Title of Unit	**Rational Numbers and Properties of Exponents**	Grade Level	8th Grade Level 2 Supplemental
Curriculum Area	Mathematics	**Time Frame**	2-3 weeks
Developed By	Munira Jamali		

Identify Desired Results (Stage 1)

Content Standards

- 8.NS.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 that terminates in the 0s or eventually repeat.

- 8.NS.2

Use rational approximation of irrational numbers to compare the size of irrational numbers. Locate them approximately on a number line diagram, and estimate the value of expressions (eg, π^2)

- 8.EE.1

Know and apply the properties of integer exponents to generate equivalent numerical expressions

For example $3^2 x\ 3^{-5} = 3^{-3} = 1/3^2 = 1/27$

- 8.EE.3

Use numbers expressed in the form of a single digit items a whole number power of 10 to estimate very large or very small quantities and to express how many times as much as one is than the other

- 8.EE.4

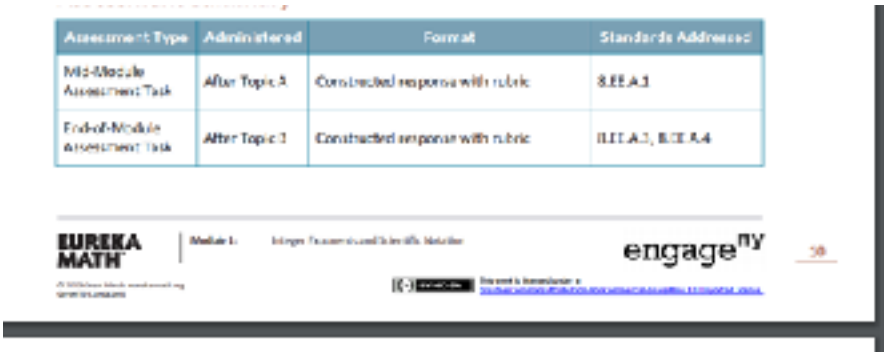
Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities

Understandings	Essential Questions	
Overarching Understanding	**Overarching**	**Topical**

• Students approximate irrational numbers using their understanding of square and cube roots. • Students extend their understanding of the number system by investigating the relationship between the sides of a right triangle. • Students create equivalent expressions using integer exponents. • Students apply their understanding of exponents to express and compare numbers. • Students understand irrational numbers and when to use them in solving problems.	How are numbers rational and irrational numbers related? How do we determine whether two expressions involving exponents are equivalent? How can we express very small or very large numbers using exponential (scientific) notation? How can you investigate the relationships between rational and irrational numbers?	How do I determine the best numerical representation (pictorial, symbolic, objects) for a given situation? • How does finding the common characteristics among similar problems help me to be a more efficient problem solver? • What kinds of experiences help develop number sense?
Related Misconceptions		
Some students are surprised that the decimal representation of pi does not repeat. Some students believe that if only we keep looking at digits farther and farther to the right, eventually a pattern will emerge. A few irrational numbers are given special names (pi and e), and much attention is given to √2. Because we name so few irrational numbers, students sometimes conclude that irrational numbers are unusual and rare. In fact, irrational numbers are much more plentiful than rational numbers, in the sense that they are —denser in the real line. Students may think that the number line only has the numbers that are labeled. Students may confuse the radical sign with the division sign. Students may forget that each rational number has a negative square root, as well as a principal (positive) square root.		

Knowledge Students will know…	**Skills** Students will be able to…
That there are numbers that are not rational, and approximate them by rational numbers Work with radical and integer exponents To perform with numbers expressed in scientific notation including problems where both decimal and scientific notation are used	Approximate irrational numbers using their understanding of square and cube roots Create equivalent expressions using integer exponents Apply understanding of exponents to express and compare numbers Understand irrational numbers and when to use them in solving problems
Assessment Evidence (Stage 2)	
Performance Task Description	

• **Goal** • **Role** • **Audience** • **Situation** • **Product/ Performance** • **Standards**	8th NYC Engage Module 1 Topic A Exponential Notation and Properties of Integer Exponents Focus Standard: 8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$. Instructional Days: 6 Lesson 1: Exponential Notation Lesson 2: Multiplication and Division of Numbers in Exponential Form Lesson 3: Numbers in Exponential Form Raised to a Power Lesson 4: Numbers Raised to the Zeroth Power (E) Lesson 5: Negative Exponents and the Laws of Exponents (S) Lesson 6: Proofs of Laws of Exponents (S) Topic B Magnitude and Scientific Notation 8.EE.A.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 times 10^8 and the population of the world as 7 times 10^9, and determine that the world population is more than 20 times larger. 8.EE.A.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. Instructional Days: 7 Lesson 7: Magnitude (P)1 Lesson 8: Estimating Quantities (P) Lesson 9: Scientific Notation (P) Lesson 10: Operations with Numbers in Scientific Notation (P) Lesson 11: Efficacy of Scientific Notation (S) Lesson 12: Choice of Unit (E) Lesson 13: Comparison of Numbers Written in Scientific Notation and Interpreting Scientific Notation Using Technology (E
Other Evidence	



Assessment Type	Administered	Format	Standards Addressed
Mid-Module Assessment Task	After Topic A	Constructed response with rubric	8.EE.A.1
End-of-Module Assessment Task	After Topic B	Constructed response with rubric	8.EE.A.3, 8.EE.A.4

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Learning Plan (Stage 3)

• **Where are your students headed? Where have they been? How will you make sure the students know where they are going?** • **How will you hook students at the beginning of the unit?** • **What events will help students experience and explore the big idea and questions in the unit? How will you equip them with needed skills and knowledge?** • **How will you cause students to reflect and rethink? How will you guide them in rehearsing, revising, and refining their work?** • **How will you help students to exhibit and self-evaluate their growing skills, knowledge, and understanding throughout the unit?** • **How will you tailor and otherwise personalize the learning plan to optimize the engagement and effectiveness of ALL students, without compromising the goals of the unit?** • **How will you organize and sequence the learning activities to optimize the engagement and achievement of ALL students?**	**In Topic A**, students begin by learning the precise definition of exponential notation where the exponent is restricted to being a positive integer. In Lessons 2 and 3, students discern the structure of exponents by relating multiplication and division of expressions with the same base to combining like terms using the distributive property and by relating multiplying three factors using the associative property to raising a power to a power Lesson 4 expands the definition of exponential notation to include what it means to raise a nonzero number to a zero power; students verify that the properties of exponents developed in Lessons 2 and 3 remain true. Properties of exponents are extended again in Lesson 5 when a positive integer, raised to a negative exponent, is defined. In Lesson 5, students accept the properties of exponents as true for all integer exponents and are shown the value of learning them; in other words, if the three properties of exponents are known, then facts about dividing numbers in exponential notation with the same base and raising fractions to a power are also known. **Topic A** culminates in Lesson 6 when students work to prove the laws of exponents for all integer exponents. Throughout Topic A, students generate equivalent numerical expressions by applying properties of integer exponents, first with positive integer exponents, then with whole number exponents, and concluding with integer exponents in general. In Topic B, students' understanding of integer exponents is expanded to include the concept of magnitude as a measurement. Students learn to estimate how big or how small a number is using magnitude. In Lesson 7, students learn that positive powers of 10 are large numbers and negative powers of 10 are very small numbers. In Lesson 8, students express large numbers in the form of a single digit times a positive power of 10 and express how many times as much one of these numbers is compared to another. Students estimate and compare national to household debt and use estimates of the number of stars in the universe to compare with the number of stars an average human can see. Lessons 9–13 immerse students in scientific notation. Each lesson demonstrates the need for such a notation and then how to compare and compute with numbers in scientific notation. In Lesson 9, students learn how to write numbers in scientific notation and the importance of the exponent with respect to magnitude. The number line is used to illustrate different magnitudes of 10, and students estimate where a particular number, written in scientific notation, belongs on the number line. Also, in this set of lessons, students use what they know about exponential notation, properties of exponents, and scientific notation to interpret results that have been generated by technology. Continuing with magnitude, Lesson 10 shows students how to operate with numbers in scientific notation by

Title of Unit	Congruence and Similarity and Problem Solving	**Grade Level**	8th Grade Level 2
Curriculum Area	Mathematics	**Time Frame**	4-5 weeks
Developed By	Munira Jamali		
Identify Desired Results (Stage 1)			
Content Standards			

- **8.G.1**
- Verify experimentally the properties of rotations, reflections and translations:
    a. Angles are taken to angles of the same measure.
    b. Lines are taken to lines, and line segments to line segments of the same length
    c. Parallel lines are taken to parallel lines.
- **8.G.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 congruent figures, describe a sequence that exhibits the congruence between them

8. G. 3

Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G .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.

- **8. G. 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.*

Understandings	**Essential Questions**	
Overarching Understanding	**Overarching**	**Topical**

Students apply their understanding of the effect of geometric transformation(s) on a figure or shape. Students describe how two figures or shapes are congruent or similar. Students create or identify a sequence of transformations that lead to congruent or similar figures. Students analyze the relationship between angles measures (triangle sum; parallel lines cut by a transversal; impact of a geometric transformation).	How are the (angles), (lengths), or (figures) changing? How are they staying the same? How is ___ related to____? What happens when an object is dilated? How could an object be transformed to enlarge or reduce its size? How can you determine the distance between two points in a coordinate plane?	How does what we measure affect how we measure? How can space be defined through numbers/ measurement?
Related Misconceptions		
Students confuse the rules for transforming two-dimensional figures because they rely too heavily on rules as opposed to understanding what happens to figures as they translate, rotate, reflect, and dilate. It is important to have students describe the effects of each of the transformations on two-dimensional figures through the coordinates but also the visual transformations that result. Students have difficulty differentiating between congruency and similarity. Assume any combination of three angles will form a congruence condition. Not recognize congruent figures because of different orientations. Confuse terms such as clockwise and counter-clockwise. Think the line of reflection must be vertical or horizontal (e.g. across the y- axis or x-axis. Not realize that rotations are not always the origin, but can be about any point.		
Knowledge Students will know…	**Skills** Students will be able to…	

Congruence and similarity using physical models, transparencies or geometry software Dilations , Translations , rotations and reflections on two dimensional figures using coordinates	Compare and contrast the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates Relationship between angle measures Identify sequence of transformations

Assessment Evidence (Stage 2)

Performance Task Description

• **Goal** • **Role** • **Audience** • **Situation** • **Product/Performance** • **Standards**	Engage NY Module 2 Topic A Definitions and Properties of the Basic Rigid Motions Focus Standard: 8.G.A.1 Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines. Instructional Days: 6 Lesson 1: Why Move Things Around? (E)1 Lesson 2: Definition of Translation and Three Basic Properties (P) Lesson 3: Translating Lines (S) Lesson 4: Definition of Reflection and Basic Properties (P) Lesson 5: Definition of Rotation and Basic Properties (S) Lesson 6: Rotations of 180 Degrees (P) Topic B Sequencing the Basic Rigid Motions Focus Standard: 8.G.A.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. Instructional Days: 4 Lesson 7: Sequencing Translations (E)1 Lesson 8: Sequencing Reflections and Translations (S) Lesson 9: Sequencing Rotations (E) Lesson 10: Sequences of Rigid Motions (P) Topic C Congruence and Angle Relationships Focus Standards: 8.G.A.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. 8.G.A.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. Instructional Days: 4 Lesson 11: Definition of Congruence and Some Basic Properties (S)1 Lesson 12: Angles Associated with Parallel Lines (E) Lesson 13: Angle Sum of a Triangle (E) Lesson 14: More on the Angles of a Triangle (S)

Other Evidence

Learning Plan (Stage 3)

• **Where are your students headed? Where have they been? How will you make sure the students know where they are going?** • **How will you hook students at the beginning of the unit?** • **What events will help students experience and explore the big idea and questions in the unit? How will you equip them with needed skills and knowledge?** • **How will you cause students to reflect and rethink? How will you guide them in rehearsing, revising, and refining their work?** • **How will you help students to exhibit and self-evaluate their growing skills, knowledge, and understanding throughout the unit?** • **How will you tailor and otherwise personalize the learning plan to optimize the engagement and effectiveness of ALL students, without compromising the goals of the unit?** • **How will you organize and sequence the learning activities to optimize the engagement and achievement of ALL students?**	In Topic A, students learn about the mathematical needs for rigid motions and begin by exploring the possible effects of rigid motions in Lesson 1. In particular, the study of rigid motions in this module is not just about moving geometric figures around by the use of reflections, translations, and rotations. Rather, students explore the geometric implications of having an abundance of these basic rigid motions in the plane. Lessons on translation, reflection, and rotation show students that lines are taken to lines, line segments are taken to line segments, and parallel lines are taken to parallel lines. In addition to the intuitive notion of figures retaining the same shape under such motions, students learn to express precisely the fact that lengths of segments and sizes of angles are preserved. Lessons 2 and 3 focus on translation but also set up precise definitions and statements related to transformations that are used throughout the remainder of the module. In Lesson 2, students learn the basics of translation by translating points, lines, and figures along a vector, and students verify experimentally that translations map lines to lines, segments to segments, rays to rays, and angles to angles. Students also verify experimentally that translations preserve length and angle measure. Lesson 3 focuses on the translation of lines, specifically the idea that a translation maps a line either to itself or to a parallel line. In Lesson 4, students verify experimentally that reflections are distance- and angle-preserving. In Lesson 5, rotation around a point is investigated in a similar manner as the other rigid motions. Students verify experimentally that rotations take lines to lines, etc., and are distance- and angle-preserving. In Lesson 6, students are provided proof that 180-degree rotations map a line to a parallel line and use that knowledge to prove that vertical angles are equal. Topic B focuses on the first part of 8.G.A.2 in the respect that students learn how to sequence rigid motions. Lesson 7 begins with the concept of composing translations and introduces the idea that translations can be undone. In Lesson 8, students explore images of figures under a sequence of reflections and translations. In Lesson 9, students explore with sequences of rotations around the same center and rotations around different centers. In each of Lessons 7–9, students verify that the basic properties of individual rigid motions remain intact and describe the sequences using precise language. In Lesson 10, students perform sequences of translations, rotations, and reflections as a prelude to learning about congruence. Topic C finishes the work of 8.G.A.2 by introducing the concept of congruence as mapping one figure onto another using a sequence of rigid motions. Lesson 11 defines congruence in terms of a sequence of the

Title of Unit	Function to Model Relationships between Quantities	Grade Level		8th Grade Level 2 Supplemental
Curriculum Area	Mathematics	Time Frame	4-5 weeks	
Developed By	Mathematics			
Identify Desired Results (Stage 1)				
Content Standards				

8.F.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.

8.F.2
Compare properties 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.

8.F.3 I
nterpret 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.

8.G.6
Explain a proof of the Pythagorean Theorem and its converse.

8.G.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.G.8
Apply the Pythagorean Theorem to find the distance between two points in a coordinate system

Understandings	Essential Questions	
Overarching Understanding	**Overarching**	**Topical**
Students understand that a function is a relationship with a unique output for each input. Students develop their ability to make connections between multiple representations of functions and interpret the features of functions in terms of real world contexts. Understand and apply the Pythagorean Theorem . Students extend their understanding of the number system by investigating the relationship between the sides of a right triangle	How would you determine that a relationship is a function? What are some characteristics of a (linear) (nonlinear) function? How would you interpret the features (e.g. rate of change, initial value, increasing/ decreasing)of a function, in a real world context?	How is thinking algebraically different from thinking arithmetically? • How do I use algebraic expressions to analyze or solve problems? • How do the properties contribute to algebraic understanding? •What is meant by
Related Misconceptions		

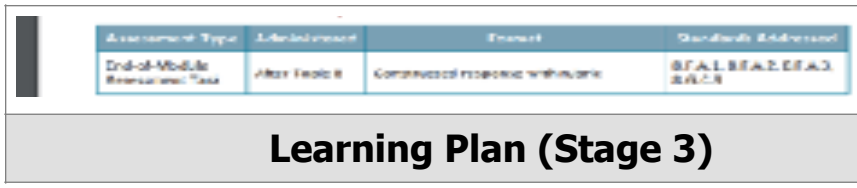
Some students will mistakenly think of a straight line as horizontal or vertical only. Students may mistakenly believe that a slope of zero is the same as “no slope” and then confuse a horizontal line (slope of zero) with a vertical line (undefined slope). Confuse the meaning of “domain” and “range” of a function. Some students will mix up x- and y-axes on the coordinate plane, or mix up the ordered pairs. When emphasizing that the first value is plotted on the horizontal axes (usually x, with positive to the right) and the second is the vertical axis (usually called y, with positive up), point out that this is merely a convention: It could have been otherwise, but it is very useful for people to agree on a standard customary practice Student errors with the Pythagorean theorem may involve mistaking one of the legs as the hypotenuse, multiplying the legs and the hypotenuse by 2 as opposed to squaring them, or using the theorem to find missing sides for a triangle that is not right.		equality?

Knowledge Students will know…	**Skills** Students will be able to…
To define, evaluate and compare functions. To use functions to model relationships between quantities. Investigate patterns of association in bivariate data. Understand and apply Pythagorean Theorem	Students grasp the concept of a function as a rule that assigns to each input exactly one output. They understand that functions describe situations where one quantity determines another. Students will apply real world problem using Pythagorean Theorem Students approximate irrational numbers using their understanding of square and cube roots. Students extend their understanding of the number system by investigating the relationship between the sides of a right triangle.

Assessment Evidence (Stage 2)

Performance Task Description

• **Goal** • **Role** • **Audience** • **Situation** • **Product/ Performance** • **Standards**	Engage NY Module 4 Topic A Functions Focus Standards: 8.F.A.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. 8.F.A.2 Compare properties 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. 8.F.A.3 Interpret the equation $yy = mmmm + bb$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. For example, the function $AA = ss^2$ 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. Instructional Days: 8 Lesson 1: The Concept of a Function (P)1 Lesson 2: Formal Definition of a Function (S) Lesson 3: Linear Functions and Proportionality (P) Lesson 4: More Examples of Functions (P) Lesson 5: Graphs of Functions and Equations (E) Lesson 6: Graphs of Linear Functions and Rate of Change (S) Lesson 7: Comparing Linear Functions and Graphs (E) Lesson 8: Graphs of Simple Nonlinear Functions € Engage NY Module 2 Topic D The Pythagorean Theorem Focus Standards: 8.G.B.6 Explain a proof of the Pythagorean Theorem and its converse. 8.G.B.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. Instructional Days: 2 Lesson 15: Informal Proof of the Pythagorean Theorem (S)1 Lesson 16: Applications of the Pythagorean Theorem (P)
Other Evidence	



Assessment Type	Administered	Format	Standards Addressed
End-of-Module [illegible]	After Topic B	Constructed response with rubric	B.P.A.1, B.P.A.2, B.P.A.3

Learning Plan (Stage 3)

• **Where are your students headed? Where have they been? How will you make sure the students know where they are going?** • **How will you hook students at the beginning of the unit?** • **What events will help students experience and explore the big idea and questions in the unit? How will you equip them with needed skills and knowledge?** • **How will you cause students to reflect and rethink? How will you guide them in rehearsing, revising, and refining their work?** • **How will you help students to exhibit and self-evaluate their growing skills, knowledge, and understanding throughout the unit?** • **How will you tailor and otherwise personalize the learning plan to optimize the engagement and effectiveness of ALL students, without compromising the goals of the unit?** • **How will you organize and sequence the learning activities to optimize the engagement and achievement of ALL students?**	**Lesson 1** Relies on students' understanding of constant rate, a skill developed in previous grade levels and reviewed in Module 4 (6.RP.A.3b, 7.RP.A.2). Students are confronted with the fact that the concept of constant rate, which requires the assumption that a moving object travels at a constant speed, cannot be applied to all moving objects. Students examine a graph and a table that demonstrate the nonlinear effect of gravity on a falling object. This example provides the reasoning for the need of functions. **In Lesson 2,** Istudents continue their investigation of time and distance data for a falling object and learn that the scenario can be expressed by a formula. Students are introduced to the terms input and output and learn that a function assigns to each input exactly one output. Though students do not learn the traditional "vertical-line test," students know that the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. Students also learn that not all functions can be expressed by a formula, but when they are, the function rule allows us to make predictions about the world around us. For example, with respect to the falling object, the function allows us to predict the height of the object for any given time interval. **In Lesson 3,** Constant rate is revisited as it applies to the concept of linear functions and proportionality in general. Lesson 4 introduces students to the fact that not all rates are continuous. That is, a cost function for the cost of a book can be written, yet the cost of 3.6 books cannot realistically be found. Students are also introduced to functions that do not use numbers at all, as in a function where the input is a card from a standard deck, and the output is the suit. **Lesson 5** When students begin graphing functions of two variables. Students graph linear and nonlinear functions, and the guiding question of the lesson, "Why not just look at graphs of equations in two variables?" is answered because not all graphs of equations are graphs of

Title of Unit	Proportional Relationships and Linear Equations Involving Bivariate Data and Solution of Simultaneous Equations	**Grade Level**	8th Grade Level 2 Supplemental
Curriculum Area	Mathematics	**Time Frame**	4-5 weeks
Developed By	Munira Jamali		
Identify Desired Results (Stage 1)			
Content Standards			

F.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.

8.F.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.EE.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. 8.EE.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.

8.EE.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 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.EE.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.

Understandings	Essential Questions	
Overarching Understanding	**Overarching**	**Topical**

Students compare proportional relationships using a variety of representations of these relationships (graph, table, symbols). Students understand and represent slope as a unit rate, and apply their knowledge of right triangles to represent slope. Students relate the slope with its concept as a rate and its visual representation as a set of right triangle that are similar for each line. Students interpret slope and intercept using real world applications (e.g. bivariate data). Students create equivalent equations to solve for an unknown. Students employ graphical, tabular and symbolic representations to express linearity and determine the number of solutions. Students interpret a linear equation in a real world application by deriving the equation.	How can I determine, when analyzing the motion of two objects, which object has the greater speed? What is the meaning of the slope and intercept of a line, in the context of the situation? How may I use similar triangles to show that the slope is the same, given two distinct sets of points on a graph? How will I explain how I know that a pair of linear equations has one solution, no solutions, or infinitely many solutions? Is the slope between any two points on the same line the same? Explain your reasoning. How can I create an equation with given information from a table, graph, or problem situation? How can mathematics be used to provide models that helps us interpret data and make predictions?	How is thinking algebraically different from thinking arithmetically? How do I use algebraic expressions to analyze or solve problems? How do the properties contribute to algebraic understanding? What is meant by equality
Related Misconceptions		
Students think that only the letters x and y can be used for variables. Students think that you always need a variable = a constant as a solution. The variable is always on the left side of the equation. Equations are not always in the slope intercept form, $y=mx+b$. Students confuse one-variable and two-variable equations		
Knowledge Students will know…	**Skills** Students will be able to…	

The connections between proportional relationships, lines and linear equations. To investigate patterns of association in bivariate data. To analyze and solve linear equations and pairs of simultaneous linear equations. Define, evaluate and compare functions. Use functions to model relationships between quantities	To construct a function to model a linear relationship. Identify (from a graph, table, y= mx+b, etc.) and interpret the rate of change and initial value of a linear function in terms of the situation. Solve linear equations in one variable with rational number coefficients. Categorize linear equations in one variable as having one, none, or infinitely many solutions

Assessment Evidence (Stage 2)

Performance Task Description

• **Goal** • **Role** • **Audience** • **Situation** • **Product/Performance** • **Standards**	Engage NY Module 4 Linear Equaitons Topic A Writing and Solving Linear Equations Focus Standard: 8.EE.C.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 equation of the form $x = aa$, $a = a$, 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. Instructional Days: 9 Lesson 1: Writing Equations Using Symbols (P)1 Lesson 2: Linear and Nonlinear Expressions in xx (P) Lesson 3: Linear Equations in xx (P) Lesson 4: Solving a Linear Equation (P) Lesson 5: Writing and Solving Linear Equations (P) Lesson 6: Solutions of a Linear Equation (P) Lesson 7: Classification of Solutions (S) Lesson 8: Linear Equations in Disguise (P) Lesson 9: An Application of Linear Equations (S) Topic B Linear Equations in Two Variables and Their Graphs 8.EE.B.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. Instructional Days: 5 Lesson 10: A Critical Look at Proportional Relationships (S)1 Lesson 11: Constant Rate (P) Lesson 12: Linear Equations in Two Variables (E) Lesson 13: The Graph of a Linear Equation in Two Variables (S) Lesson 14: The Graph of a Linear Equation—Horizontal and Vertical Lines (S) Slope and Equations of Lines Topic C 8.EE.B.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. 8.EE.B.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. Instructional Days: 9 Lesson 15: The Slope of a Non-Vertical Line (P)1 Lesson 16: The Computation of the Slope of a Non-Vertical Line (S)

Other Evidence

Assessment Summary

Assessment Type	Administration	Format	Standards Addressed
Mid-Module Assessment Task	After Topic B	Constructed response with rubric	[illegible]
End-of-Module Assessment Task	After Topic D	Constructed response with rubric	[illegible]

Learning Plan (Stage 3)

• **Where are your students headed? Where have they been? How will you make sure the students know where they are going?** • **How will you hook students at the beginning of the unit?** • **What events will help students experience and explore the big idea and questions in the unit? How will you equip them with needed skills and knowledge?** • **How will you cause students to reflect and rethink? How will you guide them in rehearsing, revising, and refining their work?** • **How will you help students to exhibit and self-evaluate their growing skills, knowledge, and understanding throughout the unit?** • **How will you tailor and otherwise personalize the learning plan to optimize the engagement and effectiveness of ALL students, without compromising the goals of the unit?** • **How will you organize and sequence the learning activities to optimize the engagement and achievement of ALL students?**	**In Lesson 1,** Students begin by transcribing written statements into symbolic language. Students learn that before they can write a symbolic statement, they must first define the symbols they intend to use. In Lesson 2, students learn the difference between linear expressions in x and nonlinear expressions in x, a distinction that is necessary to know whether or not an equation can be solved (at this point). **Lesson 2** Contains a quick review of terms related to linear equations, such as constant, term, and coefficient. In **Lesson 3,** Sudents learn that a linear equation in xx is a statement of equality between two linear expressions in xx. Students also learn that an equation that contains a variable really is a question: Is there a value of xx that makes the linear equation true? I **In Lesson 4,** Students begin using properties of equality to rewrite linear expressions, specifically using the distributive property to "combine like terms." Further, students practice substituting numbers into equations to determine if a true number sentence is produced. **In Lesson 5,** Students practice the skills of the first few lessons in a geometric context. Students transcribe written statements about angles and triangles into symbolic language and use properties of equality to begin solving equations (8.EE.C.7b). More work on solving equations occurs in Lesson 6, where the equations are more complicated and require more steps to solve (8.EE.C.7b). **In Lesson 6,** Students learn that not every linear equation has a solution (8.EE.C.7a). This leads to Lesson 7, where students learn that linear equations either have a unique solution, no solution, or infinitely many solutions (8.EE.C.7a). In Lesson 8, students rewrite equations that are not obviously linear equations and then solve them (8.EE.C.7b). Finally, in Lesson 9, students take another look at the Facebook problem from Module 1 in terms of linear equations (8.EE.C.7a). **Topic B** Begins with students working with proportional relationships related to average speed and constant speed. In Lesson 10, students use information that is organized in the form of a table to write linear equations. In Lesson 11, students learn how to apply the concept of constant rate to a variety of contexts requiring two variables (8.EE.B.5). Lesson 12 introduces students to the standard form of an equation in two variables. At this point, students use a table to help them find and organize solutions

Title of Unit	Statistics and Geometry	**Grade Level**	8th Grade Level 2 Supplemental
Curriculum Area	Mathematics	**Time Frame**	3-4 weeks
Developed By	Munira Jamali		
Identify Desired Results (Stage 1)			
Content Standards			

8.SP.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.

8.SP.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 by judging the closeness of the data points to the line.

8.SP.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?

8.G.9
Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Understandings	**Essential Questions**	
Overarching Understanding	**Overarching**	**Topical**
Students understand that a function is a relationship with a unique output for each input. Students develop their ability to make connections between multiple representations of functions and interpret the features of functions in terms of real world contexts. Students are able to construct a function to model a linear relationship. Students identify (from a graph, table, y= mx+b, etc.) and interpret the rate of change and initial value of a linear function in terms of the situation.	How would you determine that a relationship is a function? What are some characteristics of a (linear) (nonlinear) function? How would you interpret the features (e.g. rate of change, initial value, increasing/decreasing) of a function, in a real world context? How would you determine, depict, and describe “patterns of association” between two quantities, in bivariate data?	• Geometry and spatial sense offer ways to interpret and reflect on our physical environment. • Analyzing geometric relationships develops reasoning and justification skills
Related Misconceptions		

Students may believe Bivariate data is only displayed in scatter plots. Grade 8.SP.4 in this cluster provides the opportunity to display bivariate, categorical data in a table. In general, students think there is only one correct answer in mathematics. Students may mistakenly think their lines of best fit for the same set of data will be exactly the same. Because students are informally drawing lines of best fit, the lines will vary slightly. To obtain the exact line of best fit, students would use technology to find the line of regression		

Knowledge Students will know…	**Skills** Students will be able to…
Define, evaluate and compare functions. Investigate patterns of association in bivariate data. MP 1, 4, 5, 6, and 7 Solve real-world and mathematical problems involving volume of cylinders	• Determine the Volume • Analyze data • Solve real life problem

Assessment Evidence (Stage 2)

Performance Task Description

• **Goal** • **Role** • **Audience** • **Situation** • **Product/Performance** • **Standards**	**Engage NY Module 7** **Topic A** **Linear Functions** Lesson 1: Modeling Linear Relationships (P)1 Lesson 2: Interpreting Rate of Change and Initial Value (P) Lesson 3: Representations of a Line (P) Lessons 4–5: Increasing and Decreasing Functions (P, P) **Topic B** **Bivariate Numerical Data** Lesson 6: Scatter Plots (P)1 Lesson 7: Patterns in Scatter Plots (P) Lesson 8: Informally Fitting a Line (P) Lesson 9: Determining the Equation of a Line Fit to Data

Other Evidence

Learning Plan (Stage 3)

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