# Images of Multiplication

It is important that students develop strong visual images of multiplication as they develop strategies for solving multiplication problems. If students can visualize clearly how the numbers they are multiplying are related, they can develop flexible, efficient, and accurate strategies for solving multiplication problems.

Students encounter many ways to represent multiplication in Grade 3—pictures of groups of things in a story context, skip counting on a 100 chart, and arrays. As students work with larger numbers in Grades 3 and 4, it will become cumbersome to draw pictures, skip count on a large number chart, or use arrays with all the individual units shown. Students need to learn to visualize these representations mentally to help them break up the numbers and keep track of which parts of the problem have been solved and which remain to be solved.

As you work with students, suggest these ways of visualizing multiplication, especially when a student cannot figure out where to start or when a student has solved part of a problem and is unsure how to continue.

## Images of Equal Groups in a Story Context

In this unit students learn to represent a multiplication expression such as $6 \times 4$ by creating a picture similar to this one:
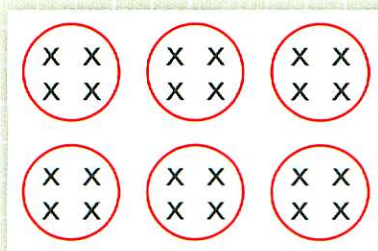


Ask students to generate simple stories that help them visualize a multiplication expression such as $6 \times 4$ as equal groups; for example, six bags with four marbles in each bag. Help students select contexts that are familiar to them. Then you can ask students to imagine that context as a way

of thinking through the problem. In Grade 3 students are moving away from thinking of multiplication as repeated addition. Instead of adding up 4s, students can be encouraged to use the image to start with a larger chunk of the problem. For example, you might ask, "Can you visualize how many marbles would be in two bags? In three bags? Now how many more bags of four are there?" A story context involving equal groups can help students use what they know to determine the product: "I know that there are 12 marbles in three of the bags, and there are three more bags, so I double that to get 24."

## Representing Multiplication as Skip Counting

In this unit, students mark off multiples of the numbers 2–6 and 10 on 100 charts.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |
| 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 |
| 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 |
| 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |

These charts provide an opportunity for students to notice patterns in each number's multiples and to consider the relationship between multiples of various numbers (for example, all of the multiples of 4 also show up on the multiples of 2 chart). Ask students questions that help them visualize the counting number sequence and think through how to calculate the next multiple as they are skip counting. For example, "You said that you've counted by 8s to 48. What is a way of quickly figuring out what 8 more will be?" If students use skip counting to solve a less familiar multiplication combination, encourage them to start with a known multiple and then continue to skip count. For example, to solve $3 \times 12$, students may know that $3 \times 10 = 30$ and then make two more jumps in their mind, to 33 and then 36.

## Representing Multiplication with Arrays

In this unit, students work with Array Cards and drawings in which all the individual units of the array are visible. These rectangular arrays are a representation of groups and amounts in a group in any multiplication problem.

$6 \times 8$
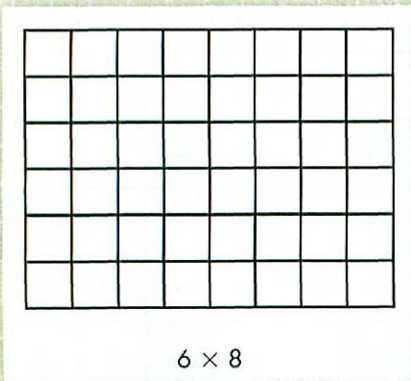
This $6 \times 8$ array can be seen as 6 groups of 8 items or 8 groups of 6 items. In either case, students can visualize the problem as a whole and the smaller parts that may help them to find the product; for example, if juice boxes come in sets of 6, a student might think of $8 \times 6$ as 8 sets of juice boxes. The student could visualize these in an array and use that image to break the problem into parts that are easier to solve.

$5 \times 8 = 40, 1 \times 8 = 8, 40 + 8 = 48$
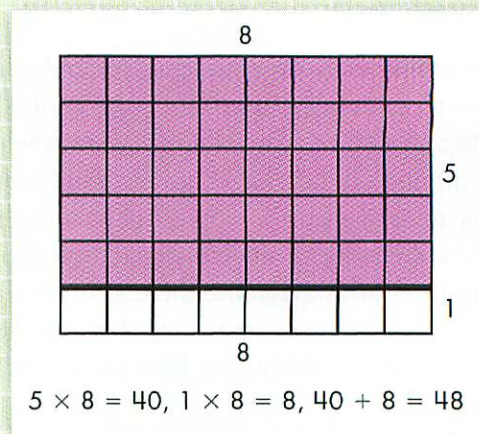
Visualizing how to break multiplication problems into parts becomes even more important as students solve multidigit problems in Grades 4 and 5. See the **Teacher Note:** Representing Multiplication with Arrays (page 157), for more information about how arrays are used in this unit and how the use of arrays can be extended to represent more difficult multiplication and division problems.