MOORESTOWN TOWNSHIP PUBLIC SCHOOLS
MOORESTOWN, NEW JERSEY

William Allen Middle School
Mathematics

Mathematics PreAlgebra
Grade 8

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Course Description and Fundamental Concepts

This course, which is aligned to the NJ Student Learning Standards, is focused on the following major concepts or Big Ideas: the Number System, Expressions and Equations, Functions, Geometry, Statistics and Probability. Students will enhance their analytical, reasoning and problem-solving skills throughout the curriculum.

PreAlgebra Overview

1. **The Number System**
   - Know that there are numbers that are not rational, and approximate them by rational numbers.

2. **Expressions and Equations**
   - Work with radicals and integer exponents.
   - Understand the connections between proportional relationships, lines, and linear equations.
   - Analyze and solve linear equations and pairs of simultaneous linear equations.

3. **Functions**
   - Define, evaluate, and compare functions.
   - Use functions to model relationships between quantities.

4. **Geometry**
   - Understand congruence and similarity using physical models, transparencies, or geometry software.
   - Understand and apply the Pythagorean Theorem.
   - Solve real-world and mathematical problems involving volume of cylinders, cones and spheres.

5. **Statistics and Probability**
   - Investigate patterns of association in bivariate data.

Mathematical Practice Standards

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

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New Jersey Student Learning Standards (NJSLS)

Subject/Content Standards
Include grade appropriate subject/content standards that will be addressed

8.NS The Number System

A. Know that there are numbers that are not rational, and approximate them by rational numbers.
   1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
   2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., sqrt2). For example, by truncating the decimal expansion of sqrt2, show that sqrt2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

8.EE Expressions and Equations

A. Work with radicals and integer exponents.
   1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 32 × 3–5 = 3–3 = 1/33 = 1/27.
   2. Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that sqrt2 is irrational.
   3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. For example, estimate the population of the United States as 3 × 108 and the population of the world as 7 × 109, and determine that the world population is more than 20 times larger.
   4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

B. Understand the connections between proportional relationships, lines, and linear equations.
   5. Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.
   6. Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation y = mx for a line through the origin and the equation y = mx + b for a line intercepting the vertical axis at b.

C. Analyze and solve linear equations and pairs of simultaneous linear equations.
   7. Solve linear equations in one variable.
      a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent

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equation of the form x = a, a = a, or a = b results (where a and b are different numbers).

b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8. Analyze and solve pairs of simultaneous linear equations.
    a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
    b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
    c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

8.F Functions

A. Define, evaluate, and compare functions.
    1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
    2. Compare properties (e.g. rate of change, intercepts, domain and range) of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.
    3. Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function A = s2 giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.

B. Use functions to model relationships between quantities.
    4. Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
    5. Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

8.G Geometry

A. Understand congruence and similarity using physical models, transparencies, or geometry software.
    1. Verify experimentally the properties of rotations, reflections, and translations:
        a. Lines are transformed to lines, and line segments to line segments of the same length.
        b. Angles are transformed to angles of the same measure.
        c. Parallel lines are transformed to parallel lines.
    2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

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3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.
5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.

B. Understand and apply the Pythagorean Theorem.
6. Explain a proof of the Pythagorean Theorem and its converse.
7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

C. Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

8.SP Statistics and Probability

A. Investigate patterns of association in bivariate data.
1. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
2. Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.
4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?

Mathematical Practice Standards

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5. Use appropriate tools strategically.
6. Attend to precision.

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7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

21st-Century Skills and Technology Integration (Standard 8)
List appropriate units below for which strands (A through F) will be addressed

Standard 8.1 (K-12)		**Educational Technology:** *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*
Unit Addressed	**Strand Letter**	**Standard Description**
Units 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**Strand A**	**Technology Operations and Concepts:** *Students demonstrate a sound understanding of technology concepts, systems, and operations.*
Units 9, 10	**Strand B**	**Creativity and Innovation:** *Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.*
Unit 6	**Strand C**	**Communication and Collaboration:** *Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.*
	Strand D	**Digital Citizenship:** *Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.*
	Strand E	**Research and Information Fluency:** *Students apply digital tools to gather, evaluate, and use information.*
Units 1, 2, 3, 4, 5, 6, 7, 8 , 9, 10, 11	**Strand F**	**Critical thinking, problem-solving, and decision making:** *Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.*

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Career Ready Practices (Standard 9)
List appropriate units below for which CRPs will be addressed

Unit Addressed	Standard #	Standard Description
Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP1**	*Act as a responsible and contributing citizen and employee.*
Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP2**	*Apply appropriate academic and technical skills.*
Units 1, 6	**CRP3**	*Attend to personal health and financial well-being.*
Units, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP4**	*Communicate clearly and effectively and with reason.*
	CRP5	*Consider the environmental, social and economic impacts of decisions.*
Units 4, 5, 6, 10	**CRP6**	*Demonstrate creativity and innovation.*
Unit 7	**CRP7**	*Employ valid and reliable research strategies.*
Units, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP8**	*Utilize critical thinking to make sense of problems and persevere in solving them.*
Units, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP9**	*Model integrity, ethical leadership, and effective management.*
	CRP10	*Plan education and career paths aligned to personal goals.*
Units, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP11**	*Use technology to enhance productivity.*
Units, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	**CRP12**	*Work productively in teams while using cultural global competence*

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Interdisciplinary Connections
List any other content standards addressed as well as appropriate units

Visual & Performing Arts Integration (Standard 1)
List appropriate units below for which standards (1.1 through 1.4) may be addressed

Unit Addressed	Standard #	Standard Description
Units 1, 7, 8, 10	**Standard 1.1**	**The Creative Process:** *All students will demonstrate an understanding of the elements and principles that govern the creation of works of art in dance, music, theatre, and/or visual art.*
	Standard 1.2	**History of the Arts and Culture:** *All students will understand the role, development, and influence of the arts throughout history and across cultures.*
	Standard 1.3	**Performing/Presenting/Producing:** *All students will synthesize those skills, media, methods, and technologies appropriate to creating, performing, and/or presenting works of art in dance, music, theatre, and/or visual art.*
	Standard 1.4	**Aesthetic Responses & Critique Methodologies:** *All students will demonstrate and apply an understanding of arts philosophies, judgment, and analysis to works of art in dance, music, theatre, and/or visual art.*

Other Interdisciplinary Content Standards
List appropriate units below for any other content/standards that may be addressed

Unit Addressed	Content / Standard #	Standard Description
Units 1, 2	MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
Units 4, 5	MS- PS3 - 5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
Unit 2	MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structure

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Unit 5	MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave
Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	NJSLSA.R7.	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
Units 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	NJSLSA.W4.	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Unit 1	6.1.8.D.4.b	Describe efforts to reform education, women's rights, slavery, and other issues during the Antebellum period.

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Pacing Guide (All Dates are approximate based on the school calendar)

Unit/ Topic	Month (w/Approx number of Teaching Days)
Unit 1: Real Number System Unit 2: Powers and Exponents	**September** **(~19 days)**
Unit 2: Powers and Exponents Unit 3: Equations in One Variable	**October** **(~19 days)**
Unit 3: Equations in One Variable Unit 4: Functions	**November** **(~16 days)**
Unit 4: Functions Unit 5: Equations in Two Variables	**December** **(~15 days)**
Unit 5: Equations in Two Variables	**January** **(~18 days)**
Unit 6: Systems of Equations	**February** **(~18 days)**
Unit 7: Lines and Triangles Unit 8: Transformations	**March** **(~15-20 days)**
Unit 8: Transformations Unit 9: Congruence and Similarity	**April** **(~15-20 days)**
Unit 10: Volume and Surface Area Unit 11: Statistics and Probability	**May** **(~18 days)**
Unit 11: Statistics and Probability	**June** **(~15 days)**

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Units

Contact the Content Supervisor for unit details.

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