Orange Public Schools

Office of Curriculum & Instruction

2019-2020 Mathematics Curriculum Guide

8th Grade Mathematics

Illustrative Mathematics – Unit 7: Exponents and Scientific Notation

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From the New Jersey Student Learning Standards:

In **Grade 8**, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

1. Students use linear equations and systems of linear equations to represent, analyze, and solve a variety of problems. Students recognize equations for proportions ($y/x = m$ or $y = mx$) as special linear equations ($y = mx + b$), understanding that the constant of proportionality (m) is the slope, and the graphs are lines through the origin. They understand that the slope (m) of a line is a constant rate of change, so that if the input or x-coordinate changes by an amount A, the output or y-coordinate changes by the amount $m \cdot A$. Students also use a linear equation to describe the association between two quantities in bivariate data (such as arm span vs. height for students in a classroom). At this grade, fitting the model, and assessing its fit to the data are done informally. Interpreting the model in the context of the data requires students to express a relationship between the two quantities in question and to interpret components of the relationship (such as slope and y-intercept) in terms of the situation.

Students strategically choose and efficiently implement procedures to solve linear equations in one variable, understanding that when they use the properties of equality and the concept of logical equivalence, they maintain the solutions of the original equation. Students solve systems of two linear equations in two variables and relate the systems to pairs of lines in the plane; these intersect, are parallel, or are the same line. Students use linear equations, systems of linear equations, linear functions, and their understanding of slope of a line to analyze situations and solve problems.

2. 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. They can translate among representations and partial representations of functions (noting that tabular and graphical representations may be partial representations), and they describe how aspects of the function are reflected in the different representations.

3. Students use ideas about distance and angles, how they behave under translations, rotations, reflections, and dilations, and ideas about congruence and similarity to describe and analyze two-dimensional figures and to solve problems. Students show that the sum of the angles in a triangle is the angle formed by a straight line and that various configurations of lines give rise to similar triangles because of the angles created when a transversal cuts parallel lines. Students understand the statement of the Pythagorean Theorem and its converse, and can explain why the Pythagorean Theorem holds, for example, by decomposing a square in two different ways. They apply the Pythagorean Theorem to find distances between points on the coordinate plane, to find lengths, and to analyze polygons. Students complete their work on volume by solving problems involving cones, cylinders, and spheres.

Yearlong Pacing Guide
Grade 8

Grade	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
5	Unit 1 5.NBT	Unit 2 5.NBT		Unit 3 5.NF	Unit 4 5.NF		Unit 5 5.MD		Unit 6 5.OA & 5.G	
6	Unit 1 6.G	Unit 2 6.RP	Unit 3 6.RP	Unit 4 6.NS		Unit 5 6.NS	Unit 6 6.EE	Unit 7 6.NS	Unit 8 6.SP	
7	Unit 1 7.G	Unit 2 7.RP	Unit 3 7.G	Unit 4 7.RP	Unit 5 7.NS	Unit 6 7.EE		Unit 7 7.G	Unit 8 7.SP	
8	**Unit 1 8.G**	**Unit 2 8.G**	**Unit 3 8.EE**	**Unit 4 8.EE**		**Unit 5 8.F**	**Unit 6 8.SP**	**Unit 7 8.EE**	**Unit 8 8.G**	

Unit 1	**Geometry:** Rigid Transformation & Congruence	Unit 2	**Geometry:** Dilations, Similarity, and Introducing Slope	Unit 3	**Expressions & Equations:** Linear Relationships	Unit 4	**Expressions & Equations:** Linear Equations & Linear Systems
Unit 5	**Functions:** Functions and Volume	Unit 6	**Statistics & Probability:** Associations in Data	Unit 7	**Expressions & Equations:** Exponents and Scientific Notation	Unit 8	**Geometry:** Pythagorean Theorem and Irrational Numbers

2019-2020 Grade 8 (iM)							
Quarter 1		**Quarter 2**		**Quarter 3**		**Quarter 4**	
Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8
8.G.1(M) 8.G.2(M) 8.G.5(M)	8.G.4(M) 8.G.3(M) 8.EE.6(M)	8.EE.5(M) 8.F.4(S) 8.EE.8(M)	8.EE.7(M) 8.EE.8(M)	8.F.1(M) 8.F.2(M) 8.F.3(M) 8.F.4(S) 8.F.5(S) 8.G.9(A)	8.SP.1(S) 8.SP.2(S) 8.SP.3(S) 8.SP.4(S)	8.EE.1(M) 8.EE.3(M) 8.EE.4(M)	8.NS.2(S) 8.EE.2(M) 8.G.6(M) 8.G.7(M) 8.G.8(M) 8.NS.1(S)
20 Days	15 Days	17 Days	18 Days	25 Days	13 Days	18 Days	17 Days
Oct. 8	Nov. 4	Dec. 6	Jan. 15	Mar. 4	Mar. 27	May 5	Jun. 3

Major Work Supporting Content Additional Content

Table of Contents

References

"Illustrative Mathematics" *Open Up Resources.* 2018 <https://auth.openupresources.org/register/complete>

I. Unit Overview

In this unit, students build on their grade 6 work with expressions that included parentheses and positive whole-number exponents with whole-number, fraction, decimal, or variable bases, using properties of exponents strategically, but did not formulate rules for use of exponents.

The first section of the unit begins with a lesson that reviews exponential expressions, including work with exponential expressions with bases 2 and 12. In the next two lessons, students examine powers of 10, formulating the rules of exponents. In the next lesson, students consider what happens when the exponent rules are used on exponential expressions with base 10 and negative integer. In the next two lessons, they expand their work to numerical bases other than 10, using exponent rules with products of exponentials with the same base and contrasting it with products of exponentials with different bases.

The second section of the unit returns to powers of 10 as a prelude to the introduction of scientific notation. Students consider differences in magnitude of powers of 10 and use powers of 10 and multiples of powers of 10 to describe magnitudes of quantities, e.g., the distance from the Earth to the Sun or the population of Russia. Initially, they work with large quantities, locating powers of 10 and positive-integer multiples of powers of 10 on the number line. Most of these multiples are products of single-digit numbers and powers of 10. The remainder are products of two- or three-digit numbers and powers of 10, allowing students to notice that these numbers may be expressed in different ways and that some forms may be more helpful in finding locations on the number line. In the next lesson, students do similar work with small quantities.

In the remaining five lessons, students write estimates of quantities in terms of integer or non-integer multiples of powers of 10 and use their knowledge of exponential expressions to solve problems, e.g., How many meter sticks does it take to equal the mass of the Moon? They are introduced to the term “scientific notation,” practice distinguishing scientific from other notation, and use scientific notation (with no more than three significant figures) in order to make additive and multiplicative comparisons of pairs of quantities. They compute sums, differences, products, and quotients of numbers written in scientific notation (some with as many as four significant figures), using such calculations to estimate quantities. They make measurement conversions that involve powers of ten, e.g., converting bytes to kilobytes or gigabytes, choose appropriate units for measurements and express them in scientific notation.

Essential Questions

- How are properties of exponents used to simplify numerical expressions?
- How is scientific notation used to represent numbers?
- How are numbers compared and manipulated using scientific notation?

Enduring Understanding

- *n* th roots and *n* th powers are inverse operations.
- Very large and very small numbers are represented using a single digit times an integer power of 10 (scientific notation).
- Powers can be used to shorten the representation of repeated multiplication.
- Operations and properties of exponents are used to determine the value and/or compare numbers in both decimal and scientific notation.
- Numbers can be represented in scientific notation and still be manipulated using operations such as addition, subtraction, multiplication, and division

II. Pacing Guide

Activity	New Jersey State Learning Standards (NJSLS)	Estimated Time (Blocks)
Unit 7 Pre-Unit Assessment *Optional*	6.NS.B.2, 6.NS.B.3, 6.EE.A.1, 7.EE.B.3, 7.RP.A.3, 6.NS.C.6, 4.NF.A.1 5.NF.B.5.b	½
Lesson 1: Exponent Review	8.EE.A.1	1
Lesson 2: Multiplying Powers of Ten	8.EE.A.1, 8.EE.3, 8.EE.A.4	1
Lesson 3: Powers of Powers of Ten	8.EE.A.1, 8.EE.A.4	1
Lesson 4: Dividing Powers of Ten	8.EE.A.1	1
Lesson 5: Negative Exponents with Powers of 10	8.EE.A.1	1
Lesson 6: What about Other Bases	8.EE.A.1	1
Lesson 7: Practice with Rational Bases	8.EE.A.1	1
Lesson 8: Combining Bases	8.EE.A.1	1
Lesson 9: Describing Large and Small Numbers Using Powers of 10	8.EE.A.3, 8.EE.A.4	1
Lesson 10: Representing Large Numbers on the Number Line	8.EE.A.3, 8.EE.A.4	1
Lesson 11: Representing Small Numbers on the Number Line	8.EE.A.1, 8.EE.3, 8.EE.A.4	1
Lesson 12: Applications of Arithmetic Powers of 10	8.EE.3, 8.EE.A.4	1
Lesson 13: Definition of Scientific Notation	8.EE.3, 8.EE.A.4	1
Lesson 14: Multiplying, Dividing, and Estimating with Scientific Notation	8.EE.A.1, 8.EE.3, 8.EE.A.4	1
Lesson 15: Adding and Subtracting with Scientific Notation	8.EE.A.4	1
Lesson 16: Is a Smartphone Smart Enough to Go to the Moon? ***(Project Based Learning)***	8.EE.3, 8.EE.A.4	1
Unit 7 Performance Task	8.EE.A.4	½
Unit 7 End of Unit Assessment *Optional*	8.EE.A.1, 8.EE.A.3, 8.EE.A.4	**1**
Total Time		**18 Blocks**

Major Work Supporting Content Additional Content

III. Pacing Calendar

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 2)*.

APRIL

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Please complete the pacing calendar based on the suggested pacing (*see Pacing Guide on page 2)*.

MAY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

IV. NJSLA Assessment Evidence Statements

Type I Type II Type III

NJSLS	Evidence Statement	Clarification	Math Practices	Calculator ?
8.EE.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 x 3^-5 = 1/3^3 = 1/27	i) Tasks do not have a context. ii) Tasks focus on the properties and equivalence, not on simplification. iii) Half of the expressions involve one property; half of the expressions involve two or three properties. iv) Tasks should involve a single common base or a potential common base, such as, a task that includes 3, 9 and 27.	MP. 7	No
8.EE.2	Use square root and cube root symbols to represent solutions to equations of the form x^2=p and x^3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.	i) Tasks may or may not have a context. ii) Students are not required to simplify expressions such as √8 to 2√2. Students are required to express the square roots of 1, 4, 9, 16, 25, 36, 49, 64, 81 and 100; and the cube roots of 1, 8, 27, and 64.	MP. 7	No
8.EE.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 x 10^8 and the population of the world as 7 x 10^9, and determine that the world population is more than 20 times larger.		MP. 4	No

8.EE.4-1	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used.	i) Tasks have "thin context" 2 or no context. ii) Rules or conventions for significant figures are not assessed. iii) Some of the tasks involve both decimal and scientific notation.	MP. 6 MP. 7 MP. 8	No
8.EE.4-2	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.	i) Tasks have "thin context". ii) Tasks require students to recognize 3.7E-2 (or 3.7e-2) from technology as 3.7 x 10^ -2 .	MP. 6 MP. 7 MP. 8	Yes or No
8.C.6	Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. Content Scope: Knowledge and skills articulated in 7.RP.A, 7.NS.A, 7.EE.A.	i) Some of the tasks may use scaffolding	MP.3 MP.6	Yes
8.D.2	Solve multi-step contextual problems with degree of difficulty appropriate to grade 8, requiring application of knowledge and skills articulated in 7.RP.A, 7.NS.3, 7.EE, 7.G, and 7.SP.B	i) Some of the tasks may use scaffolding[1]	MP. 1 MP. 2 MP. 4 MP. 5 MP. 7	Yes

V. Differentiated Instruction

Supporting English Language Learners

The purpose of this document is to nudge the field forward by offering support to the next generation of mathematics learners and by challenging persistent assumptions about how to support and develop students' disciplinary language. The goal is to provide guidance to mathematics teachers for recognizing and supporting students' language development processes in the context of mathematical sense making. UL/SCALE provides a framework for organizing strategies and special considerations to support students in learning mathematics practices, content, and language. The framework is intended to help teachers address the specialized academic language demands in math when planning and delivering lessons, including the demands of reading, writing, speaking, listening, conversing, and representing in math (Aguirre & Bunch, 2012). Therefore, while the framework can and should be used to support all students learning mathematics, it is particularly well-suited to meet the needs of linguistically and culturally diverse students who are simultaneously learning mathematics while acquiring English.

For more information, click the link below:

Supporting ELL Learners

Supporting Students with Disabilities

The philosophical stance that guided the creation of these materials is the belief that with proper structures, accommodations, and supports, all children can learn mathematics. Lessons are designed to maximize access for all students and include additional suggested supports to meet the varying needs of individual students. While the suggested supports are designed for students with disabilities, they are also appropriate for many children who struggle to access rigorous, grade-level content. Teachers should use their professional judgment about which supports to use and when, based on their knowledge of the individual needs of students in their classroom.

For more information, click the link below:

Supporting Students with Disabilities

VI. Vocabulary

Scientific Notation: Scientific notation is a way of writing very large or very small quantities using powers of 10. A number in scientific notation is the product of two factors:

- The first factor is a number greater than or equal to 1, but less than 10.
- The second factor is an integer power of 10.

It is standard for numbers in scientific notation to use the ×symbol to indicate multiplication between these two factors.

VII. Assessment Framework

Unit 7 Assessment Framework				
Assessment	**NJSLS**	**Estimated Time**	**Format**	**Graded ?**
Pre-Unit Diagnostic Assessment (Beginning of Unit – Optional) *Illustrative Mathematics*	6.NS.B.2, 6.NS.B.3, 6.EE.A.1, 7.EE.B.3, 7.RP.A.3, 6.NS.C.6, 4.NF.A.1 5.NF.B.5.b	½ Block	Individual	Yes (No Weight)
End-of-Unit Assessment (End of Unit – Optional) *Illustrative Mathematics*	8.EE.A.1, 8.EE.A.3, 8.EE.A.4	1 Block	Individual	Yes

Unit 7 Performance Assessment Framework				
Assessment	**NJSLS**	**Estimated Time**	**Format**	**Graded ?**
Unit 7 Performance Task 1 (Early May) *Giantburgers*	8.EE.A.4	½ Block	Individual	Yes; Rubric
Unit 7 Performance Task Option 1 (Optional) *Ants vs. Humans*	8.SP.A.4	Teacher Discretion	Teacher Discretion	Yes, if administered
Extended Constructed Response (ECR)* (click here for access)	Dependent on unit of study & month of administration	Up to 30 minutes	Individual	Yes; Rubric

* Use the following links to access ECR protocol and district assessment scoring documents:

- *Assessment & Data in Mathematics Bulletin*
- *Extended Constructed Response Protocol*

Name _____ Block _____ Date _____

Giantburgers (8.EE.A.4)

This headline appeared in a newspaper.

"Every day 7% of Americans eat at Giantburger restaurants"

Decide whether this headline is true using the following information.

- There are about 8×103 Giantburger restaurants in America.
- Each restaurant serves on average 2.5×103 people every day.
- There are about 3×108 Americans.

Explain your reasons and show clearly how you figured it out.

8th Grade Giantburgers Name: _____ Date: _____

NJSLS: 8.EE.A.4 Type: _____ Teacher: _____

SOLUTION

a. **The student indicates the number of Americans who eat at Giant Burgers and justifies the solution with Math**
b. **The student indicates that 6.67% percent of Americans eat at Giant Burgers by dividing the part/whole and justifies the answers**
c. **The student indicates that 6.67% is close to 7% so it is reasonable to say that 7% of the Americans eat at Giant Burgers.**

Level 5: Distinguished Command	**Level 4: Strong Command**	**Level 3: Moderate Command**	**Level 2: Partial Command**	**Level 1: No Command**
Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor computational error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical approach based on a conjecture and/or stated assumptions • a logical and complete progression of steps • complete justification of a conclusion with minor conceptual error	Clearly constructs and communicates a complete response based on concrete referents provided in the prompt or constructed by the student such as diagrams that are connected to a written (symbolic) method, number line diagrams or coordinate plane diagrams, including: • a logical, but incomplete, progression of steps • minor calculation errors • partial justification of a conclusion • a logical, but incomplete, progression of steps	Constructs and communicates an incomplete response based on concrete referents provided in the prompt such as: diagrams, number line diagrams or coordinate plane diagrams, which may include: • a faulty approach based on a conjecture and/or stated assumptions • An illogical and Incomplete progression of steps • major calculation errors • partial justification of a conclusion	The student shows no work or justification.

Answer
If there are about 8×10^3 Giant Burger restaurants in America and each restaurant serves about 2.5×10^3 people every day, then about $(8\times10^3)\times(2.5\times10^3)=(20\times10^6)=(2\times10^7)$ 2×10^7 People eat at a Giant Burger restaurant every day. Since there are about 3×10^8 Americans, the percent of Americans who eat at a Giant Burger restaurant every day can be computed by dividing the number of restaurant patrons by the total number of people: $\frac{Number\ of\ Americans\ who\ eat\ at\ Giant\ Burger}{Total\ number\ of\ americans}$ $\frac{2\times10^7}{3\times10^8}$ $\frac{2}{3}\times10^{-1}$ $\frac{2}{3}\times10^{-1}$ $\frac{2}{3}\times\frac{1}{10}$ $\frac{2}{30}=\frac{1}{15}=0.066\cong6.67\%$ Our estimate is, about 6.67% of the Americans eat at Giant Burger Restaurant, which is close to 7%. Therefore the claim in the headline is reasonable.

Name _____ Block _____ Date _____

Ants Vs. Humans? (8.EE.A.4, 8.EE.A.4)

The average mass of an adult human is about 65 kilograms while the average mass of an ant is approximately 4×10^{-3} grams. The total human population in the world is approximately 6.84 billion, and it is estimated there are currently about 10,000 trillion ants alive.[1]

Based on these values, how does the total the total mass of all living ants compare to the total mass of all living humans?

IX. Modifications

Special Education/ 504:	English Language Learners:
-Adhere to all modifications and health concerns stated in each IEP. -Give students a MENU options, allowing students to pick assignments from different levels based on difficulty. -Accommodate Instructional Strategies: reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), handouts, definition list with visuals, extended time -Allow students to demonstrate understanding of a problem by drawing the picture of the answer and then explaining the reasoning orally and/or writing , such as Read-Draw-Write -Provide breaks between tasks, use positive reinforcement, use proximity -Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum by using manipulatives -Implement supports for students with disabilities (click here) - Make use of strategies imbedded within lessons -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 17-18) - Strategies for students with 504 plans	- Use manipulatives to promote conceptual understanding and enhance vocabulary usage - Provide graphic representations, gestures, drawings, equations, realia, and pictures during all segments of instruction - During i-Ready lessons, click on “Español” to hear specific words in Spanish - Utilize graphic organizers which are concrete, pictorial ways of constructing knowledge and organizing information - Use sentence frames and questioning strategies so that students will explain their thinking/ process of how to solve word problems - Utilize program translations (if available) for L1/ L2 students - Reword questions in simpler language - Make use of the ELL Mathematical Language Routines (click here for additional information) -Scaffolding instruction for ELL Learners -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 16-17)
Gifted and Talented:	**Students at Risk for Failure:**
- Elevated contextual complexity - Inquiry based or open ended assignments and projects - More time to study concepts with greater depth - Promote the synthesis of concepts and making real world connections - Provide students with enrichment practice that are imbedded in the curriculum such as: ● Application / Conceptual Development ● Are you ready for more? - Provide opportunities for math competitions - Alternative instruction pathways available - Common Core Approach to Differentiate Instruction: Students with Disabilities (pg. 20)	- Assure students have experiences that are on the Concrete- Pictorial- Abstract spectrum - Modify Instructional Strategies, reading aloud text, graphic organizers, one-on-one instruction, class website (Google Classroom), inclusion of more visuals and manipulatives, Peer Support - Constant parental/ guardian contact - Provide academic contracts to students & guardians - Create an interactive notebook with samples, key vocabulary words, student goals/ objectives. - Plan to address students at risk in your learning tasks, instructions, and directions. Anticipate where the needs will be, then address them prior to lessons. -Common Core Approach to Differentiate Instruction: Students with Disabilities (pg 19)

21st Century Life and Career Skills:

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

https://www.state.nj.us/education/cccs/2014/career/9.pdf

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

Students are given an opportunity to communicate with peers effectively, clearly, and with the use of technical language. They are encouraged to reason through experiences that promote critical thinking and emphasize the importance of perseverance. Students are exposed to various mediums of technology, such as digital learning, calculators, and educational websites.

Technology Standards:

All students will be prepared to meet the challenge of a dynamic global society in which they participate, contribute, achieve, and flourish through universal access to people, information, and ideas.
https://www.state.nj.us/education/cccs/2014/tech/

8.1 Educational Technology:

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. **Technology Operations and Concepts:** Students demonstrate a sound understanding of technology concepts, systems and operations.
B. **Creativity and Innovation:** Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
C. **Communication and Collaboration:** Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
D. **Digital Citizenship:** Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
E. **Research and Information Fluency:** Students apply digital tools to gather, evaluate, and use of information.
F. **Critical thinking, problem solving, and decision making:** Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming:

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.

A. **The Nature of Technology: Creativity and Innovation-** Technology systems impact every aspect of the world in which we live.
B. **Technology and Society:** Knowledge and understanding of human, cultural, and societal values are fundamental when designing technological systems and products in the global society.
C. **Design:** The design process is a systematic approach to solving problems.
D. **Abilities in a Technological World:** The designed world in a product of a design process that provides the means to convert resources into products and systems.
E. **Computational Thinking: Programming-** Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Interdisciplinary Connections:	
English Language Arts:	
L.8.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
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.
W.8.1	Write arguments to support claims with clear reasons and relevant evidence.

X. Core Instruction & Supplemental Resources

Core Instruction

ILLUSTRATIVE MATHEMATICS V. 2019
(OPEN UP RESOURCES)

GRADE	TEACHER RESOURCES	STUDENT RESOURCES
6	• **Teacher Edition: Unit 1-9** • Online Course Guide	• Student Workbook Set: Unit 1-9 • Online Student Access (Digital Applets)
7	• **Teacher Edition: Unit 1-9** • Online Course Guide	• Student Workbook Set: Unit 1-9 • Online Student Access (Digital Applets)
8	• **Teacher Edition: Unit 1-9** • Online Course Guide	• Student Workbook Set: Unit 1-9 • Online Student Access (Digital Applets)

5 Practices for Orchestrating Productive Mathematics Discussions

Anticipate

Consider how students might mathematically interpret a problem, the array of strategies—both correct and incorrect—that they might use to tackle it, and how those strategies and interpretations might relate to the mathematical concepts, representations, procedures, and practices that you would like the students to learn.

- Solve the problem yourself first. If possible work with colleagues.
- Ask yourself the following questions:
  - What strategies have students used in the past?
  - What representations are students most likely to use?
  - What incorrect or unproductive strategies are students likely to try?
  - What things might get in the way of students being able to engage with the problem? How can you remove those barriers?
  - What questions will you ask those who struggle?

Monitor

Pay close attention to students' mathematical thinking and solution strategies as they work on the task.

- Create a list of strategies the students may produce.
- Circulate the room. Watch and listen to students as they work.
- If any students use strategies you anticipated, write their name or group number on your list.
- Ask questions that will help students make their thinking visible.
- Ask questions that will help students clarify their thinking.
- Press students to consider aspects of the task to which they need to attend.

Select

Select particular students to share their work with the rest of the class to get specific mathematics into the open for discussion. The selection of particular students and their solutions is guided by the previously anticipated strategies and your assessment of how each approach will contribute to that goal.

- Based on the previously anticipated strategies and the mathematical goal of the activity, decide which student strategies to highlight.
- Select students who will share their work with the class.

Sequence

Make purposeful choices about the order in which students' work is shared to maximize the chances of achieving the mathematical goals for the discussion.

- Based on the mathematical goal, decide on the purpose for the sequence of work. For example: least efficient to most efficient, concrete to abstract, misconceptions to conceptions, or building representations.
- Decide in which order students will present their work.

Connect

Help students draw connections between their solutions and other students' solutions as well as the key mathematical ideas in the lesson. Help students to make judgments about the consequences of different approaches for the range of problems that can be solved, one's likely accuracy and efficiency in solving them, and the kinds of mathematical patterns that can be most easily discerned. Know where you want the discussion to "land" and make choices that are likely to get you there. If necessary, you may have to demonstrate an approach that students didn't come up with themselves.

- As students share, ask questions to elicit and clarify student thinking.
- After each student shares, ask questions to connect it to previously shared work or ask a student to summarize what another student said in their own words.
- Ask students to compare and contrast strategies or representations during the discussion.
- If students did not come up with an approach that you need them to see in order for the discussion to "land," demonstrate this approach and connect it to the work that students did.

IDEAL MATH BLOCK

Whole Group Instruction	55min	INSTRUCTION (Grades 3 – 8) Daily Routine: Mathematical Content or Language Routine (7 – 10 min) Anchor Task: Anticipate, Monitor, Select, Sequence, Connect Tech Integration: Digital applets embedded within lessons designed to enhance student learning Collaborative Work* Guided Learning/Guided Practice Independent Work (Demonstration of Student Thinking) Additional Activities / Let's Practice		
Rotation Stations (Student Notebooks & Chromebooks Needed)	1-2X 30 min	STATION 1: Focus on current Grade Level Content STUDENT EXPLORATION* Independent or groups of 2-3 Emphasis on MP's 3, 6 (Reasoning and Precision) And MP's 1 & 4 (Problem Solving and Application) TOOLS/RESOURCES Practice Problems Extra Practice/Enrichment Are you ready for more? Put Your Thinking Cap On	STATION 2: Focus on Student Needs TECH STATION Independent TECH INTEGRATION iReady - *i-Ready* delivers online lessons driven by student data to provide tailored instruction that meets students where they are in their learning trajectory. Dreambox (ELL) – Adaptive online learning platform.	TEACHER STATION: Focus on Grade Level Content; heavily scaffolded to connect deficiencies TARGETED INSTRUCTION 4 – 5 Students TOOLS/ RESOURCES Homework Manipulatives Reteach Workbook Transition Guide *all students seen in 2 weeks
Closure	5 min	INSTRUCTION Exit Ticket (Demonstration of Student Thinking) TOOLS/RESOURCES Notebooks or Exit Ticket Slips		

* Promotes discourse and collaboration

Supplemental Resources

Achieve the Core

Tasks - https://achievethecore.org/category/416/mathematics-tasks

Coherence Map - https://achievethecore.org/page/1118/coherence-map

Embarc

https://embarc.online/

Engage NY

https://www.engageny.org/ccss-library/?f%5B0%5D=field_subject%253Aparents_all%3A13601

iReady Digital Platform

https://login.i-ready.com/

Illustrative Mathematics

Content Standard Tasks - https://tasks.illustrativemathematics.org/content-standards

Practice Standard Tasks - https://tasks.illustrativemathematics.org/practice-standards

Open Up Resources - https://access.openupresources.org/sign_in

iM Additional Resources - https://bit.ly/imshare

Khan Academy

https://www.khanacademy.org/math/illustrative-math

NJDOE Digital Item Library

https://nj.digitalitemlibrary.com/home?subject=Math

Ready Teacher Toolbox

https://teacher-toolbox.com/