Partnership for Inquiry Learning

COMPUTATION AND ALGEBRAIC THINKING (GRADE 2)
ALGEBRAIC THINKING (GRADES 3-5)

REAL-WORLD MULTIPLICATION AND DIVISION PROBLEMS

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Educators in all grade levels must provide students with real-world problems to solve. Rather than discussing strategies students might use to multiply and divide in Grades 2-5, we use this series of videos to (1) describe different ways teachers can construct problems while ensuring students deeply understand multiplication and division concepts and (2) examine real-world contexts in which students apply their knowledge of multiplication and division. As we discuss the construction of contextualized problems, we also explore ways to make these problems real-world, realistic, and relevant to the lives of students. The second-grade standard in this series does not pertain to real-world problems. However, it is an excellent precursor to preparing students to engage in this work in Grades 3-5.

GRADE 2

Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal groups. (2.CA.5)

Unpacking the Standard
Rectangular arrays are physical representations of repeated addition, can facilitate skip counting, and allow students to visualize the move from addition to multiplication. The standard also encourages students to express these visual representations in equation form. For example, an array of five rows of five dots is written as 5 + 5 + 5 + 5 + 5 = 25. This representation foreshadows the transition, in third grade, from "groups of" objects to the concept of multiplication (e.g., five "groups of" five becomes 5 x 5).

Considerations for Lessons and Assessment
Second grade provides the concrete foundation upon which later grades build. Utilizing physical objects arranged in rectangular arrays, students move beyond counting one-by-one as they use this visual representation to repeatedly add a number or skip count. As students master basic addition facts and skip counting schemes, lessons and assessments should ask them to translate these patterns into written equations that show the total number of objects as the sum of equal groups.

GRADE 3

Solve real-world problems involving whole number multiplication and division within 100 in situations involving equal groups, arrays, and measurement quantities (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem). (3.AT.2)

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Unpacking the Standard

Building off of the introduction to arrays in second grade, the third-grade standard expands students' understanding of multiplication and division to grouping and sorting into equal groups. By contextualizing these ideas with measurement quantities (intervals of time, amounts of money, and various distance measurements), educators provide students with avenues for exploring the application of strategies garnered through the computation standards.

Considerations for Lessons and Assessment

Real-world problems should offer students opportunities to group and sort in multiple ways. A variety of multiplication problems (e.g., grouping problems, rate problems) and division problems (e.g., partitioning problems, and measurement problems) are explored. Assessments are presented including those in both written and oral form.

GRADE 4

Solve real-world problems with whole numbers involving multiplicative comparison (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem), distinguishing multiplicative comparison from additive comparison. [In grade 4, division problems should not include a remainder.] (4.AT.4)

Unpacking the Standard

Students in fourth grade should continue to work on a variety of multiplication and division problems. Specifically related to the verbiage of this standard, multiplicative comparisons require students to consider ideas that can be solved using both multiplication and division (e.g., The problem, "A tree is three times as tall as Anthony. If the tree is 15 feet tall, how tall is Anthony?" could be solved using either operation: $15/3 = \square$ or $3 \times \square = 15$).

Considerations for Lessons and Assessment

Rather than framing problems as "multiplication" or "division" problems, educators might consider simply calling them "problems of the day." Otherwise, students will simply find the two numbers in the problem and use the operation they've been told to use. This would be problematic in the following problem: Ms. Spencer split the fourth grade students into six groups. If each group had 16 students, how many fourth-grade students are there? In fact, either operation could be used to achieve the answer (e.g., $6 \times 16 = \square$; or $\square/6=16$). Assessments should ensure that students can solve problems in multiple ways and are efficient in doing so.

GRADE 5

Solve real-world problems involving multiplication and division of whole numbers (e.g., by using equations to represent the problem). In division problems that involve a remainder, explain how the remainder affects the solution to the problem. (5.AT.1)

Unpacking the Standard

Fifth grade is the first time students are asked to solve division problems with remainders. Additionally, students are expected to make sense of a remainder in real-world contexts. In these situations, a remainder may require the child to round up or down, to turn the remainder into a decimal or a fraction, or to ignore the remainder altogether (e.g., In the problem, "There are 480 students at Baldwin Elementary. The school's buses seat 52 students each. How many buses would be needed to take all of the students to the Indianapolis Children's Museum?" an answer of 9 R12 would require a student to round up to 10 buses).

Considerations for Lessons and Assessment

Lessons and assessments in fifth grade should build on work done in prior grades while increasing number sizes and attending to remainders in real-world problems. Providing students with contextualized situations that require a variety of ways to make sense of remainders is essential.

ADDITIONAL RESOURCES

Carpenter, T.P., Fennema, E., Franke, M. L., Levi, L., & Empson, S. B. (2014). *Children's mathematics: Cognitively guided instruction* (2nd ed.). Heinemann.

Empson, S. B., & Levi, L. (2011). *Extending children's mathematics: Fractions and decimals.* Heinemann.

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