Multiplication support

In this pack you will find a variety of ideas to support your child at home with multiplication.
It will show ideas and strategies that the children use in the classroom and the way written strategies are introduced when it is appropriate. It also includes some video links to see some methods in action.

Progression through the National Curriculum

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
One step problems using concrete objects (e.g. cubes, numicon, money), pictorial representations and arrays with the support of the teacher	Recall and use multiplication and division facts for the 2, 5 and 10 times table, including recognizing odd and even numbers Calculate mathematical statements and write them using the x and = sign Show that multiplication of two numbers can be done in any order (commutative)	Recall and use multiplication and division facts for the 3, 4 and 8 times tables Write and calculate mathematical statements for multiplication tables that they know, including for two digit numbers, using mental and progressing to formal written methods Solve problems including missing number problems involving multiplication and division, positive integer scaling problems and corresponding problems in n objects are connected to m objects	Recall multiplication and division facts up to 12 x 12 Use place value, known and derived to multiply mentally; including multiplying by 0 and 1, multiplying three numbers Recognise and use factor pairs and commutativity in mental calculations Multiply two digit and three digit numbers by a one digit number using formal written layout Solve problems involving multiplying, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects	Identify multiples and factors, including finding all factor pairs of a number and common factors of two numbers Solve problems involving multiplication including using their knowledge of factors and multiples, squares and cubes Solve problems involving multiplication, including scaling by simple fractions and problems involving simple rates. Know and use the vocabulary of prime numbers, prime factors and composite (non- prime numbers) Establish whether a number up to 100 is prime and recall prime numbers up to 19 Multiply numbers up to 4 digits by a one or two digit number using a formal written method, including long multiplication for two digit numbers Multiply numbers mentally drawing upon known facts Multiply whole numbers and those involving decimals by 10, 100 and 1000 Recognise and use square and cube numbers and the notation for squared and cubed Solve problems involving addition, subtraction, multiplication, division and a combination of these, including understanding the meaning of the equals sign	Multiply multi-digit numbers up to 4 digits by a two digit whole number using the formal written method of long multiplication Use and estimate to check answers to calculations and determine, in context of a problem, an appropriate degree of accuracy Perform mental calculations, including with mixed operations and large numbers Identify common factors, common multiples and prime numbers Use their knowledge of the order of operations to carry out calculations involving the four operations Solve problems involving addition, subtraction, multiplication and division

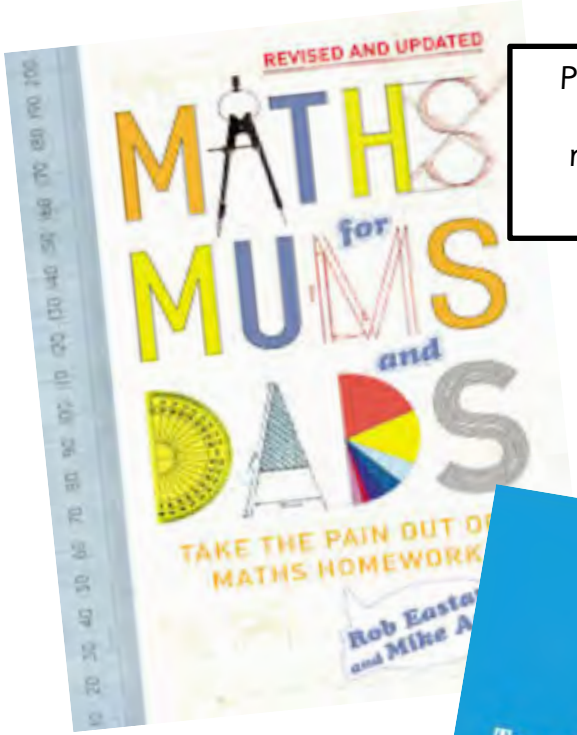
You will notice the relationship between multiplication and division is very important throughout and will usually be taught together to show the relationship so also discuss this when you are working with your child.

For example 11 x 5 = 55 so eleven fives go into fifty five and five elevens go into fifty five. You could show this with objects or pictorial representations. You could use vocabulary of sharing and dividing.

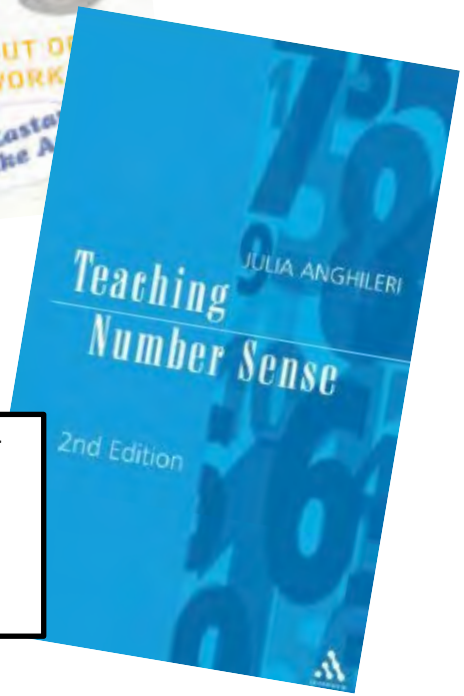
Key Vocabulary

Commutative Law	You can multiply numbers in any order and the answer stays the same e.g. 3 x 5 = 15 5 x 3 = 15	**Partitioning**	Splitting the number into smaller chunks
Composite numbers	Has three or more factors e.g 10 has four factors 1, 2, 5, and 10	**Power or Index**	Tells you how many times to multiply a number by itself e.g. 43 means 4 to the power of 3 which is 4 x 4 x 4
Cube numbers	When you multiply any number by itself and then by itself again you get a cube number e.g 2 x 2 x 2 gives you the cube number 8	**Prime numbers**	A number that you can only divide by 1 and itself e.g. 2
Distributive law	Multiplying a number that has been split up e.g. 8 x 27 8 x (20+7) (8 x 20) + (8 x 7) 160 + 56 = 216	**Product**	The result when you multiply numbers is the product e.g. 3 x 10 = 30, the product is 30
Factors	A factor of a number is a whole number that divides exactly into it e.g. Factors for 12 are 1, 2, 3, 4, 6 and 12	**Repeated addition**	So many lots of How many lots of? How many altogether? Sets of Groups of
Integers	Any whole number	**Scaling**	Multiplied by For every… For each…. Double (x2) …times as large …times as big …times as much treble or triple (x3)
Inverse	The opposite e.g. 2 x 3 = 6 6 divided by 2 = 3	**Square number**	When you multiply any number by itself you get a square number e.g 4 multiplied by itself is 16
Multiples	A multiple is the result you get when you multiply one whole number with another	**Square Root**	A square root is a factor of a number that you can multiply by itself to give that number e.g. the square root of 16 is 4
Multiplying	A quick way of adding together several lots of the same number or quantity	**Times Tables**	A list of multiplication facts
Sum	When finding a total. This word should only be used for addition. For any other number sentences use the word calculation.		

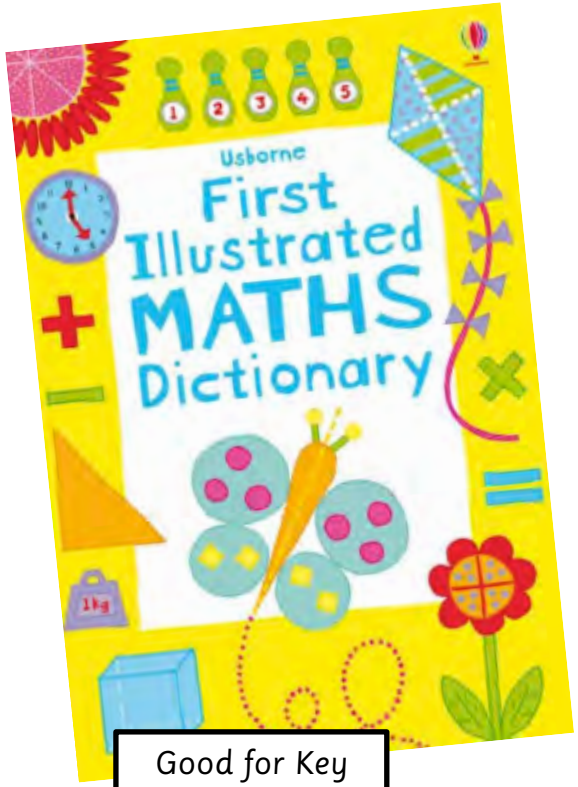
Useful Books



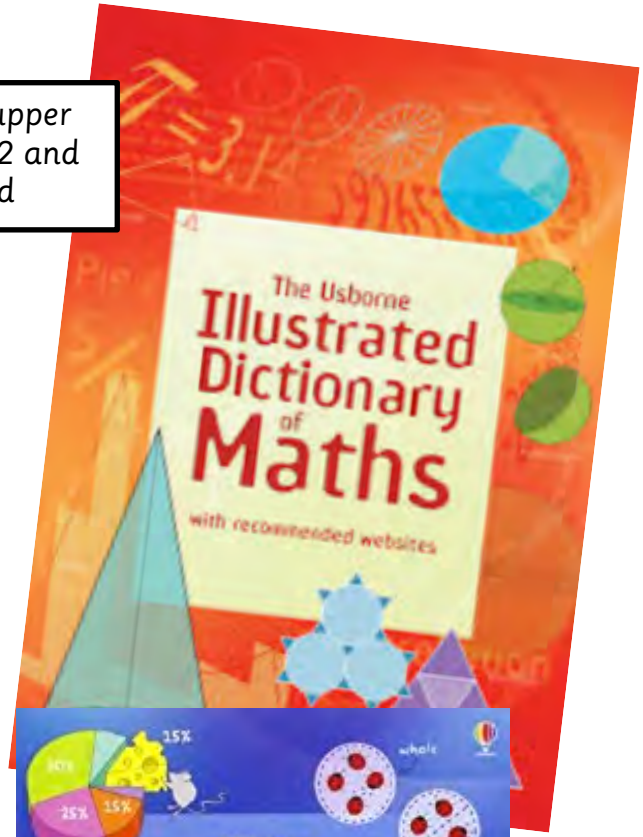
Parent friendly support for mathematical strategies



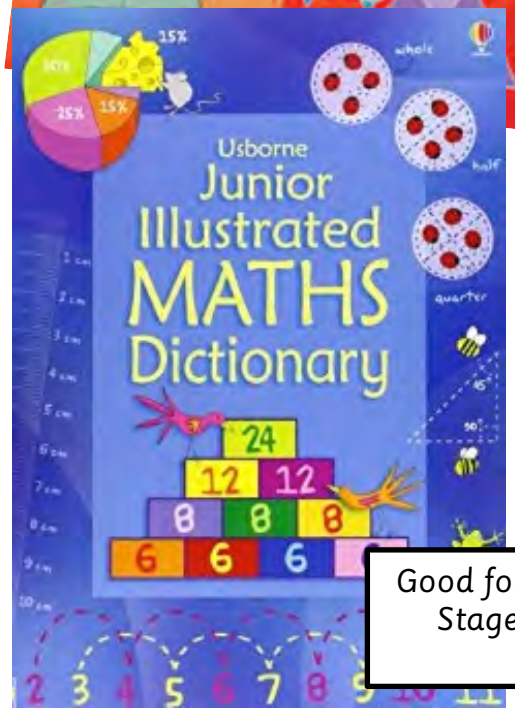
Research on number sense and the development of the understanding of number



Good for Key Stage 1



Good for upper Key Stage 2 and beyond



Good for Key Stage 2

Progression with multiplication

Concrete with objects:
Embedding the understanding of what multiplication is

You don't need to buy any specialist mathematics equipment. You can create 'lots of' with beads, objects around the house, building bricks etc. Just ensure the children are able to physically move and manipulate them.

Using coins to create amounts using the same coin e.g. how many lots of 5 here?

Numicon can be used by finding the tile that you want 'lot of' for e.g. the 5 plate. You can then stack with the ten plates when suitable to show the relationship of numbers that are being made.

Lots of

Work verbally and practically, don't feel the pressure to record it using formal methods.

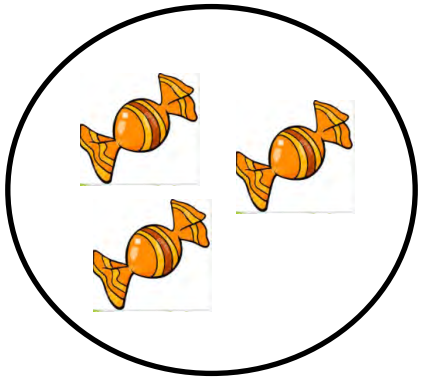
Ask the children how could they show this on paper? See what they do and discuss the recording they have created and why.

How else could you show this? If they know the symbol and confident to use it, then encourage this.

Using cubes to first group them in piles /groups and then you could formailise this further by stacking them. Again allow the child to decide on the organisation and discuss this. You can encourage them to rearrange and work on a systemic approach as they develop.

Progression with multiplication

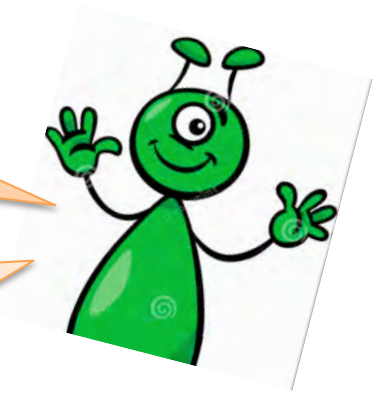
Visual representations of multiplication:



How many sweets are there in … bowls?

How many fingers are there on … aliens?

If there were …. aliens how many fingers would they have?



If I had …. Bowls how many sweets would I have?

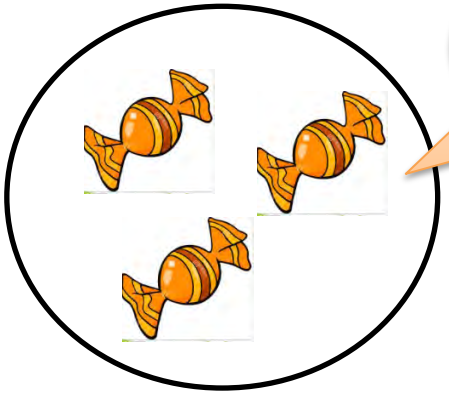
Questions like these can be used as a bridge between the concrete and visual stage but can also be revisited when formal written methods have been introduced with higher level questions.

When sharing ideas and discussing the problems continue to discuss the strategies and solution your child comes to.

- How do we know this is the answer?
- What patterns do you see?
- Why did you work this out in this way?
- How can you check your answer?
- Encourage them to trust their number sense and not have to count each individual sweet
- Encourage them to count in a number sequence rather than in ones
- Can they move from using resources e.g. cubes or numicon to counting, drawing or writing their ideas?
- Bring in vocabulary that you are multiplying
- They may notice they are adding to work out the answer – this is great and discuss how multiplication is repeated addition. Show the relationship of multiplication and addition through images and even concrete objects again if necessary

All of these support the visual stage of multiplication as they will need to move on from concrete objects they can manipulate and now need to use the next stage of their mathematical skills, but still using real life contexts to help them understand. If your child needs concrete objects to solve the problems, that is absolutely fine. Keep encouraging them to see patterns as they do and encourage them to move away from these and record ideas on paper when they are ready. Use your child's interests to enthuse them and allow them to lead the conversation to discuss their problem solving.

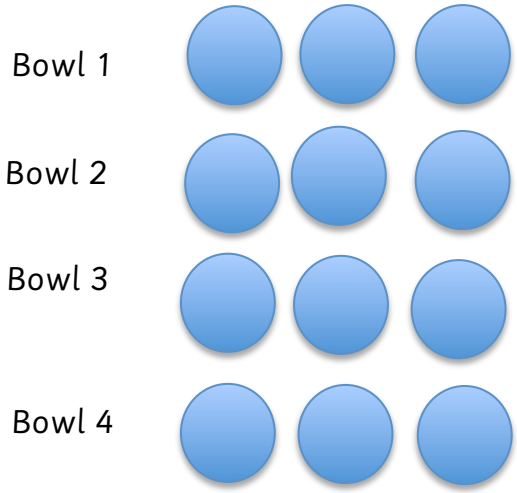
Visual representations continued: Arrays



How many sweets are there in 4 bowls?

We want to find out 3 lots of 4

3 x 4



An array can be made with counters when first learning about them and then drawn on paper when they are confident.

The children can now count the circles to find the answer to their question.

Encourage them to spot patterns they see again and you can show how 3 x 4 is the same as 4 x 3 by simply physically turning the array 90 degrees or by using counters to create it in rows of 4 instead of 3.

12 = 3 x 4
or
3 x 4 = 12

Now can you see 4 x 3 is also equal to 12 and if I have 12 I can divide it by 4 and know there will be 3 or share it with 3 and get the answer 4.
Test this with other multiplication facts to prove it to your child and consolidate it for them.

Arrays are a method taught in school to show how multiplication questions can be solved without the use of any concrete objects. However using counters at first allows children to make the arrays quickly whilst they are learning.

They demonstrate the relationship between multiplication and addition and can also be to demonstrate division. This should be discussed alongside any multiplication activities so they can begin to see patterns with the numbers they are working with.

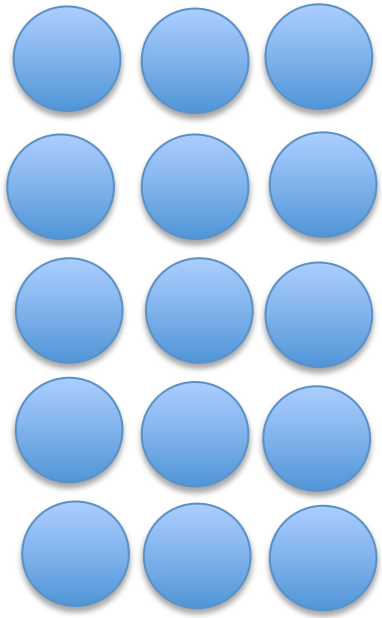
The multiplication symbol is usually introduced here, if it hasn't already. Keep referring to the concept of lots and when first working with arrays it may be useful to stick to one multiplication at a time so they see the 'lots of' in action. 2, 3, 5 are good ones to start with at first. When they are confident it can be used for any times table.

Don't feel you have to write the equals sign at this stage as children begin to see the equals symbol to mean 'the answer' rather than 'equal to'.
Use the equals sign when they have completed it to show that the answer they have found is equal to the question.

Problem solving opportunity: What arrays can we make with 20 counters or dots?
This is great to discuss patterns and relationships between different multiplication facts.

A great video to see this in action is 'The Commutative Law for Multiplication'.
This can be found on You tube at:
http://youtu.be/VGkjjVfnGYI

Visual Representations continued: Number lines



An example where your child has been asked to work out 5 lots of 3

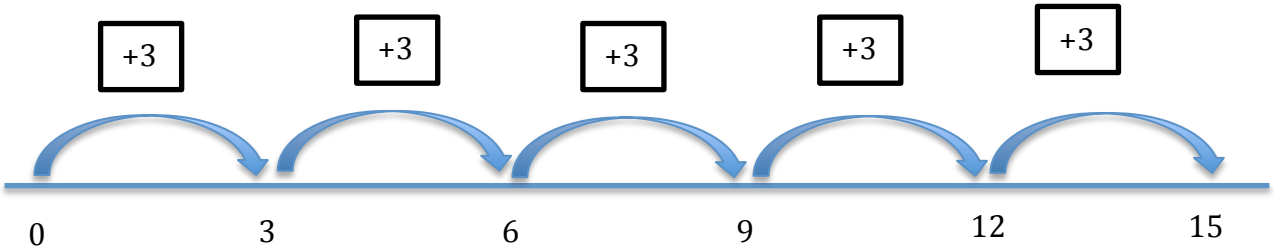
5 x 3
(remind them this is also 3 x 5)

These can link with arrays nicely and again consolidate the relationship between repeated addition and multiplication. Still keep referring back to 'lot of' all the time.

It is a more formal method to show multiplication and as the children are starting to see the relationships forming it becomes quicker and easier for them.

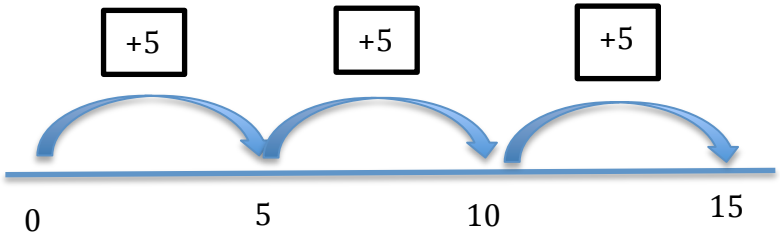
They may work with an array and a number line at first but then begin to just work using a number line.

If they want to make an array with counters still at this stage then it is fine. As they start to see patterns and relationships they will become less reliant on these and have a mental image of what the array would look like in their mind.



When using the number line at first let them jump how they want. Discuss the strategy and continue to ask questions about how and why they did it. Begin to introduce systematic thinking e.g. would it be quicker to do 3 jumps of 5 or 5 jumps of 3?
Different children will choose different options here and neither are wrong. You are just supporting your child to think methodically and find a method that suits them.

or



Some children will need to write the numbers in between each jump as they work which is fine, just try to then move them forward on an empty number line taking whole jumps when they are ready.

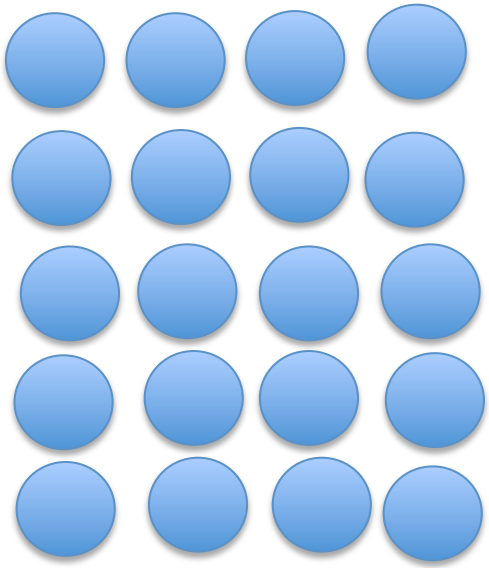
Again keep discussing the patterns you see.
Use a number line to show the 2 and 4 times table – what is happening? Can they spot the numbers double?
What other times table land on the same number on the number line?
Will all the numbers be even or odd? What do you predict?
Do you expect the number .... To be in the ... times table? Why do you think this?
They can then prove their answers using the number line.

Arrays and Number lines continued:

As mentioned before the relationship between division and multiplication is very important as they both work with 'groups of' and 'lots of'. Number lines can be used to reinforce this, so as you work jumping on the 'lots of' ask your child how they think they might be able to work out a division question using their knowledge of arrays and number lines. Talk about it at first and allow your child to have a go with a question first of all. Starting with numbers that they can work with without panicking about.

Dividing with Arrays:

Again it is fine to start this with counters to manipulate here and then move to just drawing.



The first lot of 4, 4 dots so far

2 lots of 4, 8 dots now

3 lots of 4, 12 dots now

4 lots of 4, 16 dots now

5 lots of 4, 20 dots now

Then discuss what the children can see – we organised in rows of 4 because that was the number we were dividing by. How many rows are there?
Can they see that 20 ÷ 5 is 4?

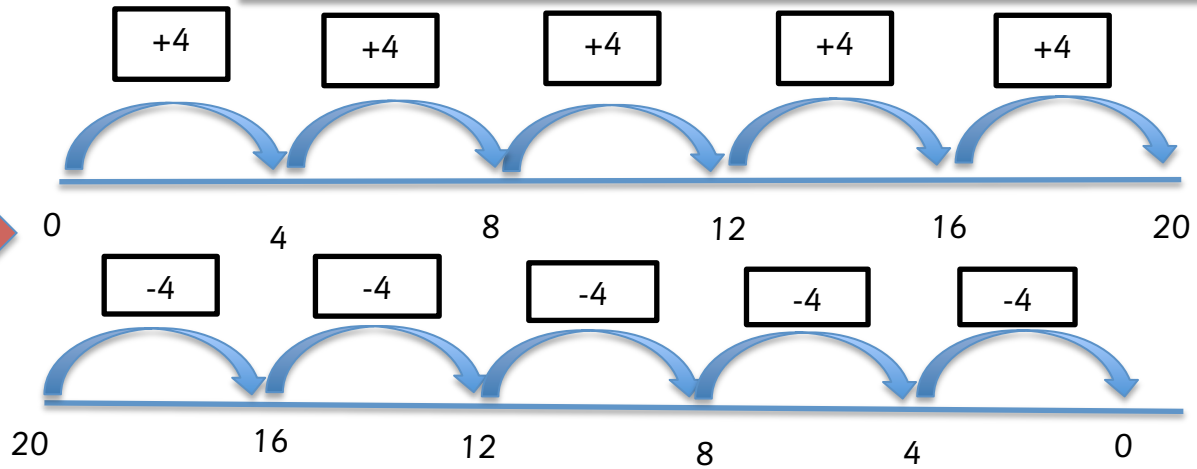
How could I use my knowledge of arrays and number lines to work out 20 ÷ 4?

Again, don't write the equals sign at this point, set a question for discussion and reasoning.

On Number Lines:

You are asking your child to work out how many lots of 4 go into 20, if you shared 20 between 4 so your jumps need to be in jumps of 4. Get your child to come up with ideas to use a number line first and let them see what they do, then support with the jumps if necessary.

You can either count on or count back. Different children will be more comfortable working one way. We always teach both and they use the accurate strategy for them.



5 jumps of 4 = 5 lots of 4.
20 ÷ 4 = 5

Problem Solving with multiplication

To consolidate these strategies it is good to check they can apply these to different problem solving situations. This will check your child has a solid understanding of the process of multiplication and what happens to the numbers when we multiply it. It will also consolidate the relationship between multiplication and division.

The children need to be encouraged to use a suitable strategy to use to solve the problem for themselves and then reason and discuss before you correct their choice.

Missing Number questions

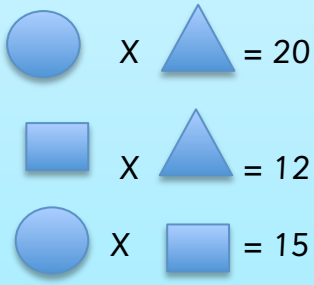
Can the children work out what the missing number is using a written strategy?
Work on the times table that your child is focused on or can do at first and then push them onto a calculation that may stretch them to rely on a written strategy to check their processing skills.

7 x ____?____ = 28

____?____ x 6 = 30

45 ÷ _____ = 9

You could introduce simple algebra techniques e.g.



What number does each shape represent?

What ways can you make...?

Challenge the children by giving them a number. What times table facts give this number as their product? How can you make sure you haven't missed any? Discuss ways to work systematically and begin to predict which numbers they expect to find.

Word Problems

Hide a question in a word problem which involves a real life situation e.g. money, shopping, organisation of an event etc.

There were 4 keys kept in a box in the school office. If there were 8 boxes how many keys were there?

A child ate 7 grapes each day for snack, how many will they eat in a week?

There are loads of examples on the internet if you Google multiplication word problems.

A good website for problem solving activities is called NRich. If you search for multiplication and choose primary it will give a wide selection.
The answers are not published as they ask you to send your solutions in, however there are help pages.

http://nrich.maths.org

Tricks to help with up to 12 x 12

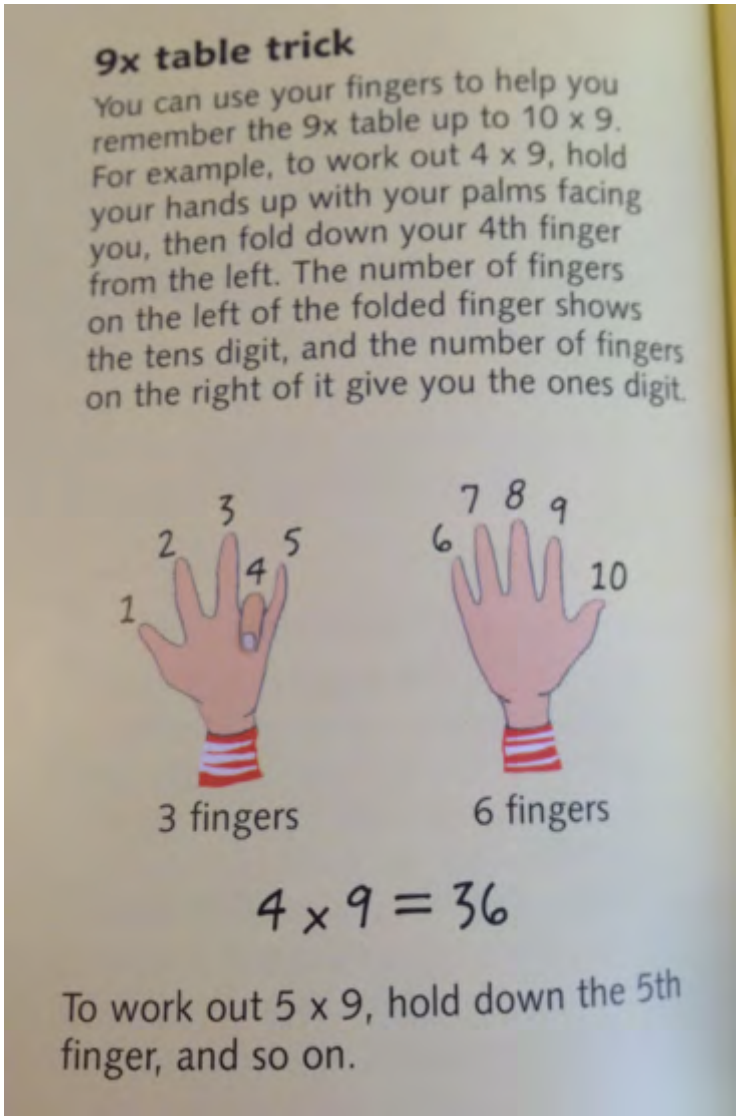
Learning x2, x5, x10 really soundly will help you to double, or count on or back the lots of.

Look for patterns with doubling and halving and also with odd and even numbers.

Do the children need to learn all of the multiplication facts for a particular number or do they need to spend the week focusing on the ones they find tricky. E.g. 8 x 6 and 8 x 12 learnt off by heart and retained in the memory?

Make up rhymes to help your child remember the times table e.g.
6 x 7 = 42, phew!
7 x 7 = 49, fine!
6 x 8 = 48, great!

Change the vocabulary you use when asking your child a question so they get used to the way a question may be asked to them.
What are 5 threes?
What is .... divided by ....?
..... times .....?
How many ..... in .....?
.... times what equals .....?
What is the product of .... and ....?



9x table trick

You can use your fingers to help you remember the 9x table up to 10 x 9. For example, to work out 4 x 9, hold your hands up with your palms facing you, then fold down your 4th finger from the left. The number of fingers on the left of the folded finger shows the tens digit, and the number of fingers on the right of it give you the ones digit.

3 fingers

6 fingers

4 x 9 = 36

To work out 5 x 9, hold down the 5th finger, and so on.

Useful websites:
www.mathszone.co.uk
http://www.primaryresources.co.uk/online/moonmaths.swf
http://resources.woodlands-junior.kent.sch.uk/maths/timestable/interactive.htm

A video to show this in action:
http://youtu.be/Wu3JSnRaaV0

Games to play

The Bean Race
You need two dice and a pile of dried beans. Take turns to roll the two dice. Multiply the two numbers and call out the answer. If you are right you win a bean, first to 10 wins!

Times Table Dominoes
Place the dominoes face down. Shuffle them and each take one domino. Multiply the two numbers together on your domino. If you gave the biggest answer wins their domino. The winner is the person with the most dominoes at the end.

Dicey Division
You each need a piece of paper. Each of you should choose five numbers from the list below and write them on your paper.

5 6 8 9 12 15 20 30 40 50

Take turns to roll a dice. If the number you roll divides exactly into one of your numbers, then cross it out e.g. you roll a 4, it goes into 8 so you could cross that out.
If you roll a 1 you miss a turn, if you roll a six you get a bonus go!

Left Overs
Take turns to choose a two digit number less than 50 and write it down. Now count up in a times table e.g. fours. What number is left over?
E.g.
Choose 27
Count: 4, 8, 12, 16, 20, 24
3 left over to get to 27 so you score 3 points.
The first person to get to 12 points wins.

Four in a Row
Draw a 6 x 7 grid and fill it with numbers under 100. Roll three dice (or one dice three times). Use all the numbers to try to take one of the numbers on the grid. You can add, subtract, multiply or divide the numbers to get there.
E.g. you roll a 3, a 5 and a 5. You could make 3 x 4 – 5 = 7 or 54 divided by 3 = 18 or (4+5) x 3 = 27 etc.
Cover the number you make with a counter or cross it out.
The aim of the game is to cover four numbers in a line.

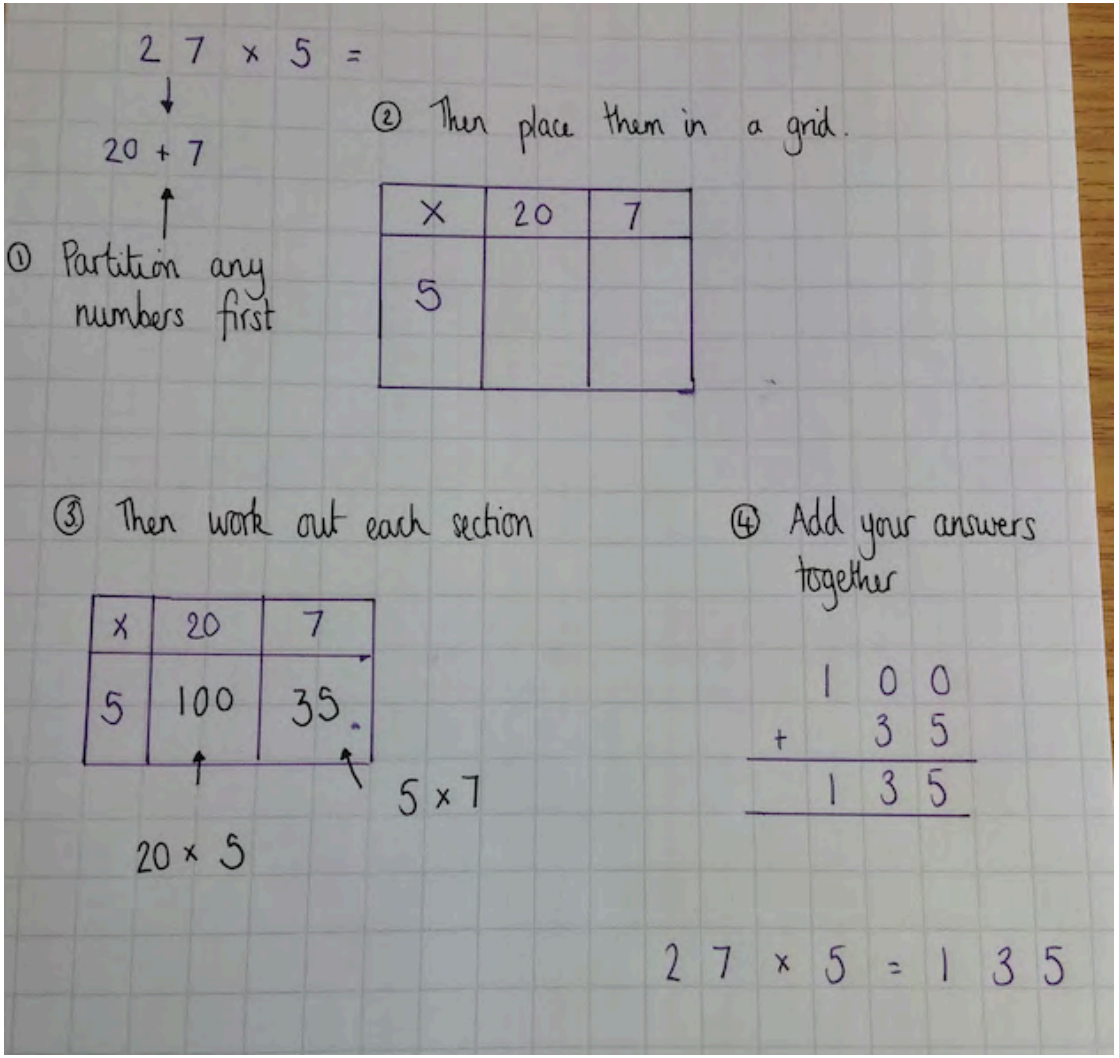
Beat the ...calculator, Dad, Mum, Grandpa, clock, time it takes for someone to run round the garden.
Set a series of ten questions to see if they can solve them quicker than whatever you have chosen to beat!

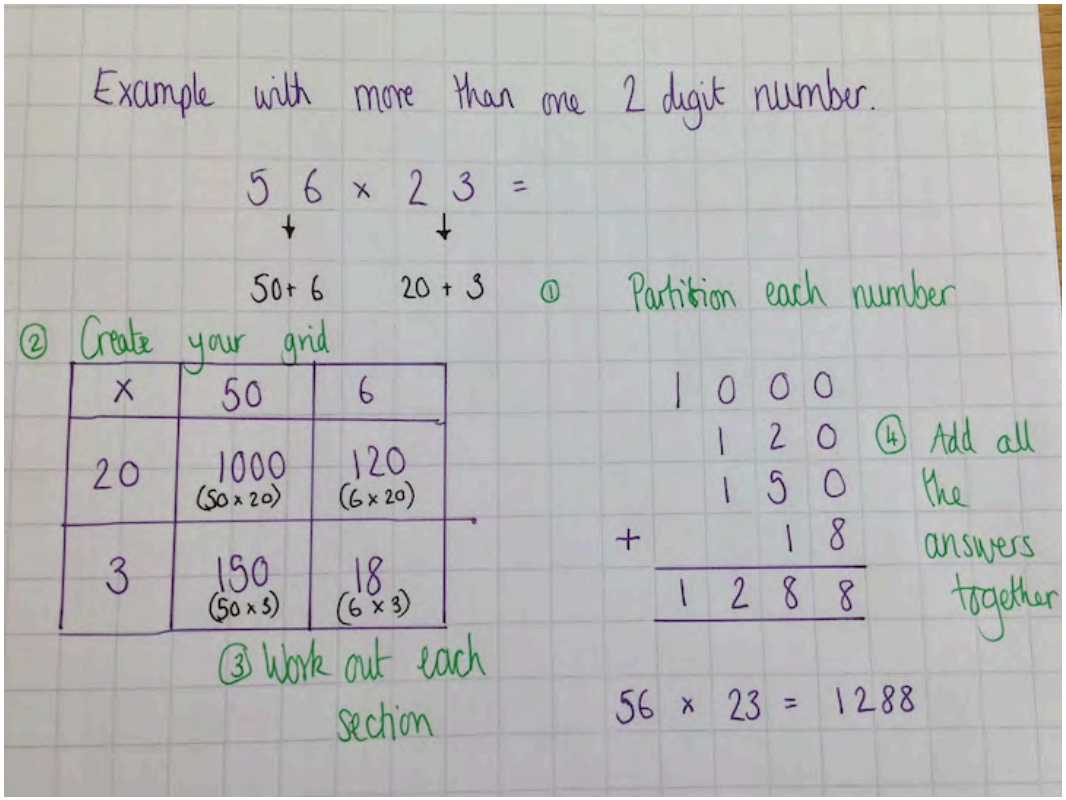
Card Game
Use a pack of playing cards but take out the jacks, queens and kings.
Take turns to take a card and roll a dice. Multiply the two numbers together and record the answer. Keep a running total and the first to 301 wins!

Further Written Strategies

Partitioning with the Grid Method

Suitable for all numbers with two or more digits:





This can be adapted to any size number given to you e.g 3 or 4 digit numbers etc.
It can also be adapted to use for decimal numbers which is shown in a few pages time.

A nice You Tube video demonstrating this can be found at: https://youtu.be/v4P4T8fg9Sk

Short Multiplication: Used for multiplying 2 or more digits by 1 digit

Step 1

24 x 6

① Set out the calculation in columns using the correct place value.

	h	t
	2	4
x		6
	2	4
1	2	0
1	4	4

② Start with the tens column
4 x 6 = 24

③ Then the tens column
20 x 6 = 120

④ Then add them together

When using this method refer back to the columns to ensure children understand where the numbers are coming from. That is why the first step is useful. We aren't just looking at 4 x 6 and then 2 x 6 as it is 24 x 6. Children will start to see a pattern and you could refer to it as 2 x 6 and then make it tens times bigger as we are multiplying a number from the tens column.

Step 2

When children are confident with this they will be able to 'carry' any remainders over to the next column. This will then remove the working out in the middle part of the calculation.

	2	4
x		6
		4
	2	

	2	4
x		6
1	4	4
	2	

6 x 20 = 120 + 20 from before
= 140

Answer has 2 tens in so goes to the tens column, but you need to work out the next part first and then add it on.

Examples from the National Curriculum

Short multiplication

24 × 6 becomes

	2	4
×		6
1	4	4
	2	

Answer: 144

342 × 7 becomes

	3	4	2
×			7
2	3	9	4
	2	1	

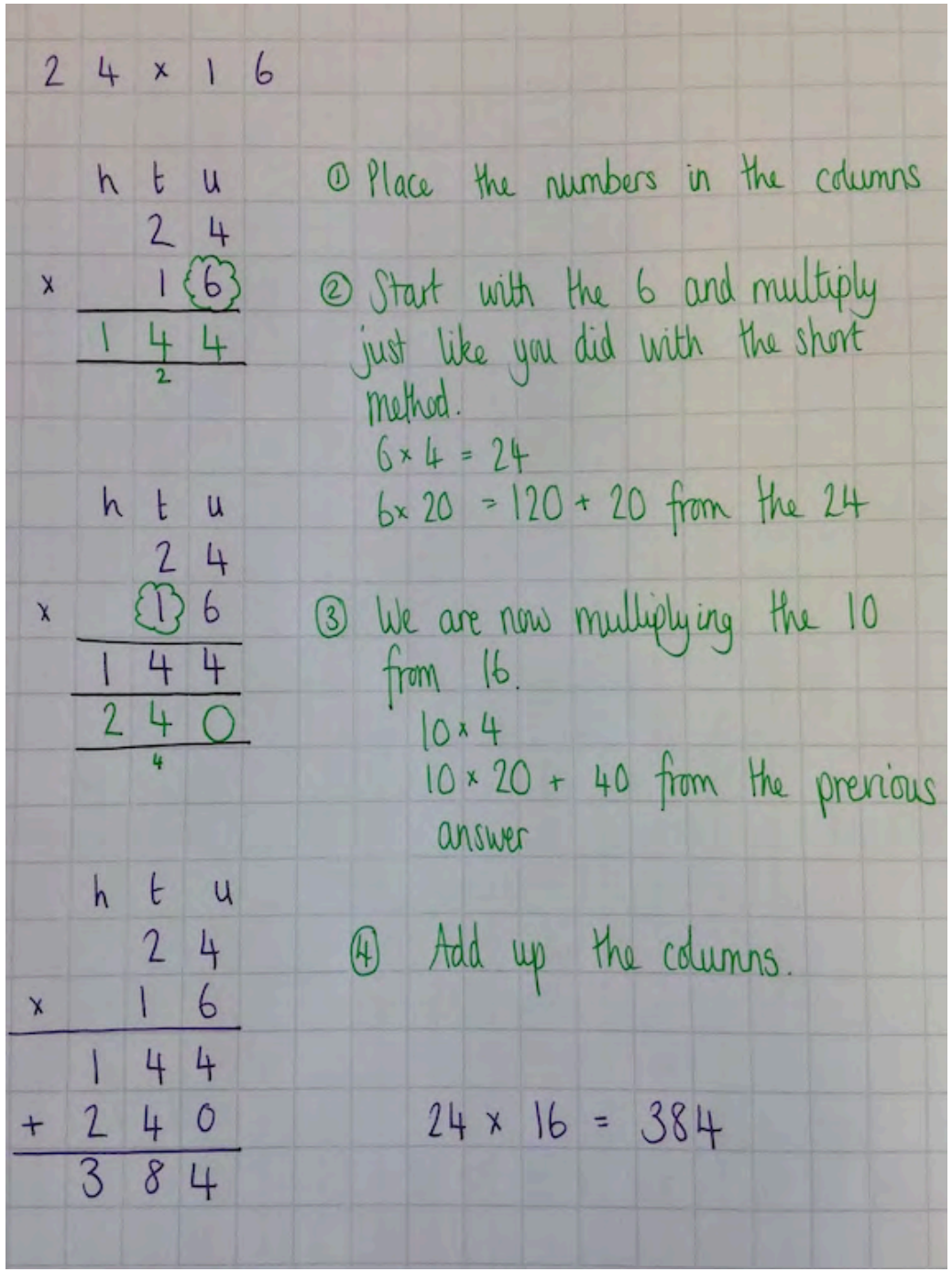
Answer: 2394

2741 × 6 becomes

	2	7	4	1
×				6
1	6	4	4	6
	4	2		

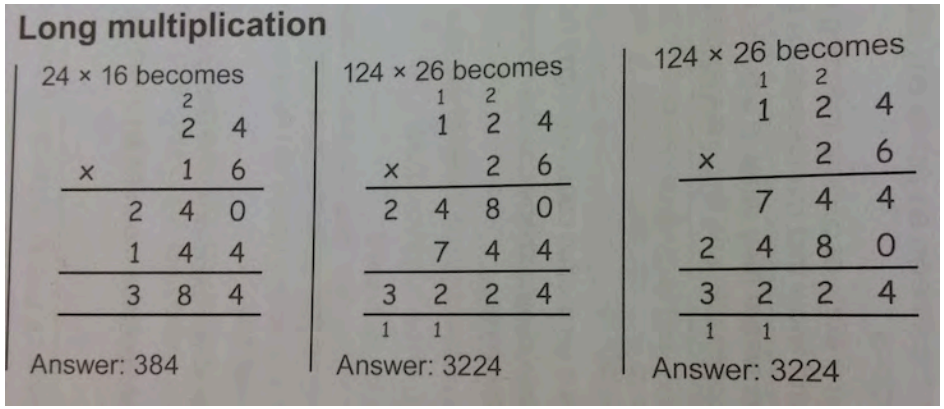
Answer: 16446

Long Mulitplication: for multiplying numbers with 2 or more digits



There are many videos on the internet to demonstrate short and long multiplication, however they will not fully explain the place value of the calculation. By all means Google these and use them but ensure your child understands why each number is placed in the column it has been. This will help them to understand the process and not just follow a set of rules.

Examples from the National Curriculum

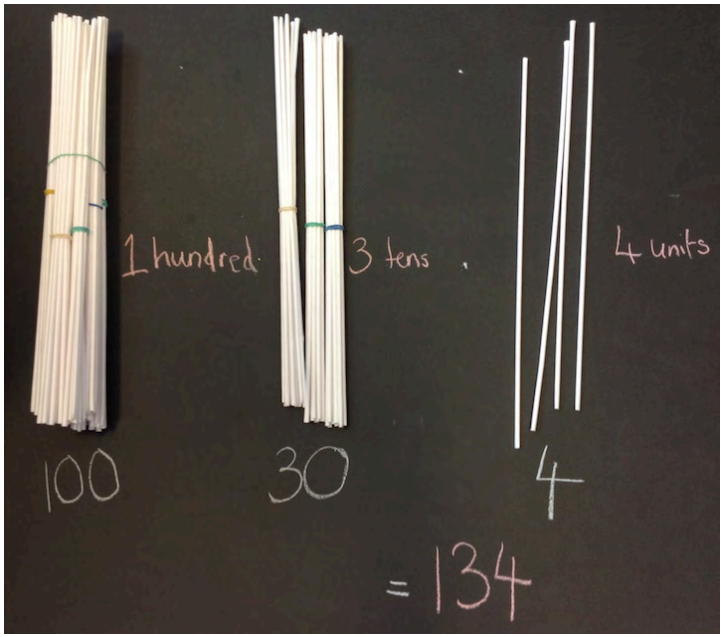


On the first two examples you may notice that they have started multiplying with the tens column rather than the units. This is fine and will still work, however as the children learn column addition and subtraction always starting from the units column it will probably link more naturally to start from the units column here too. See what your child finds easiest and talk about why as they do it.

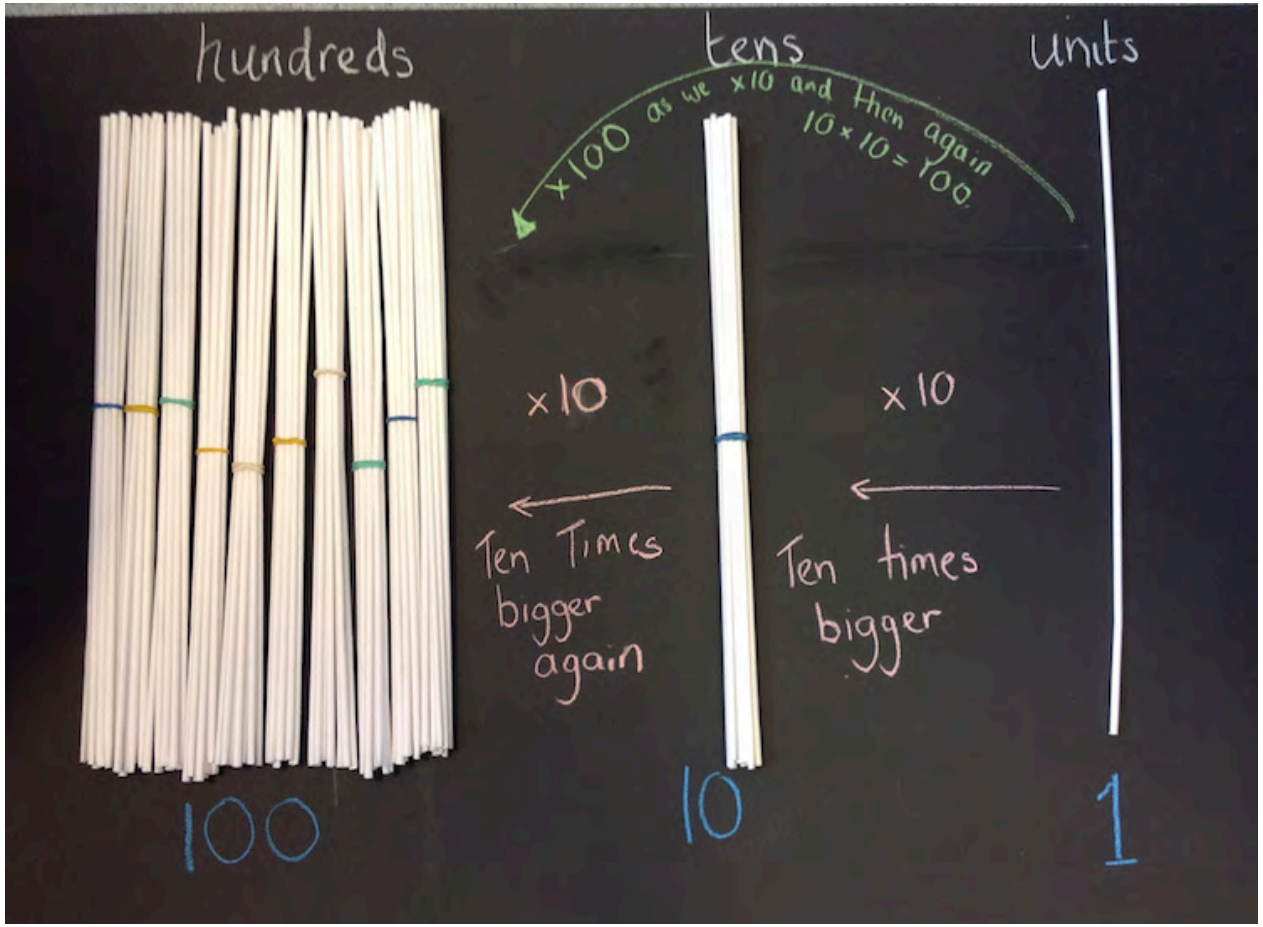
Multiplying and Dividing by 10, 100 or 1000

This is a really important step for understanding the process of multiplication and children will find many calculations easier when they have grasped this. It is very tempting to say when you times by 10 you add a zero. Yes you do and your child will probably notice very quickly when you are working with whole numbers; however they soon see this pattern doesn't translate over when using decimal number. If they understand what is actually happening to a number when it is being multiplied by 10, then they can apply it to any number that they have been given.

Children need a clear understanding of the place value of a number to complete this. In school we often use straws to show this. We have a single straw to represent one, then a bundle up ten straws to represent 10 and then we bundle ten lots of ten to make hundred. Children can then make up the numbers using these and calculate with them.

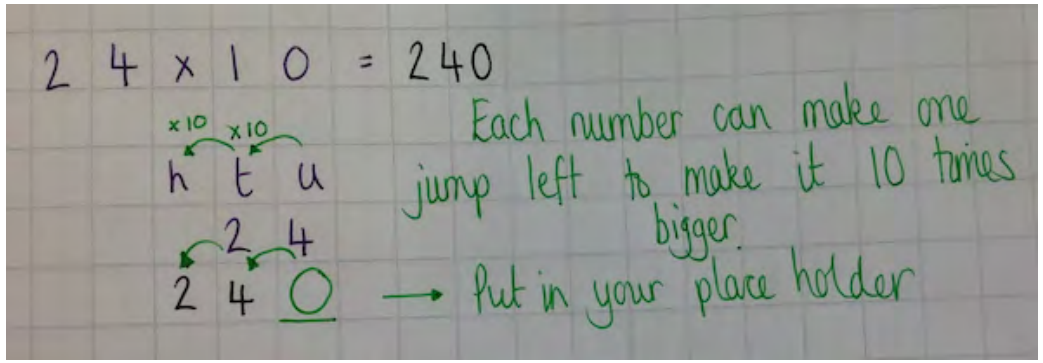


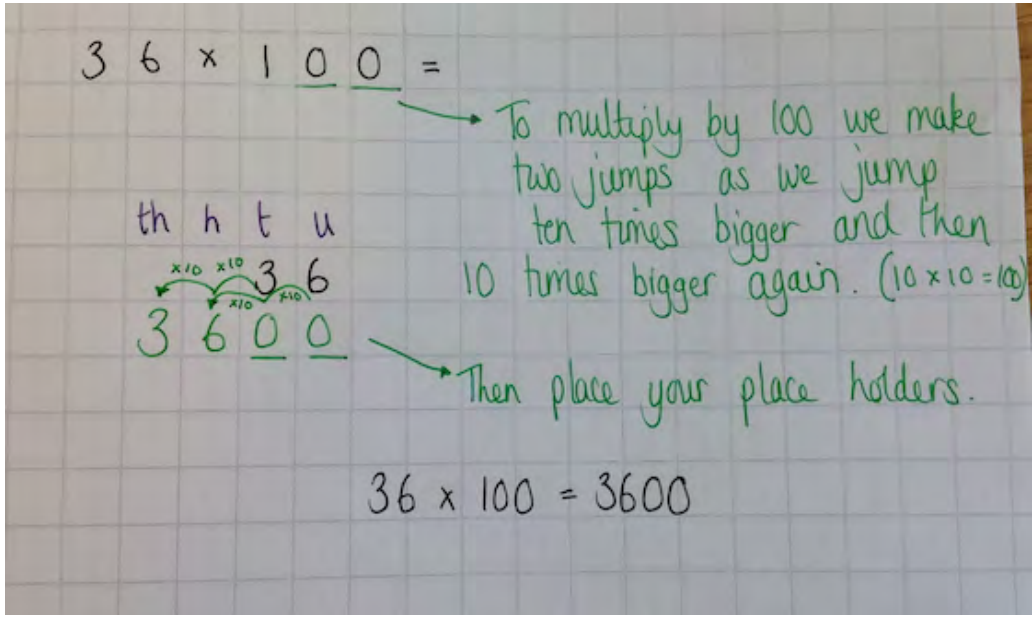
Children need to understand that each column is 10 times bigger than the one to its right or tens times smaller than the one to its left. Using one in the unit column is the easiest way to represent this, and again we can use the straws for this.



Multiplying with 10, 100 and 1000:

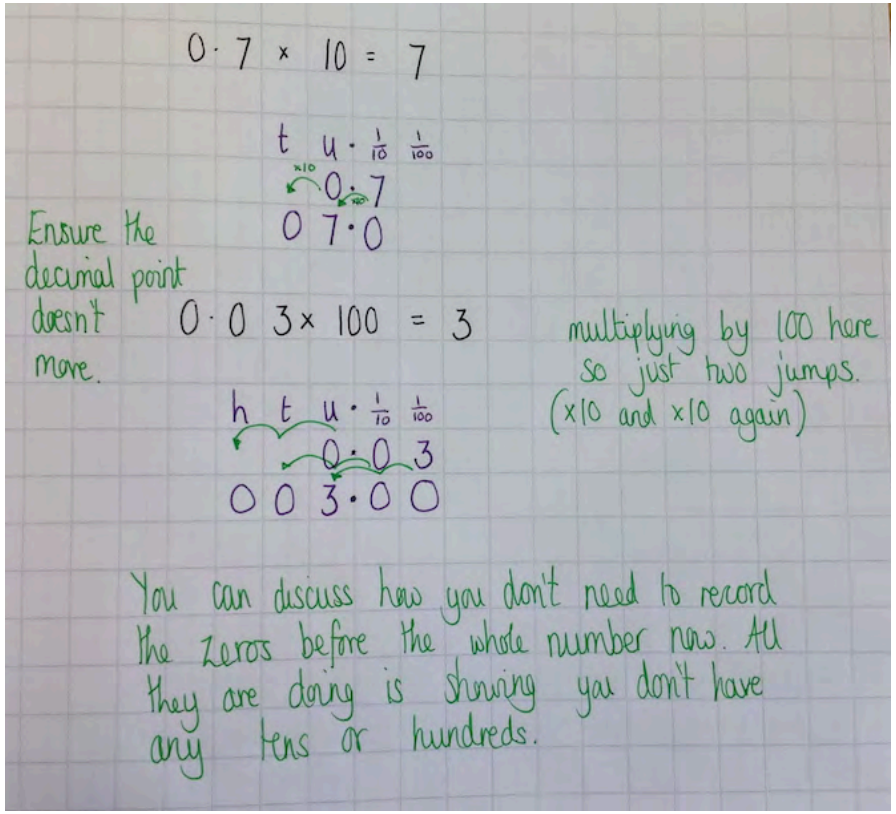
When you multiply a number by ten you are making the number ten times bigger, this can be shown on a place value grid





Children will notice the pattern of adding the zeros, this is ok! Talk about it with them and discuss how it is helping them. What I have shared with a class is that when we are multiplying by 10 we jump once and multiplying by 100 we jump twice and referred them to the number of zeros in the number. 10 = one zero and 100 has two zeros also.

This can then be applied to any number they have been given, including decimals.

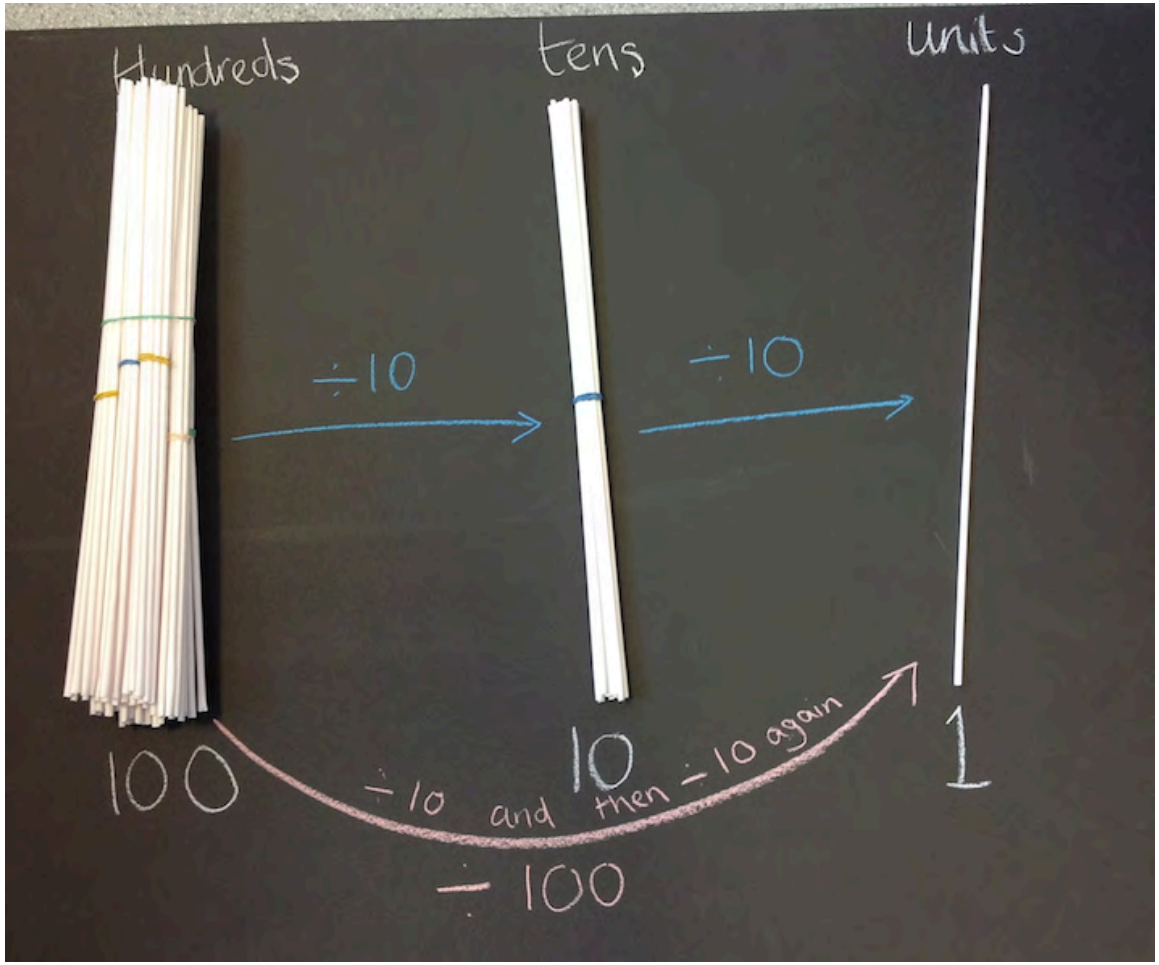


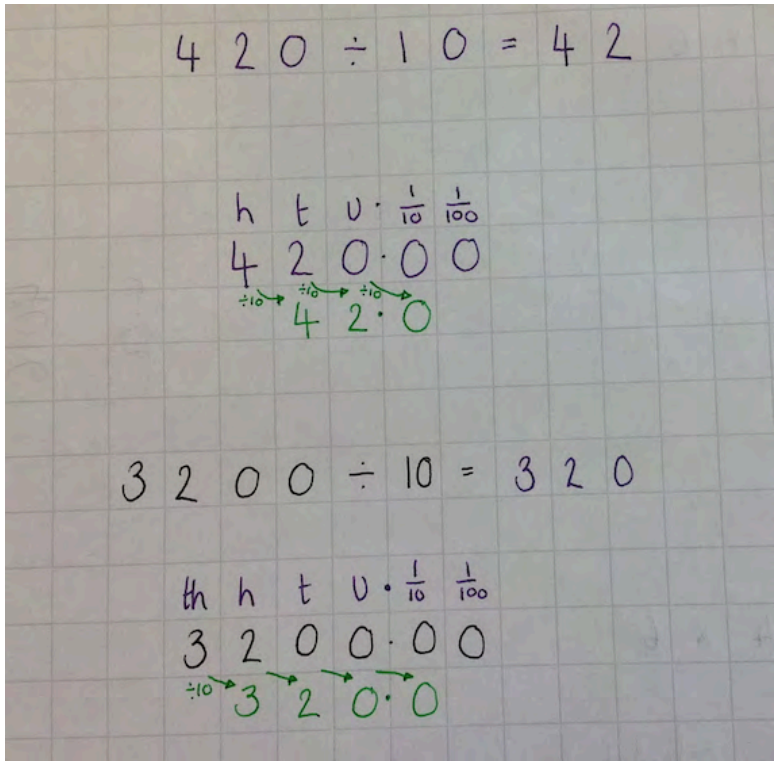
For multiplying by one thousand do exactly the same but jumping 3 columns (10 x 10 x 10 = 1000) See if you can challenge your child to show this once they have grasped the concept. If they can with ease they have understood what is happening when you multiply a number by 10 and 100.

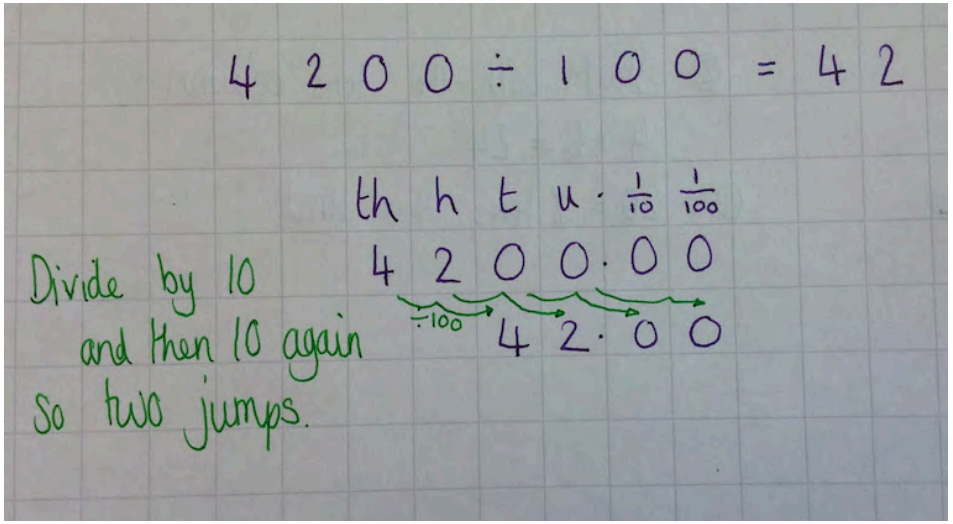
Some children will benefit from physically jumping on a giant place value grid. You could draw one with chalk on the pavement. Others will prefer moving cards with the numbers on and some children will see the patterns and be able to work mentally quite quickly. Go at the pace of your child, talking about the mathematics they complete as they go.

Dividing with 10, 100 and 1000:

Division is the inverse of multiplication (the opposite) so it works exactly the same way. Instead of making the numbers 10 times bigger, it becomes ten times smaller.







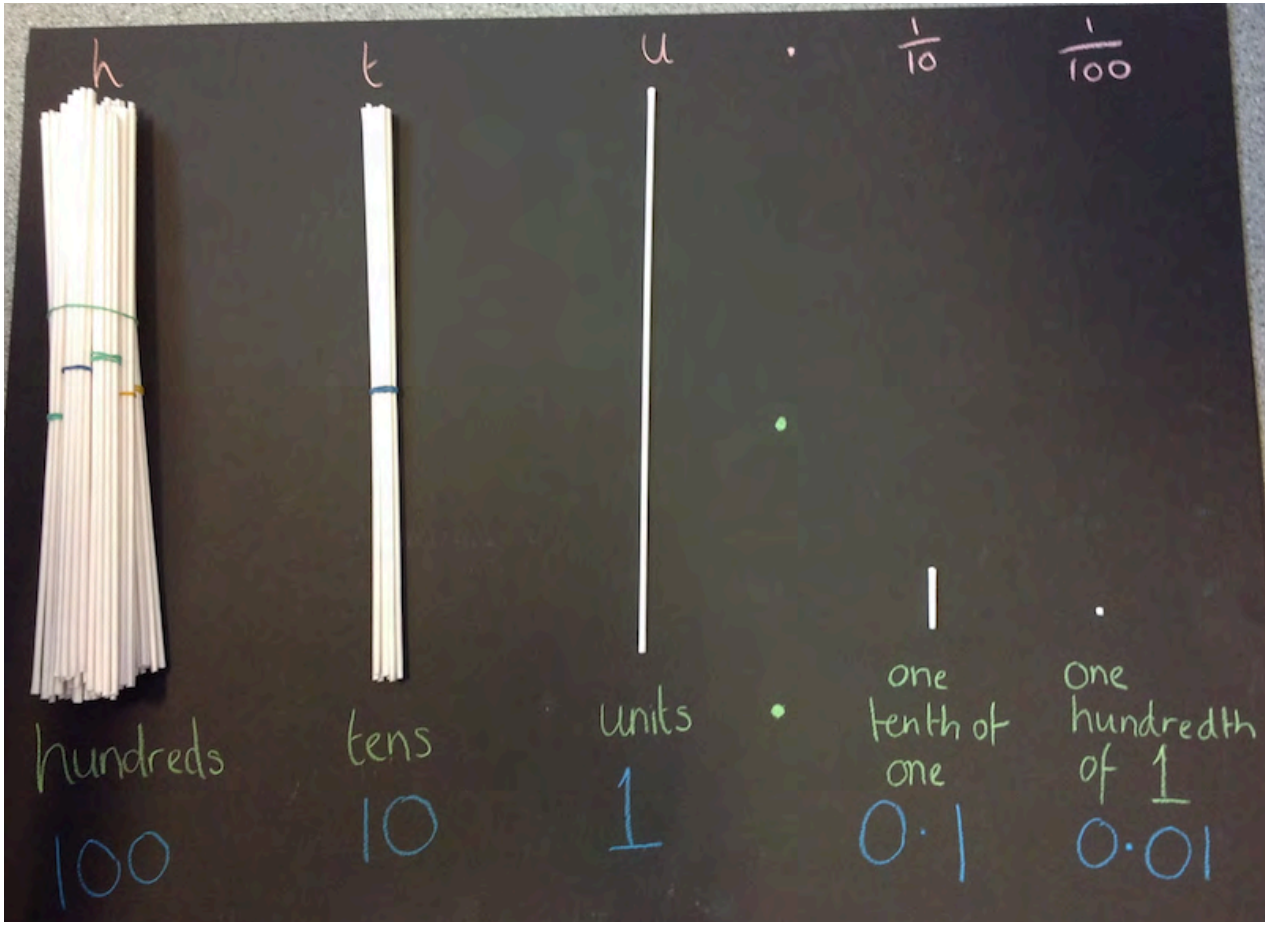
Again, see if the children can work out how to divide by 1000 when they have grasped dividing by 10 and 100.

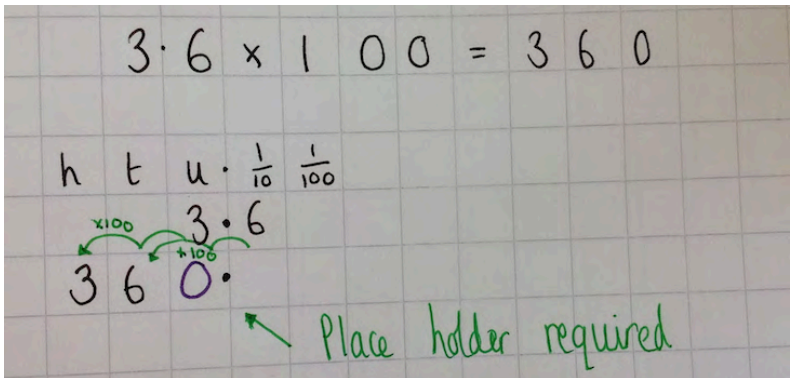
See if your child can complete these questions, and increase the pace as you go. Switch between division and multiplication questions to ensure they remember to make the number bigger or smaller. Can your child work mentally to complete these?

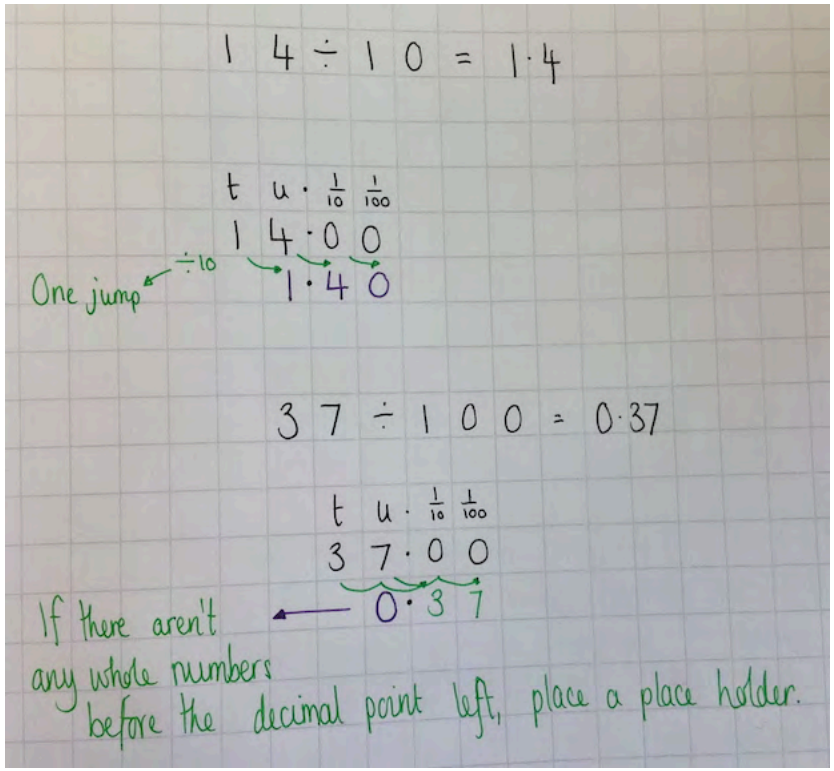
What happens when we get a decimal number as our answer or start with a decimal number?

The rule says exactly the same as one whole is ten times bigger than one tenth and one tenth is ten times bigger than one hundredth.

The place value grid may need to be drawn so the children can see it in action and understand what is happening to the numbers. In school we use the straws to show how tenths and hundredths are part of a whole.

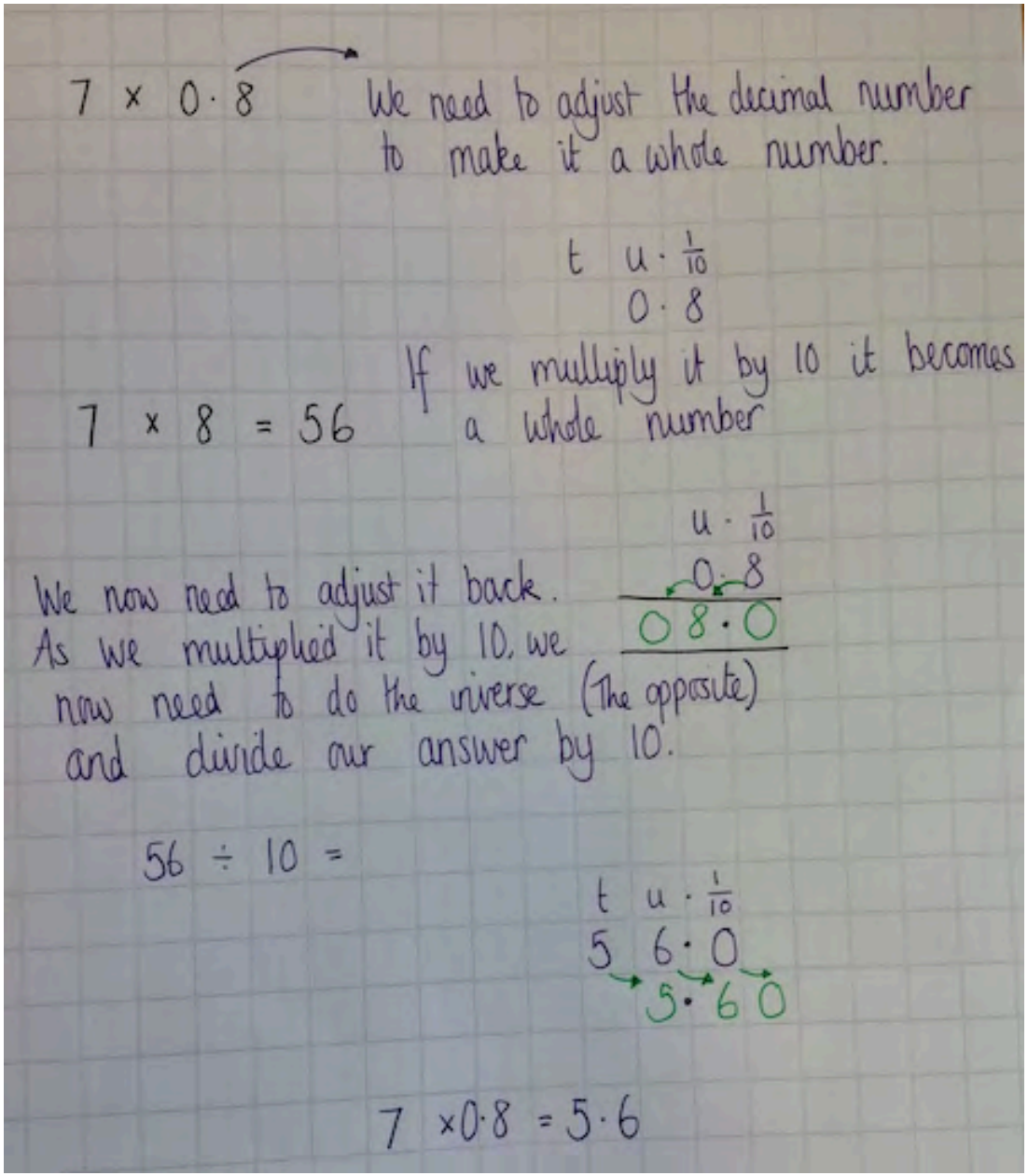


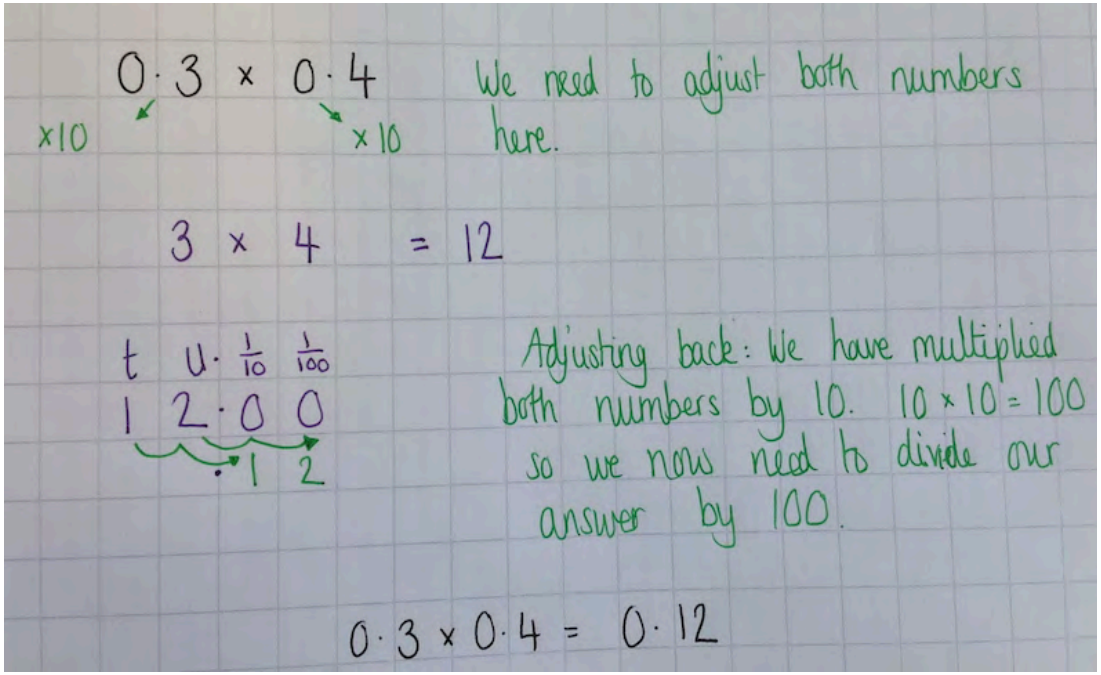




Multiplying with decimal numbers:

Children find multiplying decimal numbers a daunting experience. When learning how to do it, pattern spotting is vital. They need to be able to multiply and divide numbers by 10, 100 and 1000 with ease to really work through this strategy. The key part of the strategy is to be able to adjust the number to calculate it mentally and then adjust it back to suit the question that was originally given.



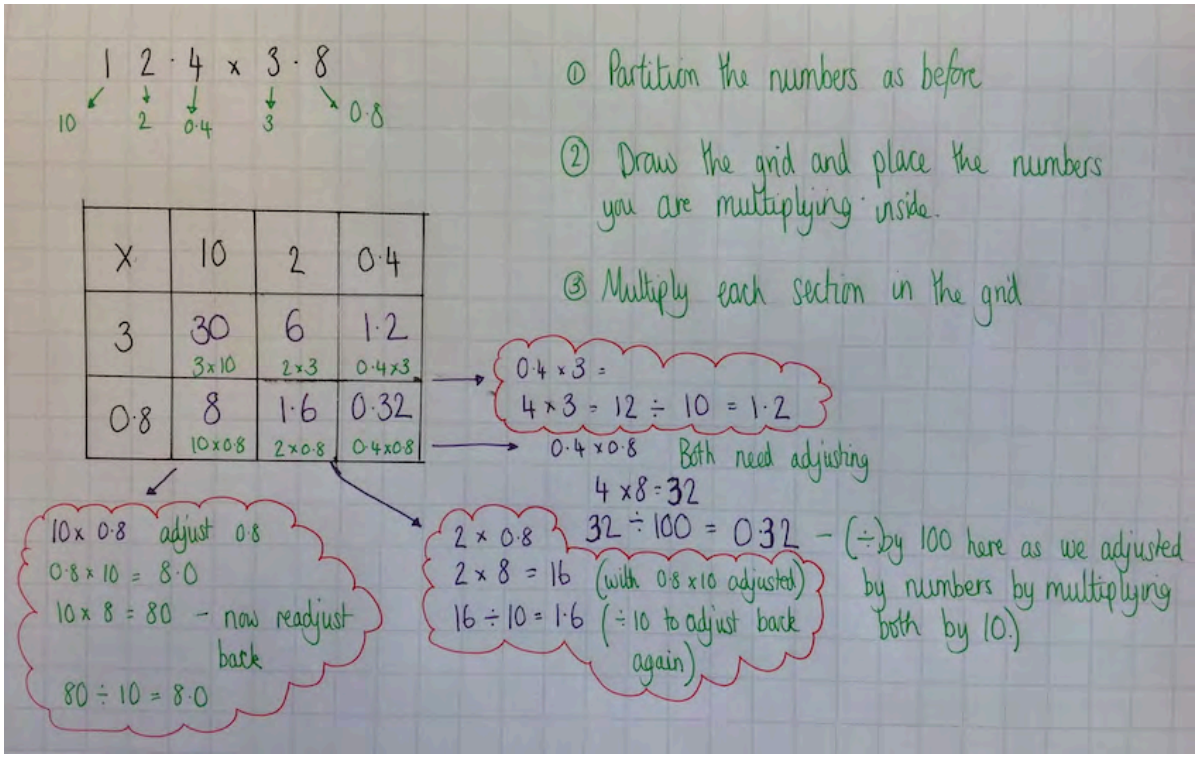


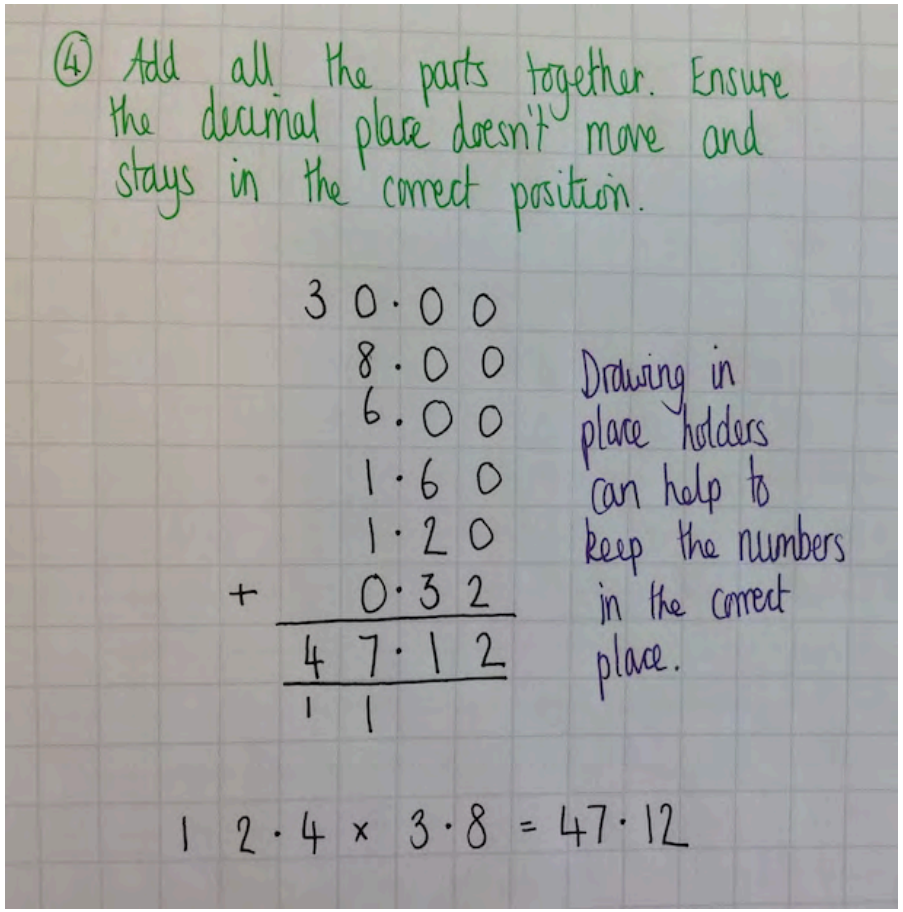
Again discuss the patterns that the children see and how the value of the numbers is changing each time. It might be useful to have a place value grid next to you so you can physically move the numbers first of all.

The Grid Method with Decimal Numbers:

Children may be asked to multiply numbers involving decimals. This can be seen in problems such as money calculations. When this occurs children need to use a mix of partitioning and adjusting to work it out. Some children will adjust mentally and that is great. If they are not working at that level yet they must write down all parts of the calculation to help them keep track and stay accurate.

The grid method will work in exactly the same way as it did before:





It may look long winded at first, but as children become more fluent at multiplying decimals, they will adjust the questions automatically and complete it without any written support. They may just need to add the numbers up using the column method to help them to ensure accuracy, especially when working with mixed decimal numbers.