



Multiplying Multi-digit Numbers

Key Content from This Unit:

Students will multiply whole numbers up to four digits by one digit and two digits by two digits. Students develop flexibility in breaking numbers apart in order to have a better understanding of the importance of place value and the distributive property in multi-digit multiplication. They investigate different patterns to find rules, identify features in the patterns, and justify the reason for those features and apply this knowledge to solve real-world math problems. Students will use multi-digit multiplication to convert measurement units and solve word problems involving distance, time and money.

Vocabulary to Know:

- Associative Property:** $3 \times (4 \times 8) = (3 \times 4) \times 8$
- Distributive Property:** $6 \times (3 + 5) = (6 \times 3) + (6 \times 5)$
- Partial Product:** $24 \times 6 = (20 \times 6) + (4 \times 6)$
- Area:** the amount of two-dimensional space in a bounded region
- Perimeter:** length of a continuous line around a geometric figure
- Area model:** a model for multiplication problems, in which the length and width of a rectangle represent the factors
- Distribute:** decompose an unknown product in terms of two known products to solve
- Rectangular array:** an arrangement of a set of objects into rows and columns

Students are asked to describe features of an arithmetic number pattern or shape pattern by identifying the rule and features that are not explicit in the rule. A t-chart is a tool to help students see number patterns.

Example:

There are 4 beans in the jar. Each day 3 beans are added. How many beans are in the jar for each of the first 5 days?

Day	Operation	Beans
0	$3 \times 0 + 4$	4
1	$3 \times 1 + 4$	7
2	$3 \times 2 + 4$	10
3	$3 \times 3 + 4$	13
4	$3 \times 4 + 4$	16
5	$3 \times 5 + 4$	19

Students use a variety of strategies when multiplying numbers.

Example:

There are 25 dozen cookies in the bakery. What is the total number of cookies at the bakery?

Student 1
 25×12
 I broke 12 up into 10 and 2
 $25 \times 10 = 250$
 $25 \times 2 = 50$
 $250 + 50 = 300$

Student 2
 25×12
 I broke 25 up into 5 groups of 5
 $5 \times 12 = 60$
 I have 5 groups of 5 in 25
 $60 \times 5 = 300$

Student 3
 25×12
 I doubled 25 and cut 12 in half to get 50×6
 $50 \times 6 = 300$

What came before this:

By the end of third grade students knew from memory all products of two one-digit numbers. Students identified patterns in multiplication and explained those using properties of operations. They developed an understanding of area and perimeter using visual models, such as counting unit squares.

What came after this:

In the next unit, students will apply their understanding of multiplication strategies to division. The use of the standard algorithm for multiplication is an expectation in fifth grade.

Common Core Focus:

- Multiply whole numbers up to four digits by one digit and two digits by two digits.
- Given a rule, generate a number sequence.
- Given a number sequence, generate a rule.
- Identify features of a number pattern that are not explicit to the given rule.
- Apply the area and perimeter formulas for rectangles in real world and math problems.
- Express measurements in a larger unit in terms of a smaller unit.
- Solve problems involving intervals of time distance and money

4.NBT. 5, 4.OA.5, 4.MD.1, 4.MD.2, 4.MD.3

Spotlight on the Math Practices

Use Appropriate Tools Strategically

Mathematically proficient students consider the available tools when solving a mathematical problem and decide when certain tools might be helpful.

In this unit, students *use appropriate tools strategically* when they:

- Consider available tools, including estimation, when solving mathematical problems.
- Use graph paper to represent an array.
- Use other measurement tools to understand the relative size of units within a system and express measurements given in larger units in terms of smaller units.

How Can You Help?

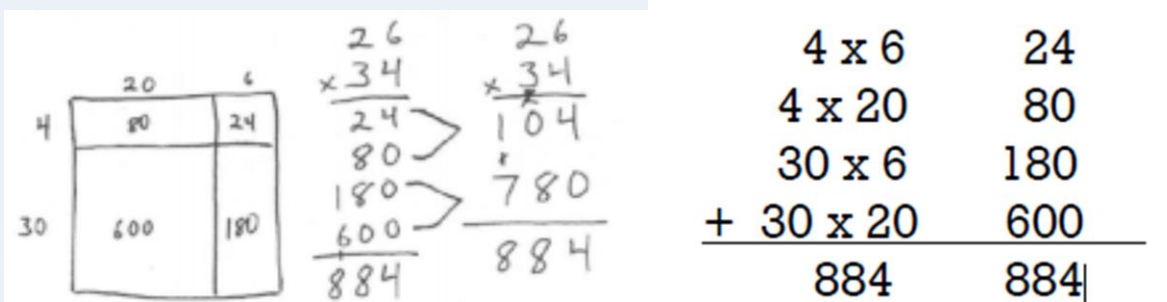
- Continue to review multiplication and division facts with your student
- Help your student notice related math facts, e.g. $6 \times 8 = (6 \times 4) + (6 \times 4) = 48$ or when solving $35 \div 7 = ?$, think $7 \times ? = 35$
- Become familiar with the area model, a different method of multiplying than you may have learned
- Discuss mathematical patterns, such as 5×9 , 5×90 , 50×90 , 50×900 , etc.

KEY MATHEMATICAL MODELS of the COMMON CORE

Area Model

Students began in earlier grades to build arrays, showing multiplication and division as a series of rows and columns. In 4th grade, they learn to show these types of problems as an area model. As students move through the grades, the area model will be a powerful tool that can take them all the way into algebra and beyond. One of the goals is to first give students concrete experiences with mathematical concepts, and then build slowly toward more abstract representations of those concepts. The area model is a tool that helps students to make that important leap.

The area model encourages students to think about each part of a number as they multiply. Thus, 34×26 becomes a series of partial products:



Some Resources to Help at Home

- <https://learnzillion.com/lessons/1879-use-an-area-model-to-multiply-two-digit-numbers-by-two-digit-numbers> - In this video you will learn how to multiply a 2 digit number by another 2 digit number by applying your understanding of the area model for multiplication.
- www.multiplication.com has engaging games for students to practice their computation
- Read about 'Cluster Problems' to help make more difficult multiplication equations easier to solve. <https://suite.io/mark-giffen/3r4p2em>
- Thinking Blocks at Math Playground provides great practice modeling and solving word problems using tape diagrams <http://www.mathplayground.com/thinkingblocks.html>
- http://www.mathplayground.com/area_perimeter.html - Students find the area and perimeter of rectangles