

# Extending Previous Understandings of Properties

6.EE.A Mini-Assessment by Student Achievement Partners

## OVERVIEW

This mini-assessment is designed to illustrate cluster 6.EE.A, which sets an expectation for students to apply and extend previous understandings of arithmetic to algebraic expressions. This mini-assessment is designed for teachers to use either in the classroom, for self-learning, or in professional development settings to:

- **Gain knowledge about** assessing conceptual understanding and application of algebraic expressions;
- **Use in professional development** as an illustration of CCSS-aligned assessment problems;
- **Evaluate** students' understanding of 6.EE.A in order to prepare to teach this material or to check for student ability to demonstrate understanding and apply these concepts;
- **Illustrate best practices** for writing tasks that allow access for all learners; and
- **Support mathematical language acquisition** by offering specific guidance.

## MAKING THE SHIFTS

This mini-assessment attends to **focus** as it addresses algebraic expressions, which are at the heart of the grade 6 standards alongside work with ratios and proportions.<sup>1</sup> This mini-assessment highlights **coherence** across grades as the cluster expands upon understandings from earlier grades. The standards within cluster 6.EE.A target both *conceptual understanding* and *application*, so this mini-assessment addresses two of the three elements of **rigor**.

## A CLOSER LOOK AT CLUSTER 6.EE.A

In the standards for grades K–5, arithmetic is both a life skill and a thinking subject—a rehearsal for algebra. Students in grades K–5 *calculated*, but they also *operated*. For example, students used the distributive property and other properties of operations as they came to learn the standard algorithms for multi-digit multiplication in grades 3 through 5. And students learned about the meanings of operations as they solved word problems with the basic operations. (Note that the four operations mean the same thing, model the same quantitative relationships, and solve the same kinds of word problems regardless of whether the numbers involved are whole numbers, fractions, decimals, or any combination of these—or even a variable standing for any of these.) In grade 6, students use properties of operations and meanings of operations as a pivot from arithmetic to algebra.

**6.EE.A.** Apply and extend previous understandings of arithmetic to algebraic expressions.

For example, standard 6.EE.A.3 requires students to apply the properties of operations to generate equivalent expressions. As noted in the footnote on page 15 of the CCSSM, “[s]tudents need not use formal terms for these properties.” This table highlights the coherence between the grade 6 expectations and the expectations of previous grades.

Property of Operations	Previous Grade Expectation	Grade 6 Expectation from 6.OA.A.3
Distributive	$8 \times (5 + 2) = (8 \times 5) + (8 \times 2)$ which is 56 (3.OA.B.5)	$24x + 18y = 6(4x + 3y)$
Associative	$3 \times 5 \times 2 = 15 \times 2$ OR $3 \times 10$ (3.OA.B.5)	$3 \times r \times 5 = 15 \times r$ OR $3r \times 5$ OR $3 \times 5r$
Commutative	$4 \times 6 = 24$ , so $6 \times 4 = 24$ (3.OA.B.5)	$r \times 6 = 24$ , so $6r = 24$

<sup>1</sup> For more on the Major Work of the Grade, see <http://achievethecore.org/focus>.

Addition and Multiplication	Interpret $5 \times 7$ as 5 groups of 7 objects	Interpret $y + y + y$ as $3y$
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### SUPPORT FOR ENGLISH LANGUAGE LEARNERS

This lesson was designed to include specific features that support access for all students and align to best practice for English Language Learner (ELL) instruction and assessment. Go [here](#) to learn more about the research behind these supports. Features that support access in this mini-assessment include:

- Tasks that allow for multi-modal representations, which can deepen understanding of the mathematics and make it easier for students, especially ELLs, to give mathematical explanations.
- Tasks that avoid unnecessarily complex language to allow students, especially ELLs, to access and demonstrate what they know about the mathematics of the assessment.

Prior to this mini-assessment, ensure students have had ample opportunities in instruction to read, write, speak, listen for, and understand the mathematical concepts that are represented by the following terms and concepts:

- **expression**
- **equivalent**
- **digit**
- **value**
- **perimeter**
- **area**
- **hundreds**
- **tens**
- **ones**

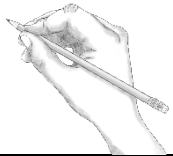

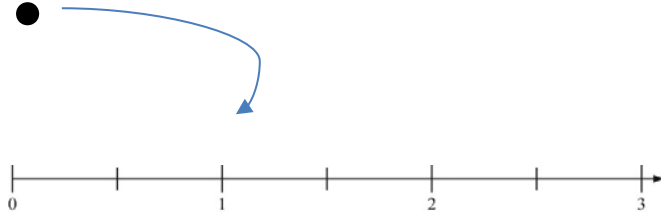
Students should engage with these terms and concepts in the context of mathematical learning, not as a separate vocabulary study. Students should have access to multi-modal representations of these terms and concepts, including: pictures, diagrams, written explanations, gestures, and sharing of non-examples. These representations will encourage precise language, while prioritizing students' articulation of concepts. These terms and concepts should be reinforced in teacher instruction, classroom discussion, and student work (for example, through engagement in [mathematical routines](#)).

ELLs may need support with the following Tier 2 words found in this mini-assessment:

- **true**
- **blank**
- **circle**
- **correct**
- **incorrect**

In preparation for giving this mini-assessment, teachers should strive to use these words in context so they become familiar to students. It will be important to offer synonyms, rephrasing, visual cues, and modeling of what these words mean in the specific contexts represented in the items in this mini-

assessment. Additionally, teachers may offer students the use of a student-friendly dictionary, or visual glossary to ensure they understand what is being asked of them in each item.

Sketch	
Point	
Locate	 <p>The diagram shows a horizontal number line with arrows at both ends. It is marked with tick marks and labeled with the numbers 0, 1, 2, and 3. A black dot is placed above the number 0. A blue curved arrow starts from this dot and points to the tick mark for the number 1.</p>

*An example of a visual glossary for student use.*

## Extending Previous Understandings of Properties Mini-Assessment

Name: \_\_\_\_\_

Write a number in every blank to make true equations.

1.  $2.3 + 0.5(3 + x) = \underline{\quad} x + \underline{\quad}$

2.  $\frac{8}{6} + (\frac{3}{8} + x)(2) = \underline{\quad} x + \underline{\quad}$

3.  $2y + 3x + 5y + 6x * 4 = \underline{\quad} x + \underline{\quad} y + \underline{\quad}$

4.

a. Circle all the expressions that are equivalent to  $7b + 38$ .

$$7(b + 5) + 3$$

$$7b + 7 \times 8$$

$$b + 38$$

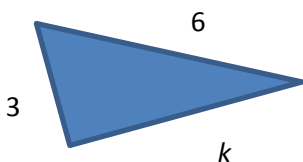
$$7b + (7 \times 5) + 3$$

b. Show that the expressions you circled above are equivalent to  $7b + 38$ .

5. There is one mistake in the work shown below. Find the mistake. Write the correct result next to where the mistake occurred.

$P + P + 6(3P + 4) + 4P = 2P + 6(3P + 4) + 4P$	
$= 6(3P + 4) + 2P + 4P$	
$= (3P + 4) + 6 + 2P + 4P$	
$= (3P + 4) + 6 + 6P$	

6. Write an expression for the perimeter of this triangle. \_\_\_\_\_



Extending Previous Understandings of Properties Mini-Assessment

7.

- a. A square bathroom tile has a length of  $T$ . Write an expression for the area of this tile.

\_\_\_\_\_



- b. Use this expression to find the area of the tile if the side length is 9 cm.

\_\_\_\_\_

8. Write an expression for “add 9 to  $A$  then multiply by 2.” \_\_\_\_\_

9. A three digit number has a hundreds digit  $S$ , tens digit  $T$ , and ones digit  $U$ .

$S$	$T$	$U$
↑ hundreds digit	↑ tens digit	↑ ones digit

Write an expression that gives the value of the number.

\_\_\_\_\_

6.EE.A – Extending Previous Understandings of Properties Mini-Assessment – Answer Key

Write a number in every blank to make true equations.

1.  $2.3 + 0.5(3 + x) = \underline{0.5}x + \underline{3.8}$  (or equivalent values)

2.  $\frac{8}{6} + (\frac{3}{8} + x)(2) = \underline{2}x + \underline{\frac{50}{24}}$  (or equivalent values)

3.  $2y + 3x + 5y + 6x * 4 = \underline{27}x + \underline{7}y + \underline{0}$

4.

a. The correct answers are circled below:

$$7(b + 5) + 3$$

$$b + 38$$

$$7b + 7 \times 8$$

$$7b + (7 \times 5) + 3$$

b. Students may show this in a variety of ways. The complete explanation must be accurate to receive one point.

For example: “I distributed the 7, so  $7(b + 5) + 3 = 7 \times b + (7 \times 5) + 3$ . Because  $7 \times b$  can be expressed as  $7b$ , I know that  $7(b + 5) + 3$  is equivalent to  $7b + (7 \times 5) + 3$ . Then, I found that the value of  $(7 \times 5) + 3$  is 38. So,  $7b + (7 \times 5) + 3$  is equivalent to  $7b + 38$ . That means all three expressions are equivalent.”

5.

$P + P + 6(3P + 4) + 4P$	=	$2P + 6(3P + 4) + 4P$	
	=	$6(3P + 4) + 2P + 4P$	
	=	$(3P + 4) + 6 + 2P + 4P$	$18P + 24 + 2P + 4P$
	=	$(3P + 4) + 6 + 6P$	

6. Write an expression for the perimeter of this triangle.  $k + 6 + 3$  or  $9 + k$  or equivalent

7.

a. Write an expression for the area of this tile.  $T \times T$  or equivalent

b. Use this expression to find the area of the tile if the side length is 9 cm.  $81 \text{ cm}^2$

8. Write an expression for “add 9 to A and then multiply by 2.”  $2(A + 9)$  or equivalent

9.  $100S + 10T + U$