Bakery Warm-Up

This string of arrays is designed to build students' number sense around multiplication. It is also designed to build students' recall of known facts and to show the ways in which the distributive property can be used to derive unknown facts. The string also highlights the structure of arrays and so enables access for students to the inquiry that is to follow.

Resources: Show slide 2 of reSolve PowerPoint *1a Bakery Warm-Up*. This first array sets the scene for the string of arrays.

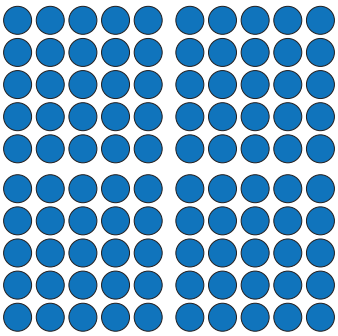
Teacher note:

- The array has a small gap between each group of 5. This allows students to use 5 as a benchmark when quickly calculating the dimensions of the array.

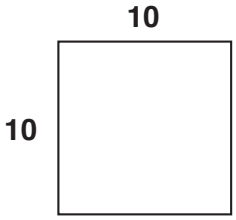
Ask the students:

- *How many dots do you see?*
- *How did you work that out?*
- *Did someone work it out differently?*

Record the different strategies used by the students. Look at the ways in which the 5 structure has been used in the array.

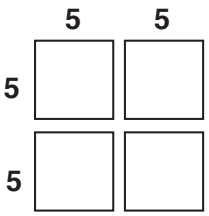


The answer is 100. I used 10 × 10 to work it out. I knew each side was 10 because I could see two groups of 5.



$10 \times 10 = 100$

I saw four groups of 5 by 5, which is 25, and 25 multiplied by 4 is 100.



$(5 \times 5) \times 4 = 100$

Now I am going to show you some more arrays. I am only going to show them to you quickly. I would like you to calculate the number of dots in the array. You may already know the answer, but I would like you to look especially at the ways in which you can work out the answers from the arrays.

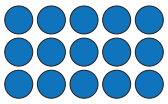
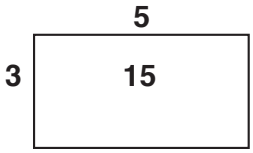
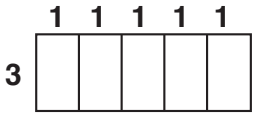
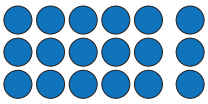
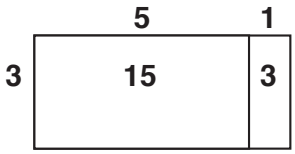
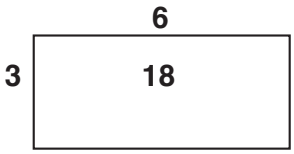
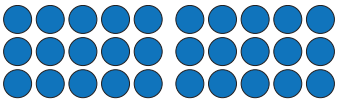
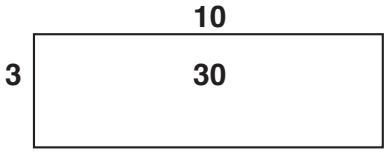
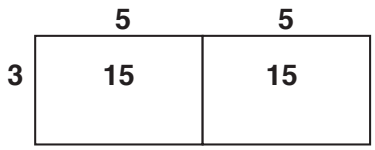
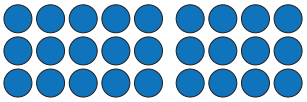
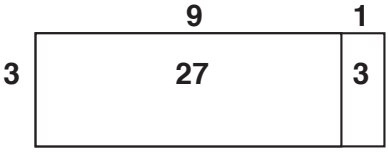
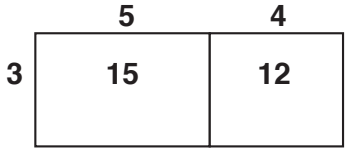
Show each array for approximately 10 seconds so students don't have time to count each dot.

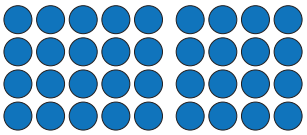
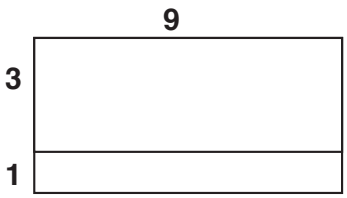
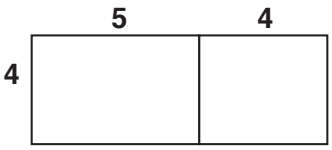
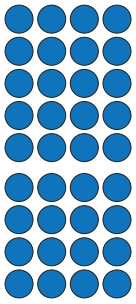
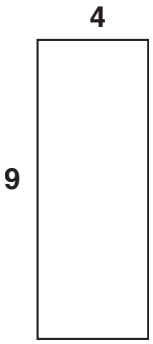
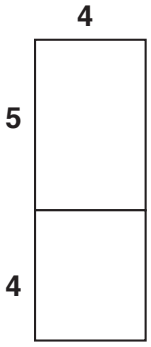
Ask: *How many dots are there here? How did you work that out? Did someone work it out differently?*

This string of arrays highlights the distributive property of multiplication over addition. While students will recall known facts, relationships between the arrays can be clearly seen and used to calculate the total number of dots.

Return to the 3 × 5 array on slide 3. Record the students' responses symbolically with the answer clearly recorded.

Continue this process throughout the sequence, placing each array under the previous one. Building the string in this manner allows the students to see the relationship between the arrays and the multiplication questions and answers.

	*The answer is 15. I saw three rows of 5.*  **3 × 5 = 15**	*I saw columns of three so I counted in 3s.*  **3, 6, 9, 12, 15** **3 + 3 + 3 + 3 + 3 = 15**
	*The answer is 18. I used 3 × 5 = 15 from the previous question and added an extra group of 3.*  **(3 × 5) × (3 × 1) = 18**	*I saw 5 and 1 more across the top and so I knew it was 6. That makes three groups of 6.*  **3 × 6 = 18**
	*There are 30 dots in the array. I saw three rows with 10 in each row.*  **3 × 10 = 30**	*I saw two groups of 3 × 5. That means it will be 15 + 15, which is 30.*  **(3 × 5) × (3 × 5) = 30**
	*The answer is 27. I used the 3 × 10 in the previous question and took off one group of 3.*  **(3 × 10) − (3 × 1) = 27**	*I saw three rows of 5 and three rows of 4. I added those together and it equals 27.*  **(3 × 5) + (3 × 4) = 27**

	*It has an extra row of 9! It is going to be 3 × 9, which is 27, and then add 9.*  **(3 × 9) + (1 × 9) = 36**	*I saw four rows of 5 and four rows of 4.*  **(4 × 5) + (4 × 4) = 36**
	*The last array has just been turned around! It is 9 × 4 now.*  **9 × 4 = 36**	*Now it is five rows of 4 and four rows of 4.*  **(5 × 4) + (4 × 4) = 36**

Discuss with the students the main points highlighted through the number string:

- The number of objects in an array can be worked out using multiplication. There is the same number of objects in each row of an array, so the array is made up of groups of equal size.
- The array can be manipulated to make the multiplication easier.
- The array can be partitioned into sections with known numbers of dots and then they can be added together.
- Easier numbers can be made by adding some rows or columns onto the array and then later subtracting to compensate.

Other number strings

These strings are designed to be presented to students numerically rather than as arrays. Record students' strategies as open arrays.

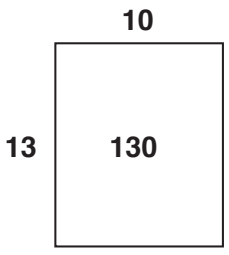
These six strings build students' understanding of the distributive property.

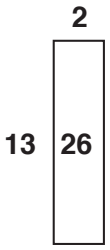
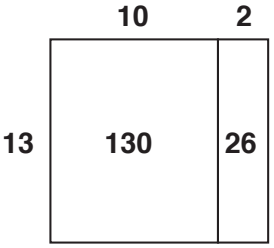
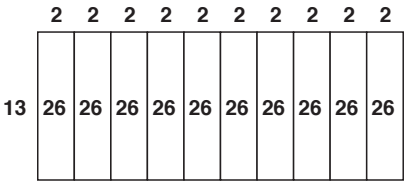
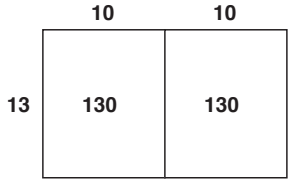
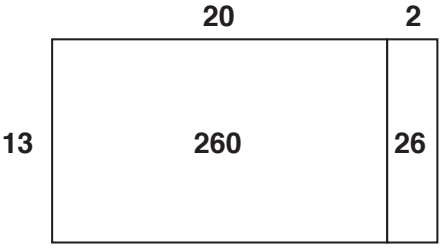
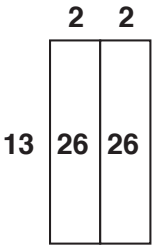
10 × 5	10 × 7	7 × 3	9 × 10	13 × 10	17 × 2
2 × 5	2 × 7	14 × 3	9 × 9	13 × 2	17 × 4
12 × 5	12 × 7	8 × 4	9 × 11	13 × 12	17 × 20
3 × 5	20 × 7	16 × 4	9 × 3	13 × 20	17 × 22
20 × 5	22 × 7	9 × 5	9 × 13	13 × 19	17 × 24
23 × 5	19 × 7	18 × 5	9 × 15	13 × 22	17 × 25

These six strings build students' understanding of the associative property.

Halving and doubling:			**Prime factors:**		
10 × 5	10 × 7	7 × 3	9 × 10	13 × 10	17 × 2
2 × 5	2 × 7	14 × 3	9 × 9	13 × 2	17 × 4
12 × 5	12 × 7	8 × 4	9 × 11	13 × 12	17 × 20
3 × 5	20 × 7	16 × 4	9 × 3	13 × 20	17 × 22
20 × 5	22 × 7	9 × 5	9 × 13	13 × 19	17 × 24
23 × 5	19 × 7	18 × 5	9 × 15	13 × 22	17 × 25

This sample transcript shows the ways in which the number string may be conducted in the classroom.

13 × 10	Student: *I know 13 × 10 is 130. You just add a zero.* Teacher: *Why do you just add a zero?* Students: *13 × 10 is the same as saying 13 tens. The 1 ten becomes 1 hundred and the 3 ones become 3 tens. It is as if it has been moved up a column on the place-value chart, so it is now 130.*	

13 × 2	Student: *13 × 2 is 26. I just doubled 13.*	
13 × 12	Student: *13 × 12 is 156. You just add together 13 × 10 and 13 × 2.* Teacher records 13 × 12 = (13 × 10) + (13 × 2).	
13 × 20	Student: *13 × 20 is 260. It is the same as 13 × 2 and then multiplied by 10.* Student: *I doubled 13 × 10 to get 260.*	 
13 × 22	Student: *13 × 22 is 13 × 20 added to 13 × 2, which gives 286.*	
13 × 4	Student: *13 × 4 is 52. It is 13 × 2 doubled.*	
13 × 24	Student: *13 × 24 is 312. It is 13 × 4 and 13 × 20 added together.*