**Session One: Thinking In Patterns**

**Common Core Standards Addressed**

#### Grade 1 – Grade 3 uses patterns in the learning process, or as a tool for reaching standards. For example, once a child has counted from 1 to 20, the child can recall patterns to count to 100. The direct application of patterns is not formally introduced until Grade 4.

#### 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 7

#### Analyze proportional relationships and use them to solve real-world and mathematical problems.

[CCSS.Math.Content.7.RP.A.1](http://www.corestandards.org/Math/Content/7/RP/A/1/)  
Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour*.

[CCSS.Math.Content.7.RP.A.2](http://www.corestandards.org/Math/Content/7/RP/A/2/)  
Recognize and represent proportional relationships between quantities.

#### 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.