Marietta City Schools

District Unit Planner

Everything on the unit planner must be included on the unit curriculum approval statement.

Grade 8 Honors Mathematics

Unit title	Unit 5: Irrational Numbers, Integer Exponents and Scientific Notation	**MYP year**	3	**Unit duration (hrs)**	*MMS- (4.5 hours per week)*

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

Georgia K-12 Standards

Standards

8.NR.1 Solve problems involving irrational numbers and rational approximations of irrational numbers to explain real-life applications.
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.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.

MCS Gifted Standards:
MCS.Gifted.S3B.

NUMERICAL REASONING *– rational and irrational numbers, decimal expansion, integer exponents, square and cube roots, scientific notation*

8.NR.1: Solve problems involving irrational numbers and rational approximations of irrational numbers to explain realistic applications.

<table>
<tr><th colspan="2">Expectations</th><th colspan="4">Evidence of Student Learning
(not all inclusive; see Grade Level Overview for more details)</th></tr>
<tr><td>8.NR.1.1</td><td>Distinguish between rational and irrational numbers using decimal expansion. Convert a decimal expansion which repeats eventually into a rational number.</td><td>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 6th and 7th 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.</td><td>Age/Developmentally Appropriate
This specific example is limited to the tenths place; however, the concept for this grade level extends to the hundredths place.</td><td>Terminology
Rational numbers are those with decimal expansions that terminate in zeros or eventually repeat.
Irrational numbers are non-terminating, non-repeating decimals.</td><td>Example
Change $0.\overline{4}$ to a fraction
1. Let x = 0.4444444 …
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 …
3. Subtract the original equation from the new equation.
$10x$ = 4.4444444 …
x = 0.44444 …
$9x$ = 4
4. Solve the equation to determine the equivalent fraction.
$9x$ = 4
x = 4/9</td></tr>
<tr><td>8.NR.1.2</td><td>Approximate irrational numbers to compare the size of irrational numbers, locate them approximately on a number line, and estimate the value of expressions.</td><td colspan="3">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.</td></tr>
</table>

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.

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.	

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

K-12 Mathematics Glossary

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

Key concept	Related concept(s)	Global context
Form	Justification, 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 forms to help them understand scientific principles.	**Formative Assessment(s):** Unit 5 CFA **Summative Assessment(s):** Unit 5 Summative Unit 5 MYP Project: **Savvas Topic 5 Performance Task Form A.**

Approaches to learning (ATL)

Give and receive meaningful feedback
Category: Thinking
Cluster: Critical Thinking
Skill Indicator: Analyzing and evaluating issues and ideas and Utilizing skills and knowledge in multiple contexts

Learning Experiences		
Objective or Content	**Learning Experiences**	**Personalized Learning and Differentiation**
8.NR.1.1 Distinguish between rational and irrational numbers using decimal expansion.	Working with Real Numbers **Brief Description:**	In this learning plan, students will distinguish between rational or irrational numbers.

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.2.2** 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.	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. **Learning Goal:** ● I can distinguish between rational and irrational numbers. ● I can locate rational and irrational numbers on a number line.	
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 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).	**Lasers and Long-Distance Text Messaging** **Brief Description:** 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. **Learning Goal:** ● I can add and subtract numbers given in scientific notation. ● I can multiply and divide numbers given in scientific notation.	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.
Content Resources		
DOE Unit 5 Link **Savvas Correlation Link**		