**PBS Lesson Series**

**Math: Grade 5, Lesson 13, Multiply 3-digit by 2-digit Numbers**

**Lesson Focus:** Multiply 3-digit by 2-digit Numbers
**Practice Focus:** Students will focus on practicing using the standard algorithm or place value in order to multiply 3-digit by 2-digit numbers.
**Objective:** Students will connect their understanding of partial products to the standard algorithm in order to multiply 3-digit by 2-digit numbers.
**Key Vocabulary:** partial products, standard algorithm
**TN Standards:** 5.NBT.B.5
**Teacher Materials:**

- Board/marker
- Student Practice Packet

**Student Materials:**

- Paper and a pencil, and a surface to write on

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| Opening (1 min)<br>**Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 5th graders out there, though all children are welcome to tune in. This lesson is the thirteenth in our series.**<br><br>**My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!**<br><br>**If you didn't see our previous lesson, you can find it on the TN Department of Education's website at www.tn.gov/education. You can still tune in to today's lesson if you haven't seen any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.**<br><br>**Today we will be learning about using the standard algorithm and place value in order to multiply 3-digit by 2-digit numbers in mathematics! Before we get started, to participate fully in our lesson today, you will need:**<br>• **Paper and pencil**<br>• **The student packet for Math, Grade 5 Lesson 13 which can be found at www.tn.gov/education.** | Students get materials ready for the lesson. |

| **Ok, let's begin!** | |
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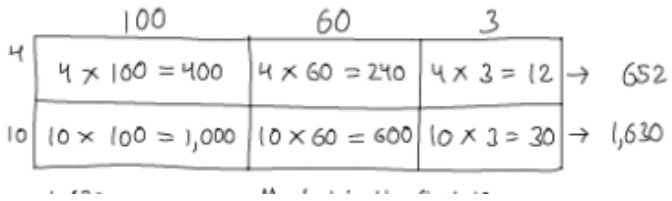
| Intro (5 min.)<br><br>**We are continuing to think about multiplying whole numbers. In the previous lesson, we learned about multiplying a 2-digit number by 2-digit numbers. In today's lesson, we will build on that understanding to learn about using place value and the standard algorithm to multiply 3-digit numbers by 2-digit numbers.**<br><br>**Let's start by looking at this problem:** [Show and read the following problem.]<br><br>**A local library collected 14 boxes of books for donation. Each box contained 163 books. How many books did they collect in all?**<br><br>**Let's think through this problem together.**<br>**How many books were in each box?** [Pause.]<br><br>**Yes, there were 163 books in each box**<br><br>**And how many boxes?** [Pause.]<br><br>**Right, there were 14 boxes. So, how can we use multiplication do determine the total number of books?** [Pause.]<br>**Yes! We can multiply 163 times 14.** [ Write 163]<br>X14<br>**We can use what we know about place value to break these factors apart and multiply. We can visualize that with an area model.**<br>**Let's draw a model of that together! Draw the model on your paper along with me.** [As you think aloud, draw the following area model.]<br><br>  <br><br><br>**We can break 163 into its place value parts, 100, 60, and 3)** [Draw the top portion of the above area model.] | |

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| **Then, we can break the factor 14 into its place value parts, 10 and 4.** [Draw the side portion of the above area model.]<br><br>**And now, we can find all of the partial products.** [Write each multiplication equation inside the corresponding squares.]<br><br>**4 times ten equals 400.**<br>**10 times 10 equals 1000.**<br>**4 times 60 equals 240.**<br>**10 times 60 equals 600.**<br>**4 times 3 equals 12.**<br>**And 10 times 3 equals 30.**<br><br>**I hope you're noticing how this is connected to multiplying by powers of ten! Do you see the multiples of ten?** [Pause.]<br><br>**Good! I see them here too!** [Point to the multiples of ten in the area model.]<br><br>**Now we can add all the partial products to get the total.** [As you say the following, write the sums to the right of the model as indicated above.]<br><br>**400 plus 240 plus 12 equals 652.**<br>**1000 plus 600 plus 30 equals 1630.**<br>**And 1630 plus 652 equals 2282.**<br><br>**The library collected 2282 books; that's a lot of books!**<br><br>**As we work through the rest of the problems today, keep thinking about how the problems can be represented using an area model like the one we just drew.** | |
| <u>Teacher Model</u> (10 min.)<br><br>Objective 1: Teacher modeling of how to multiply a 3-digit by a 2-digit number.<br><br>**Let's use partial products to solve this next multiplication problem.** [Display and read the problem aloud.]<br><br>**Last month a bakery sold 389 boxes of bagels. Each box contained 12 bagels. How many bagels did the bakery sell last month?** | Objective #1:<br>Students will be reviewing using partial products to multiply 3-digit numbers by 2-digit numbers. |

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| **We could solve this problem by showing all the partial products or by using the standard multiplication algorithm. Let's use both so we can see how they are connected! First, we will solve it by adding up all the partial products. Do this along with me. Ready?** [Pause.]<br><br>**In our problem, we are multiplying 389 by 12; that's 389 equal groups of 12 bagels.** [Write the expression.] 389<br>X 12<br><br>**First, we multiply the ones in the 12 by the value of each digit in 389.** [As you think aloud, you are modeling the following.]<br>389<br>× 12<br>18 2×9<br>160 2×80<br>600 2×300<br>**2 times 9 is 18.**<br>**2 times 8 tens is 160**<br>**2 times 3 hundreds is 600.**<br><br>**Now, we multiply the tens digit in the 12 by the value of each digit in 389.** [As you think aloud, you are modeling the following.]<br>389<br>× 12<br>18 2×9<br>160 2×80<br>600 2×300<br>90 10×9<br>800 10×80<br>+ 3,000 10×300<br>4,668<br><br>**10 times 9 ones is 90.**<br>**10 times 8 tens is 800.**<br>**10 times 3 hundreds is 3000.**<br><br>**We just found 6 partial products! How many partial products did we find in the area model?** [Pause and refer back to the area model so that students can count the partial products.]<br>**Yes! The area model gave us 6 partial products as well** [Point to the 6 partial products in the area model and count them out loud.] | |

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| **Now that we have found the partial products, we can add them up to find the total product. 18 plus 160 plus 600 plus 90 plus 800 plus 3000 equals 4668.**<br>**Wow, the bakery sold 4668 bagels last month!**<br><br>Objective 2: Teacher will explicitly instruct how to use the standard algorithm to multiply 3-digit numbers by 2-digit numbers.<br>**Now, let's solve that same problem using the standard algorithm for multiplication. I wonder how many partial products this strategy will give us. Can you guess how many?** [Quick pause.]<br>**Let's see if your guess is correct.**<br>**Solve this along with me, and look for connections to the partial product strategy we just used. Ready?** [Pause.]<br><br>**Great!**<br>**To use the standard algorithm, we still start by multiplying the value of each digit in 389 by the ones digit in 12. But we need to make sure we regroup if needed.** [As you think aloud, you are modeling the following.]<br><br>**1 1** **2x 9 ones = 18 ones; or 1 ten and 8 ones**<br>**389** **2x 8 tens = 16 tens + 1 ten = 17 tens; or 1 hundred**<br>**X 12** **and 7 tens**<br>**778** **2x 3 hundreds = 6 hundreds + 1 hundred = 7 hundreds**<br><br>**Now, we will multiply the value of each digit in 389 by the tens digit in 12, making sure that we regroup when we need to.** [As you think aloud, you are modeling the following.]<br>389<br>× 12<br>778<br>+ 3890<br><br>**10x 9 ones= 90 ones**<br>**10x8 tens=80 tens; or 8 hundreds**<br>**10x3 hundreds= 30 hundreds; or 3 thousands**<br><br>**Now, we add to get the final product. 778 plus 3890 equals 4668.** | Objective 2:<br>Students will be building off their knowledge of multiplication to find the product of a 3-digit by 2-digit numbers. |

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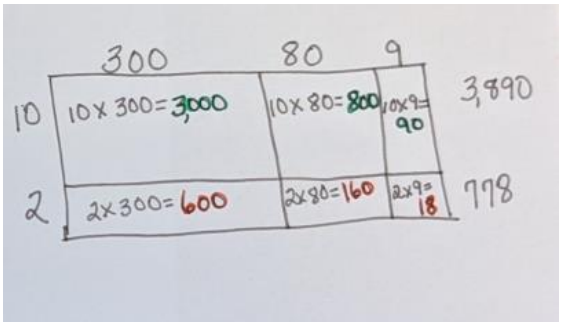
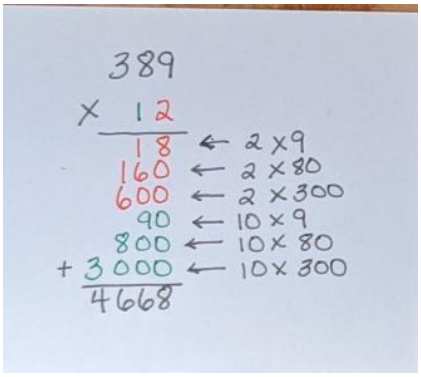
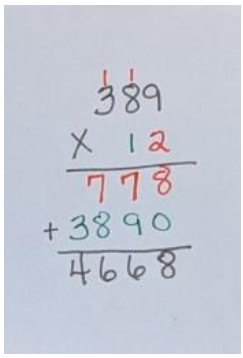
| 389<br>× 12<br>778<br>+ 3890<br>4,668<br><br>**Do you remember how many partial products you guessed the standard algorithm might give us?** [Quick pause.]<br>**If you guessed only 2, then you guessed correctly; congratulations! What are the 2 partial products?** [Pause.]<br>**Yes, the 2 partial products are 778 and 3890.**<br>**Why did this method only give us 2 partial products, but the previous methods gave us 6?** [Pause for several seconds to let students contemplate this question.]<br><br>Tying the learning together:<br>**Let's compare the strategies we've used and look for connections between them.** [Display the models similarly as below.]<br><br>  <br><br><br>  <br><br>  <br><br>**We can easily see all 6 partial products in the first 2 methods** [Gesture to them.]<br>**Do you see the same partial products in the algorithm?** [Pause for several seconds to let students look.]<br><br>**Oh yes! I see the 778 and 3890 here in the area model!** [Point to the 778 and 3890 on the right of the area model.] | Tying the learning together:<br>Students make connections to the standard algorithm for multiplication. |

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| **What partial products make up the product of 778** [Indicate the 788 in the algorithm.]**?** [pause]<br>**Yes! The 2 x 9 = 18; the 2 x 80 = 160; and the 2 x 300 = 600 make up the product of 788. How do you know?** [pause]<br><br>**Interesting! I see, 18+160+600 equal 778!**<br><br>**What partial products make up the product of 3890** [Indicate the 3890 in the algorithm.]**?** [pause]<br><br>**Exactly! 10 x 9 = 90; 10 x 80 = 800; and 10 x 300 = 3000**<br>**90+800+3000=3890.**<br>**So, all 6 partial products are in the standard algorithm!**<br><br>**Now, let's try some more multiplication problems together.** | |
| Guided Practice (10 min.)<br>Objective 3: Guided practice in applying the standard algorithm for multiplication of 3-digit numbers by a 2-digit number.<br><br>[I do.]<br>**Follow along with me on your paper as I think through this next problem.**<br><br>[As you think through the problem, write the following.]<br>**1 2**<br>**324**<br>**X 25**<br>**1620**<br><br>**We start with multiplying the value of each digit in 324 by the ones digit in 25. But we also need to make sure we regroup if needed.**<br>**5 times 4 ones equals 20 ones; or 2 tens and 0 ones**<br>**5 times 2 tens equals 100, plus 2 more tens equals 120; or 1 hundred and 2 tens.**<br>**5 times 3 hundreds equals 15 hundreds, plus one more hundred equals 16 hundreds.**<br><br>**Now, we can multiply the value of each digit in 324 by the tens digit in 25 regrouping if we need to.**<br>[As you think through the problem, write the following.] | Objective 3: Students will be applying the standard algorithm strategy to multiply 3-digit numbers by 2-digit numbers.<br><br>[I do.]<br>Students will listen to the teacher do a think aloud working a contextual problem modeling the thought process for a problem from the start of the problem through finding the solution. |

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| **1 2**<br>**324**<br>**X 25**<br>**1620**<br>**+ 6480**<br>**8100**<br>**20 times 4 ones equals 80 ones.**<br>**20 times 2 tens equals 40 tens; or 4 hundreds.**<br>**20 times 3 hundreds equals 60 hundreds; or 6 thousand.**<br><br>**Now, we can add to get the final product. 1620 + 6480 = 8100.**<br><br>[We do.]<br><br>**Let's solve this next problem together. Follow along with me on your paper.** [Display and read the problem aloud.]<br><br>**624**<br>**X 31**<br>**Let's multiply 624 times 31.**<br>**What are we going to multiply each of the values in 624 by?** [Pause.]<br><br>**Yes, we'll multiply by the digit in the ones place in the number 31. Let's do that now.** [As you think through the problem, write the following.]<br><br>**624**<br>**X 31**<br>**624**<br><br>**1 x 4 ones = 4 ones**<br>**1 x 2 tens = 2 tens**<br>**1 x 6 hundreds = 6 hundreds**<br><br>**Now, what will we multiply each of the values in 624 by?** [Pause.]<br><br>**Good job! We will multiply each by 30!**<br>**1**<br>**624**<br>**X 31**<br>**624** | [We do.]<br>Students will respond to teacher questions with less scaffolding than the previous example. Students will have more time to think and respond on their own prior to the teacher providing solutions. |

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| **+ 18720**<br>**19,344**<br><br>**30 x 4 ones equal 120 ones; or 1 hundred and 20 ones**<br>**30 x 2 tens equals 6 tens plus one ten = 7 tens; or 7 hundreds**<br>**30 x 6 hundreds = 18 hundreds; or 1 thousand and 8 hundreds.**<br><br>**Now that we have the 2 partial products, what do we need to do to find the total product?** [Pause.]<br><br>**Exactly! We need to add them. 624 plus 18720 = 19344**<br><br>**Great work!** | |
| [You do.]<br>**Now, try solving this next multiplication problem on your own. After you've worked for about 2 minutes, we will come back together and check your work.** [Display and read the problem aloud.]<br><br>**Here's your problem:**<br><br>**360**<br>**X 18**<br><br>[After approximately 2 minutes, call attention to come back and check work.]<br><br>**Let's check your work!**<br>**Our problem was 360 x 18.**<br>**Did you multiply each value of the digits in 360 by 8?** [pause]<br>**Great!** [Display and talk through.]<br>**That should've gotten you 2880.**<br><br>**Did you multiply each value of the digits in 360 by 10?** [Pause.]<br><br>**Great!** [Display and talk through.] | [You do.]<br>Students are working almost exclusively independently with the teacher providing answers at the end. |

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| **+ 3600**<br>**6480**<br><br>**That should've gotten you 3600.**<br>**And did you add the 2 partial products?** [Pause.]<br><br>**Excellent! The total then is 6480.**<br>**You've done great work!**<br><br>Additional Problems (if Needed):<br>Lat year, 23 fifth grade students were assigned a kindergarten student as a reading buddy. By the end of the year, each student had read for a total of 128 hours. How many hours in all did the fifth graders read?<br><br>346<br>x 12 | |
| Independent Practice (1 min.)<br>**Great work, students! Today, we reviewed using the standard algorithm to multiply 3-digit by 2-digit numbers. I hope you're seeing some connections to multiplying by 2-digit numbers in multiplication! You sure did a great job! After the video, you will have some problems to practice on your own. Good luck and do your best!**<br>**I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education.** [Teacher shows student practice page under a document camera or camera zooms in on student practice page.] | |
| Closing (1 min.)<br>• **Students, I enjoyed reviewing using the standard algorithm to multiply with a focus on 3-digit by 2-digit numbers with you! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series!**<br>• **Bye!** | |