

ACHIEVE THE CORE

Foundations of Multiplication and Division

3.OA Conceptual Understanding Mini-Assessment by Student Achievement Partners

OVERVIEW

This mini-assessment is designed to illustrate assessment of early progress in the 3.OA domain. This mini-assessment is designed for teachers to use either in the classroom, for self-learning, or in professional development settings to:

- Evaluate students' understanding of aspects of 3.OA addressed early in the learning of multiplication and division in order to prepare to teach this material or to check for student understanding, and to check for student progress toward fluency;
- Gain knowledge about assessing some of the conceptual understanding, procedural skills, fluencies, and applications of multiplication and division; and
- Illustrate CCSS-aligned assessment problems.

MAKING THE SHIFTS

This mini-assessment attends to focus as it addresses the earliest understandings of multiplication and division, which are at the heart of the grade 3 standards and a key component of the major work of the grade.¹ This mini-assessment addresses only some of the third-grade expectations for multiplication and division. Later in grade 3, students will use this foundational understanding of multiplication and division to coherently progress to fluency with all single-digit products and real-world applications involving area and measurement. The full 3.OA domain sets an expectation for students to understand the concepts of multiplication and division (*conceptual understanding*), be fluent in procedures of multiplying and dividing (*procedural skill/fluency*), and be able to solve word problems using multiplication and division and eventually all 4 operations (*application*). Therefore, this mini-assessment has components of all three of these aspects of rigor so that students can work toward full expression of these skills and concepts.

A CLOSER LOOK

This mini-assessment of early multiplication and division focuses largely on conceptual understanding. Specifically, grade 3 students know that the product $a \times b$ means the number of things in a groups of b objects each. Some conceptual questions on the mini-assessment are brief checks, while others require students to share their mathematical reasoning.

3.OA.A. Represent and solve problems involving multiplication and division.

3.OA.B. Understand properties of Multiplication and the relationship between multiplication and division.

3.OA.C. Multiply and divide within 100.

Knowing the multiplication table from memory is expected by year's end, so this mini-assessment of early progress focuses on fluency with the factors 0, 1, 2, 5, and 10. Students also practice finding products for the other factors so they can build toward fluency over the school year. Finally, situations of equal groups are ubiquitous in real life; the mini-assessment includes some word problems that allow students to apply multiplication and division skills.

This mini-assessment also serves as a summative assessment for a model instructional unit being developed in outline by the mathematics team at Student Achievement Partners. The unit outline is intended to suggest one way to introduce multiplication and division early in the year during grade 3. The unit encourages conceptual understanding about these operations, builds towards fluency with single-digit factors, and requires solving some real-world problems. Later in the year, students would address topics such as connecting multiplication and division to area, investigating properties of operations, and solving richer application problems. This mini-assessment measures the extent to which students have met the objectives of the first unit, and it provides information useful for teaching future units on multiplication and division.

¹ For more on the Major Work of the grade, see achievethecore.org/emphases.

ACHIEVE THE CORE

CONNECTING THE STANDARDS FOR MATHEMATICAL PRACTICE TO GRADE-LEVEL CONTENT

The Operations and Algebraic Thinking domain requires meaningful connections to several standards for mathematical practice. In questions #8 and #13, students must analyze a situation and make a conjecture. The conjecture must then be supported by evidence, whether in the form of examples or an explanation. Through this process, students are constructing viable arguments and critiquing the reasoning of others (MP.3). Problems #4, #11, and #12 show grade-appropriate modeling (MP.4). The problems require students to decide which operations apply to the context, to create equations that represent context, and to use visual models to abstract the mathematical elements of the situation.

SAMPLE ADMINISTRATION INSTRUCTIONS FOR FLUENCY SECTION

Sample instructions are given below for the first section of the mini-assessment on fluency:

You will have 2 minutes to answer as many of these questions as you can in pencil. After I call 2 minutes, switch to pen to complete the rest of the fluency problems. You may do the problems in any order you choose.

After completing the fluency section, you may switch back to pencil to complete the assessment.

Name: _____ Date: _____

Section 1: Fact Fluency

$2 \times 2 = \underline{\quad}$

$1 \times 10 = \underline{\quad}$

$3 \times 10 = \underline{\quad}$

$8 \times 2 = \underline{\quad}$

$5 \times 1 = \underline{\quad}$

$0 \times 3 = \underline{\quad}$

$5 \times 5 = \underline{\quad}$

$7 \times 10 = \underline{\quad}$

$8 \times 5 = \underline{\quad}$

$5 \times 6 = \underline{\quad}$

$\underline{\quad} = 5 \times 3$

$\underline{\quad} \times 2 = 10$

$3 \times \underline{\quad} = 6$

$8 \times \underline{\quad} = 0$

$\underline{\quad} \times 10 = 50$

$\underline{\quad} \times 4 = 40$

$7 \times 5 = \underline{\quad}$

$\underline{\quad} \times 2 = 8$

$2 \times \underline{\quad} = 12$

$\underline{\quad} \times 1 = 9$

$\underline{\quad} = 8 \times 1$

$\underline{\quad} \times 5 = 20$

$1 \times \underline{\quad} = 6$

$9 \times \underline{\quad} = 45$

$\underline{\quad} \times 10 = 0$

$\underline{\quad} \times 9 = 18$

$7 \times \underline{\quad} = 7$

$\underline{\quad} \times 2 = 20$

$2 \times \underline{\quad} = 14$

$\underline{\quad} = 10 \times 10$

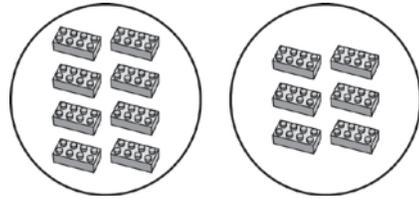
Section 2: Answer all 12 questions.

1. Circle each picture that shows equal groups.

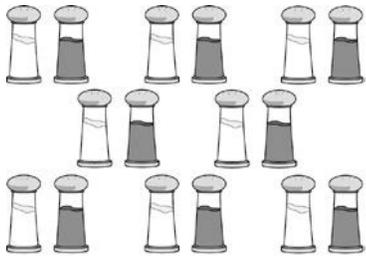
Picture 1



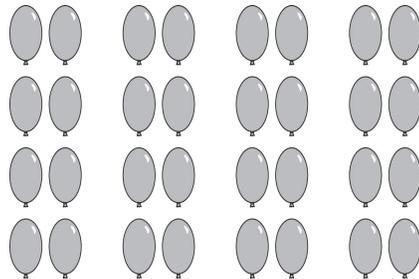
Picture 2



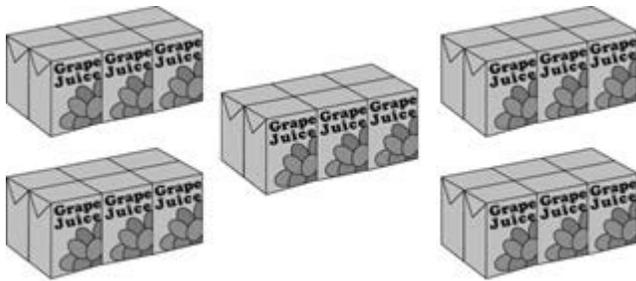
Picture 3



Picture 4



2. Packs of juice boxes are shown below.



a. How many equal groups are there? _____

How many juice boxes are in each group? _____

How many juice boxes are there total? _____

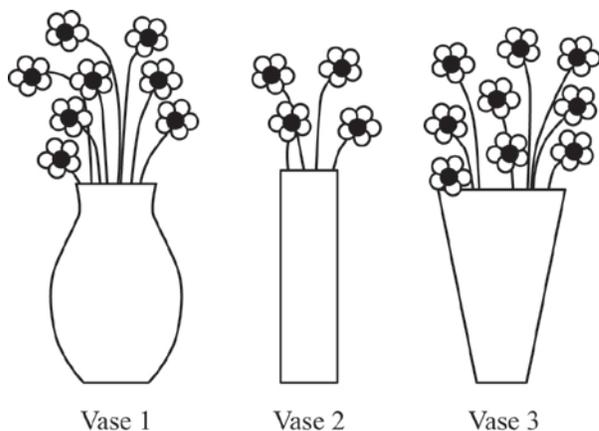
b. Write a multiplication equation that describes the arrangement of juice boxes.

3. There are 5 bowls with 4 grapes in each bowl. How many grapes are there altogether?

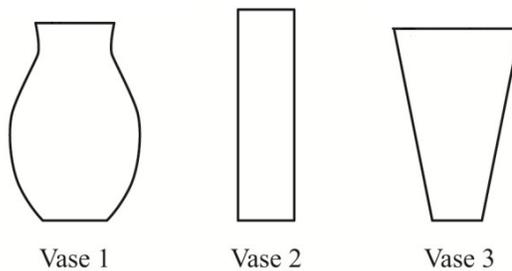
$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

 grapes altogether

4. **Parker's Flowers**



- New Flower Arrangement**



- a. Rearrange the flowers in Parker's vases so each vase has the same number of flowers.
- b. Write a multiplication equation to represent the new arrangement of Parker's flowers.

5. Mrs. Oro needs 90 corn seeds. The Garden Center sells corn seeds in packs of 10 seeds each.

a. Write a division equation showing how many packs of seeds Mrs. Oro should buy.

b. Identify the quotient in your equation above by circling it.

c. Write a multiplication equation showing how many packs of seeds Mrs. Oro should buy.

d. Identify the product in your equation above by circling it.

6. What is the unknown number in each of the four equations below?

$21 \div 7 = \blacksquare$ $\blacksquare = \underline{\hspace{2cm}}$	$\diamond \times 6 = 36$ $\diamond = \underline{\hspace{2cm}}$
$6 \times \square = 24$ $\square = \underline{\hspace{2cm}}$	$H \div 3 = 4$ $H = \underline{\hspace{2cm}}$

7. Ken says that every time you multiply two numbers, the product is greater than each of the factors.

Ken is wrong. To convince Ken that the product of two numbers is sometimes, but not always, greater than each of the factors:

- a. Write one equation where the product is **greater than** both factors.

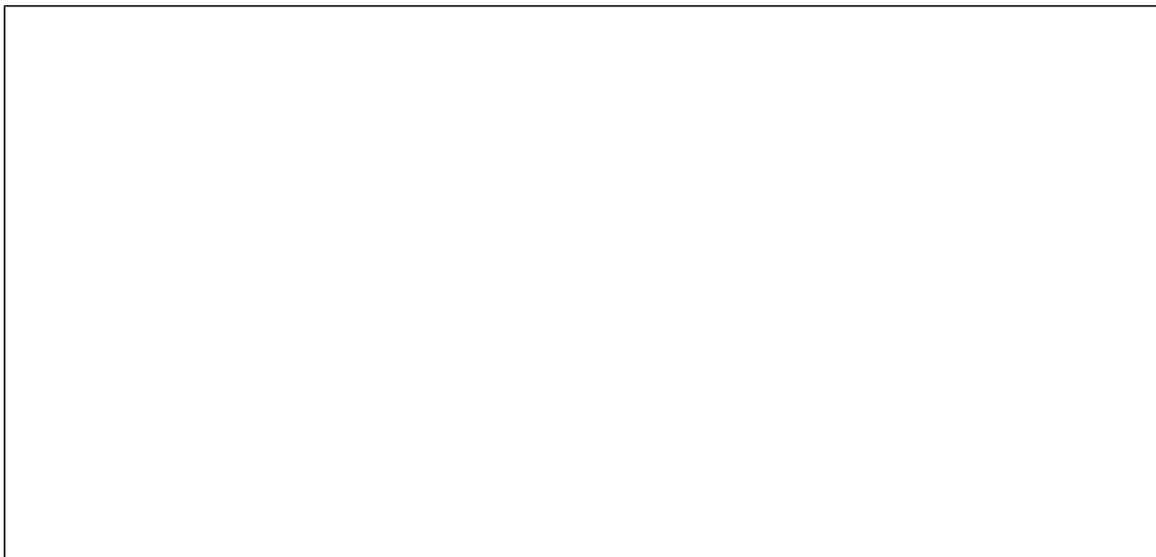
- b. Write one equation where the product is **not greater than** both factors.

8. In which situation is the number of plums equal to 58×29 ?

- a. Sam buys 58 plums and puts 29 plums in each of 2 bags.
b. Ron buys 58 bags with 29 plums in each bag.
c. Tim buys 58 plums and gives 29 of the plums away.
d. Dan has 58 plums and buys 29 more plums.

9. Mrs. Ling puts 30 students in teams of 5 students each.

a. Draw a diagram that shows how Mrs. Ling arranged the students.

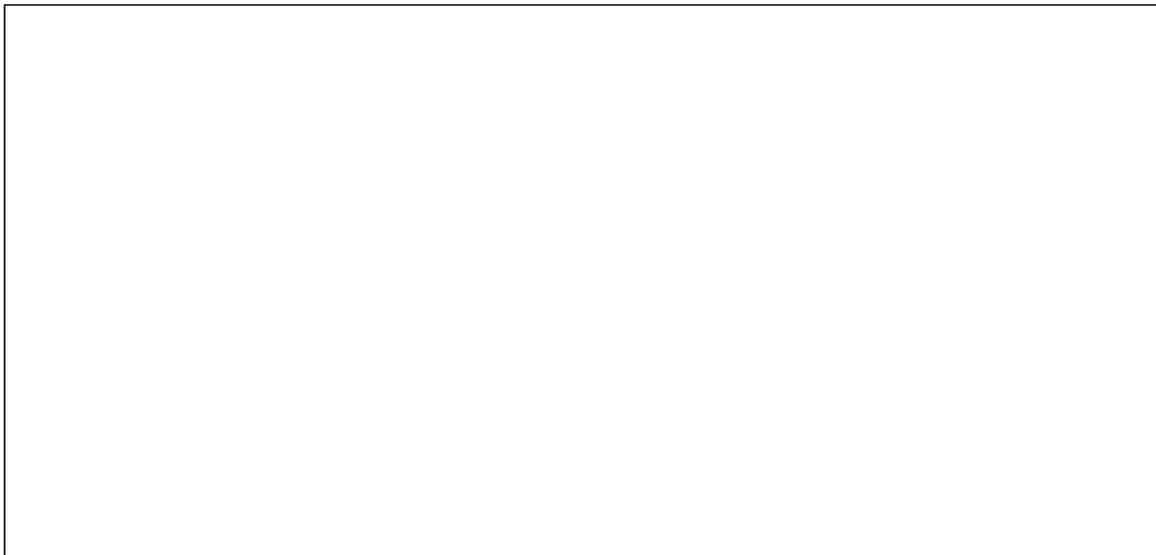


b. Write a division equation that describes the arrangement of students.

10. Mrs. Shapiro has 28 markers. She has red, blue, yellow, and black markers. She has the same number of markers in each color.

a. How many markers in each color does Mrs. Shapiro have? _____

b. Show your work or describe how you found your answer here.



- 11.** Amy and Bonnie are putting an equal number of stickers into 5 sticker books. They have 100 stickers total.

Amy wrote the following division equation to find the number of stickers to put in each sticker book:

$$100 \div 5 = \underline{\quad}$$

Bonnie wrote the following multiplication equation to find the number of stickers to put in each sticker book:

$$5 \times \underline{\quad} = 100$$

Who is correct? (Circle one answer.)

Neither person

Amy

Bonnie

Both people

Explain your answer.

- 12.** Describe a situation that could be described by the equation $10 \div 1 = 10$.

3.OA Conceptual Understanding Mini-Assessment: Foundations of Multiplication and Division
Answer Key

Timing: Overall, this assessment (both sections 1 and 2) is intended to take about 35–40 minutes.

Section 1 Instructions:

*You will have 2 minutes to answer as many of these questions as you can in **pencil**. After 1 call 2 minutes, switch to **pen** to complete the rest of the fluency problems. You may do the problems in any order you choose.*

After completing the fluency section, you may switch back to pencil to complete the assessment.

Use the answers to the fluency section to guide fluency instruction in future work on multiplication.

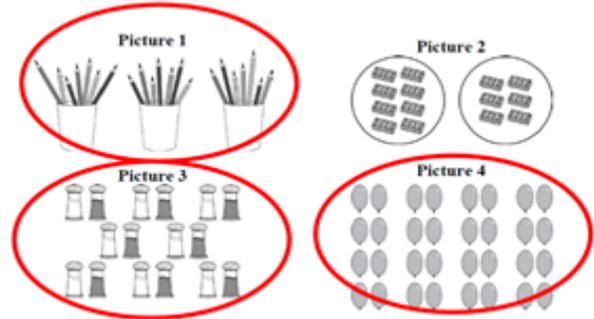
Students are not expected to complete all 30 problems in 2 minutes at this time. Students should progress throughout the year with their fluency of one-digit multiplication facts.

Section 1 Answer Key.

$2 \times 2 = \underline{4}$	$1 \times 10 = \underline{10}$
$3 \times 10 = \underline{30}$	$8 \times 2 = \underline{16}$
$5 \times 1 = \underline{5}$	$0 \times 3 = \underline{0}$
$5 \times 5 = \underline{25}$	$7 \times 10 = \underline{70}$
$8 \times 5 = \underline{40}$	$5 \times 6 = \underline{30}$
$\underline{15} = 5 \times 3$	$\underline{5} \times 2 = 10$
$3 \times \underline{2} = 6$	$8 \times \underline{0} = 0$
$\underline{5} \times 10 = 50$	$\underline{10} \times 4 = 40$
$7 \times 5 = \underline{35}$	$\underline{4} \times 2 = 8$
$2 \times \underline{6} = 12$	$\underline{9} \times 1 = 9$
$\underline{8} = 8 \times 1$	$\underline{4} \times 5 = 20$
$1 \times \underline{6} = 6$	$9 \times \underline{5} = 45$
$\underline{0} \times 10 = 0$	$\underline{2} \times 9 = 18$
$7 \times \underline{1} = 7$	$\underline{10} \times 2 = 20$
$2 \times \underline{7} = 14$	$\underline{100} = 10 \times 10$

Section 2 Instructions: As students complete Section 1, they can move to Section 2.

Section 2 Answer Key.



1. **Note:** Students should recognize the cups of pencils as equal groups, even though there are pencils of different colors and lengths.

2.

a. 5 equal groups
6 in each group
30 total

b. $5 \times 6 = 30$, or equivalent

Note: Students should not receive credit for equations using repeated addition since this application involves groups of objects which is a multiplication situation.

3. $\frac{5}{20} \times \frac{4}{20} = \frac{20}{20}$
20 grapes altogether

4.

a. Each vase should have 7 flowers.

b. $3 \times 7 = 21$

Note: Students should not receive credit for equations using repeated addition since this application involves groups of objects which is a multiplication situation.

5.

a. $90 \div 9 = 10$ (preferred); $90 \div 10 = _$; $90 \div _ = 10$; OR $90 \div 10 = 9$

b. See bolded quotients above.

c. Correct equations include: $9 \times 10 = 90$ (preferred); $_ \times 10 = 90$; $10 \times _ = 90$; OR $10 \times 9 = 90$

d. See bolded products above.

Note: Students may write equations with only numbers or may incorporate variables. Both types of responses should receive full credit as indicated.

6.

■ = 3	◇ = 6
□ = 4	H = 12

7.

a. One equation with both factors greater than 1 (e.g., $2 \times 2 = 4$, $3 \times 10 = 30$, etc.).

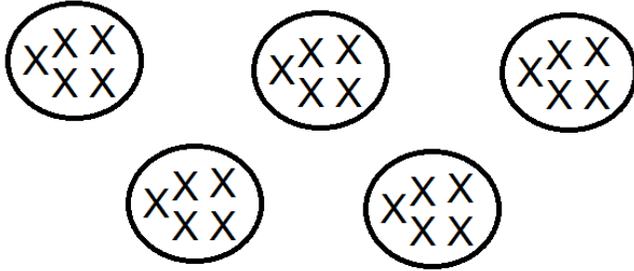
b. One equation with one or both factors equal to 0 or 1 (e.g., $0 \times 1 = 0$, $1 \times 2 = 2$, etc.).

8. b. Ron buys 58 bags with 29 plums in each bag.

3.OA Conceptual Understanding Mini-Assessment: Foundations of Multiplication and Division
Answer Key

9.

a. Sample diagram:



b. $30 \div 5 = 6$, or equivalent

10.

a. 7 markers in each color

b. Adequate work can include words, equations, or visual models detailing $28 \div 4 = 7$

11.

a. "Both people"

b. An explanation of division as the inverse of multiplication (e.g., "I know the solution to $100 \div 5 = ?$ is the same as $? \times 5 = 100$.")

12. Any situation that entails dividing 10 things into 1 group of 10