Multiplication and Division Facts (Times Tables)

Key NC Statement

Recall multiplication and division facts for multiplication tables up to 12 × 12

Related NC Statements

- count in multiples of 6, 7, 9
- solve problems involving multiplying and adding, including using the distributive law

Key Concepts

This sequence assumes that children have rehearsed and learnt the facts for the 2s, 5s,10s and 3s, 4s, 8s previously (covered in Years 2 and 3) and that recall of these facts is developing well. Pupils may benefit from further rehearsal of these, which could be part of the starters to lessons. The strategies in Step 2 within this sequence can be used to fully explore any multiplication table that pupils need to develop their recall of.

This sequence also builds on the commutative (5 x 6 = 6 x 5) and associative laws (5 x 6 = 5 x 2 x 3) already covered in Year 3. See the learning sequence on multiplication in Year 3 term 2 for further information.

This sequence begins by securing understanding of the distributive law e.g. 5 x 6 = 5 x 2 + 5 x 4, using arrays and regrouping (partitioning) them. It then explores ways to learn multiplication facts, focusing on the 6s, 7s, 9s, 11s and 12s, with strategies that would be transferable to learning the other multiplication facts (if these are still required). It is important to provide learning time for each set of facts so that the exploration and rehearsal can translate into recall memory.

Later in the sequence, teachers will develop recall and rehearsal activities whilst developing understanding of multiplication. Pupils will be encouraged to look at a range of strategies for calculating unknown facts within 12 x 12 based on known facts and the arithmetical laws.

Steps within the Learning Sequence

Step 1: Creating and regrouping arrays for multiplication (distributive law)

Step 2: Learning multiplication facts through building arrays (developing recall)

Step 3: Rehearsing and recalling multiplication facts; making links and spotting patterns

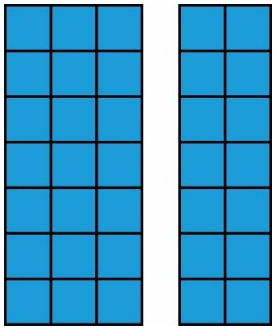
Step 4: Rehearsing division facts

Step 5: Laws of divisibility to help with division facts

Step 6: Strategies for calculating multiplication facts

© Herts for Learning Ltd - 2017

Destination Questions

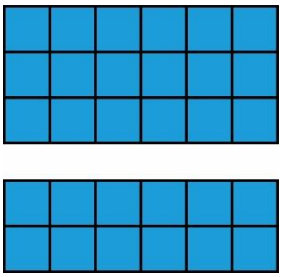
1  This shows ☐ x ☐ + ☐ x ☐ = ☐	2 ☐ x 6 = 42 ☐ x 6 = 66 ☐ x 6 = 78	3 24 = ☐ x ☐ What pairs of numbers could these be? How many ways can you complete the boxes?
4 True or false: The 9 times table only has odd numbers in the answers. Explain how you know.	5 The number 48 is divisible by 3. Explain how you know.	6 How could you work these facts out if you didn't know them: 9 x 7 12 x 6

© Herts for Learning Ltd - 2017

Step one

Creating and regrouping arrays for multiplication (distributive law)

Pupils make the array for 5 x 6 with either cubes or counters. Confirm that it shows 5 x 6 = 30. There are 5 groups of 6; five rows of six counters / cubes. Clarify that the array could be regrouped into 3 x 6 and 2 x 6 (by moving the lower 2 rows down). Then model writing 5 x 6 = 3 x 6 + 2 x 6 = 30.
This is the distributive law – the calculation has been distributed into two parts; 3 groups of 6 and 2 groups of 6.
Pupils should note that the product has not changed – only the way the number is regrouped.



Model again with 7 x 4 and show this is regrouped into 6 x 4 + 1 x 4 or 2 x 4 + 5 x 4.
Confirm that the product is still 28. There are still 28 counters or cubes.
Pupils to investigate with 8 x 6, 6 x 7 and 9 x 4. Pupils will record so that they can express the equality using symbols and arrays for example 8 x 6 = 5 x 6 + 3 x 6 = 48.
Use handout_4LS6_Step1_distributivelaw_speaking_frame to support pupils to talk about their calculations.

The calculation ☐ x ☐ = ☐

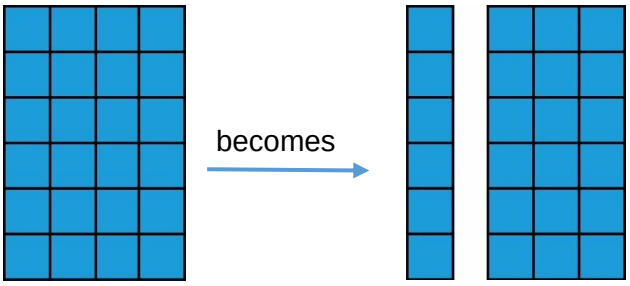
can be regrouped into

☐ **groups of** ☐ **and** ☐ **groups of** ☐

This means ☐ x ☐ + ☐ x ☐ = ☐

I have built (or drawn) the array and partitioned it to show this.

Provide a further example with the alternative layout: 6 x 4 = 6 x 1 + 6 x 3 = 24.
Pupils draw the first array and then regroup it to show the two parts:



6 x 4 = 6 x 1 + 6 x 3 = 24

1

BUFFER ZONE

© Herts for Learning Ltd - 2017

Step two

Learning multiplication facts through building arrays (developing recall)

This step is key in building multiplication knowledge towards recall.

Pupils explore and begin to learn and remember the multiplication facts for the 6 x table.
Make the facts as a growing array with cubes or counters. 1 x 6 = 6 (1 group of 6 is 6).

If this is 1 x 6, what would 0 x 6 look like?

Continue to build the array, adding a row each time and recording the corresponding fact made until 12 x 6 is reached.

2 x 6 = 12

With the full set of facts to 12 x 6, rehearse and check in order before using them out of order.

At this point, pupils can record the arrays in their books alongside the written facts (pictorial representation alongside the abstract written facts).

The aim is to create a recall memory for these facts. Spend time creating card games and rehearsing facts.
Pupils will need 13 small rectangles of card to write the question on the front and answer on the back, from 0 x 6 up to 12 x 6.

3 x 6	18

Games to play with these cards:

- **Take turns:** working in pairs, pupils take turns to choose a card and say the answer to the calculation. If correct, they keep the card in their pile until all cards are gone.
- **Switched:** play as above but mix cards so that some answers are face up. Pupils have to say the calculation for these.
- **Speedy race (in order):** working in pairs, one pupil uses the cards in order to say the answer to the calculation on each card as quickly as possible. The other pupil checks the answer on the back. Pupils swap roles when ready.
- **Speedy race (out of order):** as above, but cards can be in any order.

2 3

The whole process above to be repeated for the 7s, 9s, and 11s and 12s (or other multiplication tables that pupils do not yet have recall memory of).

Activities for exploring ideas at greater depth

The answer is ___ what could the multiplication fact have been?

24	36
60	56
96	108

What are all the possibilities? Prove it with an array (drawn or physical).

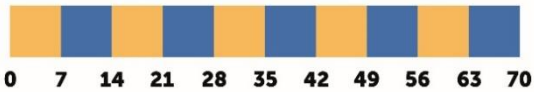
BUFFER ZONE

© Herts for Learning Ltd - 2017

Step three

Rehearsing and recalling multiplication facts; making links and spotting patterns

Counting stick:



Which facts do we know best? Can we remove those numbers now? How will you remember them?

Pupils count with the teacher in 7s from 0 to 70 along the stick. Once counting is confident forwards and backwards with numbers showing, agree numbers to remove, one at a time, starting with those known well.
Alongside developing the counting in sequence recall, rehearse facts by asking questions about where facts are positioned on the stick and the multiples.

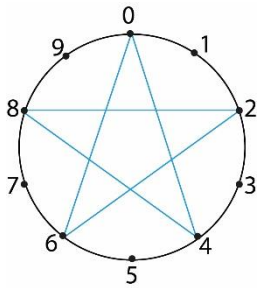
Where is 3x7 on the stick? What is the 4th multiple?

Final digit patterns:

Using a dial (circle with 10 points marked equally around the edge and numbers 0-9 against them), and selecting a starting multiplication table to model, write the multiples for that table and then mark the ones digits on the dial. Join them in the order they arise.

Is there a pattern to the final digits in the answers to the ☐ times table? How could we find out?

What do you notice about the ones digit in the answers to the 6 times table on a dial?

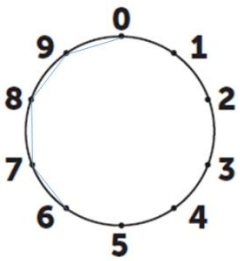


0, 6, 12, 18, 24, 30, 36, 42 and so on.

The ones digits repeats: 0, 6, 2, 8, 4… On a dial they make a star pattern. They are all even numbers.

Use handout_4LS6_Step3_multiplication_table_dials for pupils to explore other multiplication tables.

Select the dial for the 9s.



What do you notice about the answers in the 9s?

It makes a decagon shape around the inside of the circle. The ones digit counts down each time, the tens digit counts up. The sum of the digits is 9.

Explore **'always, sometimes, never'** statements for multiplication tables and explore with resources.
Is it always, sometimes or never true that:

- answers to the 7 times table are odd numbers?
- multiples of 9 are also multiples of 3?
- if you add a multiple of 2 and a multiple of 4 the answer will be a multiple of 6?
- if you multiply an odd number by an even number, the answer will be odd?

For each one, explain how you know and if possible conjecture why.

4

© Herts for Learning Ltd - 2017

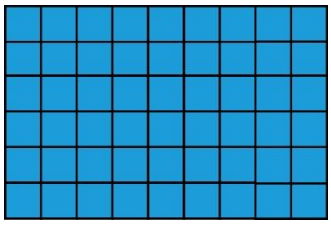
Step four

Rehearsing division facts

Recap the multiplication facts for the 9s. This could use a counting stick as in step 3.

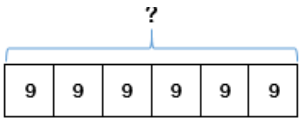
If we know 6 x 9 = 54, what else do we know? What is 54 ÷ 9? or 54 ÷ 6? Model these by returning to the array structure. Create the fact family and use the speaking frame.

6 x 9 = 54
9 x 6 = 54
54 ÷ 9 = 6
54 ÷ 6 = 9

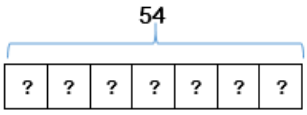


____	groups of	____	is	____			
____	shared into	____	groups is	____	in each group		
There are	____	groups of	____	in	____		
____	x	____	=	____	x	____	= ____
____	–	____	=	____	–	____	= ____

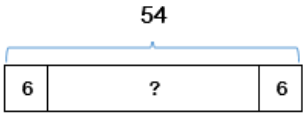
I can build this to show the arrays.



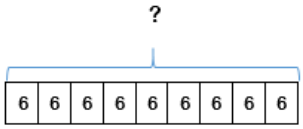
6 x 9
6 groups of 9 is 54



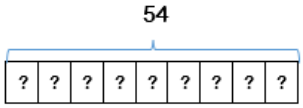
54 ÷ 6
54 shared equally into 6 groups is 9



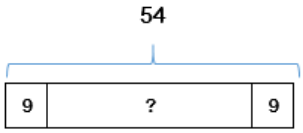
54 ÷ 6
There are 9 groups of 6 in 54



9 x 6
9 groups of 6 is 54



54 ÷ 9
54 shared equally into 9 groups is 6



54 ÷ 9
There are 6 groups of 9 in 54

Use handout_4LS6_Step4_multiplication_division_speaking_frame.

Reinforce this on a number line or beadstring as an alternative model.
There are 6 groups of 9 in 54. If we jump back from 54 in jumps of 6, we need 9 jumps.

Explore the division facts for individual multiplication tables through the arrays and bar models; writing fact families to create the corresponding division facts.

© Herts for Learning Ltd - 2017

Step five

Laws of divisibility to help with division facts

Rehearsal of facts should continue. The laws of divisibility allow pupils to check reasonableness.

Discuss divisibility patterns. For example, 36 is a multiple of numbers such as 3, 6 and 12 (pupils will remember it from learning those multiplication facts), so it must be divisible by 3, 6 and 12.

Display the multiplication tables as lists of multiples.
0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24
0, 3, 6, 9, 12, 15, 18, 21, 24, 27, 30, 33, 36

What do we already know about each of the multiplication tables which might us decide whether a number is divisible?

In the 2s, the answers are even. So if a number is even it is divisible by 2. In the 3s, the digital root is always 3, 6 or 9. So if the digital root of a number is 3, 6 or 9, then the number is divisible by 3.

Pupils prove whether multiples of 3 always, sometimes or never have a digital root of 3, 6 or 9 i.e. if we add the digits in the multiples they become 3, 6 and 9.

51 is divisible by 3 because 5 + 1 = **6**.
99 is divisible by 3 because 9 + 9 = 18 ► 1 + 8 = **9**.
Pupils explore whether this rule is true. Pupils may wish to generate larger multiples of 3 using calculators and then test them.
Pupils work in groups to find out whether this same rule works for 6s and 9s.

Continue with 4s and 8s using understanding of even numbers and halving. For the 4s, if the number can be halved the answer is even, then it is a multiple of 4 and so divisible by 4. For example, 48 halved is 24, which is even. Pupils should build and draw models that explain why multiples of 4 always result in an even number after halving. They conjecture if all multiples of 4 are multiples of 8. How does that impact on the rule for 8? The number can be halved and halved again resulting in an even number.

Summarise and display the laws of divisibility together for the 2s, 3s, 4s, 5s, 9s, and 10s.

Play 'Multiple / divisible' in pairs or threes. Pupils need the laws of divisibility visible to refer to as they play. Pupils choose a card from the pile and say which numbers their card will be divisible by based on the laws. They work together to discover what the division fact will be, either on a number line or by building an array as explored earlier in step 4.

For example, if the card is **12** then it must be divisible by 2 and 3 because it is even and the digits add to a multiple of 3. If I count up in 3s it is the 4th multiple, so 12 ÷ 3 = 4. It must be divisible by 4 because the when you halve it the answer is even. If I count up in 4s, it is the 3rd multiple so 12 ÷ 4 = 3.

5

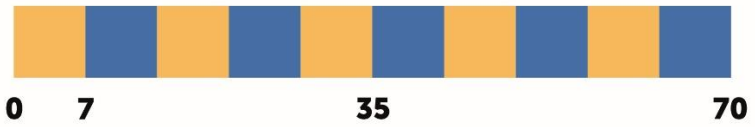
BUFFER ZONE

© Herts for Learning Ltd - 2017

Step six

Strategies for calculating multiplication facts

Use the counting stick to model again, build up the multiplication facts starting with the most well-known ones first.

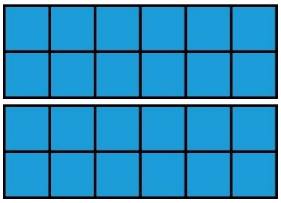


If we know 5 x 7 is 35, how does this help us find 6 x 7?
If we know 10 x 7 = 70, how does this help us with 9 x 7?

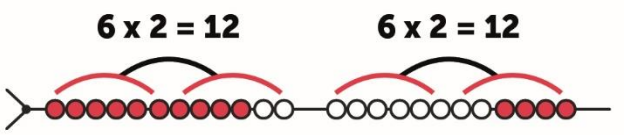
Pupils explore a range of strategies:

- For 4x a number, multiply by 2 and then double it
- Calculate 5x a number and then use adding groups on for 6x, 7x
- For 9x a number, calculate 10x and subtract one group
- Regroup (partition) the number, so for 12x calculate 10x and 2x and add them together.
- Multiplication is commutative so the numbers can be switched 8 x 3 = 3 x 8

Pupils model how their strategy works using arrays on squared paper and by using equipment. They can cut their arrays using squared paper and scissors or show using arrays and drawing lines to show the regrouping.



4 x 6 can be regrouped into 2 groups of 2 x 6.



Create a shared strategy list of the most helpful ideas and place on the working wall. Teachers display these strategies instead of times tables facts. For example:

If I didn't know 6 x 7, I could try 7 x 3 x 2 or 5 x 7 + 2 x 7.

Multi-strategy check – provide pupils with a selection of carefully chosen calculations to apply their multiplication knowledge to. Pay particular attention to hard to learn facts.

- 7 x 12 =
- 6 x 7 =
- 8 x 7 =
- 6 x 8 =
- 11 x 12 =

6

BUFFER ZONE

© Herts for Learning Ltd - 2017