

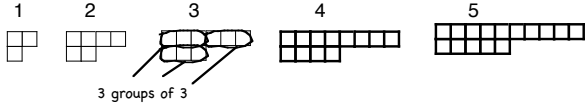
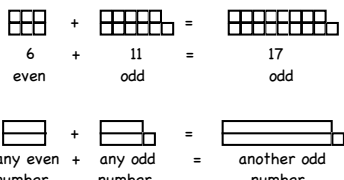
# Grade 4, Unit Seven: Algebraic Thinking

In this unit your child will:

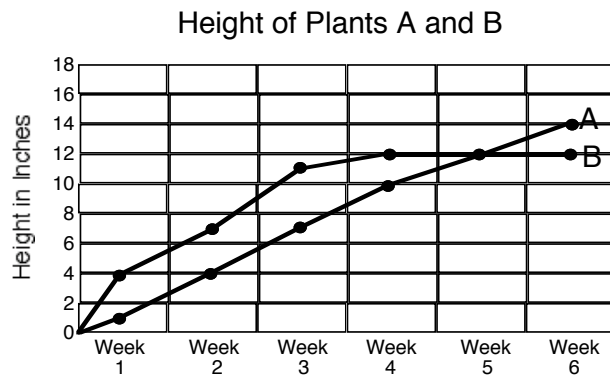
- make generalizations and conclusions about patterns
- identify what comes next in a sequence
- read and interpret line graphs
- make and support generalizations about number properties and relationships



Your child will learn and practice these skills by solving problems like those shown below. Keep this sheet for reference when you're helping with homework.

Problem	Comments
<p>Sketch the next two arrangements in this sequence. Then figure out how many pieces it would take to build the 20th arrangement in the sequence.</p>  <p>There are 3 groups in each arrangement. The number of pieces in each group is the same as the arrangement number. So the number of pieces in each arrangement is 3 times the arrangement number.</p> $3 \times 20 = 60$ <p>There would be 60 pieces in the 20th arrangement.</p>	<p>To draw what comes next, students must find and describe some kind of pattern in the sequence. There are many ways to think about it, but only one correct way to extend the sequence.</p> <p>To determine how many pieces are in <i>any</i> arrangement, students have to figure out a relationship between the arrangement number and the number of pieces. In this example, the student saw three groups equal to the arrangement number. There are other ways to think about it, but the focus is on finding a relationship between the arrangement number and the number of pieces.</p>
<p>Sally says if you add an even number and an odd number, the answer could be odd or even. Use pictures, numbers, and words to explain why you agree or disagree.</p> <p><b>Sally is wrong. When you add an even number and an odd number, the sum is always odd. All even numbers can be a 2-by-something array. All odd numbers are a 2-by-something array with 1 extra on the end. You can see in the picture that the sum is always odd: there's always 1 extra that makes the number odd.</b></p> 	<p>A simple definition of algebra is <i>the branch of mathematics concerned with generalized relationships</i>. In the example at left, students reason about adding even and odd numbers <i>in general</i>, rather than specific even or odd numbers. You might remember representing any even number as <math>2n</math> and any odd number as <math>2n + 1</math> in your high school algebra classes. In <i>Bridges</i>, students use models like those shown at left to represent even and odd numbers pictorially (you can see in the pictures why the symbolic notation makes sense). The visual models enable fourth graders (and even younger students) to make sophisticated generalizations about number relationships.</p>

Bill planted two seeds and then measured how tall the plants were at the end of each week. The line graph below shows his results for six weeks.



Which plant was taller at the end of six weeks?  
**Plant A was taller after 6 weeks.**

When did the plants grow exactly the same amount in a single week?  
**Both plants grew 3 inches between week 1 and week 2.**

Explain what this graph shows about the plants' growth. Imagine you are telling someone who can't see this graph.  
**In the beginning, Plant B grew faster than Plant A. It was taller than Plant A for 4 weeks, and then it stopped growing. Plant A kept growing, though. At the end of the fifth week, the plants were the same height. At the end of the sixth week, Plant A was taller than Plant B by 2 inches.**

The first two questions require students to find specific pieces of information on the graph. The last question asks them to interpret the graph: to determine what it shows about the situation and explain it to someone else.

It is very important that students be able to read a graph, that is, to find information and details in it. They must also be able to see the graph as a complete picture. To do this, they have to put the details together in the context of a situation and then determine what it all means. This is a sophisticated skill, and few fourth graders will write responses as clear as the one in this example. Students will continue to interpret graphs through high school and into college.

## Frequently Asked Questions about Unit Seven

**Q: What do you mean by algebraic thinking and what does this unit have to do with algebra?**

**A:** As mentioned above, algebra is the branch of mathematics concerned with generalized relationships. Algebraic thinking is a way of thinking concerned with seeing patterns and relationships among numbers and making generalizations about them. In this unit, students use pictures and graphs to see relationships between numbers and to make generalizations about them.

Starting in this unit, students will use also symbolic notation (numbers, letters, and other symbols) to represent mathematical relationships, generalizations, and their thinking about them. As they continue into algebra, students will rely more heavily on the symbolic notation: the visual models they use now provide a strong foundation for these more abstract ways of representing mathematical ideas.