

ACHIEVE THE CORE

Extending Previous Understandings of Properties

6.EE.A Conceptual Understanding and Application 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; and
- 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.

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.¹ 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

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

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

grade 6, students use properties of operations and meanings of operations as a pivot from arithmetic to algebra.

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 3×10 (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 $6r = 24$
Addition and Multiplication	Interpret 5×7 as 5 groups of 7 objects	Interpret $y + y + y$ as $3y$

The cluster is not only about extending these skills, but also applying them. This mini-assessment includes tasks that address conceptual understanding and/or application.

¹ For more on the Major Work of the grade, see <http://achievethecore.org/page/637/focus-in-grade-six>.

6.EE.A Conceptual Understanding & Application Mini-assessment: Extending Previous Understandings of Properties

Name: _____

Fill in each blank with the correct numbers.

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. Circle all the expressions that are equivalent.

$7(b + 5) + 3$

$b + 38$

$7b + 7 \times 8$

$7b + 38$

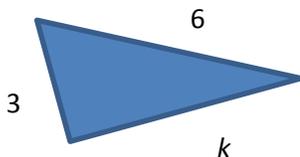
$7b + (7 \times 5) + 3$

5. Show that the expressions you circled above are equivalent.

6. There is one mistake in the work shown below. Next to the first incorrect equation, write the correct result.

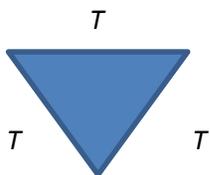
$P + P + 6(3P + 4) + 4P$	$= 2P + 6(3P + 4) + 4P$	
	$= 6(3P + 4) + 2P + 4P$	
	$= (3P + 4) + 6 + 2P + 4P$	
	$= (3P + 4) + 6 + 6P$	

7. Write an expression for the perimeter of this triangle. _____



6.EE.A Conceptual Understanding & Application Mini-assessment: Extending Previous Understandings of Properties

8. Write an expression for the perimeter of this triangle. _____



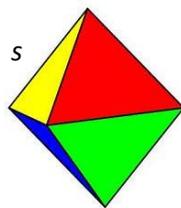
9. Write an expression for “add 9 to A then multiply by 2.” _____

10. Think about the value of a three-digit number. The 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.

11. The edge lengths of this octahedron are all equal to $s = 2$ in.



(This shape is called an octahedron because all 8 faces are equilateral triangles.)

The volume can be estimated using the equation $V = \left(\frac{1}{2}\right) s^3$.

What is the approximate volume of 100 of these shapes? _____ in^3

6.EE.A Conceptual Understanding & Application Mini-assessment: Extending Previous Understandings of Properties Answer Key

- $2.3 + 0.5(3 + x) = \underline{0.5}x + \underline{3.8}$ (or equivalent values)
- $\frac{8}{6} + (\frac{3}{8} + x)(2) = \underline{2}x + \underline{\frac{50}{24}}$ (or equivalent values)
- $2y + 3x + 5y + 6x * 4 = \underline{27}x + \underline{7}y + \underline{0}$
- The correct answers are circled below:

$7(b + 5) + 3$	$b + 38$	$7b + 7 \times 8$
$7b + 38$		$7b + (7 \times 5) + 3$

- 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.”

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

- Write an expression for the perimeter of this triangle. $k + 6 + 3$ or $9 + k$ or equivalent
- Write an expression for the perimeter of this triangle. $T + T + T$ or $3T$ or equivalent
- Write an expression for “add 9 to A and then multiply by 2.” $2(A + 9)$ or equivalent
- $100S + 10T + U$
- What is the approximate volume of 100 tops? 400 in³