# MA.5.AR.2.3

Overarching Standard: *MA.5.AR.2: Demonstrate an understanding of equality, the order of the operations and equivalent numerical expressions.*

Benchmark of Focus

MA.5.AR.2.3: Determine and explain whether an equation involving any of the four operations is true or false.

*Examples:* The equation 2.5 + (6 × 2) = 16 − 1.5 can be determined to be true because the expression on both sides of the equal sign are equivalent to 14.5.

Benchmark Clarifications

*Clarification 1:* Problem types include equations that include parenthesis but not nested parentheses.

*Clarification 2:* Instruction focuses on the connection between properties of equality and order of operations.

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Related Benchmark/Horizontal Alignment
- MA.5.NSO.1.1
- MA.5.NSO.1.2
- MA.5.NSO.1.3
- MA.5.NSO.1.4
- MA.5.NSO.1.5
- MA.5.NSO.2.1
- MA.5.NSO.2.3
- MA.5.NSO.2.5

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Vertical Alignment

| Previous Benchmarks | Next Benchmarks |
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| MA.4.AR.2.1 | MA.6.AR.2.1 |

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Terms from the K-12 Glossary
- Equal Sign
- Equation
- Expression

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Purpose and Instructional Strategies

The purpose of this benchmark is to determine if students can connect their understanding of using the four operations reliably or fluently (MTR.3.1) to the concept of the meaning of the equal sign. Students have evaluated whether equations are true or false since Grade 2. In Grade 5, additional expectations include non-whole numbers and parentheses. In Grade 6, students extend this work to involve negative numbers and inequalities (MA.6.AR.2.1).
- Students will use their understanding of order of operations (MA.5.AR.2.2) to simplify expressions on each side of an equation (MTR.5.1).

- Students will determine if the expression on the left of equal sign is equivalent to the expression to the right of the equal sign. If these expressions are equivalent, then theequation is true.
- Students may use comparative relational thinking, instead of solving, in order todetermine if the equation is true or false (MTR.2.1, MTR.3.1, MTR.5.1).

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Common Misconceptions or Errors
- Some students may not understand that the equal sign is a relational symbol showing expressions on both sides that are the same. While justifying whether equations are true or false, students should explain what makes the equation true.

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Questions to ask students:
- Is the following equation true or false: $\frac{1}{4} \times ( 2 \times 3 ) = ( 24 - 18 ) - 4\frac{2}{4}$
- Sample answer that indicates understanding: The equation is true because the expressions on each side of the equal sign are equivalent to $1\frac{2}{4}$.

- How does the order of operations help you understand if an equation is true or false?
- Sample answer that indicates understanding: Order of operations gives guidance as to the order of how this problem should be solved. The operations in parenthesis should be solved first, any exponents second, then from left to right, multiplication or division, and finally any addition or subtraction.

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Instructional Tasks
*Instructional Task 1*

Using the numbers below, create an equation that is true.

(_____ × _____) - _____ = _____ - _____

$$12, \quad 6.2, \quad 5\frac{1}{5}, \quad 4, \quad 3.5$$

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Instructional Items
*Instructional Item 1*

Which best explains the equation below?

$$13.8 - 6 + 3 = 4 \times 1.2$$

a. This equation is true because both sides of the equation are equal to 4.8.
b. This equation is true because both sides of the equation are equal to 10.8.
c. This equation is false because both sides of the equation are equal to 4.8.
d. This equation is false because both sides of the equation are unequal.

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Achievement Level Descriptors

| Benchmark | Context | Assessment Limits |
|---|---|---|
| MA.5.AR.2.3 Determine and explain whether an equation involving any of the four operations is true or false. Example: The equation 2.5 + (6 × 2) = 16 − 1.5 can be determined to be true because the expression on both sides of the equal sign are equivalent to 14.5.<br>Clarification 1: Problem types include equations that include parenthesis but not nested parentheses.<br>Clarification 2: Instruction focuses on the connection between properties of equality and order of operations. | Mathematical | Items including decimals will not include fractions. Items including fractions will not include decimals. Items will include at least two different arithmetic operations on at least one side of the equation. Items will not exceed three operations on either side of the equation. |

| ALD 2 | ALD 3 | ALD 4 | ALD 5 |
|---|---|---|---|
| Determines whether an equation, with whole numbers and parentheses or multiple operations on at least one side of the equation, involving any of the four operations is true or false. | Determines whether an equation with decimals or fractions involving any of the four operations is true or false. | Determines and explains whether an equation involving any of the four operations is true or false. | N/A |

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Additional Resources:
CPALMS Resources

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Resources/Tasks to Support Your Child at Home:
Khan Academy: Order of Operations Example

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Additional Examples:

Are the following equations True or False?

Show your work to explain how you know.

a. $7 \times (14 - 7) = 21 + (4 \times 7)$

b. $60 + (9 \times 5) = 110 - 11 + 6$

c. $6.2 \times 8 = (10 \times 5) - 2$

a. True   49 = 49

b. True   105 = 105

c. False   49.6 ≠ 48