Mathematics: Grade 6

Overview

In grade four, students express whole numbers as fractions and relate mixed numbers and improper fractions to objects and pictures.[4.NS.2] Grade five students understand fractions using part and whole reasoning and as division operations, and they model with percents.[5.NS.2,4] They also use whole numbers, fractions, and decimals to represent quantities with and without context and use number lines to compare, order, and represent those quantities.[5.NS.1]

In grade six students begin to apply negative integers within real-world contexts[6.NS.1] and use number lines to model opposite signed numbers as located on opposite sides of zero.[6.NS.2] Students also compare and order rational numbers using number lines[6.NS.3] and solve real-world problems with positive fractions and decimals.[6.NS.4]

By grade seven, students understand subtracting rational numbers as adding the additive inverse (and vice versa)[7.NS.1] and they use properties of operations to understand the rule for multiplying and dividing integers. Students begin to differentiate between rational and irrational numbers, and in grade eight they express their decimal equivalents and compare them using number lines.[8.NS.1-2]

Students in grade six use the order of operations to evaluate numerical expressions[6.NS.5] and they use properties of operations to create and identify equivalent linear expressions.[6.NS.7] These concepts, along with the use of whole number exponents,[6.NS.8] are essential understandings for student success with algebra and functions in grades seven and eight.

Algebra I Predecessor Skills

Algebra I is a key predictor of long-term academic success, strongly linked to graduation rates, college opportunities, and future earning potential. Unfortunately, many students start Algebra I with substantial learning gaps, particularly in foundational algebra-related skills from prior grades. The TNTP report Unlocking Algebra reveals that many students begin Algebra I without mastery of foundational skills—known as **Algebra I Predecessor Skills**—introduced in earlier grades. Of particular importance are a subset of the Predecessor Skills located in grades six through eight, known as the **Algebra I Key Predecessor Skills**. Students who have mastered the Algebra I Predecessor Skills—shown to be the most predictive of success—are nearly six times more likely to grasp targeted grade-level Algebra I content.

The 2023 Mathematics Instructional Frameworks have been updated to identify standards that correlate with Algebra I Key Predecessor Skills and Predecessor Skills in grades three through eight. Mastery of these targeted skills significantly boosts the likelihood of learning grade-level content and provides targeted Tier 2 support to accelerate student achievement and ensures that students can meaningfully engage with grade-level Algebra I material. To learn more about the Algebra Predecessor Skills, visit the TNTP Unlocking Algebra: Algebra 1 Predecessor Skills Guide.

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Number Sense			
Standard	**6.NS.6:** Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers from 1 to 100, with a common factor as a multiple of a sum of two whole numbers with no common factor.		
Algebra I	☐ **Key Predecessor Skill**	☑ **Predecessor Skill**	☐ **Not Applicable**

Evidence Statements	Academic Vocabulary
• Define and explain, verbally and in writing, the terms “factor”, “common factor”, and “greatest common factor”. • Define and explain, verbally and in writing, the terms “multiple”, “common multiple”, and “least common multiple”. • Explain the difference between factors and multiples. • Use various strategies to find the greatest common factor of two whole numbers less than or equal to 100 and justify the solution either verbally or in writing. • Use various strategies to find the least common multiple of two whole numbers less than or equal to 100 and justify the solution either verbally or in writing. • Use the greatest common factor or least common multiple to solve real-world situations. • Use the greatest common factor of two numbers and the distributive property to find the sum of the numbers.	• Factor • Common factor • Greatest common factor • Multiple • Common multiple • Least common multiple • Distributive property • Expression • Equation
Suggested Models	**Suggested Manipulatives**
Coming Soon	*Coming Soon*
Clarification Statements	**Common Misconceptions**
• In grade four, students investigate sets of factors and multiples of numbers from 1-100. However, students do not receive formal instruction specifically addressing this concept in grade five, therefore, teachers should preassess students’ knowledge and provide appropriate scaffolds when	• Students may not list all the factors of a number. • Students may not list all the multiples of a number. • Students may have difficulty applying the concepts of greatest common factor or least common multiple to real-world situations.

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necessary. ● It is important that teachers model appropriate vocabulary and expect students to do the same. ● When identifying greatest common factors and least common multiples, teachers may model multiple strategies such as listing factors and multiples in a table or listing multiplication facts for each given number. Many students benefit from listing factors, multiples, or multiplication facts as it reinforces multiplicative structure, relationships between numbers, and number facts. ● Often teachers jump into the practice of having students list the prime factors when finding the GCF however, this is not an expectation of the standards. Additionally, the terms prime and composite are introduced in seventh grade, standard 7.NS.5. In seventh grade, students will also use the concept of greatest common factor to create equivalent linear expressions (7.AF.1). ● Being able to see and write the relationships between numbers will be beneficial as further algebraic understandings are developed. Students will need to see, for example, that $3x^2 + 6x = 3x(x + 2)$. ● It is not enough for students to understand how to find the greatest common factor or least common multiple of two given numbers. They must also know how and when to apply these concepts to real-world situations. Students frequently struggle with application as they do not fully comprehend when the greatest common factor or least common multiple would be applicable in the real world. Teaching these concepts through real-world contexts and problem-solving is essential for conceptual understanding and mastery. ● One focus of this standard is for students to apply the concept of common factors using the distributive property to add two numbers. This is foundational for factoring algebraic expressions in subsequent grades. ○ Example: 36 + 28 = 64 Common factor: 4 (4 x 9) + (4 x 7) = 4 x (9 + 7) = 64 ● Another focus of this standard is for students	● Students may not understand the reasoning behind using the distributive property to sum two numbers. ● Students may confuse the concepts of factors and multiples. To avoid this confusion, a teacher can consistently use the vocabulary of factors and multiples every time students work on multiplication and division.

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to become aware of the relationships between numbers and their multiples. For example, consider answering the question, “If two numbers are multiples of four, will the sum of the two numbers also be a multiple of four?” ● The standard deliberately avoids the term “simplify” to highlight that expressions can take on multiple forms, each serving a distinct purpose depending on context. Rather than identifying a single “simplest” form, students are encouraged to recognize and select the most appropriate form for a given situation. This approach aligns with Indiana Mathematics Process Standard PS.7: *Look for and make use of structure*, as it fosters students’ ability to make strategic, structure-based decisions in mathematical reasoning.	

Algebra I Predecessor Skill(s)	● I will find common factors and the greatest common factor (GCF) of two or more whole numbers and rewrite expressions using common factors and the distributive property.

Looking Back	**Looking Ahead**
4.CA.4 Investigate the mathematical relationship between factors and multiples for whole numbers from 1-100, including the set of factors and multiples for given numbers. Identify sets of factors and multiples for any given whole number up to 100.	**7.NS.5:** Find the prime factorization of whole numbers and write the results using exponents.

Prior Knowledge Skills

- Define factors and multiples.
- Generate sets of factors and multiples for any given whole number up to 100.

Proficiency Level Progression

Below Proficiency:	**Approaching Proficiency:**	**At Proficiency:**	**Above Proficiency:**
Identify the greatest common factor of two whole numbers **when given a list** of factors. **Identify the least common multiple** of two whole numbers **when given a list** of multiples. **Identify equivalent expressions or analyze**	**Identify the greatest common factor** of any two whole numbers less than or equal to 100 and the least common multiple of any two whole numbers less than or equal to 12. Use the distributive property to	**Find the greatest common factor** of any two whole numbers less than or equal to 100 and the least common multiple of any two whole numbers less than or equal to 12. Apply the distributive property to **write an equivalent**	**Solve a real-world problem** using the greatest common factor or least common multiple.

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equivalent expressions using the distributive property to **find a missing value.**	**write an equivalent expression** for the sum of two whole numbers **using the greatest common factor**.	**expression** for the sum of two whole numbers **using a multiple of the sum**.	
• Identify the greatest common factor among two whole numbers when given a set of factors. • Identify the least common multiple among two whole numbers when given a set of multiples. • Identify the missing value in one of the expressions given two equivalent expressions that are related using the distributive property.	• Identify the greatest common factor among two whole numbers given a list of options. • Identify the least common multiple among two whole numbers given a list of options. • Rewrite a numerical expression using the distributive property using the greatest common factor.	• Generate the greatest common factor for two whole numbers. • Generate the least common multiple given two whole numbers • Rewrite a numerical expression using the distributive property using a factor of the student's choice.	• Solve real-world problems with whole numbers using greatest common factor, least common multiple, and/or the distributive property.

Instructional Resources

- Mathematics Grades 5-6 Vertical Articulation Guide
- Mathematics Grades 6-8 Vertical Articulation Guide
- Learning Progressions & Content Supports: Grade 6 through Grade 8
- Implementing the Mathematical Process Standards: Grades Six through Eight
- Open Up Resources-Common Factors and Common Multiples: Lessons 16-18
- Illustrative Mathematics-Adding Multiple
- Illustrative Mathematics-Bake Sale
- Illustrative Mathematics-Factors and Common Factors
- Illustrative Mathematics-Multiples and Common Multiples
- Illustrative Mathematics-The Florist Shop
- Mathematics Assessment Project-Finding Factors and Multiples
- NRICH-Factors and Multiples Game
- NRICH-Counting Factors
- Open Middle-Least Common Multiple
- Open Middle-Largest Possible GFC
- Open Middle-Largest Possible GFC #2
- Open Middle-Smallest Possible LCM
- Math For Love-Prime Climb Color Chart
- Tools for Teachers-It's the Least I Can Do.. (Login Instructions)
- Tools for Teachers-Factors and Favors (Login Instructions)

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- Tools for Teachers-Factoring Supplies (Login Instructions)
- Geogebra-Factors and Multiples

Universal Supports for All Learners

- 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

Tiered Supports and Strategies

Tier II	Tier III
Coming Soon	*Coming Soon*

Assessment Considerations

- Indiana Assessment Framework: Mathematics
- 6.NS.6 ILEARN Item Specification
- Mathematics Performance Level Descriptors: Grades 6-8
- Guide to the 2023 ILEARN Performance Level Descriptors
- ILEARN Released Items Repository
- Quality Mathematic Items for Classroom Assessments (Featuring New ILEARN Item Specifications)
- Grade 6 ILEARN Math Desmos 4-Function Calculator

Contact the Indiana Department of Education with any questions.

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