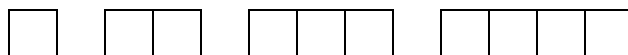


## Multiple Representations – Pattern Building

When the concept of variable is introduced in this way, students are more likely to connect the “representativeness” of  $n$  to their own way of describing pattern building. There will be repeated opportunities throughout this program to work with patterns and represent them algebraically and by using words. When students are comfortable, they need to move from words to letters to represent variables. Students should not be rushed into using variables, but rather should see the efficiency and power of this notation and move to it themselves. Descriptions at this stage are equally powerful.

### Representing Concrete Patterns with Algebra

For any concrete pattern, there are usually different ways to describe the building of a term. If we let  $n$  represent the term number, then each description yields a different-looking algebraic representation.



Each entry in the table is a different way of describing how to build the  $n$ th term.

No.	Visualization	Description	Understanding	Representation
1		Start with 4 toothpicks for the first term, then add 3 toothpicks for each subsequent term.	4 $4 + 3$ $4 + 3 + 3$	<ul style="list-style-type: none"> <li>4 plus 3 multiplied by one less than the term number</li> <li><math>4 + 3(n - 1)</math></li> </ul>
2		Two horizontal toothpicks and one vertical toothpick for each term number plus one more vertical toothpick than the number of the term.	$2 + 1 + 1$ $2 \times 2 + 2 \times 1 + 1$ $2 \times 3 + 3 \times 1 + 1$	<ul style="list-style-type: none"> <li>2 times the term number plus one more than the term number</li> <li><math>2n + n + 1</math></li> </ul>
3		Four toothpicks times the number of the term, take away the extra vertical toothpicks in the interior.	4 $4 + 4 - 1$ $4 + 4 + 4 - 1 - 1$	<ul style="list-style-type: none"> <li>4 multiplied by the term number subtract one less than the term number</li> <li><math>4n - (n - 1)</math></li> </ul>
4		Think of there being one vertical toothpick there before starting to build the squares, and add three toothpicks for each term	$1 + 3$ $1 + 3 + 3$ $1 + 3 + 3 + 3$	<ul style="list-style-type: none"> <li>1 plus 3 multiplied by the term number</li> <li><math>1 + 3n</math></li> </ul>