Winchester Math Curriculum Grade 5

Subject	Mathematics
Grade/Course	Grade Five
Unit of Study	Unit 1: Expressions, Equations, and Volume
Pacing	August / September
Unit Summary	In this first unit, students use the study of volume to review and extend a host of skills and concepts related to multiplication. In Module 1, students investigate a scenario in which they find different ways to arrange 24 cubes into a rectangular prism. This prompts a deep look at the associative and commutative properties of multiplication as students use expressions with parentheses to represent different rectangular prisms. In Module 2, students find the surface area of boxes to further develop an understanding of volume (and the ways in which it differs from area), as well as the use of the associative property in expressions with parentheses. In Module 3, students develop major multi-digit multiplication strategies to solve real-world and mathematical problems in elegant and efficient ways. In Module 4, the link between multiplication and division is revisited through the lens of the area model and extended into dividing 3-digit by 2-digit numbers. Over the course of the unit, students are introduced to four Work Place games to build multiplicative thinking—a key component for success with division and fractions throughout the rest of the year.

Overarching Mathematical Practices

5.MP.1 Make sense and persevere in solving problems.
5.MP.2 Reason abstractly and quantitatively.
5.MP.3 Construct viable arguments and critique the reasoning of others.
5.MP.4 Model with mathematics.
5.MP.5 Use appropriate tools strategically.
5.MP.6 Attend to precision.
5.MP.7 Look for and make use of structure.
5.MP.8 Look for and express regularity in repeated reasoning.

Unit CT Core Content Standards

5.OA.A.1
Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. Note: Students are learning the process based on concepts and not appropriate to move to memorizing PEMDAS

5.OA.A.2
Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

5.NBT.B.6
Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between

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multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

5.NF.B.3
Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

****Note: Students able to multiply fractions in general can develop strategies to divide fractions in general by reasoning about the relationship between multiplication and division, but division of a fraction is not a requirement at this grade**

5.NF.B.5.A
Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.

5.MD.C.3.A
A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.

5.MD.C.3.B
A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.

5.MD.C.4
Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

5.MD.C.5.A
Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.

"Unwrapped" Standards	
Skills	**Content**
Use	parentheses, brackets, or braces in numerical expressions
Evaluate	expressions
Write	expressions
Interpret	• numerical expressions without evaluating them • a fraction as division of the numerator by the denominator
Find	whole number quotients using strategies
Illustrate and Explain	calculations by using rectangular arrays, area models, or equations

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Solve	word problems involving division
Compare	the size of a product to the size of one factor on the basis of the other factor.
Measure	volume by packing and counting units
Find	● the volume of right rectangular prism by packing ● the volume is the same by multiplying
Represent	three-fold number products to represent the associative property of multiplication

Essential Questions	Corresponding Big Ideas
1. How do parentheses, brackets, and braces affect the way you simplify expressions?	1. There is an order of operations that must be followed in all mathematical expressions. Parentheses, brackets, or braces are used to guide the order of operations when simplifying expressions.
2. What is volume and how is it used in real life?	2. Volume is an attribute of three-dimensional space and is measured in cubic units. Volume can be found by repeatedly adding the area of the base or by multiplying all three dimensions. Measurement processes are used in everyday life to describe and quantify the world.
3. What methods can be used to solve mathematical/real world problems?	3. We find our own entry points to the question, consider the meaning of a problem, and look for appropriate and efficient ways to solve it, including strategies involving place value, properties of operations, the relationship between operations, equations, arrays, and models.

Evidence of Learning - Assessment

Pre/Post Assessment	Interim Assessment	Additional Evidence of Learning
● Unit 1 - Pre-Assessment and Student Reflection, Module 1, Session 3 ● Unit 1 - Post-Assessment and Self-Reflection Module 4, Session 5 ● Baseline Number Corner Assessment	● Numerical Expressions Checkpoint - M2, S1 ● Boxes Work Sample - M2, S5 ● Multiplication and Volume Checkpoint - M3, S2	Options ● Exit Tickets Observational Assessments ● The Product Game - M1, S1 ● The Multiple Game - M2, S5 ● Beat the Calculator - M3, S4 ● Quotients Win - M4, S4 ● Math Practices Observation Chart

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Smarter Balanced Interim Assessment

Smarter Balanced General Scoring Rubrics - 4 Rubrics included - Score Pt 4 to Score Pt 1

- **Smarter Balanced Interim Blocks**

- Interim assessment blocks may be used for a variety of assessment purposes, including: pre/post, interim and formative (additional evidence of learning).

- The Style Guide, which aligns with the expectations of Smarter Balanced Assessments, will support the creation of unit- and standard-aligned items for instructional use.

- The items on the interim assessments are developed under the same conditions, protocols, and review procedures as those used in the summative assessments. Therefore, they assess the same Common Core State Standards, adhere to the same principles of Universal Design in order to be accessible to all students, and provide evidence to support Smarter Balanced claims in mathematics and ELA/literacy. The interim assessment items are non-secure but non-public. This means that educators may view the items, however, they should not be made public outside of classroom, school or district.

- **Unit-aligned Smarter Balanced Interim Assessment Block (IAB)*:**

Interim Assessment Block - access through CSDE Assessment Portal

- IAB - Operations and Algebraic Thinking

- **Some interim blocks show clear, strong alignment to priority standards within the unit. Other blocks have been placed in one specific unit but could be aligned to the priority standards of several units. Blocks have been spread out over the course of all units for a more balanced approach to assessment throughout the school year. These interim blocks, used in partnership with the Style Guide, will support the creation of unit- and standard-aligned items for instructional use.*

Learning Plan

Researched-based Instructional Resources and Methods

Sequence of Instruction:
Number Corner → Problem + Investigations →Work Places → Math Forum*→Daily Practice or Home Connection

The focus areas for Bridges Number Corner for Unit 1 are:

Fractions

- Fractions and Decimals Equivalency
- Adding fractions with like denominators
- Adding Decimals

Measurement

- Relationships between dimensions, area, and volume

Computation

- Apply the associative and commutative properties of multiplication
- Computational Fluency
- Solving Problems with Multiples and Factors
- Least common multiples and greatest common factor

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- Addition and Subtraction Strategies with whole numbers and decimal numbers

Bridges - Whole Group, Small Group and Independent Problem Centered Activities

Module 1	Module 2	Module 3	Module 4
Problem + Investigation ● Sessions 1-4 Problem String ● Session 5 Work Place ● Sessions 1, 2 Math Forum ● None Daily Practice ● Sessions 1-5 Home Connection ● Sessions 2, 4	Problem + Investigation ● Sessions 1, 3, 6 Problem String ● Sessions 1, 3, 6 Work Place ● Sessions 5, 6 Math Forum ● Sessions 2, 4 Daily Practice ● Sessions 1, 3, 5, 6 Home Connection ● Sessions 1-5	Problem + Investigation ● Sessions 1, 3 Problem String ● Sessions 1-4 Work Place ● Sessions 2, 4 Math Forum ● None Daily Practice ● Sessions 1-4 Home Connection ● Sessions 1, 3	Problem + Investigation ● Sessions 1-4 Problem String ● None Work Place ● Sessions 3-5 Math Forum ● None Daily Practice ● Sessions 1-5 Home Connection ● Sessions 1, 3, 5

Possible Misconceptions	**Teacher Moves**
1. Despite the previous traditional dependence on mnemonic phrases (Please Excuse My Dear Aunt Sally, PEMDAS) and mathematical convention, but explaining the order in which to calculate and knowing when to use parentheses can become confusing to students.	1. Exploring the precedence of operations and the use of parentheses in expressions by solving a variety of multi-step problems allows students to reason about the order in which operations need to be performed. Whenever possible, provide situations that model order of operations and make connections to the properties of addition and multiplication (associative and distributive).
2. Some students will have the misconception that all multiplications are calculated before divisions and additions are calculated before subtractions.	2. Scaffold examples for students to practice solving multiplications and/or divisions in order from left to right and then additions and/or subtractions in order from left to right. Although parentheses are not necessary when the equation is written accurately, some students will find it helpful to add grouping symbols in order to solve equations and word problems.
3. Students who struggle with writing expressions.	3. Students should begin with simple expressions. Because there may be several ways to write or read an expressions, they should justify how they arrived at their answers.
4. Division is a complex operation, and students who depend on following rote	4. Emphasis on place value and connections to multiplication will help students to

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steps cannot determine whether their answer is reasonable. 5. Students may need additional experiences with the meaning of the remainder built on previous work from Grade 4. 6. Students will likely have many misconceptions about what happens to the product when one or both factors are scaled. For example, if both the length and width of a rectangle are doubled, some students will assume the product (area) is doubled. When they test their conjecture by drawing a picture, they will see that the product is actually four time greater. 7. Some students may think only about one of the dimensions needed to find volume. Some students may believe that because an object is tall, it will have lots of volume, ignoring the other two dimensions.	develop a deeper understanding of division. All division experience should be developed in the context of asking questions such as "How many groups of 20 can you make from 700?" and the allowing students to estimate and identify the number of objects (for example, If I make 30 groups of 20 that would be 600, and if I make 40 groups that would be 800 and that is too high). Such reasoning will help students to hone in on a good estimate and use partial products to determine the exact quotient. 5. Problems in which the remainder is the answer, in which the remainder is dropped, or in which the quotient should be one more because of a remainder should all be included in division problems students are asked to solve. 6. Allow students to explore a variety of multiplication scaling situations by drawing pictures and making models that will help them to make conjectures as to why the results are true, which is less likely to happen if they simple multiply. 7. Provide additional experiences for students to measure and compare a variety of objects by using all three dimensions to address this misconception.

Vocabulary and Representations	
Tier 2 (Academic Vocabulary)	**Tier 3 (Domain Specific Vocabulary**
area* base braces brackets calculations column dimension divide* double/doubling	array* area model of multiplication associative property* of multiplication + commutative property of multiplication + composite number* denominator* dividend* divisor* equation*

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estimate* evaluate expression* factor* halve/halving height illustrate interpret length models* multiple* parentheses product* relationship remainder* row strategy value width	half measurement multiply* number relationship numerator* numerical expressions open array partial products* prime number* properties of operations quotient* ratio table (right)rectangular prism* surface area volume* *Smarter Balanced Vocabulary is focused on major mathematical concepts. (Not all possible words have been identified by SBAC) + Students are not responsible for these vocabulary words at this grade level, however they should have some understanding of the mathematical concept.

Mathematics Teaching Practice Resources

1. **Bridges** - Reference Math Practices in Action Notes - The notes identify how particular mathematical practice is employed in a specific activity.
2. Developing Positive (Growth Mindset) Norms in the Classroom
3. Mistakes are Powerful - Resource to develop students' perseverance through mistakes
4. Grade 5 Standards + Practices Examples and Explanations
5. **Math Practices Teacher Question Starters**
6. **Implementing the Standards of Mathematics Practice**
7. Illustrating the Standards of Mathematical Practice
8. Math Practice Standards Posters Gr. 4-5
9. Illustrative Math – Grade 5
10. Teacher/Student Actions
11. Journal Prompts for Math
12. Bridges Interactive Math Manipulatives
13. Number Talks Matter - Number Talks at a Glance and Fluency without Fear
14. Three Act Math Tasks
15. Open Middle
16. National Library of Virtual Manipulatives
17. Accountable Talk Moves
18. Contribution Checklist
19. Sentence Frames that Can Build Metacognitive Thinking
20. Sample Language Frames for Mathematics

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21. Fraction Progression Videos
22. LearnZillion
    - Connecting the area model to volume
    - Understanding Volume
    - Find Volume by Counting Cubes
    - Connecting Area and Volume Formulas
    - Recognize that Volume is Additive
    - Find the Factor Pairs of a Number
    - Whole numbers are Multiples of their Factors
    - Create and Evaluate Expressions
    - Create a Real-Life Students for an Expression with Parentheses
    - Examine Expressions with and without Grouping Symbols
    - Interpret Expressions
    - Represent a Real World Situation as a Numerical Expression

Suggestions for Differentiation, Scaffolding and Intervention

Differentiation or Intervention

Any teacher moves/strategies that address misconceptions can be used in differentiation or as intervention.

Math Teaching Practice Resources contain resources that provide opportunities for differentiation, intervention, or extension aligned to the strategies below.

- How to Select Math Intervention Content
- CT Dept. of Education Evidence-based Practice Guides – These guides provide links to "evidence-based activities, strategies and interventions (collectively referred to as 'interventions')."
- Evidenced-based strategies for supporting struggling students (U.S. Dept. of Education – What Works Clearinghouse)
- Ensure instructional materials are systematic and explicit. In particular, they should include numerous clear models of easy and difficult problems, with accompanying teacher think alouds.
- Provide students with opportunities to solve problems in a group and communicate problem-solving strategies.
- Teach students about the structures of various problem types, how to categorize problems based on structure, and how to determine appropriate solutions for each problem type.
- Students should work with visual representations of mathematical ideas.
- If visual representations are not sufficient for developing accurate abstract thought and answers, use concrete manipulative first. (Include the next line for middle school and older students only) Although this can also be done with students in upper elementary and middle school grades, use of manipulatives with older students should be expeditious because the goal is to move toward understanding of and facility with visual representations and finally to the abstract.
- Provide carefully constructed questions to help direct students in determining what to do to solve problems, but they shouldn't be told how to reach the solution.
- Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.

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Intervention for facts

- Provide about 10 minutes per session of instruction to build quick retrieval of basic arithmetic facts. Consider using technology, flashcards, and other materials for extensive practice to facilitate automatic retrieval.
- For students in K -2 explicitly teach strategies for efficient counting to improve the retrieval of mathematics facts.
- Teach students in grade 2-8 how to use their knowledge of properties, such as commutative, associative, and distributive to derive facts in their heads.
- How to Promote Acquisition of Math Facts – Intervention for struggling students
- National Center on Intensive Intervention - Basic Facts
- Once a strategy has been taught, it is important to reinforce it. The reinforcement or practice exercises should be varied in type and focus as much on the discussion of how students obtained their answers as on the answers themselves.
- Having students work in groups (as opposed to handing your bright students a workbook to work on when the classroom material isn't challenging enough) with other children ready for advanced material shows them that mathematics is not a solitary discipline -- mathematics is exciting and vibrant and creative and fun.
- Concrete, Representational, Abstract Progression

EL Strategies

- Colorin Colorado – A Bilingual site for educators and families of English learners
- Stanford University - Principles for Mathematics Instruction of ELs
- CT State Dept. Of Education English Learner Standards and Resources
- Nonverbal responses, such as thumbs up, will help you check for understanding without requiring students to produce language. ELLs can participate and show that they understand a concept, or agree or disagree with an idea, without having to talk. This is especially important for students whose comprehension of English is more advanced than their ability to speak the language.
- Pre-teach vocabulary in ways that connect to students' prior knowledge.
- Display posters of graphic representations of vocabulary words.
- http://www.cal.org/siop/lesson-plans/
- Provide support to assist in explaining thinking with sentence starters and work banks.
- Use Work Place Sentence Frames or other sentence frames to assist students in math discourse.
- Speak slowly and use clear articulation. Reduce the amount of teacher talk and use a variety of words for the same idea. Exaggerate intonation and place more stress on important new concepts or questions. After asking a question, wait for a few moments before calling on a volunteer. Writing the question on the board will also help.
- English language learners are not always able to answer the questions posed to them, especially when the questions are open-ended. Provide support for and improve the participation of students with lower levels of English proficiency by using a prompt that requires a physical response, like "Show me a half, a third, etc.." or "Touch the larger number."
- Increase academic language knowledge for English learner success.

Extension

- Try problems such as, "What is the volume of a cube with an edge that measures 5cm?" Or, "What is the volume of a cube with an edge that measures 10 cm?
- The Painted Cube - Imagine a large cube made from small red cubes being dropped into a pot of yellow paint. How many of the small cubes will have yellow paint on their faces?

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- Changing Area, Change Volume - How can you change the surface area of a cuboid but keep its volume the same? How can you change the volume but keep the surface area the same?

Interdisciplinary Connections

Children's Literature
*You Can Count on Monsters by Richard Evan Schwartz
Full House: An invitation to Fractions by Dayle Ann Dodds
Math-terpieces by Greg Tang
Safari Park by Stuart Murphy
The Great Divide by Dayle Ann Dodds

Science
Using Mathematics and Computational Thinking
Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Measure and graph quantities such as weight to address scientific and engineering questions and problems. (5-PS1-2)

ELA

CCSS.ELA-LITERACY.SL.5.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.
CCSS.ELA-LITERACY.SL.5.1.A
Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
CCSS.ELA-LITERACY.SL.5.1.B
Follow agreed-upon rules for discussions and carry out assigned roles.
CCSS.ELA-LITERACY.SL.5.1.C
Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.
CCSS.ELA-LITERACY.SL.5.1.D
Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions

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