Multiplication Clusters and the Properties of Multiplication

Multiplication clusters are sets of problems that help students think about using what they know to solve harder problems. For example, what do you know that helps you solve 12×3? If you know that $3 \times 3 = 9$, you can double the product of 3×3 to get the product of 6×3 and then double again to get the product of 12×3. You might also start with 10×3. If you know that $10 \times 3 = 30$, then you can start with 30 and add two more 3s to get 36. As students work with multiplication clusters, they learn to think about all the number relationships they know that might help them solve a problem.

The multiplication clusters in this unit are designed to help students make sense of multiplying 2-digit numbers. Many of the clusters build an understanding of pulling apart multiplication problems into manageable subproblems, solving the smaller problems, and then putting the parts back together. This process is based on an important characteristic of multiplication called the *distributive property*. In this unit, students are not expected to learn the name of the property, but it is a core idea of the unit.

Here is an example:

$$6 \times 23 = (6 \times 10) + (6 \times 10) + (6 \times 3)$$

In this example, 23 is broken apart into $10 + 10 + 3$, and *each part* is multiplied by 6 in order to construct the solution to 6×23. The number does not have to be split into 10s and 1s.

Here is another example:

$$8 \times 12 = (4 \times 12) + (4 \times 12)$$

or

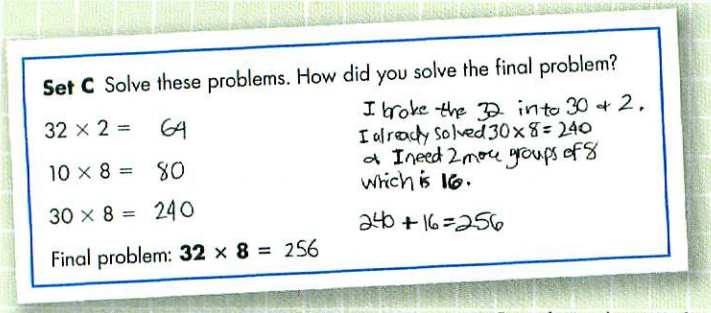
$$8 \times 12 = (8 \times 6) + (8 \times 6)$$

In each case, one of the factors is split up into parts, and each part is multiplied by the other factor in order to maintain equivalence to the original expression.

Other clusters build on ideas about halving and doubling that are developed in this unit. See **Teacher Note:** Reasoning and Proof in Mathematics?, page 168, for more about students' understanding of creating an equivalent multiplication problem by halving one factor and doubling the other.

As students solve the first few problems in each cluster, they use familiar multiplication combinations. Students say "I just knew it" for some of the problems because these single-digit multiplication combinations are part of their known repertoire. They also make use of multiplying by 10 and by multiples of 10, another essential tool in solving harder multiplication problems. See **Teacher Note:** Multiplying by Multiples of 10, page 167, for more about the ways students develop understanding of this idea.

Here are examples of student work on two multiplication clusters from the *Student Activity Book* pages 57–58.



Set C Solve these problems. How did you solve the final problem?

$32 \times 2 = 64$

$10 \times 8 = 80$

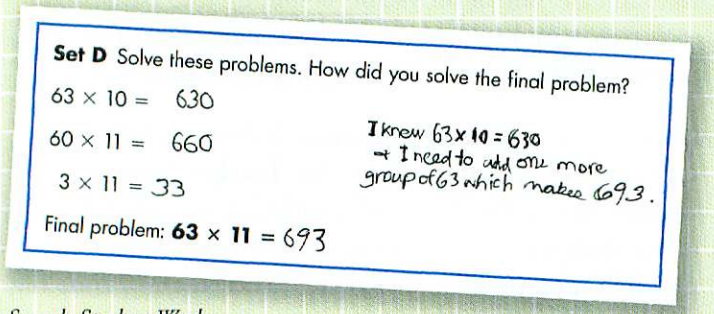
$30 \times 8 = 240$

Final problem: **32 × 8** = 256

I broke the 32 into 30 + 2. I already solved 30 × 8 = 240 & I need 2 more groups of 8 which is 16.

240 + 16 = 256

Sample Student Work



Set D Solve these problems. How did you solve the final problem?

$63 \times 10 = 630$

$60 \times 11 = 660$

$3 \times 11 = 33$

Final problem: **63 × 11** = 693

I knew 63 x 10 = 630 + I need to add one more group of 63 which makes 693.

Sample Student Work

Multiplication clusters help students learn how to look at a problem and build a strategy to solve it that is based on the number relationships they know. At first, students work on clusters of problems that are provided to help them solve a 2-digit problem, such as 4×43 or 58×6. They solve all the problems in the cluster and then decide which one(s) will most help them think about the solution to the final problem. Students may add to the cluster any other problems that help them solve the final one. Later in the unit, students create their own cluster of problems to help them solve a multiplication problem. In later units of *Investigations,* in both Grades 4 and 5, students spend more time creating their own clusters of problems as well as using a variety of given problems to solve multiplication and division problems.