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

Unit 1: Integer Exponents & Scientific Notation
(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.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.	MP 2 Reason abstractly and quantitatively. MP 3: Construct viable arguments and critique the reasoning of others. MP 6 Attend to precision. MP 7 Look for and make use of structure. MP 8 Look or and express regularity in repeated reasoning.	Concept(s): • *Understand exponents as simplified representation of repeated multiplication.* • *Understand exponent property laws can be developed by making connections to the properties of operations learned in earlier grades.* Students are able to: • represent repeated multiplication symbolically using exponents. • differentiate between base numbers that require parenthesis (negative bases, fraction bases) and those that do not. • use a decomposing strategy to build conceptual understanding of the laws of exponents. • fluently use the laws of exponents in mathematical and real world applications. **Learning Goal 1**:Apply the properties of integer exponents to write equivalent numerical expressions. **Learning Goal 2**: Understand and apply the laws of the properties of exponents to solve mathematical and real world applications.

• 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 3×10^8 and the population of the world as 7×10^9, and determine that the world population is more than 20 times larger.	MP 2 Reason abstractly and quantitatively.
	
	MP 3: Construct viable arguments and critique the reasoning of others.
	
	MP 6 Attend to precision.
	
	MP 7 Look for and make use of structure.
	
	MP 8 Look or and express regularity in
		Concept(s): *Understand the magnitude of numbers and the need for scientific notation in real world applications such as astronomy, finance, etc.*
		Students are able to:
		• Identify positive and negative powers of 10 to indicate very large or very small numbers & that this power indicates the magnitude of the number.
		• Compare and estimate quantities in the form of scientific notation.
		• Use knowledge of ratios, fractions and laws of exponents to simplify expressions.
		
		    Learning Goal 3: Estimate with very large and very small quantities using scientific notation.
		    Learning Goal 4: Express how many times greater is one value than

	repeated reasoning.	another using scientific notation.
● 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.	MP 2 Reason abstractly and quantitatively. MP 3: Construct viable arguments and critique the reasoning of others. MP 6 Attend to precision. MP 7 Look for and make use of structure. MP 8 Look or and express regularity in repeated reasoning.	Concept(s): *Perform operations with numbers expressed in scientific notation.* Students are able to: ● Write, add and subtract numbers in scientific notation. ● Convert numbers between scientific and standard notation. ● Multiply and divide numbers in scientific notation. ● Understand the need for and choose appropriate units for various real world measurements. ● Apply the laws of exponents to interpret data and use technology to compute with very large numbers. **Learning Goal 5**: Perform operations with numbers expressed in scientific notation. **Learning Goal 6:** Choose units of appropriate size for measurements of very large or very small quantities. **Learning Goal 7:** Use technology to work with data and numbers in scientific notation.
Interdisciplinary Connections: **NGSS Appendix for Alignment**	*Science:* **5-PS1 Matter and Its Interactions As part of this work, teachers should give students opportunities to relate very large and very small quantities to place value and division, convert measurement units, and work with volume:** *Foundational Standard: 5.NBT.A.1. Explain patterns in the number of zeros of the product when multiplying a number by **powers of 10**, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.* **5-ESS1 Earth's Place in the Universe As part of this work, teachers should give students opportunities to relate very large and very small quantities to place value and use the coordinate plane:** *Foundational Standard 5.NBT.A.2. Explain patterns in the number of zeros of the product when multiplying a number by **powers of 10**, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. Science example: The sun is about 10^{11} meters from Earth. Sirius, another star, is about 10^{17} meters from Earth. Write these two numbers without exponents; position the numbers one directly below the other, aligning on the 1. How many times farther away from Earth is Sirius compared to the sun?* **MS-PS1 As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use signed numbers, write and solve equations, and use order of magnitude thinking and basic statistics:** *Expressions and Equations (6–8.EE). Science examples: For Grade 8: Use <u>scientific notation</u> for atomic masses, large numbers of atoms, and other quantities much less than or much greater than 1. Also use convenient units such as unified atomic mass units.* **MS-LS4 Biological Evolution: Unity and Diversity: As part of this work, teachers should give students opportunities to work with ratios and proportional relationships, use concepts of probability, and use order of magnitude thinking:** *Expressions and Equations (6–8.EE). Science examples: For Grade 8: Use scientific notation for long intervals of time, or for dates in*

the distant past; also use convenient units (e.g., Myr, Gyr, Ma, Ga).

MS-LS1 As part of this work, teachers should give students opportunities to use order of magnitude thinking, write and solve equations & analyze data: *Expressions and Equations (6–8.EE). Science examples: (1) Quantify the sizes of cells and parts of cells, using convenient units such as microns.(2) Appreciate the orders of* **magnitude** *that span the difference in size between cells, molecules, and atoms*

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 numbers written in scientific notation 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 scientific notation, 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 find the laws of exponents through reasoning about the operations of properties that they have learned in earlier grades. ● Students will need to make sense of problems and persevere in solving them when learning about the magnitude of numbers and performing operations on numbers written in scientific notation. **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 compare and compute with numbers in scientific notation. **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 (calculators, online data) to engage with and understand real world applications of scientific notation.
- **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. (Water bottle project)

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.

- **8.2.8.B.2** Identify the desired and undesired consequences from the use of a product or system through the plastic water bottle project.
- **8.2.8.B.3** Research and analyze the ethical issues of a product or system on the environment and report findings for review by peers and /or experts through the water bottle project.

Please see relevant projects for technology standards [8.1](#) and [8.2](#):

District/School Primary and Supplementary Resources	
Primary Resource: **Eureka Math (Unbound Ed - Module 1)**	**Supplementary Resources:** *Algebra I* (Glencoe 2018) *Larsen Pre-Algebra* (Houghton Mifflin Harcourt 2012) *Chapter 4: Lessons 4.5-4.7* *NJ Progress for Grade 8* (William H. Sadlier) Unit 2: Lessons 8 & 9 *Understanding Algebra I* (The Critical Thinking Company) [Open Up Resources Online Curriculum](#) **Khan Academy** [eMath : Exponents Unit from Alg 1](#) [Desmos: Avi & Benita's Repair Shop](#) Students compare linear and exponential growth in the context of daily payments. One plan increases by $100 each day, while another grows by doubling the previous day's payment. **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**
❏ *No special materials required for this unit*	**Topic A** Remediation (Blue): Khan Academy Gr 8 Module 1 Foundations Integer Rules practice (Green): Card games On Grade Level Practice (Green): Khan Academy Gr 8 M1 Topic A *Practice Exercises*: Multiply Powers to Negative Exponents (Green) Multiply Powers (Integer Exp) (Green with quick tutorial; Gold without help) Same for other practice exercises in this section **Illustrative Mathematics** 5NBT: (Green) Multiplying decimals by 10; Marta's Multiplication Error (Do after lesson 5) 6EE: (Green) Exp Exper 1; Sierpinski Carpet; The Djinni's Offer; (Gold) Exp Exper 2 & 3; 7 to the What? 7 GB: 8 (Green) 8 Circles; (Gold) Measuring the area of a circle; Estim Area: Wedges of Circles Other Interactive Tech for Week 2 on Pacing Guide Day 1: Otter Rush Day 3: Dinosaur Dig 3 Day 4: Dinosaur Dig 4 Day 5: Dinosaur Dig 2 or 4 **Topic B** Open Up Resources Online Curriculum For EM 1.9B - Unit 7: Lesson 15
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 lessen the impact on the environment in our community.
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.* *Build fluency over time.*	**Exponential Notation** **Base** **Exponent** **Power** **Integer** **Whole Number** **Expanded Form (of decimal numbers)** **Square and Cube (of a number)** **Equivalent Fractions** **Scientific Notation** The scientific notation for a finite decimal is the representation of that decimal as the product of a decimal $\square$ and a power of 10, where $\square$ satisfies the property that it is at least 1, but smaller than 10, or in symbolic notation, $1 \leq \square < 10$. For example, the scientific notation for 192.7 is 1.927×10^2. **Order of Magnitude** The order of magnitude of a finite decimal is the exponent in the power of 10 when that decimal is expressed in scientific notation. For example, the order of magnitude of 192.7 is 2 because when 192.7 is expressed in scientific notation as 1.927×10^2, 2 is the exponent of 10^2. Sometimes we also include the number 10 in the definition of order of magnitude and say that the order of magnitude of 192.7 is 10^2.
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 and quantitatively. Students use concrete numbers to explore the properties of numbers in exponential form and then prove that the properties are true for all positive bases and all integer exponents using symbolic representations for bases and exponents. As lessons progress, students use symbols to represent integer exponents and make sense of those quantities in problem situations. Students refer to symbolic notation in order to contextualize the requirements and limitations of given statements (e.g., letting □, □ represent positive integers, letting □, □ represent all integers, both with respect to the properties of exponents).

MP 3: Construct viable arguments and critique the reasoning of others. Students reason through the acceptability of definitions and proofs (e.g., the definitions of $□^0$ and $□^{-□}$ for all integers □ and positive integers □). New definitions, as well as proofs, require students to analyze situations and break them into cases. Further, students examine the implications of these definitions and proofs on existing properties of integer exponents. Students keep the goal of a logical argument in mind while attending to details that develop during the reasoning process.

MP 6: Attend to precision. Beginning with the first lesson on exponential notation, students are required to attend to the definitions provided throughout the lessons and the limitations of symbolic statements, making sure to express what they mean clearly. Students are provided a hypothesis, such as $□ < □$, for positive integers □, □, and then asked to evaluate whether a statement, like $-2 < 5$, contradicts this hypothesis.

MP 7: Look for and make use of structure. Students understand and make analogies to the distributive law as they develop properties of exponents. Students will know $□^□ \cdot □^□ = □^{□+□}$ as an analog of $□□ + □□ = (□ + □)□$ and $(□^□)^□ = □^{□ \times □}$ as an analog of $□ \times (□ \times □) = (□ \times □) \times □$.

MP 8: Look for and express regularity in repeated reasoning. While evaluating the cases developed for the proofs of laws of exponents, students identify when a statement must be proved or if it has already been proven. Students see the use of the laws of exponents in application problems and notice the patterns that are developed in problems.

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](#)

Understand the place value system
5.NBT.A.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

Apply and extend previous understandings of arithmetic to algebraic expressions.
6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents.

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 two and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

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.