Marietta City Schools

2023–2024 District Unit Planner

Accelerated Grade 7/8 Mathematics

Unit title	Unit 2: Exploring Irrational Numbers, Integer Exponents, and Scientific Notation	**MYP year**	3	**Unit duration (hrs)**	*18 hours* *MMS- (4.5 hours per week)*

Mastering Content and Skills through INQUIRY (Establishing the purpose of the Unit): ***What will students learn?***

GA DoE Standards

Standards

8.NR.1 Solve problems involving irrational numbers and rational approximations of irrational numbers to explain real-life applications.
Strand 2: Creative Thinking SkillsStudents will develop and utilize creative thinking through a variety of products and problem solving.
Strand 3: Higher OrderThinking and Problem Solving Skills Students will develop and utilize critical thinking, higher order thinking, logical thinking and problem solving skills in various situations.
Strand 4: Advanced Communication and Collaboration Skills Students will develop advanced communication and collaboration skills in working toward a common goal with shared accountability for the final outcome.

8.NR.2: Solve problems involving radicals and integer exponents including relevant application situations; apply place value understanding with scientific notation and use scientific notation to explain real phenomena.

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Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)			
8.NR.1.1	Distinguish between rational and irrational numbers using decimal expansion. Convert a decimal expansion which repeats eventually into a rational number.	***Strategies and Methods*** • Students should be provided with experiences to use numerical reasoning when describing decimal expansions. • Students should be able to classify real numbers as rational or irrational. • Students should know that when a square root of a positive integer is not an integer, then it is irrational. • Students should use prior knowledge about converting fractions to decimals learned in 6^{th} and 7^{th} grade to connect changing decimal expansion of a repeating decimal into a fraction and a fraction into a repeating decimal. • Emphasis is placed on how all rational numbers can be written as an equivalent decimal. The end behavior of the decimal determines the classification of the number.	***Age/Developmentally Appropriate*** • This specific example is limited to the tenths place; however, the concept for this grade level extends to the hundredths place.	***Terminology*** • Rational numbers are those with decimal expansions that terminate in zeros or eventually repeat. • Irrational numbers are non-terminating, non-repeating decimals.	***Example*** • Change $0.\overline{4}$ to a fraction 1. Let $x = 0.4444444\ldots$ 2. Multiply both sides so that the repeating digits will be in front of the decimal. In this example, one digit repeats so both sides are multiplied by 10, giving $10x = 4.4444444\ldots$ 3. Subtract the original equation from the new equation. $10x = 4.4444444\ldots$ $x = 0.44444\ldots$ $9x = 4$ 4. Solve the equation to determine the equivalent fraction. $9x = 4$ $x = 4/9$
8.NR.1.2	Approximate irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions.	***Strategies and Methods*** • Students should use visual models and numerical reasoning to approximate irrational numbers.	***Example*** • By estimating the decimal expansion of $\sqrt{17}$, show that $\sqrt{17}$ is between 4 and 5 and closer to 4 on a number line.		

8.NR.2 Solve problems involving radicals and integer exponents including relevant application situations; apply place value understanding with scientific notation and use scientific notation to explain real-life phenomena.

Expectations		Evidence of Student Learning (not all inclusive; see Grade Level Overview for more details)		
8.NR.2.1	Apply the properties of integer exponents to generate equivalent numerical expressions.	***Strategies and Methods*** • Students should use numerical reasoning to identify patterns associated with properties of integer exponents. • The following properties should be addressed: product rule, quotient rule, power rule, power of product rule, power of a quotient rule, zero exponent rule, and negative exponent rule.		***Example*** $3^2 \times 3^{(-5)} = 3^{(-3)} = \frac{1}{(3^3)} = \frac{1}{27}$
8.NR.2.2	Use square root and cube root symbols to represent solutions to equations. Recognize that $x^2 = p$ (where p is a positive rational number and $\|x\| \leq 25$) has two solutions and $x^3 = p$ (where p is a negative or positive rational number and $\|x\| \leq 10$) has one solution. Evaluate square roots of perfect squares ≤ 625 and cube roots of perfect cubes ≥ -1000 and ≤ 1000.	***Strategies and Methods*** • Students should be able to find patterns within the list of square numbers and then with cube numbers. • Students should be able to recognize that squaring a number and taking the square root of a number are inverse operations; likewise, cubing a number and taking the cube root are inverse operations.	***Fundamentals*** • Equations should include rational numbers such as $x^2 = \frac{1}{4}$.	***Example*** • $\sqrt{64} = \sqrt{8^2} = 8$ and $\sqrt[3]{(5^3)} = 5$. Since $\sqrt{p}$ is defined to mean the positive solution to the equation $x^2 = p$ (when it exists). It is not mathematically correct to say $\sqrt{64} = \pm 8$ (as is a common misconception). In describing the solutions to $x^2 = 64$, students should write $x = \pm\sqrt{64} = \pm 8$.
8.NR.2.3	Use numbers expressed in scientific notation to estimate very large or very small quantities, and to express how many times as much one is than the other.	***Strategies and Methods*** • Students should use the magnitude of quantities to compare numbers written in scientific notation to determine how many times larger (or smaller) one number written in scientific notation is than another. • Students should have opportunities to compare numbers written in scientific notation in contextual, mathematical problems, including scientific situations.		***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.
8.NR.2.4	Add, subtract, multiply and divide numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology (e.g., calculators or online technology tools).	***Fundamentals*** • Students should use place value reasoning which supports the understanding of digits shifting to the left or right when multiplied by a power of 10.	***Strategies and Methods*** • Students combine knowledge of integer exponent rules and scientific notation to perform operations with numbers expressed in scientific notation. • Students should solve realistic problems involving scientific notation.	

8.MP: Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals.

Concepts/Skills to support mastery of standards

- 8.NR.1.1 - Distinguish between rational and irrational numbers
- 8.NR.1.1 - Convert a repeating decimal into fraction (rational number)
- 8.NR.1.2 - Approximate irrational numbers on a number line
- 8.NR.1.2 - Compare the size of irrational numbers
- 8.NR.1.2 - Estimate the value of expressions
- 8.NR.2.1 -Apply the properties of integer exponents to generate equivalent numerical expressions
- 8.NR.2.2 - Use square root and cube root symbols to represent solutions to equations
- 8.NR.2.2 - Evaluate square roots of perfect squares
- 8.NR.2.3 - Use numbers expressed in scientific notation to estimate very large or very small quantities
- 8.NR.2.4 - Add, subtract, multiply and divide numbers expressed in scientific notation
- 8.NR.2.4 - Interpret scientific notation that has been generated by technology

Vocabulary

Integer	Whole Number	Natural Numbers	Rational Number	Irrational Number	Number System
Scientific Notation	Exponents	Perfect Cubes	Perfect Squares	Radicals/Square Roots	Cube Roots
Estimate	Approximate				

Notation

Key concept	Related concept(s)	Global context
Form – The shape and underlying structure of an entity or piece of work, including its organization, essential nature and external appearance”	Justification and Simplification	Scientific and Technical Innovation
Statement of inquiry		
Various numeric forms can be used to enhance our understanding of scientific principles		
Inquiry questions		
Factual— How can we simplify exponential expressions?		

Conceptual— How are exponents and scientific notation related?

Debatable - What is the best form of representing numbers and expressions?

MYP Objectives	**Assessment Tasks**	
*What specific MYP **objectives** will be addressed during this unit?*	***Relationship** between summative assessment task(s) and statement of inquiry:*	*List of common formative and summative assessments.*
Criterion A: Knowledge and Understanding Criterion B: Investigating Patterns Criterion C: Communication Criterion D: Applying Mathematics In real life contexts	Students will use various numeric forms to help them understand scientific principles.	**Formative Assessment(s):** Unit 2 CFA **Summative Assessment(s):** Unit 2 Summative Assessment MYP: Topic 1 Performance Assessment A # 3 and 4, Assessment B # 1-3

Approaches to learning (ATL)

Category: Social
Cluster: Collaboration Skills
Skill Indicator: Give and receive meaningful feedback

Category: Self Management
Cluster: Organization Skills
Skill Indicator: Bring necessary equipment and supplies to class

Learning Experiences

Add additional rows below as needed.

Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**

8.NR.1 Solve problems involving irrational numbers and rational approximations of irrational numbers to explain realistic applications. **8.NR.1.1** Distinguish between rational and irrational numbers using decimal expansion. Convert a decimal expansion which repeats eventually into a rational number. **8.NR.1.2** Approximate irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions. **8.NR.2** Solve problems involving radicals and integer exponents including relevant application situations; apply place value understanding with scientific notation and use scientific notation to explain real phenomena. Sample Mathematics Learning Plan Grade 8 **8.NR.2.2** Use square root and cube root symbols to represent solutions to equations. Recognize that x2 = p (where p is a positive rational number and |x| ≤ 25) has two solutions and x3 = p (where p is a negative or positive rational number and |x| ≤ 10) has one solution. Evaluate square roots of perfect squares ≤ 625 and cube roots of perfect cubes ≥ -1000 and ≤ 1000.	**Working With Real Numbers** In this learning plan, students will distinguish between rational or irrational numbers. Students will understand that a rational number is any number that can be represented as a fraction with a non-zero denominator, and an irrational number is any number that is not rational. Rational numbers can be written as decimals that terminate or eventually repeat; irrational numbers are represented as decimals that neither terminate nor repeat.	The teacher will want to be intentional in making the connections between what is being asked in this task and how all the things they have learned regarding what a rational and irrational number is and how to make the same when comparing them. The teacher may want to have a yardstick to use to generate numbers from to show how they fall in sequence according to their numerical value. The teacher may want to then transition to the number line and how the numbers used for the yardstick will fall on the number line.
8.NR.2 Solve problems involving radicals and integer exponents including relevant application situations; apply place value understanding with scientific notation and use scientific notation to explain real-life phenomena. **8.NR.2.3** Use numbers expressed in scientific notation to estimate very large or very small quantities, and to express how many times as much one is than the other. **8.NR.2.4** Add, subtract, multiply and divide	**Lasers and Long-Distance Text Messaging** In this learning plan, students will explore operations using scientific notation. Students will discover how long it would take a light from a laser to travel across different distances in the universe and the distances between planet orbits. Students will also discuss how long it would take to receive a text message to the Earth from different planets! This plan will cover operations with scientific notation through pattern recognition and a foundation of exponent rules through a discovery of larger numbers.	The teacher will use think aloud strategies to make connections between mathematics concepts for the students to be able to complete the task. When doing think aloud strategies, give the students a series of prompts— e.g., questions or sentence starters—to guide them through the process of thinking aloud. Make sure you include questions that require them to justify their decisions, such as:

numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Interpret scientific notation that has been generated by technology (e.g., calculators or online technology tools).		

Content Resources

[6-11 Savvas Correlation to 2021 standards]

Intervention Tasks

Irrational folding - 8.NR.1.1 8.NR.1.2

Exploring Exponents - 8.NR.2.1

Other Resources

- **Savvas**
- **Desmos**
- **Hands-On Math**
- [GaDOE Unit 1 Curriculum Map]