PBS Lesson Series

Math: Grade 3, Lesson 18, Multiplication Facts and Strategies

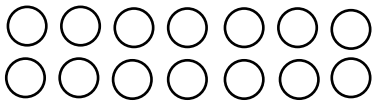
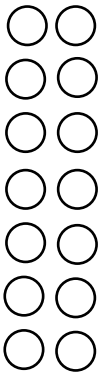
Lesson Focus: Use strategies to multiply with 7.
Practice Focus: Students will focus on practicing using properties and known facts to multiply with 7.
Objective: Students will use strategies to multiply with 7.
Key Vocabulary: factor, product, property, known fact
TN Standards: 3.OA.B.5
Teacher Materials:

- Paper, pencil, and dry erase board/marker
- Counters to model properties
- Student Practice Packet

Student Materials:

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

Teacher Do	Student Do
Opening (1 min) **Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 3rd graders out there, though all children are welcome to tune in. This lesson is the eighteenth in our series.** **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!** **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 see 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.** **Today we will be learning about using strategies to multiply with 7 in mathematics! Before we get started, to participate fully in our lesson today, you will need:** • **Paper and a pencil, and a surface to write on** • **The student packet for Math, Grade 3 Lesson 18 which can be found at www.tn.gov/education.** **Ok, let's begin!**	Students get materials ready for the lesson.
Intro (5 min) **In third grade math, you have learned many strategies to help you become fluent with all of your multiplication facts. Today we will review how to use the commutative property,**	

the distributive property, or known facts to help us multiply by the factor 7. **Did you know you started using the commutative property in first grade when you were learning addition facts? You probably didn't use that vocabulary term, but you did learn that 2 + 3 = 3 + 2. The sum stays the same even if you change the order of the addends. That's an example of the commutative property in addition.**	
The commutative property also applies to multiplication facts. Let's draw a picture to show the commutative property. On your paper, draw an array for 2 x 7, or 2 rows of 7, and another array for 7 x 2, or 7 rows of 2. [Pause.] 2 x 7  7 x 2 	Students review the meaning of the commutative property by drawing arrays for 2 x 7 and for 7 x 2.
Do your arrays look similar to my arrays? [Teacher shows image of arrays.] **Notice that the total number of counters are the same in both arrays. The product stays the same even though the order of the factors changed.**	Students compare their drawings with the teacher's arrays.
Help me complete the equation in this sentence. If I know that 2 x 7 = 14, I also know that ___ x ___ = 14. On your paper, write the completed equation. [Pause.] **Give me a thumbs up if you wrote 7 x 2 = 14. Great thinking! The commutative property says that the product stays the same even when the order of the factors change.** **Since we will be practicing multiplying by 7 today, let's use the commutative property to write the equivalent multiplication expressions for the sevens facts.** [Teacher shows list below.]	Students complete the sentence: If I know that 2 x 7 = 14, I also know that 7 x 2 = 14.

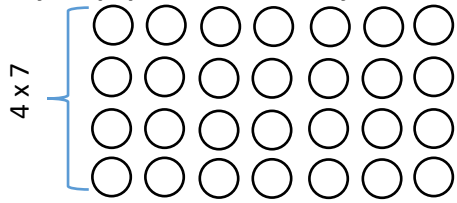
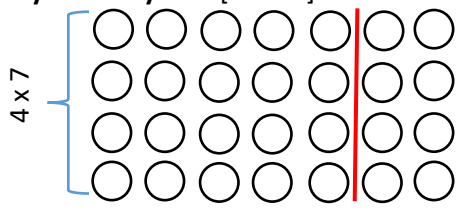
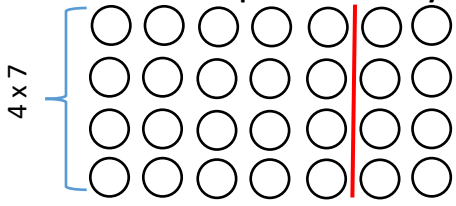
On your paper, write this list of sevens facts and complete the equations by writing the equivalent multiplication expression. For example, to complete 7 x 2 = _____, I'll write 14 = 7 x 2 = 2 x 7. Go ahead and complete the equations. [Pause.] **7 = 7 x 1 = _____ 14 = 7 x 2 = _____ 21 = 7 x 3 = _____** **28 = 7 x 4 = _____ 35 = 7 x 5 = _____ 42 = 7 x 6 = _____** **49 = 7 x 7 = _____ 56 = 7 x 8 = _____ 63 = 7 x 9 = _____**	Students record on their paper the list of sevens facts along with their equivalent expressions when applying the commutative property.
Here is the completed list of equivalent expressions. [Teacher shows completed list below.] **Check your list with this one.** [Pause.] **7 = 7 x 1 = 1 x 7 14 = 7 x 2 = 2 x 7 21 = 7 x 3 = 3 x 7** **28 = 7 x 4 = 4 x 7 35 = 7 x 5 = 5 x 7 42 = 7 x 6 = 6 x 7** **49 = 7 x 7 = 7 x 7 56 = 7 x 8 = 8 x 7 63 = 7 x 9 = 9 x 7** **The reason I wanted you to record this list is because it's important to remember that the commutative property can help you find a product for a fact that you think you don't know.**	Students check their list and make corrections if needed.
Have you ever heard another student say that they don't know their sevens facts, but they do know their ones facts, twos facts, and fives facts, or something similar to this? When you know about the commutative property, then you can help them see that if they know their ones facts, twos facts, and fives facts, then they also know the products for 7 x 1, 7 x 2, and 7 x 5! [Teacher shows table below and explains that there are three sevens facts in the list of known facts for that student.]	Students consider what sevens facts they already know because of the commutative property.

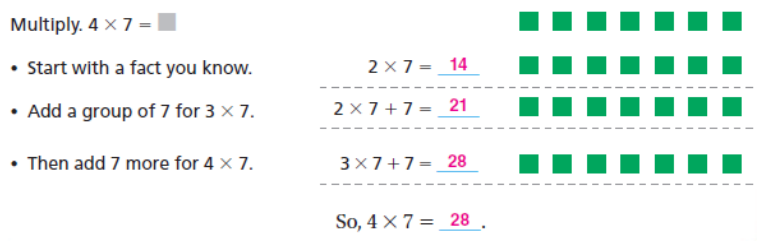
Ones Facts	Twos Facts	Fives Facts
1 x 1 = 1	2 x 1 = 2	5 x 1 = 5
1 x 2 = 2	2 x 2 = 4	5 x 2 = 10
1 x 3 = 3	2 x 3 = 6	5 x 3 = 15
1 x 4 = 4	2 x 4 = 8	5 x 4 = 20
1 x 5 = 5	2 x 5 = 10	5 x 5 = 25
1 x 6 = 6	2 x 6 = 12	5 x 6 = 30
1 x 7 = 7	2 x 7 = 14	5 x 7 = 35
1 x 8 = 8	2 x 8 = 16	5 x 8 = 40

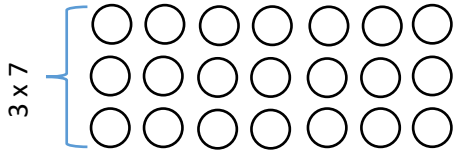
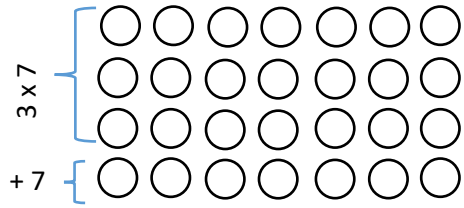
1 x 9 = 9	2 x 9 = 18	5 x 9 = 45

Now that we've warmed up by reviewing the commutative property and by considering how this can help us multiply by the factor 7, we're ready to review other strategies that can help us multiply with 7.

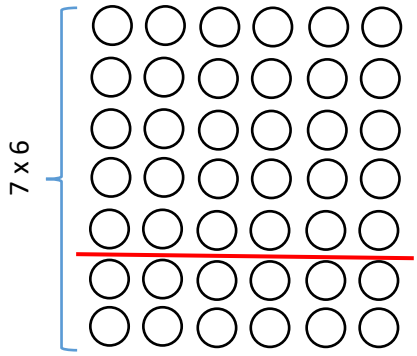
Teacher Model (10 min) Objective 1: Teacher modeling multiplying with 7 by using the distributive property to break apart arrays into two smaller arrays to find products.	Objective 1: Students will be reviewing multiplying by 7 by using the distributive property to break apart arrays into smaller arrays. This will support students developing multiplication fact fluency.
Today we are focusing on multiplying by the factor 7. When I think about groups of seven, I think about weeks because one week has a total of 7 days. I can describe this with the fact 1 x 7 = 7 where the factor one is the one group or week, and the factor seven is the number of days in each week.	
Let's solve a problem where we'll need to use what we know about the number of days in a week. Listen as I read the problem. [Teacher reads and shows problem below.]	Students listen to teacher read problem.
Jason's family has a new puppy. Jason takes a turn walking the puppy once a day. How many times will Jason walk the puppy in 4 weeks? Use a multiplication equation to solve the problem.	
Let's make sense of this problem. It says that Jason takes a turn walking the puppy once a day. Show me with your fingers how many times a day is once. [Pause.] **Good. Once means that Jason walks his puppy one time each day. The problem tells us to write a multiplication equation to figure out how many times Jason walks his puppy in 4 weeks. What do we know about the relationship between days and weeks? We talked about this just a few moments ago.** [Pause.] **Give me a thumbs up if you said that 1 week has 7 days. Great! And remember we said that we can represent this with the equation 1 x 7 = 7.**	Students make sense of the problem by responding to teacher's guided questions. Students give a thumbs up to indicate that one week is equal to 7 days.
Write on your paper the multiplication equation that you think will help us figure out how many times Jason will walk the puppy in four weeks. Leave a blank for the product. [Pause.]	Students record the equation 4 x 7 = ___ for what they need to find to solve the problem.

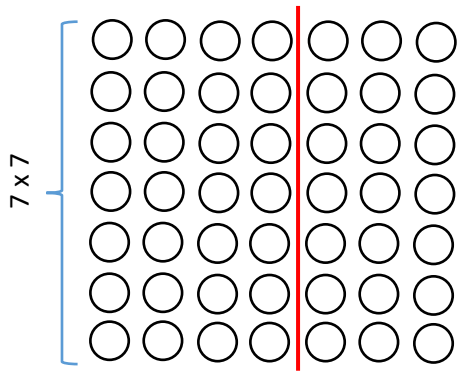
Give me a thumbs up if you wrote 4 x 7 = ____. The factor 4 represents the number of weeks and the factor 7 represents the number of days in each week.	
Now that we have our equation, let's think of a strategy we can use the find the product.	Students consider the commutative property.
I always think about the commutative property first. If 4 x 7 is an unknown fact for me, I'll visualize changing the order of the factors to see if this helps me know the fact. I don't know 4 x 7, but do I know 7 x 4? Remember, we can do this with multiplication because the product will be the same.	
Changing the order of the factors didn't help me, so now I need to think of another strategy I can use. Let's use the distributive property to find the product of 4 x 7. This property tells us that we can break apart our expression into facts that we know. The sum of the products of the known facts equals the product of the unknown fact.	Students consider the distributive property.
On your paper, draw an array for 4 x 7. [Pause.] 	Students draw an array for 4 x 7.
Your array should have 4 rows of 7. [Teacher shows above image.] **I know I'm really fluent at multiplying with fives so I'm going to break apart the array so that one of the smaller arrays only has 5 counters in its rows. Draw this vertical line on your array too.** [Pause.] 	Students draw a vertical line in their array to break it apart where one of the smaller arrays has 5 counters in each of its rows.
The equation that describes the smaller array on the left is 4 x 5 = 20. Say out loud what equation describes the other small array. [Pause.] **Pat yourself on the back if you said 4 x 2 = 8. Record these two equations below your arrays.** [Pause.] 	Students verbalize 4 x 2 = 8 for the equation that describes the smallest array. Students label their arrays with the appropriate equations.

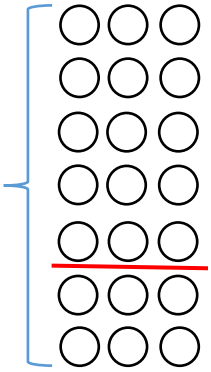
4 x 5 = 20 4 x 2 = 8 **The total number of counters stayed the same in the whole array. We only changed that we wanted to distribute the counters in smaller parts. Now that we have our smaller parts, we can add the products of the smaller parts to find the product of the whole. When you find the sum, complete the equation 4 x 7 = ____ on your paper.** [Pause.] **Make sure you have the equation 4 x 7 = 28. We found the product 28 by adding together the counters in the smaller arrays, or 20 + 8. In the problem we were solving, 28 is the number of times that Jason walks his puppy in 4 weeks.** **Remember, there are many ways we could have broken apart the 4 x 7 array. I drew a vertical line which broke apart the factor 7 into smaller parts. We also could have drawn a horizontal line. This would break apart the factor 4. When you use this strategy, you'll want to break the array apart in the way that best works for you and the facts that you already know. The sum of the parts will always be equal to the total of the whole array.**	Students find the sum of the parts to complete the equation 4 x 7 = 28.
Objective 2: Teacher modeling multiplying with 7 by using known facts to find unknown sevens' facts. **To find the product of 4 x 7, we also could use the strategy called using known facts. To use this strategy, we start with a fact we know and then count on to add the extra groups. Listen to my think aloud as I use this strategy.** **I don't know the product for 4 groups of 7, but I do know the product for 2 groups of 7. I know that 2 x 7 = 14. I can start at the product 14 and add additional groups of 7 until I have 4 groups of 7 or 4 x 7. So if 2 x 7 = 14, then 3 x 7 = 14 + 7 = 21. Then 4 x 7 = 21 + 7 = 28.** [Teacher can consider acting out this think aloud using counters or making a drawing similar to image below.]  	Objective #2: Students will be reviewing multiplying with the factor 7 by using known facts to find unknown facts. This will support students developing multiplication fact fluency. Students listen to teacher think aloud of using the known fact 2 x 7 to find the unknown fact 4 x 7.

Or maybe I already know the product for 3 groups of 7. In this case, I only need to add one additional group of 7 to find the product of 4 x 7. I'll write an equation to show my thinking. On your paper, you also write the equation. [Teacher does a think aloud as she records and reads equation below.] **4 x 7 = 3 x 7 + 7 = 21 + 7 = 28.**	Students listen to teacher think aloud of using the known fact 3 x 7 to find the unknown fact 4 x 7.
How do we know that 3 x 7 + 7 = 4 x 7? [Pause.] **Let's illustrate it with a picture.**	Students record the equation 4 x 7 = 3 x 7 + 7 = 21 + 7 = 28 to illustrate using the known fact 3 x 7 to find the unknown fact 4 x 7.
On your paper, use dots to draw a quick array for 3 x 7. [Teacher shows picture below.] 	Students use dots to draw a 3 x 7 array which illustrates the known fact used to find the unknown fact 4 x 7.
This 3 x 7 array describes the known fact that we used to find the unknown fact 4 x 7. **During my think aloud, I stated that 3 x 7 + 7 = 4 x 7. How can we make the 3 x 7 array describe 3 x 7 + 7? Say what you think out loud.** [Pause.]	Students verbalize that we need to draw another row of 7 counters to the array.
Right, we draw another row of 7. Let's do this now. [Teacher shows image below with additional row of 7.] 	Students draw an additional row of 7 counters onto their array and label it like the teacher's array.
This makes the array have a total of 4 rows of 7! We started with 21 counters in the 3 x 7 array. Then we added another group of 7 counters. Adding on to the known fact gave us 21 + 7 = 28. We knew to stop there because we only needed to have a total of 4 rows of 7. **So 3 x 7 + 7 = 4 x 7.**	

Tying the learning together: Students use strategies to multiply by 7 when given a math fact with a missing factor. **So far today, we've been working to solve problems with the factor 7 where we need to find the product. Sometimes, we'll know the product but will need to find a factor. Let's look at one of these problem types now.** **Use strategies to find the missing factor in the equation 7 x ___ = 28.**	Tying the learning together: Students notice that sometimes when solving problems with a factor of 7 that they may need to find the other factor instead of the product.
Let's try using known facts to find the missing factor. **I know that 7 x 2 = 14. Give me a thumbs up if 7 x 2 = 14 is also a known fact for you.** [Pause.] **Great! So we'll start here with 7 groups of 2 equaling 14. Record 7 x 2 = 14 on your paper.** [Pause.]	Students give a thumbs up to indicate 7 x 2 = 14 is a known fact. Students record 7 x 2 = 14 on their paper.
Let's look back at what we're trying to find. We need to find the missing factor in the equation 7 x ___ = 28. Record this equation next to your known fact 7 x 2 = 14. [Pause.] 7 x 2 = 14 7 x ___ = 28	Students record the equation 7 x ___ = 28 next to their known fact of 7 x 2 = 14.
[Teacher shows both equations as above.] **What do you notice about the equations of our known fact and our unknown fact? How are their products related? Say out loud what you think the relationship is.** [Pause.]	Students consider the relationship between the two equations.
Give yourself some applause if you said that the product 28 is double the product 14. That's exactly right! Since both facts have 7 rows and the product 28 is the double of the product 14, we can use a strategy we learned before to find fours facts from known twos facts. Do you remember what the strategy was called? [Pause.] **It's the doubles strategy.**	Students give themselves applause for verbalizing that 28 is double 14.
What do you think the missing factor is? Show me using your fingers. [Pause.] **Yes! The missing factor is 4 because that is the double of the factor 2 in our known fact. We were just able to use a fact we know and the doubles strategy to find 7 x 4 = 28.** **Great job practicing using strategies to find products and missing factors when we multiply by 7. Let's move on to some guided practice problems where we'll continue to multiply by the factor 7.**	Students show 4 fingers to indicate that the missing factor is 4.

Guided Practice (10 min) [I do.] **I'll do the first practice problem.** [Teacher reads the problem out loud and does a think aloud as she solves it.]	
Use the distributive property or known facts to find the product. 7 x 6 = ____. **I'll use the distributive property to break apart 7 x 6 into smaller arrays.**  	Students listen to teacher solve the problem 7 x 6 using the distributive property.
On your paper, write the equations that describe the two smaller arrays. [Pause.] **My two smaller arrays can be described with the equations 5 x 6 = 30 and 2 x 6 = 12.**	Students write the equations for the two smaller arrays: 5 x 6 = 30 and 2 x 6 = 12.
The distributive property says that the sum of the products of the parts equals the product of the whole. That is, I can add the products of these smaller arrays to find the product of the whole array. Find the sum of the products on your paper and then complete the equation 7 x 6 = ___ + ___ = ___. [Pause.]	Students complete the equation 7 x 6 = 30 + 12 = 42.
Give me a thumbs up if you found that 30 + 12 = 42. Great! So our completed equation is 7 x 6 = 30 + 12 = 42. This means that 7 x 6 = 42.	
[Teacher describes finding the product using known facts.] **I also could have used known facts to find the product of 7 x 6 because I know the product of 6 x 6. Record 6 x 6 = 36 on your paper.** [Pause.] **Since 6 x 6 = 36, I can add another group of 6 which gives me 7 groups of 6. I can describe this action with the equation 7 x 6 = 6 x 6 + 6. Now let's do the math to complete the equation 7 x 6 = ___ + ___ = ___.** **Complete the equation on your paper as I complete it.**	Students listen to teacher think aloud for using the strategy known facts to find 7 x 6. Students complete the equation 7 x 6 = 36 + 6 = 42 on their paper.

So 7 x 6 = 36 + 6 = 42.	
[We do.] **Now let's do this next problem together.** **Use the distributive property or known facts to find the product. 7 x 7 = ____.**	Students solve the problem 7 x 7 with the teacher.
On your paper, write the equation 7 x 7 = ___.	Students record the equation 7 x 7 = ___.
Let's use the distributive property to break the problem into smaller parts. Look at the array that I've drawn for 7 x 7. [Pause.]  	
Notice that I've drawn a vertical line to break apart the array into two smaller arrays. On your paper, write the equations that describe the two smaller arrays. [Pause.]	Students record the equations for the two smaller arrays.
Our two smaller arrays can be described with the equations 7 x 4 = 28 and 7 x 3 = 21. Check your equations. [Pause.]	Students check their equations.
Now we can add the products of these smaller arrays to find the product of the whole array. Do this now and complete the equation 7 x 7 = ___ + ___ = ___. [Pause.]	Students find that 7 x 7 = 28 + 21 = 49.
Give me a thumbs up if your completed equation is 7 x 7 = 28 + 21 = 49. Excellent! We just used the distributive property to find that 7 x 7 = 49. Remember, we could have broken apart the array in many ways and the sum of the parts would still equal the whole!	Students give a thumbs up to indicate a correct equation.
Now let's talk through how we could have used known facts to find 7 x 7 = ___.	With the teacher, students use the strategy known facts to find 7 x 7.
We're all quite fluent with our fives facts so let's start with the known fact 5 x 7 = 35. This is the product for 5 groups of 7. We want to use this fact to find the product for 7 groups of 7. Take a minute to try to work this out on your paper. [Pause.]	Students use the known fact 5 x 7 = 35 to find the unknown fact 7 x 7 = ___.

So we started with the known fact 5 x 7 = 35. Show me with your fingers how many times you had to add another group of 7 to find 7 x 7 = ___. [Pause.]	Students show two fingers to indicate they had to add a group of seven two times.
That's right, to get to seven groups of 7, you had to add a group of seven two times. Your work should look similar to this equation: 7 x 7 = 5 x 7 + 7 + 7 = 35 + 7 + 7 = 49.	Students check their work.
[You do.] **Now you try one by yourself!** **Use the distributive property or known facts to find the product. 7 x 3 = ____. [Pause.]**	
You should have found that 7 x 3 = 21.	Students use the distributive property or known facts to find the product for 7 x 3 = 21.
If you used the distributive property, you may have broken apart an array similar to this picture. The two smaller arrays in this picture are 5 x 3 = 15 and 2 x 3 = 6. The sum of the products of the two smaller arrays equals the total 21. **So 7 x 3 = 21. Even if you broke it apart a different way, the sum of the products of the two smaller arrays should equal 21.**	Students listen to teacher explanation of using the distributive property.
7 x 3 	
If you used known facts to find the product of 7 x 3, then you started with a known fact for rows of 3, and then you added rows of 3 until you had a total of 7 rows of 3. For instance, if you started with 4 x 3 = 12, then you added a group of 3 three more times to get 7 x 3 = 21.	Students listen to teacher explanation of using known facts.
Great job!	
Additional Problems (if needed): **Alia arranges some playing cards in 7 equal rows with 8 cards in each row. How many cards does Alia arrange?**	

Julie buys a pair of earrings for $7. Now she would like to buy the same earrings for 2 of her friends. How much will she spend for all 3 pairs of earrings?	
Independent Practice (10 min) **Great work, students! Today, we reviewed using strategies to multiply with the factor 7. I hope you are feeling more fluent with your sevens facts. You sure did a great job! 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 document camera or camera zooms in on student practice page.] **Good luck and do your best!**	Students listen to teacher summarize today's learning and view the independent practice problems.
Closing (1 min) **Students, I enjoyed practicing strategies to multiply by sevens 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! Bye!**	