stage 16:
multiply & divide with 1/10/100

Big Idea: Repeated Equal Groupings and Hierarchical Groupings

The Repeated Equal Groupings big idea builds upon the Parts-to-Whole idea. With Repeated Equal Groupings, the whole is not only broken into parts but broken into a specific number of parts and each part is of equal size. For example, there are 30 students in the class (the whole). The teacher divides the class into groups of 6 (the equal groups). These equal groups are repeated 5 times to equal the whole.

Repeated equal groupings is the big idea that underlies multiplication and division. Multiplication consists of taking a part (the multiplicand) and repeating it a certain number of times (the multiplier) to equal the whole (the product). Division consists of a whole (the dividend) that is partitioned into a certain number of equal groups (the divisor) that is equal to the size of the parts (the quotient).

Hierarchical Groupings is the idea that amounts can be grouped into a system of sets and subsets. We count 11 objects and group them into 1 ten and 1 one, or we can call them 11 ones. Seventy five represents 7 tens and 5 ones. When an understanding of hierarchical groupings is combined with repeated equal groupings, students can begin to understand the relationship between 4 x 7, 4 x 70, and 4 x 700.

Why are Repeated Equal Groupings Important?

It is possible for students to memorize multiplication facts without understanding what they mean. Students can also use skip counting to correctly solve multiplication problems without appreciating the significance of how they arrived at the correct answer. In addition to being able to immediately recall multiplication and division facts, students also need to be able to understand what these operations mean.

In Stage 16, students experience how numbers grow multiplicatively when using 1s, 10s, and then 100s. Rather than simply learning a procedure of 'add a zero', students are able to visualize the relationship between multiplying similar place values. Six groups of '2-dot' cards looks similar to six groups of '20-dot' cards, except the dots each have different values (1 and 10). Six groups of '2-bars' and six groups of '20-bars' also have similarities, but the magnitude of the two sets of groups is very apparent. And the number line that shows different groups of place values will also have a similar look, especially if the end points of the number line are represented appropriately. Stage 16 consolidates ideas that have been used in every previous Stage, and by the end, students will be prepared to approach multi-digit multiplication and division tasks with a high level of understanding.

Stage 16 Learning Progression

Concept	Standard	Example	Description
16.1: Multiply by 1, 10, 100: Missing Result	4.NBT.1	1 x 3 = ? 1 x 30 = ? 1 x 300 = ?	Students experience how numbers grow multiplicatively when using 1s, 10s, and then 100s as the multiplier. Rather than have students use the short cut, "add a zero" when multiplying by 10, Symphony Math shows students, through the use of visual aids, how numbers grow in an understandable manner. They are learning that a number to the left of another number is 10 times larger, and a number to the right is 10 times smaller. Students will be able to use mental math strategies with reason, sense making, and appreciation.
16.2: Multiply by 1, 10, 100: Unknown Factor	4.NBT.1	7 x ? = 7 7 x ? = 70 7 x ? = 700	Students continue multiplying with 1s, 10s, and 100s, using what they have learned about the relationship between these powers of ten to supply missing factors.
16.3: Divide by 1, 10, 100: Missing Result	4.NBT.1	8 ÷ 1 = ? 80 ÷ 10 = ? 800 ÷ 100 = ?	Students progress with powers of 10 into division, where they have the opportunity to apply their knowledge of the relationship between multiplication and division. They can see division as an unknown factor problem. In the problem 90 ÷ 10 = ?, a student can ask herself, "what do I multiply by 10 to make 90," for example.
16.4: Divide by 1, 10, 100: Unknown Factor	4.NBT.1	8 ÷ ? = 1 80 ÷ ? = 10 800 ÷ ? = 100	Similarly to 16.3, 16.4 builds on students' understanding of how multiplication and division are connected. 16.4 also continues developing the powers of ten in the place value system as students decompose 90 into 9 groups of 10, for example, to solve 90 ÷ ? = 10.
16.5: Multiplying 1s and 10s	3.NBT.3	7 x 60 = ?	Students extend their work with 1s, 10s, and 100s to multiplying multiples of 10. As in 16.1, the "adding a zero" approach is turned into something solid: in the problem 6 x 40, students will see 6 groups of 4 tens, or 24 tens. They will further come to understand that 24 tens is another name of 240, and so create a deeper understanding of the place value system. The more students experience that numbers have different names, and that they can rename any 3-digit number into hundreds or tens or ones, for example, the more flexible they will be when working with large quantities and with decimals numbers.

Using the Extra Practice Worksheets

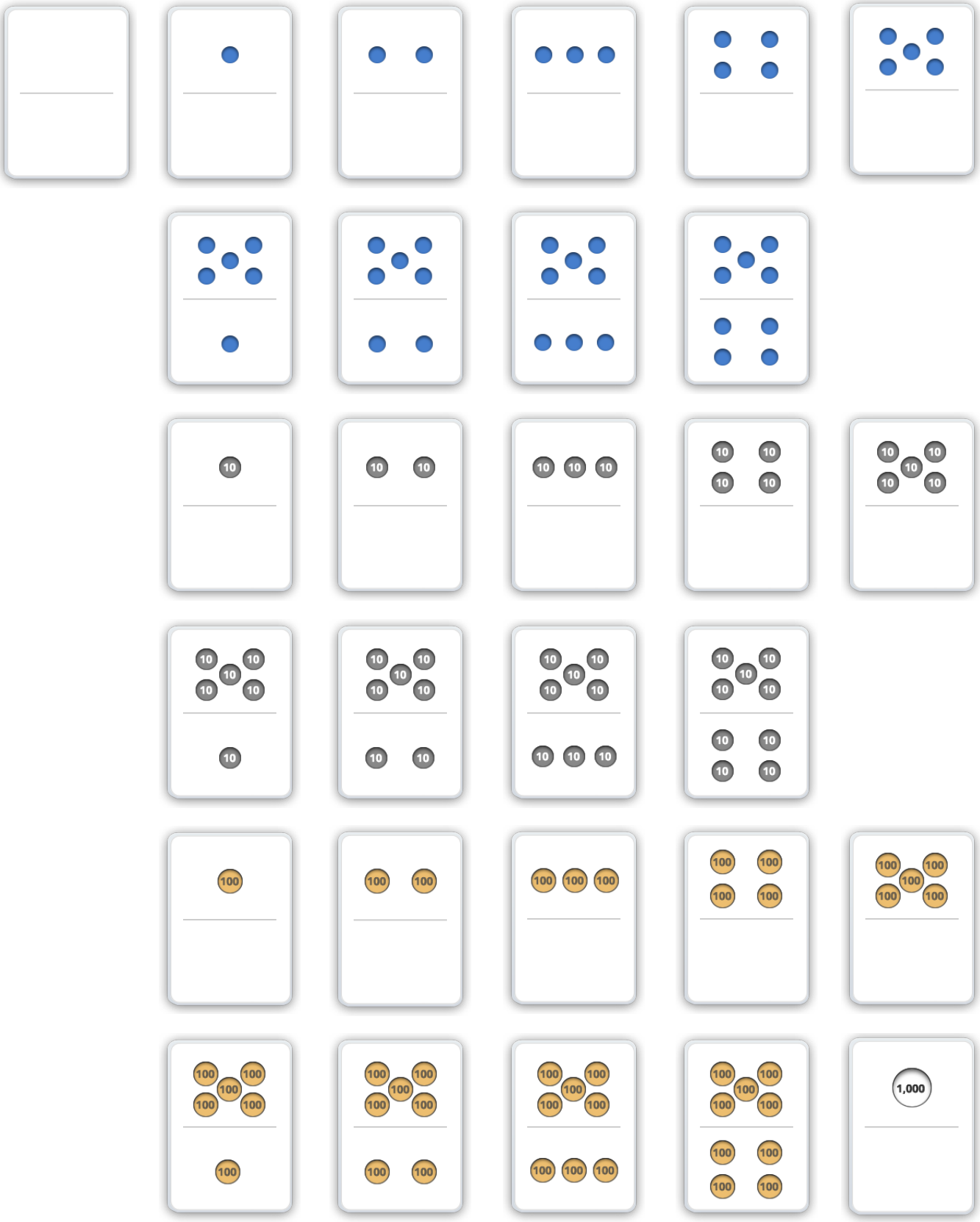
The Symphony Math Worksheets provide extended practice using the Multiples Ways of Knowing from the Symphony Math program. Students should work through all worksheets in the order given:

Worksheet	Purpose	Instructions
Manipulatives	Use a visual model to represent the concept.	Create bars, dot cards, or number lines for each item.
Bridge	Connect symbols to their visual representations.	Create objects, numbers, and symbols to complete each item.
Symbols	Understand the concept at the abstract level.	Create numbers and symbols to complete each item.
Apply	Extend understanding to real-life problem solving.	1) Read the story presented at the top of the page. 2) Create a number model of the full solution. 3) Write the number sentence that matches the model.

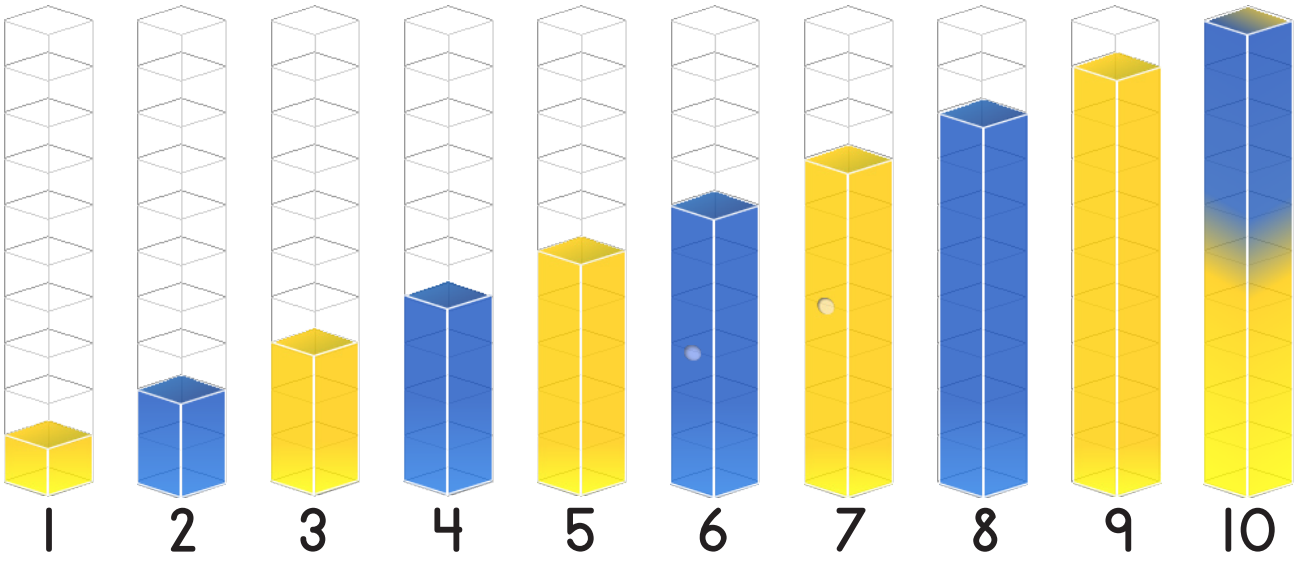
Group Learning

The Symphony Math Extra Practice materials are designed to promote a conversation about the Big Ideas in math. One-on-one or small group instruction with the materials is recommended for students who need more time to make connections between the mathematical concepts in the Stage and the application of those concepts in their math curriculum.

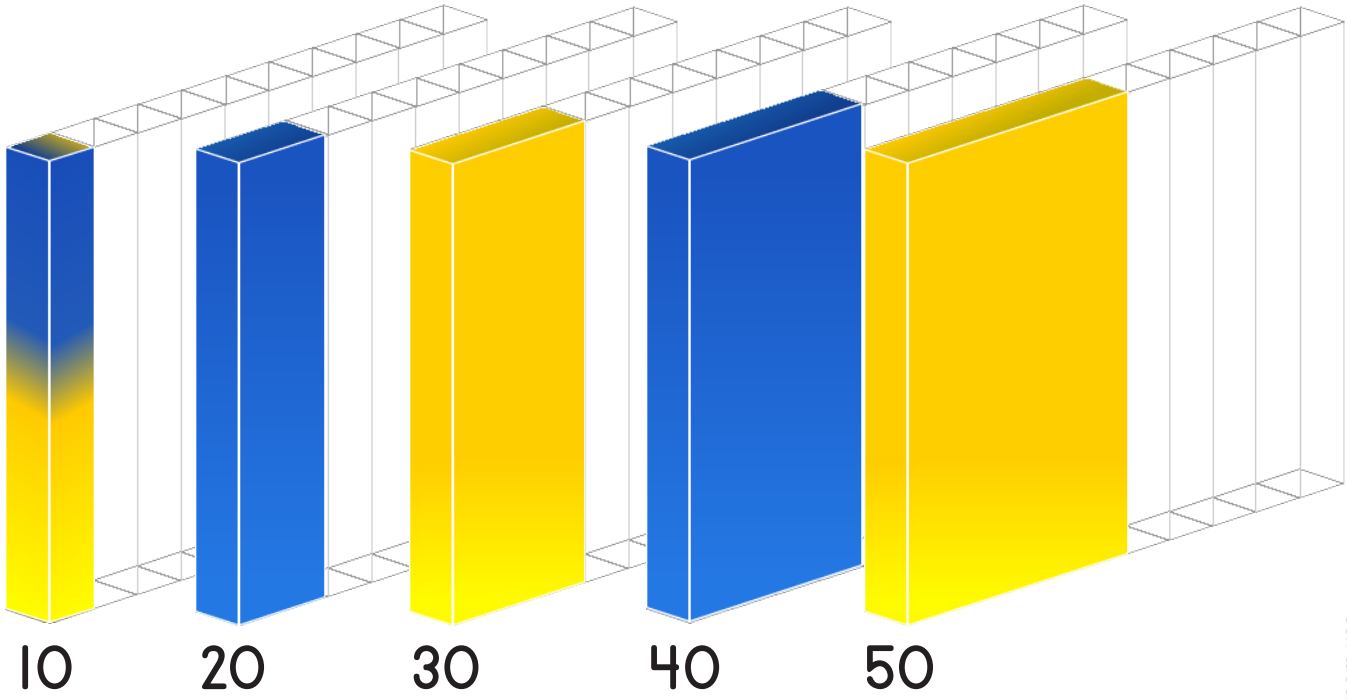
Dot Cards

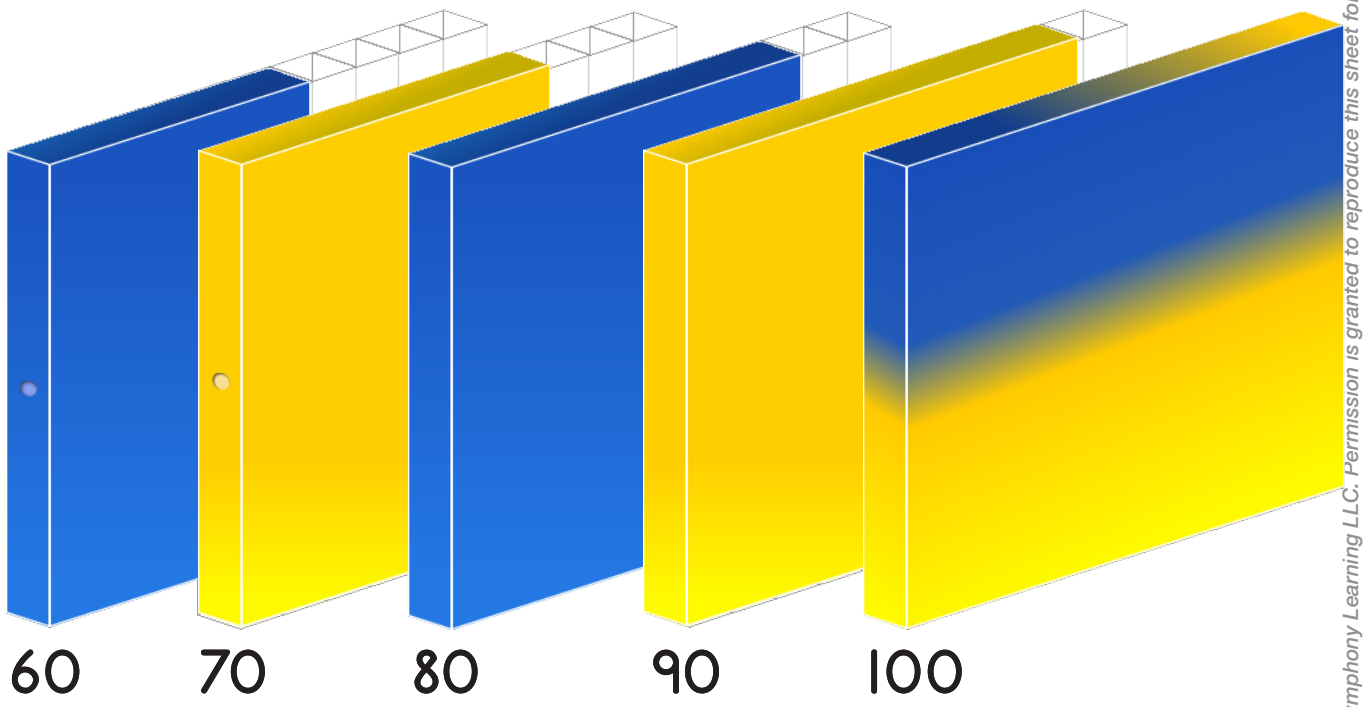


Symphony Bars: Ones & 10



Symphony Bars: Tens





Symphony Bars: Hundreds