MA.3.AR.2.2

Overarching Standard: MA.3.AR.2 Develop an understanding of equity and multiplication and division.

Benchmark of Focus

MA.3.AR.2.2: Determine and explain whether an equation involving multiplication or division is true or false.

> *Example:* Given the equation 27 ÷ 3 = 3 × 3, it can be determined to be a true equation by dividing the numbers on the left side of the equal sign and multiplying the numbers on the right of the equal sign to see that both sides are equivalent to 9.

Benchmark Clarifications:
Clarification 1: Instruction extends the understanding of the meaning of the equal sign to multiplication and division.

Clarification 2: Problem types are limited to an equation with three or four terms. The product or quotient can be on either side of the equal sign.

Clarification 3: Multiplication is limited to factors within 12 and related division facts.

Related Benchmark/Horizontal Alignment

- MA.3.NSO.1.3
- MA.3.NSO.2.2/2.4
- MA.3.AR.1.2

Vertical Alignment

Previous Benchmarks	Next Benchmarks
MA.2.AR.2.1	MA.4.AR.2.1

Terms from the K-12 Glossary

- Equation
- Expression
- Equal sign

Purpose and Instructional Strategies

The purpose of this benchmark is to extend the understanding of the meaning of the equal sign inmultiplication and division situations. In Grades 1 and 2, students determined and explained when addition and subtraction equations were true or false (MA.1.AR.2.2, MA.2.AR.2.1).

- Instruction should emphasize that the equal sign can be read as “the same as” to show

thebalance of two multiplication and/or division expressions. When those expressions are evaluated as the same product or quotient, the equation is balanced, or true. If those expressions evaluate differently, then the equation is not balanced, or false (MTR.2.1, MTR.5.1).

- When students explain whether an equation is true or false, they should justify by explaining the equivalence of its expressions. (Note: The expectation of this benchmark is not to compare the expressions of a false equation using symbols of inequality, < or >.) (MTR.4.1, MTR.6.1)

Common Misconceptions or Errors

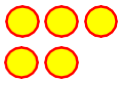
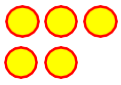
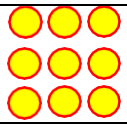
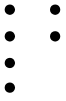
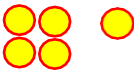
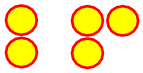
- By Grade 3, students may grow to expect equation solutions to be represented as the expressions on the right side of the equal sign. When having students evaluate true or false equations with only three terms (e.g., 18 = 3 x 6), teachers should give examples showing products and quotients on the left side.

Strategies to Support Tiered Instruction

- Instruction includes opportunities to explore the meaning of the equal sign. The teacher provides clarification that the equal sign means "the same as" rather than "the answer is." Multiple examples are provided to evaluate equations as true or false using the four operations with the answers on both the left and right side of the equation, beginning by using single numbers on either side of the equal sign to build understanding. The same equations are written in different ways to reinforce the concept.
    - For example, the teacher shows the following equations, asking students if they are true or false statements. Students explain why each equation is true or false, repeating with additional true and false equations using the four operations.

Example	True/False	Sample Student Rationale
5 = 5	True	They are both the same number; five is the same as five.
9 = 3	False	Nine and three have different values; they are not the same.
2 + 11 = 13	True	When you add two and eleven, the total has a value of thirteen.
13 = 2 + 11	True	The value of thirteen is the same as the value of two and eleven combined.
4 + 2 = 42	False	The sum of four and two is six, not forty-two.
25 − 5 = 20	True	When you take five away from twenty-five, the difference is twenty.
20 = 25 − 5	True	The value of twenty is the same as the difference between twenty-five and five.
20 = 25 + 5	False	The value of twenty-five plus five is thirty, not twenty.
4 + 1 = 2 + 3	True	Four plus one has a value of five. Two plus three also has a value of five.
2 × 3 = 8 − 2	True	Two times three has a value of six. Eight minus two also has a value of six.

- Teacher provides opportunities to explore the meaning of the equal sign using visual representations (e.g., counters, drawings, base-ten blocks) on a t-chart to represent equations. The teacher provides clarification that the equal sign means "the same as" rather than "the answer is." Multiple examples are provided for students to evaluate equations as true or false using the four operations with the answers on both the left and right side of the equation, beginning by using single numbers on either side of the equal sign to build understanding. The same equations are written in different ways to reinforce the concept.
    - For example, the teacher shows the following equations. Students use counters, drawings, or base-ten blocks on a t-chart to represent the equation. The teacher asks students if they are true or false statements and has them explain why each equation is true or false, repeating with additional true and false equations using the four operations.

$5 = 5$	True			They are both the same number; the same amount is on both sides.
$9 = 3$	False			Nine and three have different values; there is a different number on each side.
$2 + 11 = 13$	True			When you add two and eleven, the total has a value of thirteen. Each side has the same amount.
$13 = 2 + 11$	True			The value of thirteen is the same as the value of two and eleven combined. Each side has the same amount.
$4 + 2 = 42$	False			The sum of four and two is six, not forty-two. The value on each side is different.
$4 + 1 = 2 + 3$	True			Four plus one has a value of five. Two plus three also has a value of five. Each side has the same number of counters.

Questions to ask students:

Ask students: Is the equation 5 x 6 = 30 + 6 true or false?

- Sample answer that demonstrates understanding: The equation is false because you must solve both sides of the equal sign and they must be balanced. On the left side the product is 30, but on the right side of the equal sign the sum is 36.

Ask: How can you prove that 56 ÷ 4 = 7 x 2 is a balanced equation?

- Sample answer that indicates understanding*: This equation is balanced or the same on both sides. I know this because 56 ÷ 4 equals 14 and 7 + 2 equals 14. They both equal the same so the equation is balanced.*

Instructional Tasks

Instructional Task 1

Two equations are below. One equation is true, and the other equation is false. Choose one ofthe equations and explain why it is true or false.

$2 \times 3 = 4 \times 6$ $2 \times 12 = 4 \times 6$

Instructional Items

Instructional Item 1

Which of the following describes the equation $16 \div 2 = 36 \div 9$?

a) This equation is true because the expressions on each side have a quotient of 8.
b) The equation is true because the expressions on each side have a quotient of 4.
c) This equation is false because the expressions on each side have a quotient of 8.
d) This equation is false because the quotient on the left is 8 and the quotient on the right is 4.

Benchmark	Context	Assessment Limits
MA.3.AR.2.2 Determine and explain whether an equation involving multiplication or division is true or false. Example: Given the equation $27 \div 3 = 3 \times 3$, it can be determined to be a true equation by dividing the numbers on the left side of the equal sign and multiplying the numbers on the right of the equal sign to see that both sides are equivalent to 9. Clarification 1: Instruction extends the understanding of the meaning of the equal sign to multiplication and division. Clarification 2: Problem types are limited to an equation with three or four terms. The product or quotient can be on either side of the equal sign. Clarification 3: Multiplication is limited to factors within 12 and related division facts.	Mathematical	Items including four terms may have the same operator or different operators on each side of the equation. Items are limited to one procedural step on either side of the equation.

ALD 2	ALD 3	ALD 4	ALD 5
determines whether an equation with no more than three terms involving multiplication or division is true or false.	determines and explains whether an equation with no more than three terms involving multiplication or division is true or false.	determines and explains whether an equation involving multiplication or division is true or false.	determines and explains whether an equation involving multiplication or division is true or false and rewrites false equations as true.

Additional Resources:

CPALMS Resources

Khan Academy equal sign (focuses on addition and subtraction but concept stays true for multiplication and division)

Resources/Tasks to Support Your Child at Home:

Ask your child if two expressions are equal to each other, such as "is 5 x 4 equal to 6 x 3? Is 24 ÷ 3 equal to 3 x 24? Why or why not?"