

# Teacher Guide to Clarification

## 3.OA.3

### Multiplication and Division with Arrays and Drawings

3.OA.3 Use Multiplication and division within 100 to solve word problems in situations involving equal groups, **arrays** and measurement quantities, e.g., **by using drawings** with a symbol for the unknown number to represent the problem.

## Arrays and Drawings

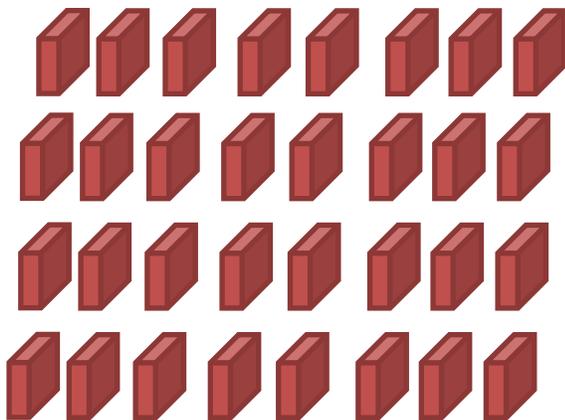
Utilizing Arrays and Drawings to multiply and divide. These strategies will build the foundation needed to understand what happens to numbers when multiplied or divided. Students will be able to reason through the problems visually and then mentally.

### Multiplication word problem with group size unknown

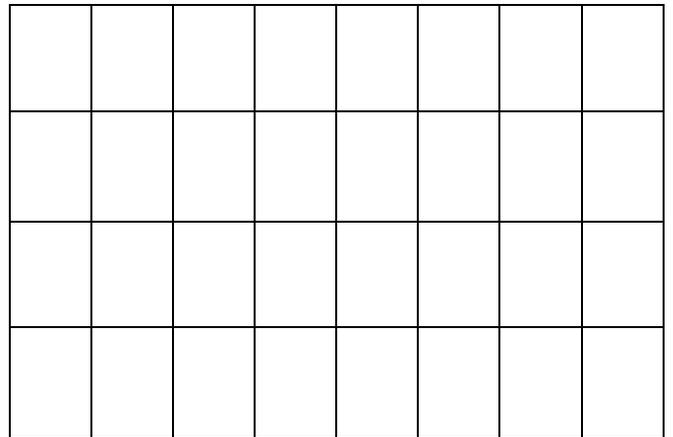
#### Problem 1 Array

There are a total of 32 books. Each book shelf holds 8 books. How many shelves are there?

$$8 \times ? = 32$$



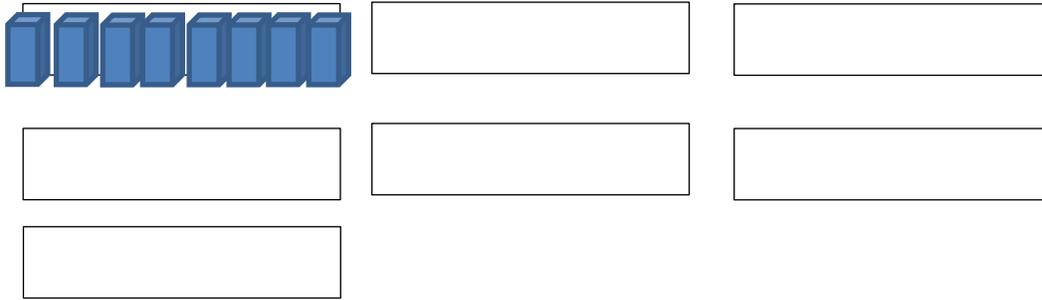
or



An Array can look like pictures or drawings in rows and columns or in a connected grid that shows the number of items in each row or column.

### Problem 1 Drawing

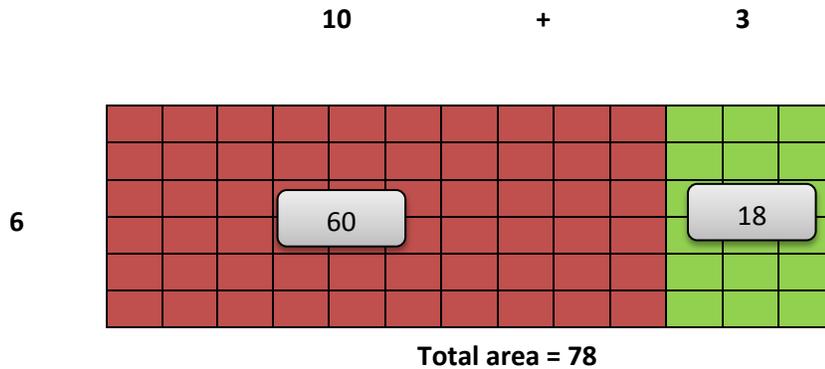
Students can draw each shelf with 8 books on it.



A student may know that 8 books on 3 shelves equals 24,  $24 + 24 = 48$   
I need one more shelf  $48 + 8 = 56$ . Therefore, the books would fill 7 shelves. There are multiple ways a student can draw the picture. Make sure students have an opportunity to explain their thinking.

### Problem 2 Multiplication Problem with an Array Area Model

$13 \times 6 = ?$

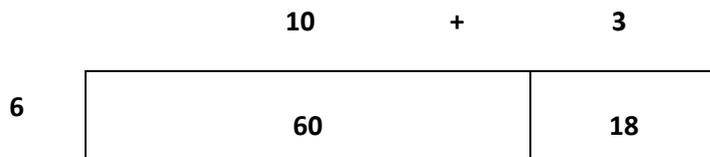


Students can actually see the total with this representation. This visually representation is setting the foundation for what happens when a number is multiplied by another. Students will be able to understand the relationship between multiplication and addition.

**Problem 2 Multiplication Problem with an Array Area Model**

**13 x 6 =? (same problem represented a little different)**

As the numbers get bigger, drawing each individual object or grid in its entirety might take too much time. Students can make a box with estimated divisions.

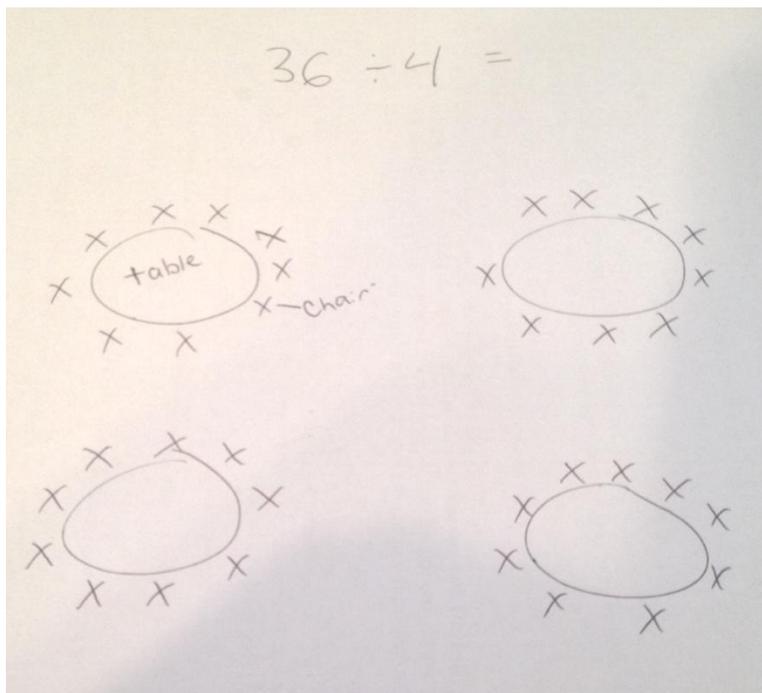


**Total area = 78**

**Division word problem with the number of groups unknown**

**Problem 3 Drawing**

I have 36 chairs and 4 tables. How many people can sit at the tables? 9 people

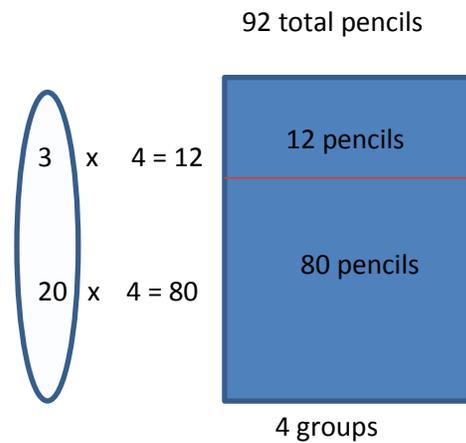


When answering word problem students must label their work correctly. (MP 6)



4 groups of students

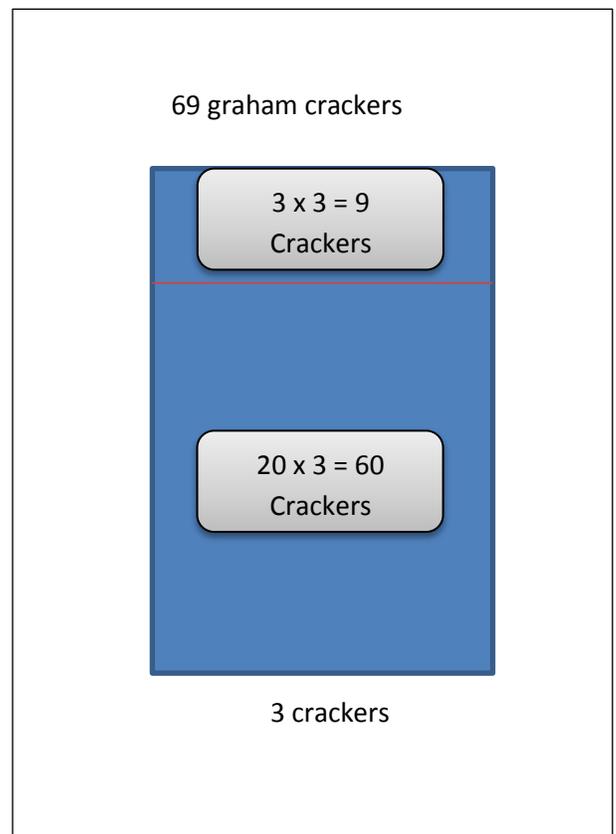
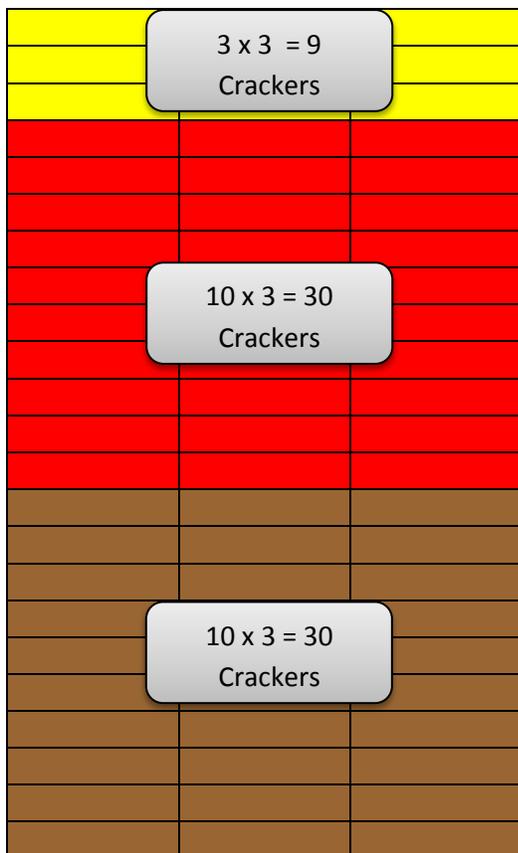
Same Problem different way to think about it. This drawing has also taken out all of the grid lines and has partitioned according to the partial areas.



**Problem 5 Area Array Model Number of groups unknown**

My friend is having a picnic. She has 69 graham crackers. Each student will receive 3 crackers. How many students will be going on the picnic? After solving with an area array model I can see that 23 students will be going to the picnic.

69 graham crackers



## Coherence and Connections: Need to Know

Below Grade Level	At Grade Level	Above Grade Level
	3.OA.1 3.OA.2 <b>3.OA.3</b> 3.OA.4 3.OA.7 3.OA.8	4.OA.1 4.OA.2 4.NF.4c

Evidence Statement Key	Evidence Statement Text	Clarifications	MP
3.OA.3-1 PBA/MYA	Use multiplication within 100 (both factors less than or equal to 10) to solve word problems in situations involving equal groups, arrays, or area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	i) All products come from the harder three quadrants of the times table ( $a \times b$ where $a \leq 5$ and/or $b \leq 5$ ). ii) 50% of tasks involve multiplying to find the total number (equal groups, arrays); 50% involve multiplying to find the area. iii) For more information see CCSS Table 2, p. 89 and the OA Progression.	1,4
3.OA.3-2 PBA/MYA	Use multiplication within 100 (both factors less than or equal to 10) to solve word problems in situations involving measurement quantities other than area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	i) All products come from the harder three quadrants of the times table ( $a \times b$ where $a \leq 5$ and/or $b \leq 5$ ). ii) Tasks involve multiplying to find a total measure (other than area). iii) For more information see CCSS Table 2, p. 89 and the OA Progression.	1,4
3.OA.3-3 PBA/MYA	Use division within 100 (quotients related to products having both factors less than or equal to 10) to solve word problems in situations involving equal groups, arrays, or area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	i) All quotients are related to products from the harder three quadrants of the times table ( $a \times b$ where $a \leq 5$ and/or $b \leq 5$ ). ii) A third of tasks involve dividing to find the number in each equal group or in each equal row/column of an array; a third of tasks involve dividing to find the number of equal groups or the number of equal rows/columns of an array; a third of tasks involve dividing an area by a side length to find an unknown side length. iii) For more information see CCSS Table 2, p. 89 and the OA Progression.	1,4

3.OA.3-4 PBA/MYA	Use division within 100 (quotients related to products having both factors less than or equal to 10) to solve word problems in situations involving measurement quantities other than area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	<ul style="list-style-type: none"> <li>i) All quotients are related to products from the harder three quadrants of the times table (<math>a \times b</math> where <math>a \leq 5</math> and/or <math>b \leq 5</math>).</li> <li>ii) 50% of tasks involve finding the number of equal pieces; 50% involve finding the measure of each piece.</li> <li>iii) For more information see CCSS Table 2, p. 89 and the OA Progression.</li> </ul>	1,4
3.D.2 PBA/MYA	Solve multi-step contextual problems with degree of difficulty appropriate to Grade 3, requiring application of knowledge and skills articulated in 2.OA.A, 2.OA.B, 2.NBT, and/or 2.MD.B.	<ul style="list-style-type: none"> <li>i) Tasks may have scaffolding if necessary in order to yield a degree of difficulty appropriate to Grade 3.</li> <li>ii) Multi step problems must have at least 3 steps</li> </ul>	
3.OA.3-1 EOY	Use multiplication within 100 (both factors less than or equal to 10) to solve word problems in situations involving equal groups, arrays, or area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	<ul style="list-style-type: none"> <li>i) All products come from the harder three quadrants of the times table ( where and/or ).</li> <li>ii) 50% of tasks involve multiplying to find the total number (equal groups, arrays); 50% involve multiplying to find the area.</li> <li>iii) For more information see CCSS Table 2, p. 89 and the Progression document for Operations and Algebraic Thinking.</li> </ul>	1, 4
3.OA.3-2 EOY	Use multiplication within 100 (both factors less than or equal to 10) to solve word problems in situations involving measurement quantities other than area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	<ul style="list-style-type: none"> <li>i) All products come from the harder three quadrants of the times table ( where and/or ).</li> <li>ii) Tasks involve multiplying to find a total measure (other than area).</li> <li>iii) For more information see CCSS Table 2, p. 89 and the Progression document for Operations and Algebraic Thinking</li> </ul>	1, 4
3.OA.3-3 EOY	Use division within 100 (quotients related to products having both factors less than or equal to 10) to solve word problems in situations involving equal groups, arrays or area, e.g. by using drawings and equations with a symbol for the unknown number to represent the problem.	<ul style="list-style-type: none"> <li>i) All quotients are related to products from the harder three quadrants of the times table ( where and/or ).</li> <li>ii) A third of tasks involve dividing to find the number in each equal group or in each equal row/column of an array; a third of tasks involve dividing to find the number of equal groups or the number of equal rows/columns of an array; a third of tasks involve dividing an area by a side length to find an unknown side length.</li> <li>iii) For more information see CCSS Table 2, p. 89 and the Progression document for Operations and Algebraic Thinking</li> </ul>	1, 4
3.OA.3-4 EOY	Use division within 100 (quotients related to products having both factors less than or equal to 10) to solve word problems in situations involving measurement quantities other than area, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	<ul style="list-style-type: none"> <li>i) All quotients are related to products from the harder three quadrants of the times table ( where and/or ).</li> <li>ii) 50% of tasks involve finding the number of equal pieces; 50% involve finding the measure of each piece.</li> <li>iii) For more information see CCSS Table 2, p. 89 and the Progression document for Operations and Algebraic Thinking</li> </ul>	1, 4
3.Int.1 EOY	Given a two-step problem situation with the four operations, round the values in the problem, then use the rounded values to produce an approximate solution. See 3.OA.8, 3.NBT.1, 3.NBT.2, 3.NBT.3	<ul style="list-style-type: none"> <li>i) Be careful that tasks do not require computations beyond the grade 3 expectations. See 4.NBT for computations expected only at the next grade.</li> </ul>	4, 6

3.Int.2 EOY	Solve two-step word problems using the four operations requiring a substantial addition, subtraction, or multiplication step, drawing on knowledge and skills articulated in 3.NBT. See 3.OA.8, 3.NBT.2, and 3.NBT.3	i) Addition, subtraction, multiplication and division situations in these problems may involve any of the basic situation types with unknowns in various positions (see CCSS Table 1, p. 88 and Table 2, p. 89 . and the Progression document for Operations and Algebraic Thinking). Substantial (def.) – Values should be towards the higher end of the numbers identified in the standards. ii) If scaffolded, one of the 2 parts must require 2-steps. The other part many consist of 1-step. iii) Conversions should be part of the 2-steps and should not be a step on its own. iv) If the item is 2 points, the item should be a 2 point, unscaffolded item but the rubric should allow for 2-1-0 points.	1, 4
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PARCC Mathematics Evidence Tables. (2013, April). Retrieved from:  
<http://www.parcconline.org/assessment-blueprints-test-specs>

Take a look at the clarification statements. This give an idea of what students will need to know and be able to do. It also gives a suggestion to the percentages of different tasks on the assessment.

It is important to establish the foundation of arrays in 3<sup>rd</sup> grade. This strategy is used with larger numbers in 4<sup>th</sup> grade. This standard refers to Table 2 in the glossary of the standards. Problems should be presented with unknown factors along with unknown products.

In grade 4, the standard algorithm for multiplication will be introduced (4.NBT.4) Example of 4<sup>th</sup> grade problem  $529 \div 30$  using an array <http://www.youtube.com/watch?v=u7M7G9bnQy0>

TABLE 2. Common multiplication and division situations.<sup>7</sup>

	Unknown Product	Group Size Unknown ("How many in each group?" Division)	Number of Groups Unknown ("How many groups?" Division)
	$3 \times 6 = ?$	$3 \times ? = 18$ , and $18 \div 3 = ?$	$? \times 6 = 18$ , and $18 \div 6 = ?$
<b>Equal Groups</b>	There are 3 bags with 6 plums in each bag. How many plums are there in all? <i>Measurement example.</i> You need 3 lengths of string, each 6 inches long. How much string will you need altogether?	If 18 plums are shared equally into 3 bags, then how many plums will be in each bag? <i>Measurement example.</i> You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?	If 18 plums are to be packed 6 to a bag, then how many bags are needed? <i>Measurement example.</i> You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?
<b>Arrays,<sup>4</sup> Area<sup>5</sup></b>	There are 3 rows of apples with 6 apples in each row. How many apples are there? <i>Area example.</i> What is the area of a 3 cm by 6 cm rectangle?	If 18 apples are arranged into 3 equal rows, how many apples will be in each row? <i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?	If 18 apples are arranged into equal rows of 6 apples, how many rows will there be? <i>Area example.</i> A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?
<b>Compare</b>	A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost? <i>Measurement example.</i> A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?	A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost? <i>Measurement example.</i> A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?	A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat? <i>Measurement example.</i> A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?
<b>General</b>	$a \times b = ?$	$a \times ? = p$ , and $p \div a = ?$	$? \times b = p$ , and $p \div b = ?$

<sup>4</sup>The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns. How many apples are in there? Both forms are valuable.

<sup>5</sup>Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations.

Multiplication and Division problems should be written both horizontally and vertically. Students can then apply the strategy they are comfortable with.

# Classroom Resources

PowerPoint with multiple multiplication and division word problems and a variety of strategies

## Hot Questions

**3.OA.3 Use Multiplication and division within 100 to solve word problems in situations involving equal groups, arrays and measurement quantities, e.g., by using drawings with a symbol for the unknown number to represent the problem.**

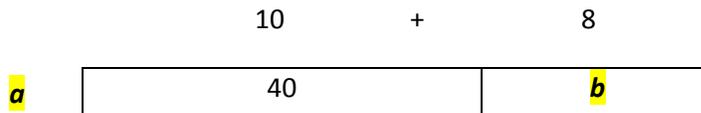
### Problem 1

I have 18 cookies that I would like to split into 6 boxes. Be able to explain your answer and strategy used.

### Problem 2

My friend drew an *area model array* to help him multiply. What would the missing numbers be? What is the total and solve for **a** and **b**?

$18 \times 4 = ?$  **a = ?** **b = ?**



Answers

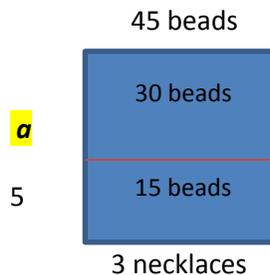
Total = 72

a = 4

b = 32

### Problem 3

I have 45 beads and I would like to make 3 necklaces. How many beads would be on each necklace? What would the missing number (a) be?



Answers:

15 beads on each necklace

**a** = 10

## Additional Resources

Standard Aligned Task with instructional supports from NYC Department of Ed.

Cookie Dough

[http://schools.nyc.gov/NR/ronlyres/0ACC1E30-0BB7-42AC-93D7-7CE7B83E0136/0/NYCDOEG3MathCookieDough\\_Final.pdf](http://schools.nyc.gov/NR/ronlyres/0ACC1E30-0BB7-42AC-93D7-7CE7B83E0136/0/NYCDOEG3MathCookieDough_Final.pdf)

Multiplication Word Problems

<http://www.k-5mathteachingresources.com/support-files/multiplication-word-problems-3.oa.3-.pdf>

Building Arrays – multiplication

<http://www.k-5mathteachingresources.com/support-files/equalrowsinamarchingband.pdf>

Division

<http://www.k-5mathteachingresources.com/support-files/sharingmarbles.pdf>

Problem of the Month

<http://www.insidemathematics.org/assets/problems-of-the-month/the%20wheel%20shop.pdf>