Grade 3 B1G-M

MA.3.NSO.2.2

Benchmark

MA.3.NSO.2.2 Explore multiplication of two whole numbers with products from 0 to 144, and related division facts.

Benchmark Clarifications:
Clarification 1: Instruction includes equal groups, arrays, area models and equations.
Clarification 2: Within the benchmark, it is the expectation that one problem can be represented in multiple ways and understanding how the different representations are related to each other. *Clarification 3:* Factors and divisors are limited to up to 12.

Connecting Benchmarks/Horizontal Alignment

- MA.3.NSO.2.3
- MA.3.NSO.2.4
- MA.3.AR.2.1
- MA.3.AR.2.2
- MA.3.GR.2.2
- MA.3.GR.2.4

Terms from the K-12 Glossary

- Area Model
- Commutative Property of Multiplication
- Dividend
- Divisor
- Equation
- Expression
- Factors
- Rectangular Array

Vertical Alignment

Previous Benchmarks

- MA.2.AR.3.2

Next Benchmarks

- MA.4.NSO.2.1

Purpose and Instructional Strategies

The purpose of this benchmark is for students to build conceptual understanding of what multiplication is and how it relates to division. Because the expectation of this benchmark is at the explore level, instruction should focus on building understanding of multiplication and division facts from 0 to 144 using manipulatives (e.g., counters), visual models (e.g., rectangular arrays, equal groups), discussions, estimation and drawings (e.g., rectangular arrays, equal groups) *(MTR.2.1)*.

- Instruction should relate multiplication to repeated addition work that began in Grade 2. In Grade 2, students used repeated addition to find the total number of objects using rectangular arrays and equations (MA.2.AR.3.2).
- Students should explore multiplication and division through word problems, writing expressions and drawing models that match the problems' contexts *(MTR.2.1, MTR.3.1)*.
- In division, students should see examples of sharing, or partitive division (where the number of groups are given and students determine the number in each group), as well as measurement, or quotative division (where the number in each group is given and students determine the number of groups).

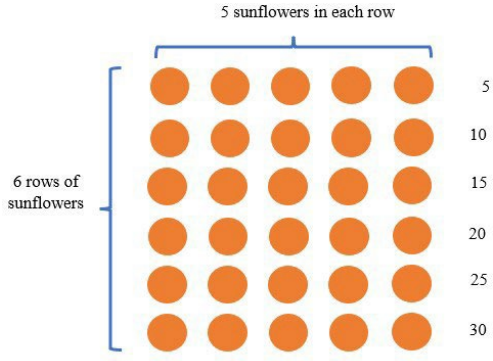
- Instruction should relate division facts to known multiplication facts (e.g., fact families). Fact families can be explored through arrays and equal groups *(MTR.5.1)*.

Common Misconceptions or Errors

- Students may have difficulty relating word problems and real-world scenarios to models, expressions, and equations. For example, students may not differentiate the number of groups versus number in each group in multiplication, which then impacts their models, expressions, and equations.
- Students may be confused by measurement (or quotative) division, when the amount in each group is given and the number of equal-sized groups is found.

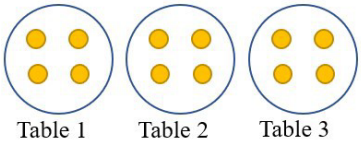
Strategies to Support Tiered Instruction

- Instruction includes demonstrating the use of counters, arrays and skip counting to model groups of objects, including the use of real-world scenarios to support students' understanding of the number of groups versus the size of each group. Students represent their models with equations to reinforce the concept of multiplication. ○ For example, a farmer is planting rows of sunflowers. He plants 6 rows with 5 sunflowers in each row. How many sunflowers does he plant?



6 row of 5 sunflowers= 30 sunflowers
6 x 5 = 30

  - For example, there are 3 tables in the library. There are 4 students sitting at each table. How many students are sitting at tables in the library?

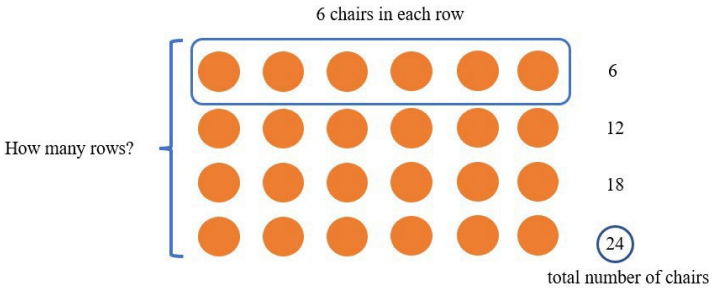


3 groups of 4 students = 12 students
3 x 4 = 12

- Instruction includes demonstrating the use of counters and arrays to model division problems where the amount in each group is given and the number of equal-sized groups is found. The teacher provides real-world scenarios to represent the number of objects in each group and the number of groups Students form a group based on the context of the problem continuing to form

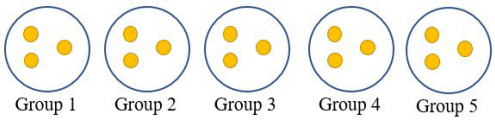
groups of that size until the total is reached. Students can skip count to keep track of how many counters they have used, representing their models with equations to reinforce the concept of division.

- For example, Renee is setting up chairs in the library. She is placing 24 chairs into rows. If she places 6 chairs in each row, how many rows of chairs will she have?



24 chairs divided into rows of 6
24 ÷ 6 =4
There are 4 rows of chairs.

- For example, there are 15 students working on an art project. The art teacher divides them into groups of 3 students to work on the project. How many groups are there?



15 students divided into groups of 3
15 ÷ 3 = 5
There are 5 groups of students.

Instructional Tasks

Instructional Task 1

Tina has 4 shelves on her bookshelf. Each row has 6 books. How many books are on Tina's bookshelf in all? Draw a model and write an equation to represent your answer.

Instructional Items

Instructional Item 1

A total of 56 chairs are in the cafeteria for an assembly. The principal arranges the chairs into 8 rows with the same number of chairs in each. Which equation shows the quotient as the number of chairs that will be in each row?

a. $56 \div 8 = 7$
b. $56 \div 8 = 48$
c. $56 \div 8 = 64$
d. $56 \div 8 = 6$

**The strategies, tasks and items included in the B1G-M are examples and should not be considered comprehensive.*

MA.6.NSO.2.2

Benchmark

MA.6.NSO.2.2 Extend previous understanding of multiplication and division to compute products and quotients of positive fractions by positive fractions, including mixed numbers, with procedural fluency.

Benchmark Clarifications:
Clarification 1: Instruction focuses on making connections between visual models, and the relationship between multiplication and division, reciprocals and algorithms.

Connecting Benchmarks/Horizontal Alignment

- MA.6.NSO.3.3
- MA.6.AR.1.1
- MA,6.AR.3
- MA.6.GR.2
- MA.6.DP.1.2, MA.6.DP.1.3, MA.6.DP.1.4

Terms from the K-12 Glossary

- Area Model
- Commutative Property
- Dividend
- Divisor
- Expression

Vertical Alignment

Previous Benchmarks

- MA.5.FR.2.2
- MA.5.FR.2.4

Next Benchmarks

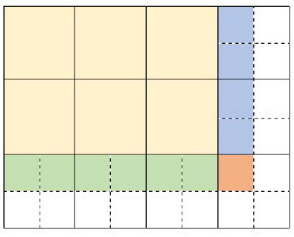
- MA.7.NSO.2.2

Purpose and Instructional Strategies

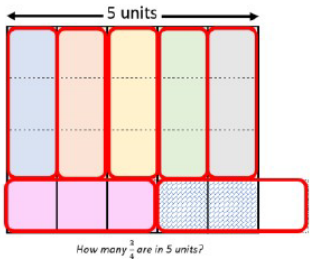
In grade 5, students multiplied fractions by fractions with procedural reliability and explored how to divide a unit fraction by a whole number and a whole number by a unit fraction. In grade 6, students become procedurally fluent with multiplication and division of positive fractions. The expectation is to utilize skills from the procedural reliability stage to become fluent with an efficient and accurate procedure, including a standard algorithm. In grade 7, students will become fluent in all operations with positive and negative rational numbers.

- Instruction includes using concrete and pictorial models, writing a numerical sentence that relates to the model and discovering the pattern or rules for multiplying and dividing fractions by fractions *(MTR.2.1, MTR.3.1, MTR.5.1)*.
  - Area Model

$$2\frac{1}{2} \times 3\frac{1}{2} = 8\frac{3}{4}$$

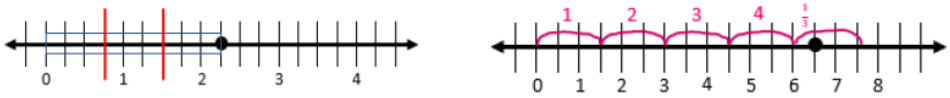


$$5 \div \frac{3}{4} = 6\frac{2}{3}$$



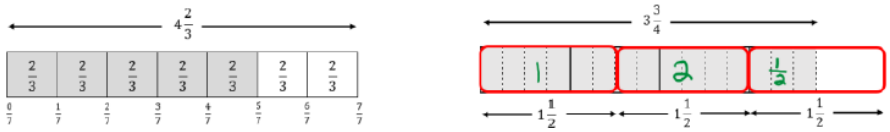
- Linear Model

$$2\frac{1}{4}\times\frac{2}{3}=1\frac{1}{2} \qquad 6\frac{1}{2}\div 1\frac{1}{2}=4\frac{1}{3}$$



- Bar Model

$$4\frac{2}{3}\times\frac{5}{7}=3\frac{1}{3} \qquad 3\frac{3}{4}\div 1\frac{1}{2}=2\frac{1}{2}$$



- Instruction includes making connections to the distributive property when multiplying fractions.
  - For example, when multiplying $1\frac{1}{2}$ by $\frac{3}{4}$, it can be written as $\left(1+\frac{1}{2}\right)\frac{3}{4}$ to determine $\frac{9}{8}$ as the product.
- Instruction includes making connections to inverse operations when multiplying or dividing fractions.
  - For example, when determining $\frac{3}{4}\div\frac{5}{8}$, students can write the equation $x\left(\frac{5}{8}\right)=\frac{3}{4}$ and then solve for x.
- Instruction focuses on appropriate academic vocabulary, such as reciprocal. Avoid focusing on tricks such as "keep-change-flip." Using academic language and procedures allow for students to connect to future mathematics *(MTR.5.1)*.
  - For example, $\frac{3}{4}\div\frac{5}{8}$ can be read as "How many five-eighths are in three-fourths?".
- Instruction includes providing opportunities for students to analyze their own and others' calculation methods and discuss multiple strategies or ways of understanding with others *(MTR.4.1)*.

Common Misconceptions or Errors

- Students may forget that common denominators are not necessary for multiplying or dividing fractions.
- Students may have incorrectly assumed that multiplication results in a product that is larger than the two factors. Instruction continues with students assessing the reasonableness of their answers by determining if the product will be greater or less than the factors within the given context.
- Students may have incorrectly assumed that division results in a quotient that is smaller than the dividend. Instruction continues with students assessing the reasonableness of their answers by determining if the quotient will be greater or less than the dividend within the given context.

Strategies to Support Tiered Instruction

- Teacher encourages and allows for students who have a firm understanding of multiplying and dividing decimals to convert the provided fractional values to their equivalent decimal form before performing the desired operation and converting the solution back to fractional form.
- Instruction includes the use of fraction tiles, fraction towers, or similar manipulatives to make connections between physical representations and algebraic methods.
- Instruction includes the co-creation of a graphic organizer utilizing the mnemonic device Same, Inverse Operation, Reciprocal (S.I.R.) for dividing fractions, which encourages the use of correct mathematical terminology, and including examples of applying the mnemonic device when dividing fractions, whole numbers, and mixed numbers.
- Teacher provides students with flash cards to practice and reinforce academic vocabulary.
- Instead of multiplying by the reciprocal to divide fractions, an alternative method could include rewriting the fractions with a common denominator and then dividing the numerators and the denominators.
    - For example, $\frac{5}{6} \div \frac{3}{2}$ is equivalent to $\frac{5}{6} \div \frac{9}{6}$ which is equivalent to $\frac{5/9}{1}$ which is equivalent to $\frac{5}{9}$.
- Instruction provides opportunities to assess the reasonableness of answers by determining if the product will be greater or less than the factors within the given context.
- Instruction provides opportunities to assess the reasonableness of answers by determining if the quotient will be greater or less than the dividend within the given context.

Instructional Tasks

Instructional Task 1 (MTR.2.1, MTR.4.1)

Jasmine wants to build a $2\frac{5}{6}$ meters long garden path paved with square stones that measure $\frac{1}{4}$ meter on each side. There will be no spaces between the stones.

Part A. Create a model that could be used to answer the following question: How many stones are needed for the path?

Part B. How many stones are needed for the path?

Instructional Task 2 (MTR.3.1, MTR.6.1)

A container at a juicing plant holds $6\frac{2}{3}$ tons of oranges. The plant can juice $1\frac{1}{2}$ tons of oranges per day. At this rate, how long will it take to empty the container?

Instructional Task 3 (MTR.2.1)

Explain using visual models why $\frac{4}{5} \times \frac{2}{3} = \frac{8}{15}$.

Instructional Items

Instructional Item 1

What is the value of the expression $\frac{3}{5} \div \frac{5}{8}$?

Instructional Item 2

What is the value of the expression $8\frac{1}{10} \div \frac{5}{8}$?

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