**Session Two: Introduction to Algebraic Expressions**

**Common Core Standards Addressed**

#### Algebraic Expressions are first introduced in Grade 3. For children in lower grade levels knowledge of: the counting sequence, adding and subtracting within 20, the relationship between addition and subtraction, and place value form the base necessary for working with algebraic expressions.

#### Grade 3

#### Solve problems involving the four operations, and identify and explain patterns in arithmetic.

[CCSS.Math.Content.3.OA.D.8](http://www.corestandards.org/Math/Content/3/OA/D/8/)
Solve two-step word problems using the four operations. 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.3

[CCSS.Math.Content.3.OA.D.9](http://www.corestandards.org/Math/Content/3/OA/D/9/)
Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that 4 times a number is always even, and explain why 4 times a number can be decomposed into two equal addends*.

#### Grade 4

#### Generate and analyze patterns.

[CCSS.Math.Content.4.OA.C.5](http://www.corestandards.org/Math/Content/4/OA/C/5/)
Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way*.

#### Grade 5

#### Write and interpret numerical expressions.

[CCSS.Math.Content.5.OA.A.1](http://www.corestandards.org/Math/Content/5/OA/A/1/)
Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols.

[CCSS.Math.Content.5.OA.A.2](http://www.corestandards.org/Math/Content/5/OA/A/2/)
Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three times as large as 18932 + 921, without having to calculate the indicated sum or product*.

#### Analyze patterns and relationships.

[CCSS.Math.Content.5.OA.B.3](http://www.corestandards.org/Math/Content/5/OA/B/3/)
Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so*.

#### Grade 8

#### Define, evaluate, and compare functions.

[CCSS.Math.Content.8.F.A.1](http://www.corestandards.org/Math/Content/8/F/A/1/)
Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.1

[CCSS.Math.Content.8.F.A.2](http://www.corestandards.org/Math/Content/8/F/A/2/)
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).

For example, in the Activity some participants to the pattern as 2+3(p) others see it as 3(p+1)-1.