying Algebraic Expressions Using the Distributive Property
	· Divide a polynomial by a monomial	HA1-355	Dividing Polynomials
	2. Select and use appropriate methods to solve equations and inequalities.		
	· Linear equations - algebraically	HA1-115	Using the Addition and Subtraction Properties for Equations
		HA1-120	Using the Multiplication and Division Properties for Equations
		HA1-124	Using a Concrete Model to Solve One- and Two-Step Equations
		HA1-125	Solving Equations Using More Than One Property
		HA1-140	Solving Equations by Combining Like Terms
		HA1-144	Using a Concrete Model to Solve Equations with Variables on Both Sides
		HA1-145	Solving Equations with Variables on Both Sides

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		HA1-360	Expressing Ratios in Simplest Form and Solving Equations Involving Proportions
	· Quadratic equations - factoring (when the coefficient of x2 is 1) and using the quadratic formula	HA1-271	Factoring Trinomials and the Differences of Squares Using Algebra Tiles
		HA1-275	Factoring the Difference Between Two Squares and Perfect Square Trinomials
		HA1-280	Factoring $x^2 + bx + c$ When c is Greater Than Zero
		HA1-285	Factoring $x^2 + bx + c$ When c is Less Than Zero
		HA1-525	Solving Quadratic Equations Involving Perfect Square Expressions
		HA1-530	Solving Quadratic Equations by Completing the Square
		HA1-535	Developing the Quadratic Formula and Using it to Solve Equations
	· All types of equations using graphing, computer, and graphing calculator techniques	HA1-291	Factoring Quadratic Equations Using the Graphing Calculator
		HA1-536	Solving Quadratic Equations Using the Graphing Calculator
		HA1-805	Applying Algebra Concepts
	3. Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.	Throughout	
Data Analysis, Probability, and Discrete Mathematics			
4.4.11.A	Data Analysis (or Statistics)		
	1. Use surveys and sampling techniques to generate data and draw conclusions about large groups.	Grade level content under review	
	· Advantages/disadvantages of sample selection methods (e.g., convenience sampling, responses to survey, random sampling)	*Activity	
	2. Evaluate the use of data in real-world contexts.		
	· Accuracy and reasonableness of conclusions drawn	HA1-877	Drawing Inferences and Making Predictions from Tables and Graphs
	· Bias in conclusions drawn (e.g., influence of how data is displayed)	HA1-877	Drawing Inferences and Making Predictions from Tables and Graphs
	· Statistical claims based on sampling	*Activity	
	3. Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome.	*Activity	
	4. Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of the data.	HA1-965	Determining the Best-Fitting Line
	5. Analyze data using technology, and use statistical terminology to describe conclusions.	HA1-541	Analyzing Data Using the Measures of Central Tendency and the Range
		HA1-892	Data Analysis Using the Graphing Calculator
	· Measures of dispersion: variance, standard deviation, outliers	HA1-555	Computing the Range, Variance, and Standard Deviation of a Set of Data
	· Correlation coefficient	HA1-965	Determining the Best-Fitting Line
	· Normal distribution (e.g., approximately 95% of the sample lies between two standard deviations on either side of the mean)	HA1-885	Histograms and the Normal Distribution
4.4.11.B	B. Probability		
	1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair.	HA1-560	Determining Probability of an Event and Complementary Event from a Random Experiment
	2. Use concepts and formulas of area to calculate geometric probabilities.	*Activity	
	3. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models, and solve problems using these models.	*Activity	
	4. Determine probabilities in complex situations.		
	· Conditional events	*Activity	
	· Complementary events	HA1-560	Determining Probability of an Event and Complementary Event from a Random Experiment
	· Dependent and independent events	HA1-565	Solving Problems Involving Independent, Dependent, and Mutually Exclusive and Inclusive Events

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	5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.	HA1-565	Solving Problems Involving Independent, Dependent, and Mutually Exclusive and Inclusive Events
	6. Understand and use the "law of large numbers" (that experimental results tend to approach theoretical probabilities after a large number of trials).	Content under review	
4.4.11.C	C. Discrete Mathematics—Systematic Listing and Counting		
	1. Calculate combinations with replacement (e.g., the number of possible ways of tossing a coin 5 times and getting 3 heads) and without replacement (e.g., number of possible delegations of 3 out of 23 students).	HA1-879	Applying Counting Techniques to Permutations and Combinations
	2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations.	HA1-879	Applying Counting Techniques to Permutations and Combinations
	3. Justify solutions to counting problems.	HA1-879	Applying Counting Techniques to Permutations and Combinations
	4. Recognize and explain relationships involving combinations and Pascal's Triangle, and apply those methods to situations involving probability.	HA1-879	Applying Counting Techniques to Permutations and Combinations
4.4.11.D	D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms		
	1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems.		
	· Circuits that include every edge in a graph	*Activity	
	· Circuits that include every vertex in a graph	*Activity	
	· Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring	*Activity	
	· Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures)	*Activity	
	2. Explore strategies for making fair decisions.		
	· Combining individual preferences into a group decision (e.g., determining winner of an election or selection process)	Content under review	
	· Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment)	Content under review	

*Activities include Problem Sets of the Day and Journal Questions.

MM1-Fundamentals of Mathematics

MPA- Pre-Algebra

HA1-Algebra 1

HGM - Geometry (New course in development)

Note: Standards were taken from the New Jersey High School (9-12) Mathematics Content Standards document adopted by the New Jersey State Board of Education in 1/9/2008.