Mathematics: Grade 8

Overview

The Number Sense standards in grade eight include ideas about rational and irrational numbers and also extend student understanding about exponents to include properties of exponents. In grade six, students compare and order rational numbers and plot them on a number line,[6.NS.3] and in grade seven they show that the distance between two rational numbers on a number line is the absolute value of their difference[7.NS.2] and compute fluently with rational numbers using algorithms.[7.NS.7] Students in grade eight continue to deepen their understanding of rational and irrational numbers by explaining the differences between them and by understanding the character of their decimal equivalents. [8.NS.1] Students also use rational approximations to estimate the value of expressions involving irrational numbers.[8.NS.1]

In grade six, students evaluate positive rational numbers with whole number exponents as well as numerical expressions with non-negative rational numbers,[6.NS.5,8] and in grade seven, they use exponents to express prime factorization and understand the inverse relationship between perfect squares and square roots. [7.NS.5-6] All of these standards support work in grade eight where students generalize and apply the properties of exponents.[8.NS.3]

Standards in grade six ask students to solve real-world problems with positive fractions and decimals,[6.NS.4] and students in grade seven generalize the rules for operations with integers and compute fluently with all rational numbers.[7.NS.3,4,7] In grade eight, students solve real-world problems with rational numbers using multiple operations.[8.NS.4] The procedures and concepts embedded in the grade eight *Number Sense* standards support important standards in the *Algebra and Functions* domain.

<table>
<tr><th colspan="3">Number Sense</th></tr>
<tr><td>Learning Outcome</td><td colspan="2">Students continue to deepen their understanding of rational and irrational numbers by explaining the differences between them and by solving real-world problems.</td></tr>
<tr><td>Standard</td><td colspan="2">8.NS.3: Given a numeric expression with common rational number bases and integer exponents, apply the properties of exponents to generate equivalent expressions. (E)</td></tr>
<tr><th colspan="2">Evidence Statements</th><th>Academic Vocabulary</th></tr>
<tr><td colspan="2">● Generate equivalent expressions that represent the expanded notation of the application of a property of exponents.
● Apply the following properties of exponents to generate equivalent expressions with common rational number bases and integer exponents:
○ Product rule;</td><td>● Rational number
● Integer
● Exponent
● Base
● Properties of exponents
● Equivalent expressions
● Product of powers</td></tr>
</table>

○ Quotient rule; ○ Power rule; ○ Power of a product rule; ○ Power of a quotient rule; ○ Zero rule; ○ Negative exponent rule. ● Generate equivalent expressions involving rational number bases, such as fractions or decimals, raised to integer exponents.	● Power of a power ● Negative exponent ● Zero exponent ● Quotient of powers
Clarification Statements	**Common Misconceptions**
● When teaching the properties of exponents, students should be given opportunities to explore the expanded notation of each property in order to make meaning of each. ● Students should be familiar with the concept of raising a base to an exponent and the resulting effect on the value of the expression.	● Students may believe that they can apply the properties of exponents exclusively to either the base or the exponent. ● Students may confuse the order of operations with the properties of exponents. ● Students may apply the wrong property if parentheses are contained within the expression, confusing the product of powers and the power of a power. ● Students may confuse properties if only taught rules and not given the opportunity to connect them to concepts.
Looking Back	**Looking Ahead**
7.NS.5 Find the prime factorization of whole numbers and write the results using exponents.	**AI.NF.2:** Add, subtract, and multiply polynomials. Divide polynomials by monomials. Use these operations to rewrite algebraic expressions in equivalent forms, and justify them with algebraic properties. (E)
7.NS.6 Apply the inverse relationship between squaring and finding the square root of a perfect square whole number. Find square roots of perfect square whole numbers.	
Instructional Resources	
● Mathematics Grades 6-8 Vertical Articulation Guide ● Learning Progressions & Content Supports: Grade 6 through Grade 8 ● Implementing the Mathematics Process Standards: Grades Six to Eight ● Illustrative Mathematics - Ants versus humans ● Mathematics Assessment Resource Service Shell Center - 100 People	
Universal Supports for All Learners	
● 2024 Content Connectors ● Universal Design for Learning Playbook ● UDL Guideline Infographic, from Learning Designed ● UDL Tips from CAST	

- Mathematics Learning Recovery Series: Part 2-Addressing the Gaps in Student Learning
- Mathematics Learning Recovery Series: Part 3-Instructional Strategies for All Learners

Instructional Strategies

- What Works Clearinghouse-Concrete-Semi-Concrete-Abstract Video (Print Recommendations)
- What Works Clearinghouse-Clear & Concise Mathematical Language Video (Print Recommendations)
- NYSED-Frayer Vocabulary Model Scaffolding Example & Template
- Magma Math: Math Teaching Practices
- Problem Solving Instructional Support
- WIDA-Doing and Talking Mathematics: A Teachers Guide to Meaning-Making with English Learners
- Virginia Department of Education Students with Disabilities in Mathematics Frequently Asked Questions

Assessment Considerations

- ILEARN Test Blueprint: Mathematics 2025-2026 (Spreadsheet)
- ILEARN Test Blueprint: Mathematics 2025-2026 (PDF)
- IDOE Released Items Repository
- I AM - Indiana's Alternate Measure
- Quality Mathematic Items for Classroom Assessments (Featuring New ILEARN Item Specifications)
- Grade 7 & 8 ILEARN Math Desmos Scientific Calculator
- UDL Assessment StrategiesEARN Test Blueprint: Mathematics 2025-2026 (PDF)

Interdisciplinary Connections

Coming Soon

Disciplinary Literacy

Coming Soon

Contact IDOE's Office of Teaching and Learning with any questions.