

Vertical Progression:

<p>2nd Grade</p>	<p>2.OA.C Work with equal groups of objects to gain foundations for multiplication.</p> <ul style="list-style-type: none"> ○ 2.OA.C.3 Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends. ○ 2.OA.C.4 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 addends.
<p>3rd Grade</p>	<p>3.OA.B Understand properties of multiplication and the relationship between multiplication and division.</p> <ul style="list-style-type: none"> ○ 3.OA.B.5 Apply properties of operations as strategies to multiply and divide. Examples: If $6 \times 4 = 24$ is known, then $4 \times 6 = 24$ is also known. (Commutative property of multiplication.) $3 \times 5 \times 2$ can be found by $3 \times 5 = 15$, then $15 \times 2 = 30$, or by $5 \times 2 = 10$, then $3 \times 10 = 30$. (Associative property of multiplication.) Knowing that $8 \times 5 = 40$ and $8 \times 2 = 16$, one can find 8×7 as $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$. (Distributive property.) ○ 3.OA.B.6 Understand division as an unknown-factor problem. For example, find $32 \div 8$ by finding the number that makes 32 when multiplied by 8.
<p>4th Grade</p>	<p>4.OA.A Use the four operations with whole numbers to solve problems.</p> <ul style="list-style-type: none"> ○ 4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. ○ 4.OA.A.2 Multiply or divide to solve word problems 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. ○ 4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.

Students will demonstrate command of the ELG by:

- Explaining how multiplication and division problems are related using manipulatives.
- Using a variety of strategies (e.g., skip counting, doubling, arrays) to solve multiplication problems.
- Solving multiplication and division problems with an unknown in all positions.
- Identifying the factors in a multiplication problem.
- Applying properties of operations as strategies to multiply and divide.

Vocabulary:

- associative property
- commutative property
- distributive property
- dividend
- division
- divisor
- factor
- groups of
- multiple
- multiplication
- partition equally
- pattern
- product
- place value
- quotient
- unknown

Sample Instructional/Assessment Tasks:

1) Standard(s): 3.OA.B.5

Source: Illustrative Mathematics

Item Prompt: Decide if the equations are true or false. Explain your answer.

- a) $4 \times 5 = 20$
- b) $34 = 7 \times 5$
- c) $3 \times 6 = 9 \times 2$
- d) $5 \times 8 = 10 \times 4$
- e) $6 \times 9 = 5 \times 10$
- f) $2 \times (3 \times 4) = 8 \times 3$
- g) $8 \times 6 = 7 \times 6 + 6$
- h) $4 \times (10 + 2) = 40 + 2$

Correct Answer

- a) $4 \times 5 = 20$ This is true. Both sides have a value of 20.
- b) $34 = 7 \times 5$ This is not true. The value of 7×5 is 35. Students may also recognize that all multiples of 5 end in 0 or 5 and conclude that this equation is not true without evaluating 7×5 .
- c) $3 \times 6 = 9 \times 2$ This is true. Both sides have a value of 18.
- d) $5 \times 8 = 10 \times 4$ This is true. Both sides have a value of 40.
- e) $6 \times 9 = 5 \times 10$ This is not true. The value of 6×9 is 54 and the value of 5×10 is 50. This is included to see if students mistakenly try to use compensation strategies from addition.
- f) $2 \times (3 \times 4) = 8 \times 3$ This is true. Both sides have a value of 24. See the commentary for further suggestions on what ideas to elicit from students.
- g) $8 \times 6 = 7 \times 6 + 6$ This is true. Both sides have a value of 48.
- h) $4 \times (10 + 2) = 40 + 2$ This is not true. $4 \times (10 + 2)$ has a value of 48, and $40 + 2$ has a value of 42. This equation presents an opportunity for students to reason using the distributive property.

2) Standard(s): 3.OA.B.5

Source: NC Common Core

Item Prompt:

A student knows that $2 \times 9 = 18$. Use that fact to help you solve the following problem:
18 people are divided into pairs for a P.E. class. How many pairs are there? Write a division equation and explain your reasoning.

Correct Answer:

There are 9 pairs. Division equation would be $18 \div 2 = 9$. Students would need to know that a pair was 2 shoes and if 18 shoes were divided into groups of 2, there would be 9 groups. Explanation of reasoning would need to include a demonstration of understanding of how 18 people are divided into groups of 2 resulting in 9 groups with 2 in each group.

Commentary:

Students who respond with $18 \div 9 = 2$, will need to have additional instruction around the difference between the number of groups and the number of members in groups.

3) Standard(s): 3.OA.B.6

Source: Howard County Public Schools

(<https://grade3commoncoremath.wikispaces.hcpss.org/Assessing+3.OA.6>)

Directions:

- 1) Roll 2 dice. Write the numbers that are rolled on the lines (see cards below).
- 2) Write the equation on the line including the product.
- 3) Use the commutative property to rewrite the multiplication equation on the next line.
- 4) Use the same numbers to write two division equations.

_____	_____
_____ x _____ = _____	
_____ x _____ = _____	
_____ ÷ _____ = _____	
_____ ÷ _____ = _____	

_____	_____
_____ x _____ = _____	
_____ x _____ = _____	
_____ ÷ _____ = _____	
_____ ÷ _____ = _____	

_____	_____
_____ x _____ = _____	
_____ x _____ = _____	
_____ ÷ _____ = _____	
_____ ÷ _____ = _____	

_____	_____
_____ x _____ = _____	
_____ x _____ = _____	
_____ ÷ _____ = _____	
_____ ÷ _____ = _____	

Considerations:

- Are students fluent in their math facts or do they use a different strategy?
- Do students understand the commutative property of multiplication?
- Do students understand the relationship between multiplication and division?

Students who demonstrate mastery apply a strategy such as think multiplication. Students may make arrays, use repeated addition or use a number line to help them solve for the unknown factor.