Green Township School District Gr. 8 Math Curriculum - July 2018

Unit 5: Examples of Functions in Geometry **(Approximate Instructional Time: 3 weeks)**		
NJ Student Learning Standards	**Suggested Standards for Mathematical Practice**	**Critical Knowledge & Skills** ***(Learning goals are for the Unit but may not necessarily be in sequential order.)***
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.	MP.2 Reason abstractly and quantitatively. MP.5 Use appropriate tools strategically.	Concept(s): ● *A function is a rule.* ● *If a rule is a function, then for each input there is exactly one output.* Students are able to: ● Use function language. ● Describe a function as providing a single output for each input. ● Determine whether non-numerical relationships are functions. ● Describe a function as a set of ordered pairs. ● Read inputs and outputs from a graph. ● Describe the ordered pairs as containing an input, and the corresponding output. **Learning Goal 1**:Define a function as a rule that assigns one output to each input and determine if different representations (i.e. ordered pairs, tables, graphs, etc.) of data represent a function.
8.F.A.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.*	MP.2 Reason abstractly and quantitatively. MP.3 Construct viable arguments and critique the reasoning of others. MP.5 Use appropriate tools strategically.	Concept(s): ● *A linear function is defined by the equation y = mx + b.* ● *The graph of a linear function is a straight line.* Students are able to: ● Analyze tables of values, graphs, and equations in order to classify a function as linear or non-linear. ● Determine if equations presented in forms other than y = mx + b (for example 3y – 2x = 7 is an equation, not a function) define a linear function. ● Give examples of equations that are non-linear functions. ● Show that a function is not linear using pairs of points.

		Learning Goal 2: Classify functions as linear or non-linear by analyzing equations, graphs, and tables of values; interpret the equation y = mx + b as defining a linear function.
8.F.A.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.*	MP.5 Use appropriate tools strategically. MP.8 Look for and express regularity in repeated reasoning.	Concept(s): ● *Functions (quantitative relationships) can be represented in different ways.* ● *Functions have properties; properties of linear functions.* Students are able to: ● Analyze functions represented algebraically, as a table of values, and as a graph. ● Interpret functions represented by a verbal description. ● Given two functions, each represented in a different way, compare their properties. **Learning Goal 3**: Compare two functions each represented in a different way (numerically, verbally, graphically, and algebraically) **Learning Goal 4:** Draw conclusions about their properties (rate of change and intercepts).
8.F.B.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.	MP.6 Attend to precision. MP.2 Reason abstractly and quantitatively. MP.7 Look for and make use of structure.	Concept(s): *As with equations, two (x,y) values can be used to construct a function* Students are able to: ● Determine the rate of change and initial value of a function from a description of a relationship. ● Determine the rate of change and initial value of a function from two (x, y) values by reading from a table of values. ● Determine the rate of change and initial value of a function from two (x, y) values by reading these from a graph. . **Learning Goal 5:** Model a linear relationship by constructing a function from two (x,y) values and be able to determine the rate of change and initial values from several representations.
8.G.C.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real world and mathematical problems.	MP.2 Reason abstractly and quantitatively. MP.4 Model with mathematics.	Concept(s): *Volume* Students are able to: ● Find volume of cones, cylinders and spheres to solve real world problems. ● Use volume formulas to find a single unknown dimension of cones, cylinders and

	MP.5 Use appropriate tools strategically. MP.6 Attend to precision. MP.7 Look for and make use of structure. MP.8 Look for and express regularity in repeated reasoning.	spheres when solving real world problems. **Learning Goal 6**: Apply formulas to find the volume of a cone, a cylinder, or a sphere when solving real-world and mathematical problems. **Learning Goal 7:** Apply the formula for the volume of a cone, a cylinder, or a sphere to find an *unknown dimension* in real world and mathematical problems.
Interdisciplinary Connections: **NGSS Appendix for Alignment**	***Science:*** **MS-PS3 Energy: As part of this work, teachers should give students opportunities to work with ratios and proportional relationships and basic statistics** *Ratios and Proportional Relationships (6–7.RP) and Functions (8.F). Science examples: (1) Analyze an idealized set of bivariate measurement data for kinetic energy vs. mass (holding speed constant). Decide whether the two quantities are in a proportional relationship, e.g., by testing for equivalent ratios or graphing on a coordinate plane and observing whether the graph is a straight line through the origin. (2) Do the same for an idealized set of data for kinetic energy vs. speed (holding mass constant). For Grade 8: Recognize from the data that the relationship is not proportional; that kinetic energy is a nonlinear function of speed. Draw conclusions such as that doubling the speed more than doubles the kinetic energy. What are some possible implications for driving safety?* **MS-PS4 Waves and Their Applications in Technologies for Information Transfer** **As part of this work, teachers should give students opportunities to use ratios and proportional relationships and functions** *Ratios and Proportional Relationships (6–7.RP) and Functions (8.F). Science examples: (1) Analyze an idealized set of bivariate measurement data for wave energy vs. wave amplitude. Decide whether the two quantities are in a proportional relationship, (e.g., by testing for equivalent ratios or graphing on a coordinate plane and observing whether the graph is a straight line through the origin). (For Grade 8: Recognize that wave energy is a nonlinear function of amplitude, and draw conclusions such as that doubling the amplitude more than doubles the energy. Discuss possible implications for the safety of wading in the ocean during a storm.) (2) Interpret an idealized set of bivariate measurement data for wave energy vs. wave speed.* ***English-Language Arts:*** **RI.8.4**. Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. **RI.8.5**. Analyze the structure an author uses to organize a specific paragraph in a text, including the role of particular sentences, to develop and to refine a key concept. **RI.8.6.** Determine an author's point of view or purpose in a text and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. **RI.8.7.** Evaluate the advantages and disadvantages of using different mediums (e.g., print or digital text, video, multimedia) to present a particular topic or idea. **W.8.2.** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

	A. Introduce a topic and organize ideas, concepts, and information, using text structures (e.g., definition, classification, comparison/contrast, cause/effect, etc.) and text features (e.g., headings, graphics, and multimedia). B. Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples. C. Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts. D. Use precise language and domain-specific vocabulary to inform about or explain the topic. E. Establish and maintain a formal style/academic style, approach, and form. F. Provide a concluding statement or section that follows from and supports the information or explanation presented. **W.8.4**. Produce clear and coherent writing in which the development, organization, voice and style are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.) **W.8.5.** With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed. **W.8.6.** Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others. **W.8.7**. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. **SL.8.1.** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. A. Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. B. Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. C. Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas. D. Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. **SL.8.2**. Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. **SL.8.3**. Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced. **SL.8.5**. Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
21st Century Skills/ Career Ready Practices:	**CRP1. Act as a responsible and contributing citizen and employee.** ● Students will learn to work respectfully in groups within the classroom. **CRP2. Apply appropriate academic and technical skills.** ● Students will use technology to collect and compare data to understand concepts with linear functions as applied to real world situations such as in astronomy, biology, physics, finance, and population. **CRP4. Communicate clearly and effectively and with reason.** ● In line with the mathematical practices, students will explain and defend their reasoning when working on tasks in class and support this reasoning with evidence either verbally or in writing. **CRP5. Consider the environmental, social and economic impacts of decisions.**

	● Through the course of real world applications and use of linear functions students will have the opportunity to discuss issues related to the environment (astronomy, bacteria), society (population) and economics (population, finance). **CRP6. Demonstrate creativity and innovation.** ● Students are encouraged to look at more than one way to solve a problem. This is evident through tasks that require the mathematical practice: modeling with mathematics. **CRP7. Employ valid and reliable research strategies.** ● Students will have the opportunity when exploring real world applications and resources through the Internet to question the validity of the data presented, and to use the information gathered to make decisions. **CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.** ● Students will be prompted to explore and determine the meaning of each term of a linear function. ● Students will need to make sense of problems and persevere in working with linear functions related to real world applications. **CRP9. Model integrity, ethical leadership and effective management.** ● Students will learn time management skills when given both short-term and long-term tasks to complete. ● Students will learn leadership skills when working with groups. ● Students model integrity when completing assignments independently. **CRP10. Plan education and career paths aligned to personal goals.** ● In this unit, various real world applications are explored which may lead to a student's interest in a particular career field. **CRP11. Use technology to enhance productivity.** ● Students will use technology (calculator, online resources) to understand functions and to graph the relationship between two variables. **CRP12. Work productively in teams while using cultural global competence.** ● When working in groups, students will be encouraged to include all members and to encourage the contribution of all members.
2014 NJ Technology Standards:	**8.1 Educational Technology** (Word | PDF) All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge. ● **8.1.8.A.1:** Students will use technology (calculator, online resources) to understand functions and to graph the relationship between two variables. ● **8.1.8.F.1**: Explore a local issue, by using digital tools to collect and analyze data to identify a solution and make an informed decision. **8.2 Technology Education, Engineering, Design and Computational Thinking - Programming** (Word | PDF) All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Please see relevant projects for technology standards 8.1 and 8.2:

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District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 5)**	**Supplementary Resources:** *Algebra I* (Glencoe 2018) *Larsen Pre-Algebra* (Houghton Mifflin Harcourt 2012) *Chapter 8: Lessons 8.1;8.7* *NJ Progress for Grade 8* (William H. Sadlier) Unit 3: Lessons 17-20; Unit 4: Lesson 36 *Understanding Algebra I* (The Critical Thinking Company) Open Up Resources Online Curriculum **Khan Academy** eMath : Unit 3 from Alg 1 Desmos: Card Sort (ExploratoryFunction Activity) This activity asks students to notice and use properties of linear functions to make groups of three. Different properties will lead to different groupings by different students. Later we ask students to make conjectures about different groupings – why might another student have grouped the cards in a particular way? **NOTE: The Desmos activities that follow are also relevant for Unit 4.** Desmos: Which is the Steepest? In this activity, students explore the idea of "steepness" of line segments. This activity serves as a prelude to formal conversations about vertical change, horizontal change, and slope. Desmos: Investigate Rate of Change In this activity students will compare slopes of lines with a y-intercept of zero. They'll use their comparisons to learn how to write the equations of lines of the form y=ax. Desmos: Land the Plane In this activity, students practice finding equations of lines in order to land a plane on a runway. Most of the challenges are well-suited to slope-intercept form, but depending on the goals of an individual class or student they are easily adapted to other forms of linear equations. Desmos: Linear Systems: Gym Membership In this activity, students analyze several gym membership plans in order to make a recommendation to a friend. The activity assumes some familiarity with linear equations, particularly how slope and intercept appear in equations and how they affect the graph. If your students need a quick refresher on these concepts, consider offering a brief review prior to starting this activity. Desmos: 400 Meter Modeling

	In this linear modeling activity, students make predictions about record times for the women's 400 meter dash. They also reflect on the contextual meaning of the slope and intercept, and consider shortcomings of the model over the long run. **Performance Tasks are available for use from the following sites:** Illustrative Mathematics Coherence Map Inside Mathematics Problems of the Month YouCubed Tasks PARCC Released test items- Grade 8
Materials:	**Suggested Workstations & Activities for Use During Unit**
❑ *3D solids: cones, cylinders, and spheres.*	**TBD and updated as lesson planning commences**
District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
● Teacher observation of students engaged in group and independent activities. ● Individual and small group conferences/interviews to assess understanding with rubric ● Self-assessment by students with guidance from teacher. ● Eureka Math Sprints ● Exit tickets	● Teacher created assessments and projects ● ***Eureka Math*** Mid- and End- Module Assessments (Constructed response item with rubric) ● Teacher/District created Quarterly Assessments ● **Project on the use of water bottles** Students should investigate how many water bottles are purchased versus recycled and use scientific notation to demonstrate understanding of the magnitude of numbers; extend to explore the impact on the environment and solutions to lesson the impact on the environment in our community. Volume Extension.
Instructional Best Practices and Exemplars	**Mathematical Terms/Vocabulary**
● *Facilitate partner and group collaborations* ● *Inquiry based tasks introduced before direct teaching* ● *Small and large group discussions* ● *Have students use a variety of representations or methods to show and explain their understanding.*	● **Area** ● **Linear Equation** ● **Nonlinear equation** ● **Rate of change** ● **Solids**

• *Build fluency over time.*	• **Volume** • **Function** A function is a rule that assigns to each input exactly one output. • **Input** The number or piece of data that is put into a function is the input. • **Output** The number or piece of data that is the result of an input of a function is the output.

Focus Mathematical Concepts

Grade Level Fluency Requirement:

- *Concepts related to linear algebra and linear functions*

Mathematical Practices Applied to this Unit

MP 2: Reason abstractly or quantitatively. Students examine, interpret, and represent functions symbolically. They make sense of quantities and their relationships in problem situations. For example, students make sense of values as they relate to the total cost of items purchased or a phone bill based on usage in a particular time interval. Students use what they know about rate of change to distinguish between linear and nonlinear functions. Further, students contextualize information gained from the comparison of two functions.

MP 6: Attend to precision. Students use notation related to functions, in general, as well as notation related to volume formulas. Students are expected to clearly state the meaning of the symbols used in order to communicate effectively and precisely to others. Students attend to precision when they interpret data generated by functions. They know when claims are false; for example, calculating the height of an object after it falls for −2 seconds. Students also understand that a table of values is an incomplete representation of a continuous function, as an infinite number of values can be found for a function.

MP 8: Look for and express regularity in repeated reasoning. Students will use repeated computations to determine equations from graphs or tables. While focused on the details of a specific pair of numbers related to the input and output of a function, students will maintain oversight of the process. As students develop equations from graphs or tables, they will evaluate the reasonableness of their equation as they ensure that the desired output is a function of the given input.

Prerequisite skills & Foundational Standards

Refer to Achieve the Core Coherence Map for full detail on vertical and horizontal alignment to prerequisite skills & future skills.

Coherence Map

Geometric measurement: Understand concepts of volume and relate volume to multiplication and to addition.

5.MD.C.3 Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.

b. A solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units.

5.MD.C.5 Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.
a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.
b. Apply the formulas V = l × w × h and V = B × h for rectangular prisms to find volumes of right rectangular prisms with whole number edge lengths in the context of solving real world and mathematical problems.
c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real world problems.

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.
7.G.B.4 Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.
7.G.B.6 Solve real-world and mathematical problems involving area, volume and surface area of twoand three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Understand the connections between proportional relationships, lines, and linear equations.
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.

Analyze and solve linear equations and pairs of simultaneous linear equations.
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 = 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.C.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.*

Differentiation/Accommodations/Modifications

Gifted and Talented

(content, process, product and learning environment)

Extension Activities

- Conduct research and provide presentation of various topics.
- Design surveys to generate and analyze data to be used in discussion.
- Debate topics of interest / cultural importance.
- Authentic listening and reading sources that provide data and support for speaking and writing prompts.
- Implement RAFT Activities as they pertain to the types / modes of communication (role, audience, format, topic).
- Activities defined as “Gold” require more advanced logic and reasoning skills and will be provided as additional or replacement work on a weekly basis.
- Coordination with the G&T teacher in order to supplement the math curriculum as needed.

Anchor Activities

- Use of Higher Level Questioning Techniques
- Provide assessments at a higher level of thinking

English Language Learners

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice.
- Model skills/techniques that need to be mastered.
- Extended time to complete class work
- Visual dictionaries to help build vocabulary
- Provide copy of class notes
- Pair with a peer for assistance during class

Modifications for Homework/Assignments

- Modified Assignments
- Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary)
- Extended time for assignment completion as needed
- Highlight key vocabulary
- Use graphic organizers

Students with Disabilities

(**possible appropriate accommodations, instructional adaptations, and/or modifications as determined by the IEP or 504 team**)

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of class notes
- Preferential seating to be mutually determined by the student and teacher
- Establish expectations for correct spelling on assignments.
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests and check Google classroom for updates and assignments
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.

- Establish procedures for accommodations / modifications for assessments.

Students at Risk of School Failure

Modifications for Classroom

- Pair visual prompts with verbal presentations
- Ask students to restate information, directions, and assignments.
- Repetition and practice
- Model skills / techniques to be mastered.
- Extended time to complete class work
- Provide copy of classnotes
- Preferential seating to be mutually determined by the student and teacher
- Assign a peer helper in the class setting
- Provide oral reminders and check student work during independent work time
- Assist student with long and short term planning of assignments
- Encourage student to proofread assignments and tests
- Provide regular parent/ school communication
- Teachers will check/sign student agenda daily

Modifications for Homework and Assignments

- Extended time to complete assignments.
- Student requires more complex assignments to be broken up and explained in smaller units, with work to be submitted in phases.
- Provide the student with clearly stated (written) expectations and grading criteria for assignments.
- Implement RAFT activities as they pertain to the types / modes of communication (role, audience, format, topic).

Modifications for Assessments

- Extended time on classroom tests and quizzes.
- Student may take/complete tests in an alternate setting as needed.
- Restate, reread, and clarify directions/questions
- Distribute study guide for classroom tests.
- Establish procedures for accommodations / modifications for assessments.