Y4

MENTAL CALCULATION
Multiplication & Division

National Curriculum Programme of Study:

- count in multiples of 6, 7, 9, 25 and 1000.
- recall multiplication and division facts for multiplication tables up to 12 × 12.
- use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers.
- recognise and use factor pairs and commutativity in mental calculations.
- solve problems involving multiplying and adding, 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.

FLUENCY

By the end of Year 4, children should fluently derive and recall:

- multiplication facts to 12 × 12 and the corresponding division facts
- fraction and decimal equivalents of one-half, quarters, tenths and hundredths, e.g. 3/10 is 0.3 and 3/100 is 0.03
- factor pairs for known multiplication facts

COUNT IN MULTIPLES OF 6, 7, 9, 25 AND 1000

Teaching should focus on:

- Counting on and back to zero in steps of 6, 7, 9 and 25
- Counting on and back in 1000s from any given number

- The counting stick can be considered as part of a continuous or ‘empty number line’ with clearly marked intervals along the stick to represents specific points. Progressing from activities in Year 3, pupils can focus on counting on and back in steps of 6, 7, 9 and 25.

Tell the children, they are counting in steps of 7 and practice counting forwards and backwards from a starting point of zero, counting in steps of 7 as each interval line is touched. Attach number cards to the interval lines to remind children of the steps. Make links to multiplication and division. What are 5 steps of 7? How many steps of 7 make 56? How do you know? How could we write that? Repeat for other counts.

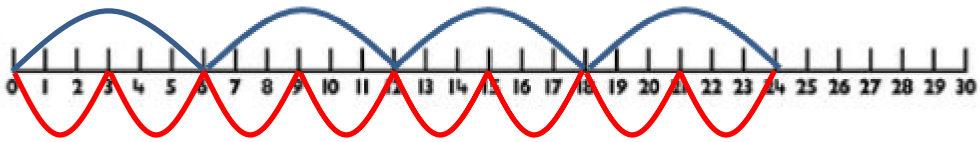
When counting on in 1000s, make the beginning of the stick any number, for example 245. Count along the stick in 1000s from 245. What patterns do the children notice? Which digits change? Which digits stay the same? Try using different starting points such as 310, 105, 8. Ask a pupil to record the numbers counted and focus on the writing of the numbers, “How do we write 2105?. “Ask, “If this point is 2650 and we are counting on in 1000s, what number will this be (point to an interval further along the stick.)?”

Next count in 3s and 6s from zero and place markers on the stick. What do they notice about the relationship between the numbers when counting in 3s and the numbers when counting in 6s? If the count continued past the end of the stick, which other numbers would appear in both the 3 and the 6 counts? How could this help with learning the 3 and 6 times tables?

6 x 1 = 3 x 2
6 x 2 = 3 x 4
6 x 4 = 3 x 8

As 2 jumps of 3 are the same as 1 jump of 6, you can work out the 6 times table by working out double the steps of the 3 times table.

For example
6 x 4 will be the same as 3 x 8.



Ask pupils, “How can this help us to learn the 12 times table?”

RECALL MULTIPLICATION AND DIVISION FACTS FOR MULTIPLICATION TABLES UP TO 12 × 12

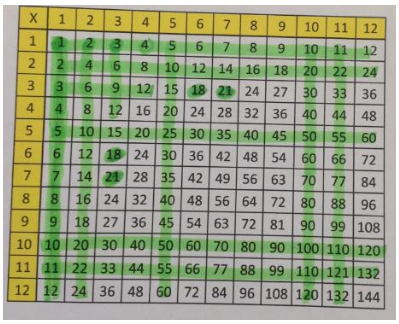
Teaching should focus on:

- Deriving and recalling multiplication facts for the 7, 9, 11 and 12 times-tables and corresponding division facts.
- Rehearsing multiplication and division facts for multiplication tables up to 12 x 12.
- Identifying doubles of two digit numbers and corresponding halves.
- Deriving doubles of multiples of 10 and 100 and corresponding halves.
- Recognising multiples of 2 -12 up to the twelfth multiple.

- Demonstrate the relationship between the 3 times table and the 6 times table and the relationship between 6 times table and the 12 times table using the counting stick and number lines as shown above. Construct an explanation which describes, for other pupils, how to use the 3 x table to work out the 6 x table and the 12 x table.

- Explore, also, the relationship between the 3 times table and the 9 times table – what patterns can the pupils see? Are all the multiples of 9 in the 3 times table? Why?

- Provide pupils with a 12 x 12 multiplication square and ask them to colour the facts that they already know. This will show that not all the facts need to be learned each time a new times table is introduced. For example, when learning the 9 times table, it is possible that only 7 x9, 8 x 9, 9 x 9, 11 x 9 and 12 x 9 will need to be learned as previous facts have been embedded during the learning of other tables. This will enable pupils to concentrate on the facts that they are finding most difficult to learn.



X	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

- Give each pair of pupils a set of cards containing multiplication facts with one number missing and a ‘sorting board’. Pupil A uses a stopwatch to time how quickly pupil B can sort their cards onto the sorting board. For example. ? x 5 =35 would be placed on the 7 section of the board . Pupil A then takes their turn at sorting their cards. Can the pupils improve their sorting times over several weeks/ months?

? x 5 = 35

6 x ? = 18

2	3	4	5
6	7	8	9
10	11	12	

- Show pupils a target board with a range of numbers. Which multiples do they recognise?

36 is in the 2, 3, 4, 6, 9 and 12 times tables. I know that because I know all my table facts.

15 is a multiple of 5 because it has 5 in the units.

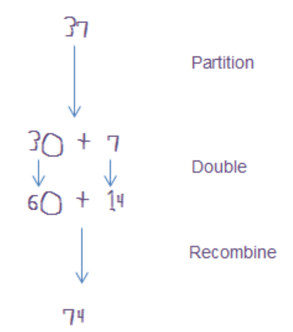
108	15	56	12	100
63	44	24	49	36
42	64	40	6	33

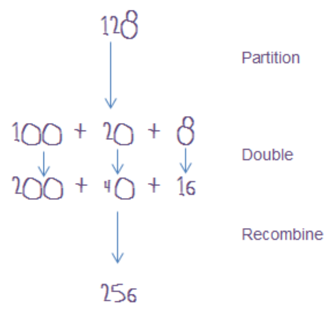
56, 12, 100, 44, 24, 36, 42, 64, 40 and 6 are all multiples of 2 because they are even numbers.

63 is a multiple of 9 because the digits add to 9. As it is a multiple of 9, it will also be a multiple of 3.

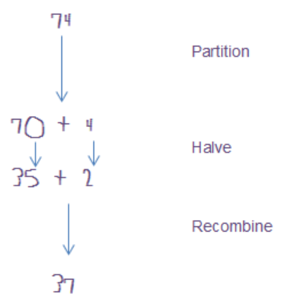
- Demonstrate partitioning and recombining strategies to halve and double numbers.

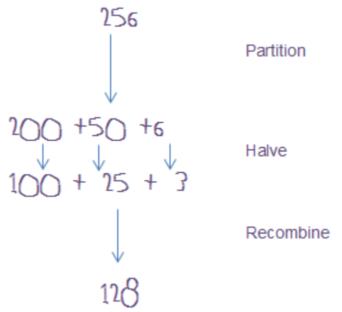
Double





Halve



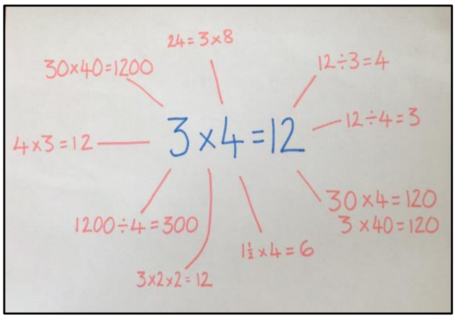


USE PLACE VALUE, KNOWN AND DERIVED FACTS TO MULTIPLY AND DIVIDE MENTALLY, INCLUDING: MULTIPLYING BY 0 AND 1; DIVIDING BY 1; MULTIPLYING TOGETHER THREE NUMBERS

Teaching should focus on:

- Using known facts to derive others.

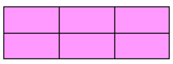
- Write down a known multiplication fact. What other facts can pupils derive from this known fact? Can they think of another fact? Another fact? A fact that no one else is thinking of?



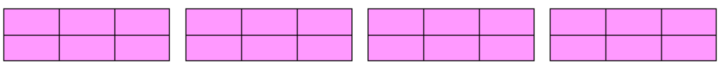
- Pupils should understand that more than 2 numbers can be multiplied. For example,

2 x 3 x 4

2 x 3 =



(2 x 3) x 4 =



Look at situations when this skill will support mental calculation. For example, it may be easier to solve 28 x 6 mentally by working out 4 x 7 x 6 by doing 7 x 6 and then double and double than by using a written method.

RECOGNISE AND USE FACTOR PAIRS AND COMMUTATIVITY IN MENTAL CALCULATIONS

Teaching should focus on:

- Finding factor pairs for multiplication facts to 12 x 12
- Further developing mental methods using commutativity and associativity (see also year 3 mental calculation)

The commutative law: 4 x 3 = 12 and 3 x 4 = 12
When multiplying the 2 two numbers, it does not matter what order we multiply them in. This is not true of division.

The associative law: 3 x 2 x 2 = 12 or 2 x 3 x 3 = 12.
The 4 can be broken down into its factor pairs and the answer will remain unchanged. When three or more numbers are multiplied, the product is the same regardless of the order of the factors.

- Explore which calculation sentences are easier/ harder to solve and why.

2 x 7 x 4
2 x 4 x 7
4 x 2 x 7
7 x 4 x 2
7 x 2 x 4

How could you rearrange
8 x 2 x 5
to make it easier to solve?

- Encourage pupils to find factor pairs when multiplying larger numbers in order to make the calculation easier.
For example 18 x 9

18 x 9
2 x 9
2 x 9 x 9
= 9 x 9 x 2
= 81 x 2
= 162

SOLVE PROBLEMS INVOLVING MULTIPLYING AND ADDING, 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.

Teaching should focus on:

- Multiplying a two-digit, and a three-digit number, by a single-digit number.
- Dividing a two digit, and a three-digit number, by a single-digit number.
- Developing mental methods using the distributive law.
- Solving integer scaling problems and correspondence problems.

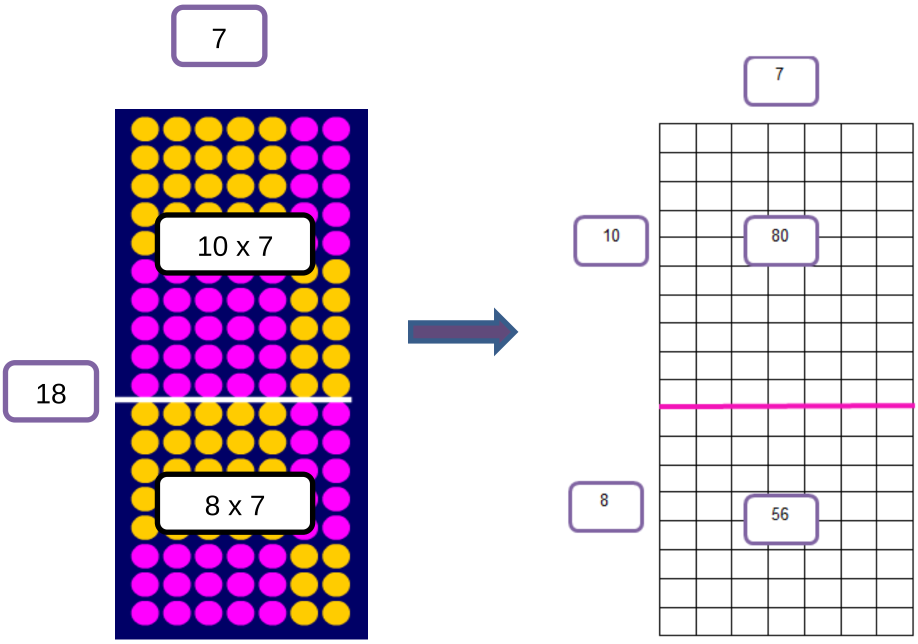
*See also **Year 4 Written Calculation Guidance for Multiplication and Division***

***The distributive law:* For example,** 3 x 4 = 12

3 x (3 +1 **)** = (3 x 3) + (3 x 1) = 12

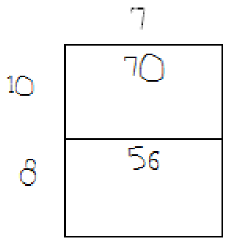
The 4 can be partitioned in different ways and when each smaller part is multiplied by 3 and recombined, the answer will still be 12.The sum of two numbers times a third number is equal to the sum of each addend times the third number.

- Using the work in year 3 as a starting point, continue to explore representing new multiplication facts from known facts.



18 x 7
10 x 7 = 70
8 x 7 = 56
70 + 56 = 126
18 x 7 = 126

Leading to more efficient representations



or

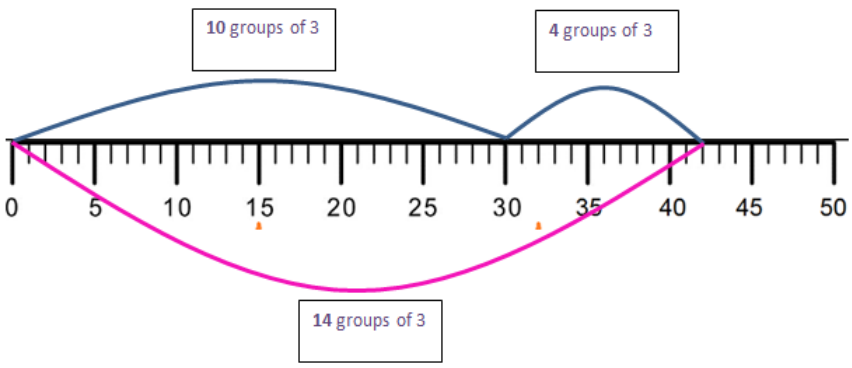
x	7
10	70
8	56
	126

- By partioning the dividend into multiples of the divisor, pupils can use grouping/ chunking as an efficient mental method for division. For example,

42 ÷ 3

42 = 30 + 12
30 ÷ 3 = 10
12 ÷ 3 = 4
10 + 4 = 14

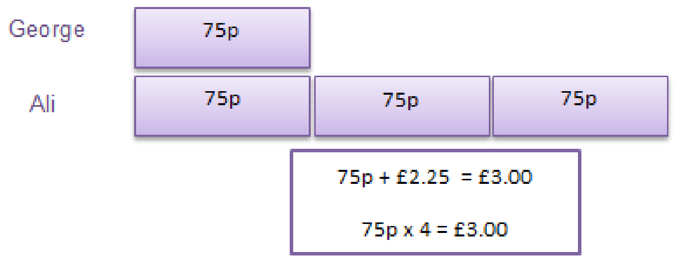
This can also be explored as counting on or back in ‘chunks’ or groups of the divisor



Encourage pupils to write their jottings or calculation sentences alongside their number lines.

- Multiplication is often taught as repeated addition. Another way of looking at is as scaling quantities.

  George had 75p. Ali had three times as much money as George. How much did they have altogether?



Cake Recipe

110g butter
110g sugar
2 eggs
110g flour

How much of each ingredient would you need for 2 people? 3 people?

- Pupils will have previously experienced correspondence problems in year 3, and will continue developing these skills during more complex problems. For example

Starters

Toast and pate
Tomato soup

Main meals

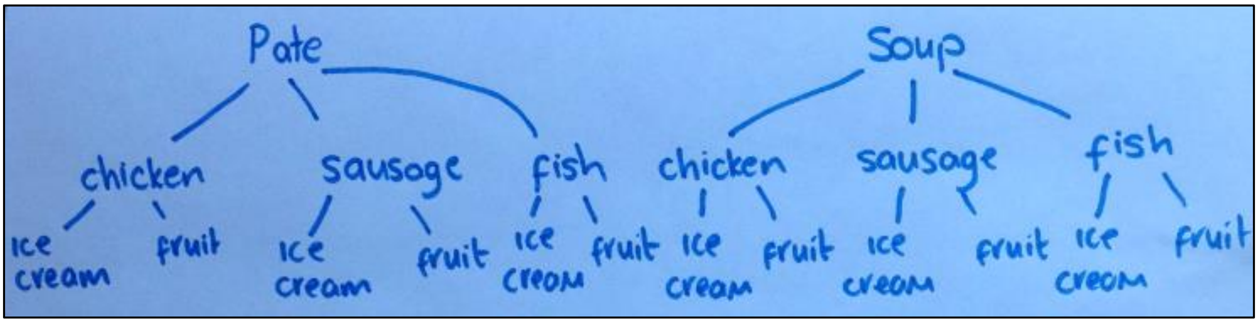
Fish and chips
Sausage and chips
Chicken and chips

Dessert

Ice cream
Fruit salad

How many different meal choices can you create from this menu? How do you know you have all possible options?

Mapping diagrams could help to represent the process.



Starter and main meal options: 3 options with pate starter + 3 options with soup starter
2 x 3 = 6 options

Starter, main and dessert: 6 options for starter and main each with 2 dessert choices
6 x 2 = 12 options altogether