HARFORD COUNTY PUBLIC SCHOOLS
MATHEMATICS 8 CURRICULUM

[CLICK HERE] for the Maryland College and Career Ready Standards for Grade 8 Mathematics.

Module 1, Topic 1: Rigid Motion Transformations

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- Objects in space can be oriented in an infinite number of ways, and an object's location in space can be described quantitatively.
- Objects in space can be transformed in an infinite number of ways, and those transformations can be described and analyzed mathematically.

Essential Questions

- What are the effects of dilations, translation, rotation, and/or reflection on a two-dimensional figure in the coordinate plane?
- Which transformations preserve angle measure, congruence, distance, and orientation?
- How can real-world situations be modeled by geometric figures to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 1, Topic 1, students should complete the following units in Mathia: • Pre-Launch Protocol • Rigid Motions on the Coordinate Plane (5 workspaces)	
Patty Paper, Patty Paper	Students recall geometry vocabulary and notation as they describe a provided shape. They use patty paper to investigate and verify characteristics of the shape. Students sort figures based on their shapes and sizes to develop a definition of congruent figures. Students make conjectures, investigate with patty paper, and then explain how they could slide, flip, or spin the original figure to obtain each congruent figure.	8.G.A.1.a 8.G.A.1.b 8.G.A.2

Slides, Flips, and Spins: Introduction to Rigid Motion	Students explore properties of translations and reflections in the plane. Students explore properties of rotations in the plane. Students use rigid motions to transform non-geometric objects in the plane using either patty paper or the properties of the transformations.	8.G.A.1.a 8.G.A.1.b 8.G.A.1.c 8.G.A.2
Lateral Moves: Translations of Figures on the Coordinate Plane	Students perform horizontal and vertical translations and explore how the translation affected the coordinates of the pre-image. Students write the coordinate of translated points in terms of x and y. They determine the coordinates of images that result from various translations. Students describe a sequence of translations that can be used to show that two figures are congruent.	8.G.A.2 8.G.A.3
Mirror, Mirror: Reflections of Figures on the Coordinate Plane	Students perform reflections over the x- and y-axes and explore how the reflections affected the coordinates of the pre-image. Students describe a sequence of reflections and translations that can be used to show that two figures are congruent.	8.G.A.2 8.G.A.3
Half Turns and Quarter Turns: Rotations of Figures on the Coordinate Plane	Students perform 90° and 180° rotations and explore how the rotations affected the coordinates of the pre-image. Students describe a sequence of rigid motions that can be used to show that two figures are congruent.	8.G.A.2 8.G.A.3
Every Which Way: Combining Rigid Motions	Students write congruence statements and use rigid motions to verify congruence. Given the coordinates of a pre-image and image, students describe the rigid motion or combination of rigid motion transformations used to form the image from a pre-image.	8.G.A.2 8.G.A.3

Module 1, Topic 2: Similarity

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- If two quantities vary proportionally, that relationship can be represented as a linear function.

Essential Questions

- What are the effects of a dilation on a two-dimensional figure in the coordinate plane?
- How can proportions be used to find side lengths in similar polygons?
- How can similar polygons and triangles be identified?
- How can real-world situations be modeled by geometric figures to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 1, Topic 2, students should complete the following units in Mathia: • Dilating Figures on the Coordinate Plane (2 workspaces) • Mapping Similar Figures Using Transformations (3 workspaces)	
Pinch-Zoom Geometry: Dilations of Figures	Students relate terms associated with scale factors to dilations and similarity. Students learn that dilations create similar figures, with congruent corresponding angles and equal ratios of their corresponding side lengths.	8.G.A.4
Rising, Running, Stepping, Scaling: Figures on the Coordinate Plane	Students differentiate between congruent and similar figures. Students create and modify conjectures about the effect of dilations from different centers on the coordinates of a figure. Students use transformations to verify that two figures are similar.	8.G.A.3 8.G.A.4
From Here to There: Mapping Similar Figures Using Transformations	Students determine similarity using a single dilation. Students verify similarity through a sequence of transformations. Students explore the relationship between images of a common pre-image under different conditions and the relationship between figures similar to congruent figures.	8.G.A.4

Module 1, Topic 3: Line and Angle Relationships

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- Two- and three-dimensional objects with or without curved surfaces can be described, classified, and analyzed by their attributes.

Essential Questions

- What is the relationship between the interior and exterior angles of a triangle?
- What types of angles are formed by parallel lines and a transversal?
- How can real-world situations be modeled by geometric figures to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 1, Topic 3, students should complete the following units in Mathia: • Triangle Sum and Exterior Angle Theorems (2 workspaces) • Angle Relationships Formed by Lines Intersected by a Transversal (3 workspaces) • The Angle-Angle Similarity Theorem (2 workspaces)	
Pulling a 180: Triangle Sum and Exterior Angle Theorems	Students explore and justify the Triangle Sum Theorem and the Exterior Angle Theorem. Students investigate the relationship between interior angle measures and the side lengths of a triangle. Students will practice applying the Triangle Sum Theorem and the Exterior Angles Theorem.	8.G.A.5
Crisscross Applesauce: Angle Relationships Formed by Lines Intersected by a Transversal	Students identify the angles formed when two lines are intersected by a transversal. Students determine that when the two lines are parallel, special angle pairs are either congruent or supplementary. Students solve problems using parallel line and angle relationships.	8.G.A.5
Vanishing Point: The Angle-Angle Similarity Theorem	Students establish and use the Angle-Angle Theorem to show two triangles are similar. Students determine if triangles in complex diagrams are similar using the AA Theorem.	8.G.A.5

Module 2, Topic 1: From Proportions to Linear Relationships

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- If two quantities vary proportionally, that relationship can be represented as a linear function.
- Mathematical rules (relations) can be used to assign members of one set to members of another set. A special rule (function) assigns each member of one set to a unique member of the other set.

Essential Questions

- How can one determine rate of change for a linear function displayed algebraically, graphically, numerically in tables, or by verbal descriptions?
- How can one determine the y-intercept for a linear function displayed algebraically, graphically, numerically in tables, or by verbal descriptions?
- How can linear equations be written given numerical or graphical information that defines the line?
- How can real-world situations be modeled by linear functions to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 2, Topic 1, students should complete the following units in Mathia: • Representations of Proportional Relationships (3 workspaces) • Using Similar Triangles to Describe the Steepness of a Line (2 workspaces) • Exploring Slopes (2 workspaces)	
Post-Secondary Proportions: Representations of Proportional Relationships	Students use ratios to analyze proportional relationship representations. Students write equivalent ratios, write equations, create a table of values, and graph proportional relationships. Students write equivalent ratios, write equations, create a table of values, and graph proportional relationships. Students analyze two scenarios involving proportional relationships represented in different forms.	8.EE.B.5

Jack and Jill Went Up the Hill: Using Similar Triangles to Describe the Steepness of a Line	Students connect unit rate, constant of proportionality, and scale factor with slope, which is introduced as the rate of change of the dependent quantity compared to the independent quantity. Students derive the equations for a proportional linear relationship, $y = mx$, and for a non-proportional linear relationship, $y = mx + b$. Students derive the equations for a proportional linear relationship, $y = mx$, and for a non-proportional linear relationship, $y = mx + b$.	8.EE.B.5 8.EE.B.6
Slippery Slopes: Exploring Slopes Using Similar Triangles	Students use similar triangles to explain why the slope of any line is the same between any two distinct points on a non-vertical line. Students explore the slope of $y = x$ and $y = 2x – 5$ by drawing right triangles on the lines, verifying that the triangles are similar, and show the slope of any two points on the non-vertical line is the same. Students show that the slope of any two points on a non-vertical line is not only similar, but the same.	8.EE.B.6
Up, Down, and All Around: Transformations of Lines	Students apply geometric transformations to the basic function, $y = x$. Students recognize $y = mx$ as a dilation of $y = x$ and $y = mx + b$ as a translation of $y = mx$. Students learn that lines with the same slope are parallel and that parallel lines remain parallel after a reflection or rotation.	8.EE.B.6 8.G.A.1.a 8.G.A.1.c

Module 2, Topic 2: Linear Relationships

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- If two quantities vary proportionally, that relationship can be represented as a linear function.
- Mathematical rules (relations) can be used to assign members of one set to members of another set. A special rule (function) assigns each member of one set to a unique member of the other set.

Essential Questions

- What are the effects of a dilation, translation, rotation, and/or reflection on a two-dimensional figure in the coordinate plane?
- Which transformations preserve angle measure, congruence, distance, and orientation?
- How can real-world situations be modeled by linear functions to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 2, Topic 2, students should complete the following units in Mathia: • Using Tables, Graphs, and Equations (2 workspaces) • Linear Relationships in Tables (1 workspace) • Slope-Intercept Form of a Line (4 workspaces) • Point-Slope Form of a Line (2 workspaces) • Graphing Linear Equations (5 workspaces)	
U.S. Shirts: Using Tables, Graphs, and Equations	Students create equations, tables, and graphs to analyze linear relationships. Students compare two t-shirt company pricing rates algebraically and graphically. Students create equations, tables, and graphs to analyze linear relationships. They compare two t-shirt company pricing rates algebraically and graphically. Students write a response that compares the pricing plans for the two companies and predict how the pricing affects business.	8.F.B.4

At the Arcade: Linear Relationships in Tables	Students use the slope formula to determine the rate of change for a table of values or two points. Students determine whether a given table of values represents a linear relationship using rate of change. Students determine whether a given table of values represents a linear relationship by examining the first differences.	8.F.B.4
Dining, Dancing, Driving: Linear Relationships in Context	Students analyze a context that represents linear relationships among distance, cost, and gallons of gas. Students represent a context using different independent and dependent quantities, each time calculating the rate. Students analyze a context that represents linear relationships and represent the same context using different independent and dependent quantities, each time calculating the rate to connect processes and representations.	8.F.B.4
Derby Day: Slope-Intercept Form of a Line	Students learn about the y-intercept of a linear graph and the slope-intercept form of a linear equation. Students use the slope formula in their calculations to derive the slope-intercept form. Students will practice writing and analyzing equations in slope-intercept form.	8.F.B.4
What's the Point: Point-Slope Form of a Line	Students use the slope formula to derive the point-slope form of a linear equation. Students practice writing equations in point-slope and slope-intercept forms when given a variety of information. They write equations for horizontal and vertical lines.	8.F.B.4
The Arts Are Alive: Using Linear Equations	Students graph lines using the following linear equations forms: slope-intercept, and point-slope. Students graph lines using the standard form. Students compare the advantages and disadvantages of each of the three forms of linear equations: slope-intercept, point-slope, and standard form.	8.F.B.4

Module 2, Topic 3: Introduction to Functions

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- If two quantities vary proportionally, that relationship can be represented as a linear function.
- Mathematical rules (relations) can be used to assign members of one set to members of another set. A special rule (function) assigns each member of one set to a unique member of the other set.

Essential Questions

- How do functions and relations differ?
- How can functions be used to model relationships between quantities?
- How can real-world situations be modeled by linear functions to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 2, Topic 3, students should complete the following units in Mathia: • Defining Functional Relationships (2 workspaces) • Describing Graphs of Functions (2 workspaces) • Comparing Functions Using Different Representations (1 workspace)	
Patterns, Sequences, Rules: Analyzing Sequences as Rules	Students analyze sequences that decrease, increase, and alternate between decreasing and increasing. They generate the next terms, describe the patterns in the sequences, and compare the sequences.	8.F.A.1
Once Upon a Graph: Analyzing the Characteristics of Graphs of Relationships	Students complete a sorting activity to distinguish the graphs that are discrete or continuous; linear or nonlinear; increasing, decreasing, neither increasing nor decreasing, or both increasing and decreasing. They use these terms to qualitatively describe numberless piecewise linear graphs. Students use the terms discrete or continuous; linear or nonlinear; increasing, decreasing, neither increasing nor decreasing, or both increasing and decreasing to qualitatively describe numberless piecewise linear graphs.	8.F.B.5

One or More x's to One y: Defining Functional Relationships	The terms relation and function are defined. Students analyze mappings, sets of ordered pairs, tables, and contexts, and determine which are functions. Students analyze mappings, sets of ordered pairs, sequences, tables, graphs, equations, and contexts, and determine which are functions. Students analyze equations and determine which are functions.	8.F.A.1
Over the River and Through the Woods: Describing Functions	Students analyze the graphical behavior of linear and nonlinear functions. They conclude that nonvertical linear relationships are linear functions. Then students learn about and apply intervals of increase and decrease and constant intervals to descriptions of a day. Students apply intervals of increase and decrease and constant intervals to descriptions of a day and to specific nonlinear functions (absolute value, quadratic, cubic).	8.F.A.3 8.F.B.4 8.F.B.5
Comparing Apples to Oranges: Comparing Functions Using Different Representations	Students compare the rate of change associated with functions represented by equations, tables of values, graphs, and verbal descriptions. They also order rates of change associated with various representations.	8.F.A.2

Module 2, Topic 4: Patterns in Bivariate Data

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- Mathematical rules (relations) can be used to assign members of one set to members of another set. A special rule (function) assigns each member of one set to a unique member of the other set.

Essential Questions

- Does a line that is fit to data describe a positive or negative association?
- What can be determined by analyzing bivariate categorical data in a two-way table?
- How can real-world situations be modeled by linear functions to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 2, Topic 4, students should complete the following units in Mathia: • Analyzing Patterns in Scatter Plots (2 workspaces) • Patterns of Association of Two-Way Tables (4 workspaces)	
Pass the Squeeze: Analyzing Patterns in Scatter Plots	Students construct and analyze scatter plots of bivariate data to explore patterns in the data. They analyze scatter plots as they learn the terms bivariate data, explanatory variable, response variable, linear association, positive association, negative association, cluster, and outlier. Students construct and analyze scatter plots of bivariate data to explore patterns in the data. They analyze scatter plots as they learn the terms bivariate data, explanatory variable, response variable, linear association, positive association, negative association, cluster, and outlier.	8.SP.A.1
Where Do You Buy Your Books: Drawing Lines of Best Fit	Students analyze two scatter plots to show the percentage of book sales from bookstores and the internet for time from 2004 to 2010. They write an equation of the line of best fit for each scatter plot and draw it on their plot. Using their line of best fit, students predict the percentage of book sales.	8.SP.A.2 8.SP.A.3

Mia is Growing Like a Weed: Analyzing Lines of Best Fit	Students create a scatter plot for age and height. They draw the line of best fit and determine the equation of the line of best fit for each scatter plot. Students then make predictions for height based on age using the equation of each line of best fit. Students create a scatter plot for age and weight. They draw the line of best fit and determine the equation of the line of best fit for each scatter plot. Students then make predictions for weight based on age using the equation of each line of best fit. Students create a scatter plot for age and weight. They draw the line of best fit and determine the equation of the line of best fit for each scatter plot. Students then make predictions for weight based on age using the equation of each line of best fit.	8.SP.A.2 8.SP.A.3
The Stroop Test: Comparing Slopes and Intercepts of Data from Experiments	Students conduct the Stroop Test Experiment, calculate the mean time for various matching and non-matching lists of words and create scatter plots of the list length versus the amount of time. Students draw the line of best fit for each scatter plot and make predictions for the amount of time based on the list length using the equations of the lines of best fit.	8.SP.A.3
Would you Rather: Patterns of Association in Two-Way Tables	Students construct and use two-way tables containing tally marks and numerical data describing the frequencies of occurrence. Then they construct relative frequency tables and use the tables to answer questions related to the problem situation. Students construct and use two-way tables containing tally marks and numerical data describing the frequencies of occurrence. Then they construct relative frequency tables and use the tables to answer questions related to the problem situation.	8.SP.A.4

Module 3, Topic 1: Solving Linear Equations

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- Rules of arithmetic and algebra can be used together with notions of equivalence to transform equations and inequalities so solutions can be found.
- Mathematical situations and structures can be translated and represented abstractly using variables, expressions, and equations.

Essential Questions:

- How can the Properties of Equality be used to solve linear equations with variables on both sides?
- How can linear equations be used to solve real world problems?
- What are the defining characteristics of linear equations with no solutions, one solution, or infinitely-many solutions?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 3, Topic 1, students should complete the following units in Mathia: • Solving Multi-Step Equations (5 workspaces) • Analyzing Linear Equations Involving the Distributive Property (4 workspaces) • Interpreting the Number of Solutions to Equations (2 workspaces) • Solving Linear Equations with Variables on Both Sides (4 workspaces)	
Strategic Solving: Equations with Variables on Both Sides	Students solve equations with the same variable on both sides of the equal sign. They use combining like terms, the Properties of Equality, the additive inverse, and the Distributive Property to solve. Students explore strategies to convert fractions and decimals in equations to whole numbers. Students explore strategies to convert fractions and decimals in equations to whole numbers.	8.EE.C.7.b

MP3s and DVDs: Analyzing and Solving Linear Equations	Students write algebraic expressions within the context of different situations. They will then use the expressions to write equations and solve the equations for unknown values. Students interpret solutions and determine when equations have one solution, no solutions, or infinitely many solutions. Students interpret solutions and determine when equations have one solution, no solutions, or infinitely many solutions.	8.EE.C.7.a
Tic-Tac-Bingo: Creating Linear Equations	Students use their knowledge of solving linear equations to create linear equations with one solution, no solution, or infinite solutions. They play Tic-Tac-Bingo as they work together to create equations with given solution types from assigned expressions. Then students summarize the strategies they used to create the equations. Students play Tic-Tac-Bingo as they work together to create equations with given solution types from assigned expressions. Then students summarize the strategies they used to create the equations.	8.EE.C.7.a 8.EE.C.7.b

Module 3, Topic 2: Systems of Linear Equations

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- Rules of arithmetic and algebra can be used together with notions of equivalence to transform equations and inequalities so solutions can be found.
- Mathematical situations and structures can be translated and represented abstractly using variables, expressions, and equations.

Essential Questions:

- How can real-world situations be modeled by systems of equations to help solve problems?
- What are the advantages and disadvantages of solving a system of linear equations graphically versus algebraically?
- What does the number of solutions (one, none or infinitely many) of a system of linear equations represent in the given context?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 3, Topic 2, students should complete the following units in Mathia: • Systems of Linear Equations (4 workspaces)	
Crossing Paths: Point of Intersection of Linear Graphs	Students compare and analyze cost and income equations graphically and algebraically. They graph cost and income equations on the same graph to determine a point of intersection and interpret the point of intersection as the solution to two equations. Students compare determining a point of intersection from a table along with doing so using equations and a graph. Students compare determining a point of intersection from a table along with doing so using equations and a graph.	8.EE.C.8.a

The Road Less Traveled: System of Linear Equations	Students write and analyze linear systems of equations. They informally calculate the solutions to systems of linear equations and then graph the systems of equations. Students conclude when parallel lines comprise the system, the lines will never intersect, so there is no solution to the system. Students determine whether the graphs of linear systems of equations are parallel, perpendicular, or neither through analysis of their slopes. Students determine whether the graphs of linear systems of equations are parallel, perpendicular, or neither through analysis of their slopes.	8.EE.C.8.b
The County Fair: Using Substitution to Solve Linear Systems	Students learn to use the substitution method to solve systems of linear equations. They define variables, write systems of equations, solve systems, and interpret the meaning of the solution in terms of the problem context. Students use substitution to solve systems of linear equations including systems with no solution or with infinite solutions. They define variables, write systems of equations, solve systems, and interpret the meaning of the solution in terms of the problem context. Students use substitution to solve systems of linear equations including systems with no solution or with infinite solutions. They define variables, write systems of equations, solve systems, and interpret the meaning of the solution in terms of the problem context.	8.EE.C.8.a 8.EE.C.8.b 8.EE.C.8.c
Rockin' Roller Rinks: Choosing a Method to Solve a Linear System	Students compare the cost of holding a middle school skating event at three different locations. They write equations for each location and compare the cost for different numbers of skaters, by solving systems of equations, completing tables of values, and creating graphs. Students compare the cost of holding a middle school skating event at three different locations. They write equations for each location and compare the cost for different numbers of skaters, by solving systems of equations, completing tables of values, and creating graphs. Students compare the cost of holding a middle school skating event at three different locations. They write equations for each location and compare the cost for different numbers of skaters, by solving systems of equations, completing tables of values, and creating graphs.	8.EE.C.8.a 8.EE.C.8.b 8.EE.C.8.c

Module 4, Topic 1: The Real Number System

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- The set of real numbers is infinite, and each real number can be associated with a unique point on the number line.
- Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.
- For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra.
- Numerical calculations can be approximated by replacing numbers with other numbers that are close and easy to compute with mentally. Measurements can be approximated using known referents as the unit in the measurement process.

Essential Questions

- What are rational and irrational numbers?
- How can a number line be used to compare rational and irrational numbers?
- What are perfect squares and non-perfect squares?
- What are perfect cubes and non-perfect cubes?
- How can real-world situations be modeled by real numbers to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 4, Topic 1, students should complete the following units in Mathia: • The Real Numbers (4 workspaces)	
So Many Numbers, So Little Time: Number Sort	Students sort numbers and justify their reasoning. They analyze the work of their peers and provide reasoning for the way in which their peers grouped their numbers.	8.NS.A.1
Rational Decisions: Rational and Irrational Numbers	Students learn formal definitions for rational and irrational numbers. They conclude the set of rational numbers is closed and includes the set of whole numbers, the set of integers, some fractions, and some decimals. Students write fractions as repeating decimals and convert terminating and repeating decimals to fractions.	8.NS.A.1

What are Those: The Real Numbers	Students calculate square roots of perfect square and cube roots of perfect cubes. They locate irrational numbers on a number line between two rational numbers. Students locate irrational numbers on a number line between two rational numbers. Then they summarize the relationships among the sets of numbers in the real number system.	8.EE.A.2 8.NS.A.2

Module 4, Topic 2: Pythagorean Theorem

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- The set of real numbers is infinite, and each real number can be associated with a unique point on the number line.
- Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.
- For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra.
- Numerical calculations can be approximated by replacing numbers with other numbers that are close and easy to compute with mentally. Measurements can be approximated using known referents as the unit in the measurement process.
- Two- and three-dimensional objects with or without curved surfaces can be described, classified, and analyzed by their attributes.

Essential Questions

- How can the Pythagorean Theorem be applied to real-world situations?
- How can distance be determined using the Pythagorean Theorem?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 4, Topic 2, students should complete the following units in Mathia: • The Pythagorean Theorem (3 workspaces) • Distances in a Coordinate System (1 workspace)	
The Right Triangle Connection: The Pythagorean Theorem	Students learn about and prove the Pythagorean Theorem using area models. They practice using the Pythagorean Theorem to solve for unknown side lengths in mathematical and contextual problems. Students practice using the Pythagorean Theorem to solve for unknown side lengths in mathematical and contextual problems.	8.EE.A.2 8.G.B.6 8.G.B.7
Can That Be Right: The Converse of the Pythagorean Theorem	Students learn about and prove the Converse of the Pythagorean Theorem. They generate Pythagorean triples and use the Pythagorean Theorem and its converse to solve problems. Students use the Pythagorean Theorem and its converse to solve problems.	8.EE.A.2 8.G.B.6 8.G.B.7

Pythagoras Meets Descartes: Distances in a Coordinate System	Students apply the Pythagorean Theorem to the coordinate plane. They calculate various distances using coordinates of points aligned either horizontally or vertically using subtraction and diagonal distances using the Pythagorean Theorem.	8.EE.A.2 8.G.B.8
Catty Corner: Side Lengths in Two and Three Dimensions	Students use the Pythagorean Theorem to determine the length of a three-dimensional diagonal of a rectangular solid. Students apply the Pythagorean Theorem to determine two-dimensional diagonals of rectangles and trapezoids.	8.EE.A.2 8.G.B.7

Module 5, Topic 1: Exponents and Scientific Notation

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- The set of real numbers is infinite, and each real number can be associated with a unique point on the number line.
- Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.
- For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra.
- Numerical calculations can be approximated by replacing numbers with other numbers that are close and easy to compute with mentally. Measurements can be approximated using known referents as the unit in the measurement process.

Essential Questions

- How are the properties of integer exponents used to simplify numerical and algebraic expressions?
- How is scientific notation used to describe very large or very small quantities and the relationship between quantities?
- How can real-world situations be modeled by powers to help solve problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 5, Topic 1, students should complete the following units in Mathia: • Properties of Powers with Integer Exponents (6 workspaces) • Scientific Notation (2 workspaces)	
It's a Generation Thing: Properties of Powers with Integer Exponents	Students write and evaluate expressions with positive integer exponents. They begin with a context using the power with a base of 2. Students write and evaluate expressions with positive integer exponents. Students investigate positive and negative integer bases where the negative sign may or may not be raised to a power depending on the placement of parentheses.	8.EE.A.1

Show What You Know: Analyzing Properties of Powers	Students organize and discuss the properties of powers. They write mathematical justifications for each step within a solution path using the properties of powers. Students solve additional practice problems and examine student work for correctness.	8.EE.A.1
The Big and Small of It	Students are introduced to scientific notation. They convert from standard form to scientific notation and from scientific notation to standard form. Students begin comparing numbers written in scientific notation.	8.EE.A.3 8.EE.A.4
How Much Larger: Operations with Scientific Notation	Students perform operations on numbers represented in scientific notation with and without context. Students connect the Product Rule of Powers and the Quotient of a Power Rule with scientific notation. Students perform operations with numbers written in scientific notation. Students compare and operate on numbers expressed in standard form or scientific notation.	8.EE.A.3 8.EE.A.4

Module 5, Topic 2: Volume of Curved Figures

Primary Resource: *Middle School Math Solution Course 3,* Carnegie Learning, 2017.

Enduring Understandings

- The set of real numbers is infinite, and each real number can be associated with a unique point on the number line.
- Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value.
- For a given set of numbers there are relationships that are always true, and these are the rules that govern arithmetic and algebra.
- Numerical calculations can be approximated by replacing numbers with other numbers that are close and easy to compute with mentally. Measurements can be approximated using known referents as the unit in the measurement process.
- Two- and three-dimensional objects with or without curved surfaces can be described, classified, and analyzed by their attributes.

Essential Questions

- What is the relationship, if any, between volume of cones, cylinders, and spheres?
- How can the formulas of cones, cylinders, and spheres to solve real-world and mathematical problems?

Lesson Title	Lesson Overview	Standards
Mathia	By the end of Module 5, Topic 2, students should complete the following units in Mathia: • Volume of a Cylinder (3 workspaces) • Volume of a Cone (2 workspaces) • Volume of a Sphere (2 workspaces)	
Drum Roll, Please: Volume of a Cylinder	Students learn the formula for the volume of a cylinder and use it to solve volume problems. Students investigate the effect on the volume of a cylinder if one of its dimensions is doubles. Students calculate the volume of oblique cylinders.	8.G.C.9
Cone of Silence: Volume of a Cone	Students use 3-dimensional models to investigate the relationship between the volume of a cylinder and the volume of a cone. Students learn the formula for the volume of a cone and use it to solve volume problems.	8.G.C.9

Pulled in All Directions: Volume of a Sphere	Students use modeling clay to derive the formula for the volume of a sphere. Students solve problems involving the volume of a sphere.	8.G.C.9
Silos, Frozen Yogurt, and Popcorn: Volume Problems with Cylinders, Cones, and Spheres	Students determine the volume of grain needed to fill a silo as well as the volume of a cone and a melted scoop of yogurt. Students determine the volume of cylindrical and rectangular-prism shaped popcorn containers.	8.G.C.9