

Lesson 6: The Standard Multiplication Algorithm

Getting Started

? Big Ideas

- What are some strategies we can use to multiply large numbers?



Facts and Definitions

- **algorithm:** a set of steps that can be used to solve a particular type of problem
- The standard algorithm for multiplication is a common approach to solving multiplication problems where factors are stacked vertically and a series of steps are followed to find the product
- When using the standard algorithm for multiplication, it is important to line up the places of the two factors correctly (for example, the ones place of the first factor directly on top of the ones place of the second factor)

⦿ Skills

- Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations
- Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models

✂ Materials

- | | |
|------------------------|--------------------------------------|
| ✓ calculator | ✓ fine point dry-erase markers (kit) |
| ✓ glue or glue stick | ✓ Interactive Notebook (kit) |
| ✓ laminated grid (kit) | ✓ scissors |
| ✓ whiteboard (kit) | |

Introduction

Explain to your child that now that she's practiced multiplying multi-digit numbers using arrays and the area model, it's time to move on to a more challenging approach. Say, "This approach is called the standard algorithm for multiplication. An **algorithm** is a set of steps that we can use to solve a particular type of problem. This approach is the one that most people use when multiplying big numbers."

Write $12 \times 4 = 48$ vertically on the whiteboard, and ask, "What do you see happening here?" Lead your child to see that the top number (12) is being multiplied by the bottom number (4) one digit at a time. Remind your child that, as with multi-digit addition and subtraction problems, it's important to line up the places correctly. That means that bottom number must line up right under the ones place of the top number.

As needed, say, "First, we multiply 2 times 4 and write 8 in the ones place and below the 2 and 4. Next, we multiply 1 times 4 and write 4 in the tens place and below the 1."

Now, write $13 \times 5 = 65$ vertically on the whiteboard, and explain that we always begin multiplying on the right and move to the left. Ask, "What is 3 times 5?" (15) Show your child that the 5 is written in the ones place and the 1 in 15 is then carried over the tens place (above the 1 in 13) and added to the product of 1 and 5 to make 6.

Next, provide time for your child to watch the video at the following web link.

Multi-Digit Multiplication Part 1

www.movingbeyondthepage.com/link/7819/

Activities

Activity 1: The Standard Algorithm Steps

Your child will complete the "Standard Algorithm Steps" sheets by cutting out the boxes on the first sheet and then gluing them in the correct order on the second sheet. When your child completes the second sheet, she can store it in her Interactive Notebook.

Here are the steps in order for multiplying 126×5 using the standard algorithm. The product is 630.

1. Write the problem in stacked form with the bigger number on top
2. Multiply 6×5
3. Write 0 in the ones place
4. Carry the 3 and write it above the tens place
5. Multiply 2×5
6. Add the carried 3 to the product of 2×5
7. Write 3 in the tens place
8. Carry the 1 and write it above the hundreds place
9. Multiply 1×5
10. Add the carried 1 to the product of 1×5
11. Write 6 in the hundreds place

Activity 2: Practicing the Standard Algorithm

As needed, allow your child to re-watch the video at the following web link, and tell her to pay close attention to the steps in the standard algorithm.

Multi-Digit Multiplication Part 1

www.movingbeyondthepage.com/link/7820/

Write 21×8 on the whiteboard, and ask, "Do you think the product is closer to 16 or 160? Why?" Allow your child to share her thinking. Next, tell her to rewrite the problem in stacked form and begin finding the product. She should first multiply 1 and 8 and write 8 in the ones place. She should then multiply 2 and 8 and find a product of 16. Show her that she should write 6 in the tens place and 1 in the hundreds place to show a product of 168. Say, "You don't need to carry the 1 because there's no place to carry it to. The number 21 has only 2 digits." If needed, repeat this process with 35×9 (315) and 806×3 (2418). Say, "Once you understand the standard algorithm, you can multiply numbers with lots of digits."

Your child will complete the "Using the Standard Algorithm for Multiplication" sheet by finding the missing products. Make sure that she has access to the laminated grid, dry-erase markers, and a calculator.

"Using the Standard Algorithm for Multiplication" Answer Key

1.	$\begin{array}{r} 54 \\ x 4 \\ \hline 216 \end{array}$	2.	$\begin{array}{r} 29 \\ x 3 \\ \hline 87 \end{array}$	3.	$\begin{array}{r} 554 \\ x 2 \\ \hline 1108 \end{array}$	4.	$\begin{array}{r} 4633 \\ x 2 \\ \hline 9266 \end{array}$
5.	$\begin{array}{r} 7 \times 68 \\ x 7 \\ \hline 476 \end{array}$	6.	$\begin{array}{r} 253 \times 6 \\ x 6 \\ \hline 1518 \end{array}$	7.	$\begin{array}{r} 4321 \times 5 \\ x 5 \\ \hline 21605 \end{array}$	8.	$\begin{array}{r} 3 \times 8183 \\ x 3 \\ \hline 24549 \end{array}$

Activity 3: Multiplying More Big Numbers

Write the following multiplication problems on the whiteboard and then give your child the laminated grid and dry-erase markers and ask her to use the standard algorithm for multiplication to solve them:

- 89×4
- 321×6
- 5×412

As needed, remind her that, in the last problem, she should put the larger number on top to make the problem easier to solve. Provide time for your child to watch the video at the following web link. This video is an extension of the one that she watched previously and introduces multiplying when both numbers have more than one digit. Tell her to watch the steps closely and to look for something special that she needs to do when she multiplies multi-digit numbers. When she finishes watching the video, explain that she'll be working on multiplying two-digit numbers.

Multi-Digit Multiplication Part 2

www.movingbeyondthepage.com/link/7821/

If your child would benefit from seeing the steps again, allow her to watch the slide presentation at the following web link. She can move through the slides at her own pace by clicking on the arrows.

2-Digit Multiplication Easily Explained

www.movingbeyondthepage.com/link/7822/

Now, ask your child to look at the example at the top of the "Area Model for Multiplication" sheet in her Interactive Notebook. Give her the first "Multiplying Two-Digit Numbers" sheet, and show her the example explained on that page. Ask her how that method and the area model method are similar. (She may notice that in both, numbers are multiplied by other numbers and the products are added together.)

Put the problem 26×34 on the whiteboard and ask your child to solve it. As she works, ask her why she needs to put 0 as a place holder when she multiplies by the 3 in the tens place (because the value of the digit 3 is 30 or because multiplying by the tens place makes the answer ten times bigger). She should find the answer to be 884.

Next, she should complete the problems on the second page. Be sure she has access to the laminated grid and dry-erase markers. She can use the first "Multiplying Two-Digit Numbers" sheet as needed. When she is done, she should put the first sheet in her Interactive Notebook for future reference.

- 46×16 (736)
- 28×25 (700)
- 88×77 (6776)
- 36×12 (432)
- 45×15 (675)
- 99×13 (1287)
- 58×15 (870)
- 22×76 (1672)
- 33×63 (2079)
- 85×12 (1020)
- 62×29 (1798)
- 57×34 (1938)
- Charlie bought 15 boxes of donuts. Each box contained 24 donuts. How many donuts did he buy in all? (360)

Activity 4: Multiplying Two-Digit Numbers

Provide time for your child to watch the music video at the following web link. You should stop the video at the 1:40 mark. This video reviews the steps required to multiply two-digit numbers. (The later part of the video introduces checking multiplication using long division — which will be addressed in an upcoming unit — and multiplying decimals.)

Long Multiplication Song
www.movingbeyondthepage.com/link/9433/
Stop the video around the 1:40 mark.

Now, give your child the "Multiplication Practice" page and ask her to complete the problems.

1. $62 \times 9 = 558$
2. $539 \times 7 = 3773$
3. $84 \times 26 = 2184$
4. $261 \times 41 = 10,701$
5. At the fair, each ride cost 8 tickets. Jake went on a total of 24 rides. How many tickets did he use? (192 tickets)
6. Each person attending the comic book convention got 4 free comic books in their gift bag. There were 672 people at the convention. How many comic books were given away in all? (2688 comic books)
7. Janet brought 30 packages of donuts for the community center's fall festival. Each package contained 12 donuts. How many donuts were there in all? (360 donuts)
8. Each day, Arnold does 15 pull-ups. How many total pull-ups will he do in 25 days? (375 pull-ups)

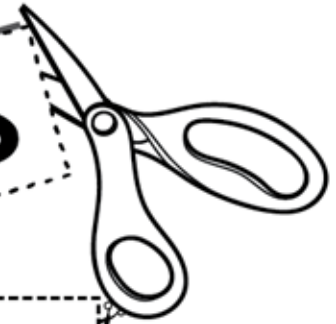
Wrapping Up

Write the following multiplication problems horizontally on the whiteboard, and ask your child to find the products. Ask her to explain how she's doing so as she works. She should be able to explain how she can use what she knows about place value and the steps in the standard algorithm.

- 36×2000 (72000)
- 452×7 (3164)
- 83×17 (1411)

Standard Algorithm

S T E P S



Write 3 in the tens place

Multiply 6×5

Write 0 in the ones place

Multiply 1×5

Add the carried 1 to the product of 1×5

Multiply 2×5

Write 6 in the hundreds place

Carry the 3 and write it above the
tens place

Add the carried 3 to the product of 2×5

Carry the 1 and write it above the hundreds place

Write the problem in stacked form with
the bigger number on top

Here's the problem:

$$126 \times 5$$

Glue the steps in the correct order to find the product.

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Step 6:

Step 7:

Step 8:

Step 9:

Step 10:

Step 11:

What's the product? $126 \times 5 =$ _____

Using the Standard Algorithm for Multiplication

Instructions: Find the missing products using the standard algorithm.

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Instructions: Rewrite the problems in stacked form, and find the products.

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★ Now, use a calculator to check your answers. ★
★ Rework any problems that you missed. ★



Multiplying Two-Digit Numbers

Follow these 4 easy steps to solve a 2-digit multiplication problem.

$$\begin{array}{r} 37 \\ \times 56 \\ \hline \end{array}$$

1) Multiply your top number by the number in the **ones** place of your bottom number.

$$\begin{array}{r} 4 \\ 37 \\ \times 56 \\ \hline 2 \end{array} \Rightarrow \begin{array}{r} 4 \\ 37 \\ \times 56 \\ \hline 222 \end{array}$$

* Don't forget to add any carried numbers

2) Before multiplying by the number in the tens place, we need to insert the 0 placeholder to show we are moving up in place value. (The zero shows that we are technically multiplying 37 by 50 in this step.)

$$\begin{array}{r} 4 \\ 37 \\ \times 56 \\ \hline 222 \\ 0 \end{array}$$

3) Multiply the top number by the number in the **tens** place of the bottom number.

$$\begin{array}{r} 3 \\ 37 \\ \times 56 \\ \hline 222 \\ 50 \end{array} \Rightarrow \begin{array}{r} 3 \\ 37 \\ \times 56 \\ \hline 222 \\ 1850 \end{array}$$

4) Finally, **add** the two lines to get the final product.

$$\begin{array}{r} 3 \\ 37 \\ \times 56 \\ \hline 222 \\ +1850 \\ \hline 2072 \end{array}$$

Instructions: Use the laminated grid paper and a dry-erase marker to work out each of the following problems.

$$\begin{array}{r} 46 \\ \times 16 \\ \hline \end{array}$$

$$28 \times 25 =$$

$$\begin{array}{r} 88 \\ \times 77 \\ \hline \end{array}$$

$$\begin{array}{r} 36 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 45 \\ \times 15 \\ \hline \end{array}$$

$$99 \times 13 =$$

$$\begin{array}{r} 58 \\ \times 15 \\ \hline \end{array}$$

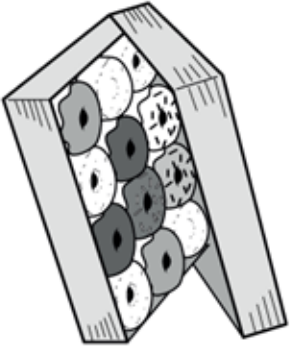
$$\begin{array}{r} 22 \\ \times 76 \\ \hline \end{array}$$

$$33 \times 63 =$$

$$\begin{array}{r} 85 \\ \times 12 \\ \hline \end{array}$$

$$\begin{array}{r} 62 \\ \times 29 \\ \hline \end{array}$$

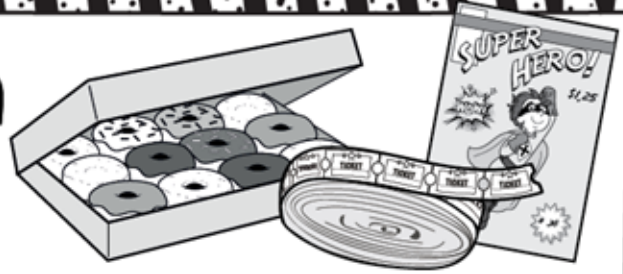
$$\begin{array}{r} 57 \\ \times 34 \\ \hline \end{array}$$



Charlie bought 15 boxes of donuts. Each box contained 24 donuts. How many donuts did he buy in all?

*** Now, check your answers using a calculator, and rework any problems that you missed.**

Multiplication Practice



1. 62×9

2. 539×7

3. 84×26

4. 261×41

5. At the fair, each ride cost 8 tickets. Jake went on a total of 24 rides. How many tickets did he use?

6. Each person attending the comic book convention got 4 free comic books in their gift bag. There were 672 people at the convention. How many comic books were given away in all?

7. Janet brought 30 packages of donuts for the community center's fall festival. Each package contained 12 donuts. How many donuts were there in all?

8. Each day, Arnold does 15 pull-ups. How many total pull-ups will he do in 25 days?
