Mental and Written Methods of Calculation Policy

Company:	Effective Date : 12.08.2017
Star International School	Revision Due Date : 19.08.2019
24b Street	First Edition Date : 12.08.2016
Mirdif	Edition No: 1
Dubai	

Teaching Mental and Written Methods of Calculation at Star International School Mirdif

New National Curriculum 2014

Our Calculation Policy reflects the requirements of the programmes of study in the New National Curriculum 2014. It reflects the age-related expectations from Year 1 to Year 6.

The policy outlines the progression for both mental and written methods for performing addition, subtraction, multiplication and division calculations.

Expectations

Contained within this policy are the standards that we expect the majority of children at Star International School to achieve in the four operations: addition, subtraction, multiplication and division in each year group. However, we understand that some children will not be ready for the year related expectations and some will be working beyond these expectations therefore, class teachers are expected to evaluate the needs of individual children when considering which methods of calculation should be taught.

The pupils will have access to the relevant practical apparatus they require e.g. bead strings and hundred squares, to aid them in their thinking. Children will continue to have access to models and images, e.g. empty number lines, 100 squares, bead bars, computing programmes including ITPs, to support their thinking.

Consistency and Continuity

We acknowledge that many of our children have been educated in a number of different schools and that the methods we teach may be unfamiliar to them. Therefore, it is essential that we are consistent in our teaching of the methods used.

Children in Key Stage 1 will be taught the terms '**tens'** and '**ones'** when partitioning numbers. Once the children have a concrete understanding of the term 'ones' they will be introduced to the term 'units'.

In Key Stage 2, the term units will be used more frequently. When children are secure in their understanding of the value of each digit in a number, they may move onto using the annotations of H T U in preparation for introducing tenths (t), hundredths (h) and thousandths (th).

Progression of Calculation Representation

In order to ensure that children gain a clear and secure understanding of the strategy that is being used, teaching will demonstrate the progression from concrete to pictorial and then abstract representations as children progress through a unit. Refer to Appendix 1.

Mental and Oral skills

Children will secure mental strategies and will utilise these to solve a calculation, where possible. Consequently, oral and mental work remains ongoing and essential. Children will need to be fluent in key number skills, such as knowledge of number facts and place value, and these will be practised within and outside of the daily Maths lesson.

Progression through the school

It is crucial that children develop a secure sense of number before attempting written methods, understanding place value and relative size of numbers when compared to others.

As children move through the school a greater emphasis will be placed on:

- Addition and subtraction being taught alongside each other, to ensure children see clear links between these inverse operations. Likewise, multiplication and division will be taught alongside each other.
- Approximating answers before calculating.
- Checking answers after completing calculations using an appropriate strategy.
- Considering if a mental calculation would be appropriate before using written methods.

YEAR 1

ADDITION AND SUBTRACTION

Mental calculation	Vocabulary
▪ Know number bonds [pairs of numbers to make 5, 6, 7, 8, 9 and 10] and related subtraction facts, within 20. ▪ Count on and back in ones from a given 2-digit number. ▪ Count on and back in tens from any given 2-digit number. ▪ Add two single-digit numbers. ▪ Subtract one single-digit number from another. ▪ Add three single-digit numbers by spotting doubles or pairs to 10. ▪ Add by putting the larger number first. ▪ Add 10 to and subtract 10 from any given 2-digit number – make use of hundred square. ▪ Use number facts to add single-digit numbers to two-digit numbers, e.g. use 4 + 3 to work out 24 + 3, 34 + 3… ▪ Use number facts to subtract single-digit numbers from two-digit numbers, e.g. use 7 – 2 to work out 27 – 2, 37 – 2… ▪ Begin to add 9 to a single digit number by adding 10 then adjusting by subtracting 1 – use a number line and later a hundred square. ▪ Add and subtract 1 and 2-digit numbers to 20, including 0.	Put together, add, altogether, total, plus, double, take away, subtract, distance between, more than, less than, greater, fewer, find the difference, difference between, count on/back, count up, pairs, facts, calculate, digit, number, tens, ones, place, value, equals.

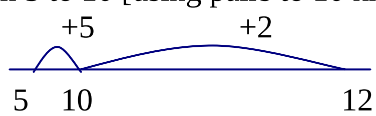
Concepts and towards written methods

- Read, write and interpret mathematical statements involving the +, - and = signs.
- Recognise the symbol □ as a missing number and solve missing number problems. See below. [This is the start of algebra]

3 + 4 = □	□ = 3 + 4
3 + □ = 7	7 = □ + 4
□ + 4 = 7	7 = 3 + □
□ + ∇ = 7	7 = □ + ∇

- Begin to see a relationship between addition and subtraction.
- Recognise that addition can be done in any order. Put the larger number 1st [see mental calculation] e.g. arrange 4 + 7 as 7 + 4 and count on 4 from 7 on a number track, number line, bead string and mentally.
- Begin to bridge through 10 and later 20 when adding a single number e.g. 5 + 7. [HA pupils with *possible use of beaded or empty number line to support these calculations*].

Jump from 5 to 10 [using pairs to 10 knowledge] and then add a further 2.



- Recognise that more than 2 numbers can be added together.
- Add multiples of 10 (such as 60 + 70) or of 100 (600 + 700) using the related addition number fact, 6 + 7, and their knowledge of place value.
- Read and say numbers to at least 100. Partition 2-digit numbers into tens and ones.

- Recognise the symbol □ as a missing number and solve missing number problems. See below.

7 - 3 = □	□ = 7 - 3
7 - □ = 4	4 = □ - 3
□ - 3 = 4	4 = 7 - 3
□ - ∇ = 4	4 = □ - ∇

- Count back from the larger to the smaller number and by counting on from the smaller to the larger number i.e. finding the difference between numbers. Begin to bridge through a landmark number i.e. a multiple of 10 when subtracting numbers e.g. 16 – 7. [HA pupils with p*ossible use of beaded or empty number line to support these calculations*].

  Count on from 7 to <u>10</u>, then from <u>10</u> to 16.

  +3 +6

  7 10 16

- **Solve 1-step problems involving addition and subtraction, using concrete objects and pictorial representations.**

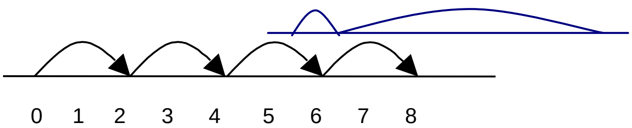
YEAR 1

MULTIPLICATION AND DIVISION

Mental calculation	Vocabulary
▪ Begin to count in 2s, 5s and 10s. ▪ Begin to say what three 5s are by counting in 5s or what four 2s are by counting in 2s, etc. ▪ Double numbers to 10. ▪ Find half of even numbers to 12 [by sharing] i.e. even numbers and know it is hard to halve odd numbers. ▪ Begin to use visual and concrete arrays or 'sets of' to find how many sets of a small number make a larger number i.e. beginning of the concept of grouping.	Lots of, sets of, groups, array, multiples, pattern, odd, even, grouping, sharing, double, half, doubling, halving, share by.

Concepts and towards written methods

- Use models and images e.g. bead strings, coins, hundred squares etc. to count in 2's, 5's and 10's.
- Begin to record jumps of 2, 5 and 10 on a completed number line or beaded line e.g.



- Begin to understand division as **<u>sharing</u>** e.g. 6 ÷ 2 can be modelled as 6 sweets shared equally between 2 people. How many does each person have? [You need to share the sweets by giving each person one at a time until no sweets remain].

- Understand division as **<u>grouping</u>** i.e. repeatedly taking the divisor away from the number i.e. repeated subtraction. If there are 6 sweets, how many people can have 2 sweets? (How many 2's in 6?)
  This can be recorded as repeatedly counting in 2's along a completed number line or using concrete objects arranged in an array. They count up the number of rows in each array to give the answer.

  ☺☺
  ☺☺ There are 3 rows of 2 in this array so the answer is that 3 people can have 2 sweets each.
  ☺☺

- **Solve 1-step problems involving multiplication and division by using concrete objects, pictorial representations and arrays with the support of the teacher.**

YEAR 2

ADDITION AND SUBTRACTION

Mental calculation	Vocabulary
▪ Know number bonds – know all the pairs of numbers which make numbers to 20. Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts to 100 e.g. 3 + 7 = 10, 10 – 7 = 3 and 7 = 10 – 3 to calculate 30 + 70 = 100, 100 – 70 = 30 and 70 = 100 – 30. ▪ Count on and back in ones and tens from any given 2-digit number. ▪ Add 2 or 3 single digit numbers. ▪ Add a single digit number to any 2-digit number using number facts, including bridging multiples of 10 [e.g. 38 + 7]. ▪ Subtract a single-digit number from any 2-digit number using number facts, including bridging multiples of 10 [e.g. 56 – 3, 53 – 5]. ▪ Add or subtract 10 and small multiples of 10 to/from any given 2-digit number. ▪ Add any pair of 2-digit numbers. ▪ Subtract any pair of 2-digit numbers by counting back in tens and ones or by counting up.	Put together, add, altogether, total, plus, double, take away, subtract, distance between, more than, less than, greater, fewer, find the difference, difference between, count on/back, count up, pairs, facts, calculate, digit, number, hundreds, tens, ones, place, value, partition, recombine, equals.

Concepts and towards written methods - ADDITION

- Continue using a range of equations as in Y1 to develop their knowledge in algebra but with larger numbers. See below.

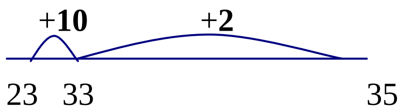
  $\square + \Delta = 9$ $\quad\quad$ $61 + 14 = \square$

  Extend to $\quad 14 + 5 = 10 + \square$

  and, for HA, adding three numbers $\quad 32 + \square + \square = 100 \quad\quad 35 = 1 + \square + 5$
- Recognise that addition and subtraction are inverse operations and use this to check calculations and solve missing number problems, as above.
- Know that addition of two numbers can be done in any order [commutative property].
- <u>Partition</u> into tens and units and then <u>recombine</u>.

  e.g. 12 + 23 = 10 + 20 + 2 + 3
  = 30 + 5
  = 35
- Refine the above and support understanding using a <u>number line.</u> Start with the largest number 1st and partition the 2nd number only.

  e.g. 23 + 12 = 23 + **10** + **2**
  = 33 + 2
  = 35



- Add a near multiple of 10 i.e. 9 or 11 by adding 10 and then adjusting by 1.

  e.g. 35 + 9
  35 + 10 = 45
  45 – 1 = 44

  Use an empty number line or a hundred square to support these calculations. Extend to adding by 19 or 21.
- Identify near doubles by using doubles already known e.g. 7 + 8 = 7 + 7 + 1
- **Begin** using the **expanded column method** leading to a compact column method.

$$\text{e.g.}\quad \begin{array}{r} 35 \\ +\ 14 \end{array} \quad \begin{array}{l} = 30 + 5 \\ = \underline{10 + 4} \\ \quad 40 + 9 = 49 \end{array} \qquad\qquad \begin{array}{r} 3\,5 \\ \underline{+\,1\,4} \\ 4\,9 \end{array}$$

YEAR 2

Concepts and towards written methods - SUBTRACTION

- Record number sentences using the – and = sign. Continue using a range of equations as in Y1 but with appropriate numbers. See below.

  25 – 8 = □   Δ - □ = 16

  Extend to   14 + 5 = 20 - □
- Recognise that addition and subtraction are inverse operations and use this to check calculations and solve missing number problems, as above.
- Show that addition of two numbers can be done in any order and subtraction of one number from another cannot.
- Subtract 9 or 11 by subtracting and adjusting by 1.

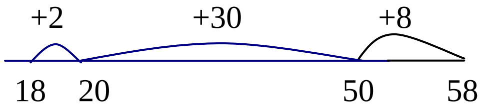
  e.g. 43 – 9

  43 – 10 = 33

  33 + 1 = 34

  Use of an empty number line or a hundred square to support these calculations. Extend to subtracting by 19 or 21.
- Use of landmark numbers and counting up, from the smallest number, to find the difference. Use a number line to support these calculations.

  e.g. 53 – 18



- Begin using expanded column method to subtract numbers.

$$\begin{array}{rcrcrcl} 58 & = & 50 & + & 8 & & \\ -13 & = & 10 & + & 3 & & \\ \hline & & 40 & + & 5 & = & 45 \end{array}$$

  Extend to decomposition. Make use of practical apparatus to aid their understanding of decomposition e.g. multibase materials.

  e.g.

$$\begin{array}{rcrcrcrcrcl} 53 & = & \mathbf{50} & + & \mathbf{3} & = & \mathbf{40} & + & \mathbf{13} & & \\ -18 & = & 10 & + & 8 & = & 10 & + & 8 & & \\ \hline & & & & & & 30 & + & 5 & = & 35 \end{array}$$

- **Solve problems with addition and subtraction – using concrete objects and pictorial representations, including those involving numbers, quantities and measures.**

YEAR 2

MULTIPLICATION AND DIVISION

Mental calculation	Vocabulary
▪ Recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables. ▪ Count in 2s, 5s and 10s and begin to count in 3s. ▪ Using fingers, say where a given number is in the 2s, 5s or 10s tables e.g. 8 is the 4th number when I count in 2s. [Towards using multiplication facts to derive division facts]. ▪ Recognise odd and even numbers and discuss the fact that even numbers can be shared equally by 2, with no reminders. ▪ Begin to understand that multiplication is repeated addition and to use arrays e.g. 3 x 4 is represented as 3 rows of 4 objects. ☺☺☺☺ ☺☺☺☺ ☺☺☺☺ ▪ Begin to learn the 2, 3, 5 and 10 times tables – seeing these as 'lots of' i.e. 3 lots of 4 in the above array. ▪ Relate division to grouping i.e. use arrays to see how many 4s there are in 12. How many lots of 4 are there in 12? How many groups of 5 are there in 15? ▪ Double numbers to 20. ▪ Begin to double multiples of 5 up to 100 i.e. up to double 50 = 100. ▪ Begin to double 2-digit numbers less than 50 with ones digits of 1, 2, 3, 4 or 5. ▪ Halve numbers to 20. ▪ Begin to halve numbers to 40 and multiples of 10 to 100 i.e. up to ½ of 100 is 50. ▪ Find ½, ⅓, ¼ and ¾ of a quantity of objects and of amounts [only whole number answers i.e. no remainders].	Lots of, sets of groups, array, multiples, pattern, odd, even, grouping, sharing, double, half, doubling, halving, share by, multiplication facts/tables, division facts, repeated addition, repeated subtraction. Partition, recombine, commutative, inverse. Remainder.

Concepts and towards written methods - MULTIPLICATION

- Understand and record number sentences using the x and = sign. See below.

  7 x 2 = □   □ = 2 x 7
  7 x □ = 14   14 = □ x 7
  □ x 2 = 14   14 = 2 x □
  □ x ∇ = 14   14 = □ x ∇

- <u>Arrays and repeated addition –</u>
  Understand that multiplication is repeated addition and this can be represented using an array e.g. 3 x 4 is represented as 3 rows of 4 objects.
  ☺☺☺☺
  ☺☺☺☺
  ☺☺☺☺
- **S**how that multiplication of 2 numbers can be done in any order [commutative] and division of 1 number by another cannot. Use arrays to show this.
  e.g. 3 x 4 is represented as 3 rows of 4 objects.
  ☺☺☺☺
  ☺☺☺☺   3 x 4 = 12
  ☺☺☺☺
  and 4 x 3 is represented as 4 rows of 3 objects.
  ☺☺☺
  ☺☺☺
  ☺☺☺   4 x 3 = 12
  ☺☺☺
- Use their understanding of arrays to know that multiplication and division are inverse operations.
- Record multiplication of 2, 5 and 10 as jumps on a number line, showing repeated addition.
  e.g. 5 x 2 as 5 jumps of 2 along a completed number line.
- Know that halving is the inverse of doubling.
- Partition numbers to aid doubling e.g. double 15 or 15 x 2

  10   +   5
  ↓   ↓
  20   +   10 = 30

- **Begin grid method** for **more able** pupils.
  * When multiplying TU x U, it is better to place the number with the most digits in the left hand column of the grid so that it is easier to add the partial products.

  e.g. 25 x 3

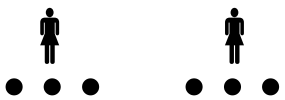
x	3
20	60
5	15
	75

Concepts and towards written methods - DIVISION

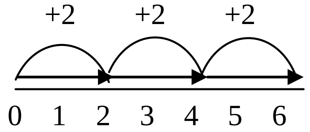
- Understand and record number sentences using the ÷ and = sign. See below.

6 ÷ 2 = □	□ = 6 ÷ 2
6 ÷ □ = 3	3 = 6 ÷ □
□ ÷ 2 = 3	3 = □ ÷ 2
□ ÷ ∇ = 3	3 = □ ÷ ∇

- Know that division can be performed by **sharing** an amount equally. Below is shown 6 shared by 2 **or** 6 ÷ 2.



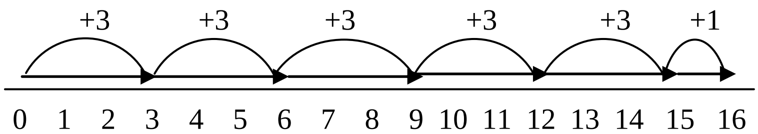
- Understand division as **grouping** i.e. repeated subtraction.
  e.g. If there are 6 sweets, how many people can have 2 sweets? (How many 2's in 6?)
  This can be recorded as repeatedly counting in 2's along a completed number line.
  e.g.



  or it can be recorded using **arrays**. They can count the number of rows in each array to give them the answer.

  ☺☺
  ☺☺ There are 3 rows of 2 in this array so the answer is that 3 people can have 2 sweets each.
  ☺☺

- **Begin** to understand **remainders**.
  e.g. 16 ÷ 3 = 5 r1
  Sharing - 16 sweets are shared between 3 people. How many does each person get? How many left over?
  Grouping – A baker bakes 16 cakes. She puts 3 cakes in every box. How many boxes can she fill?
  Answer –5 boxes filled and 1 cake left over. Again., this can be recorded as repeatedly counting in 3's along a completed number line.



  or it can be recorded by using an **array**.

  ☺☺☺
  ☺☺☺
  ☺☺☺
  ☺☺☺
  ☺☺☺
  ☺

- Use their understanding of arrays to know that division and multiplication are inverse operations.

- **Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in context.**

YEAR 3

ADDITION AND SUBTRACTION

Mental calculation	Vocabulary
▪ Know number bonds – know all pairs of numbers that total 20. Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts to 100 e.g. 3 + 7 = 10, 10 – 7 = 3 and 7 = 10 – 3 to calculate 30 + 70 = 100, 100 – 70 = 30 and 70 = 100 – 30. ▪ Know pairs of multiples of 10 with a total of 100. ▪ Add any 2-digit numbers by counting on in 10s and 1s or by using partitioning and then recombining. ▪ Add multiples and near multiples of 10 and 100. ▪ Perform additions relying upon their place value knowledge e.g. 300 + 8 + 50 = 358. ▪ Use place value and number facts to add a 1-digit or 2-digit number to a 3-digit number e.g. 104 + 56 = 160 [4 + 56 = 60 and 100 + 60 = 160]. ▪ Add pairs of 'friendly' 3-digit numbers i.e. the total of the tens do not exceed 100 e.g. 320 + 450. ▪ Begin to add amounts of money using partitioning. ▪ Subtract any two 2-digit numbers. ▪ Perform subtractions relying upon their place value knowledge e.g. 536 – 30 = 506. ▪ Subtract 2-digit numbers from numbers >100 by <u>counting up</u> – use a mental number line to aid calculation e.g. 143 – 76 is done by starting at 76 and counting up to 80, then 100 and finally 143. Add the jumps [or differences] to find the answer i.e. 4 + 20 + 43 = 67. ▪ Subtract multiples and near multiples of 10 and 100. ▪ Subtract, when appropriate, by counting back or taking away, using place value knowledge and number facts. ▪ Find change from £1, £5 and £10.	Put together, add, altogether, total, plus, double, take away, subtract, distance between, more than, less than, greater, fewer, find the difference, difference between, count on/back, count up, pairs, facts, calculate, digit, number, hundreds, tens, ones, place, value, partition, recombine, equals.

Concepts and written methods - ADDITION

- Continue using a range of equations to develop their knowledge in algebra but with larger numbers. See below.

  36 + 58 = □   □ + 36 = 94   ◇ + □ = 100
  94 = □ + 58   □ = 127 + 40   14 + □ + 6 = 37

- Estimate and use inverse operations to check answers to a calculation and to solve missing number problems.
- Know that addition of two numbers can be done in any order [commutative property].
- **<u>Partition</u>** into tens and units and then **<u>recombine</u>**.

  e.g. 12 + 23 = 10 + 20 + 2 + 3
  = 30 + 5
  = 35

- Refine above by partitioning the 2nd number only. Place the largest number 1st.

  e.g. 36 + 53
  53 + 36 = 53 + 30 + 6
  = 83 + 6
  = 89

- Add a near multiple of 10 e.g. 9, 19, 11, 21. Continue as in Y2 but with larger numbers.

  e.g. 35 + 29
  35 + 30 = 65
  65 – 1 = 64

- Use the expanded column method to add three 2-digit numbers or two or three 3-digit numbers.

  e.g.
  ```
      34   =  30 +  4
      26   =  20 +  6
  +   55   =  50 +  5
             100 + 15 = 115
  ```
  e.g.
  ```
     135   =  100 + 30 + 5
  +  214   =  200 + 10 + 4
              300 + 40 + 9 = 349
  ```

YEAR 3 continued

- Children may need to revert to expanded method as below, particularly if their place value knowledge is not secure.

Again, add the units 1st and arrange in columns.

e.g.

```
   1 2 6
+    5 3
       9
     7 0
   1 0 0
   1 7 9
```

- Begin to use compact column addition to add up to 3-digit numbers, adding the units 1st.

e.g.

```
   1 2 6
+    5 3
   1 7 9
```

Concepts and written methods - SUBTRACTION

- Record number sentences using the – and = sign. Continue using a range of equations but with appropriate numbers. See below.

126 - □ = 86 □ - 86 = 30

□ - 30 = 86 126 - □ = 30

Extend to 20 - Δ - □ = 5

- Recognise that addition and subtraction are inverse operations and use this to check calculations and solve missing number problems, as above.
- Show that addition of two numbers can be done in any order and subtraction of one number from another cannot.
- Continue to subtract near multiples of 10 by subtracting and adjusting by 1, but using larger numbers.

e.g. 83 – 49

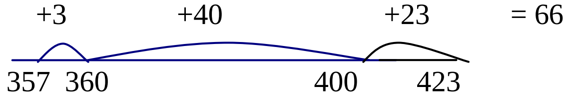
83 – 50 = 33

33 + 1 = 34

Continue using an empty number line or a hundred square to support these calculations.

- Use of counting up, from the smallest number, to find the difference between two 3-digit numbers. Use a number line to support these calculations.

e.g. 423 – 357



- Use an expanded column method to subtract two numbers up to 3-digit numbers.

e.g.

```
   187   =  100 +  80 +  7
 -  64   =         60 +  4
            100 +  20 +  3  = 123
```

Extend to decomposition in preparation for a compact column subtraction method. Make use of practical apparatus to aid their understanding of decomposition e.g. multibase materials.

e.g.

```
   81   =  80 + 1   = 70 + 11
 - 57      50 + 7     50 +  7
                      20 +  4  = 24
```

- Begin to use **compact column subtraction**.

e.g. 187 – 64

```
   1 8 7
 -   6 4
   1 2 3
```

Leading to e.g. 181 - 64

```
     7 1
   1 8 1
 -   6 4
   1 1 7
```

- **Solve problems using number facts, place value and more complex addition and subtraction.**

YEAR 3

MULTIPLICATION AND DIVISION

Mental calculation	Vocabulary
▪ Recall and use multiplication and division facts for the 2, 3, 4, 5, 8 and 10 multiplication tables. ▪ Perform divisions within the tables, including those with remainders e.g. 38 ÷ 5. ▪ Multiply whole numbers by 10 and 100 and divide whole numbers by 10 and 100 to give whole number answers. ▪ Recognise that multiplication is commutative and that division is not. ▪ Use place value knowledge and number facts in mental multiplication e.g. 30 x 5 = 15 x 10. ▪ Use place value knowledge and number facts in mental division e.g. 84 ÷ 4 is half of 42 [or when you divide by 4, halve the number and then halve it again]. ▪ Partition teen numbers to multiply by a single digit number e.g. 3 x 14 = 3 x 10 and 3 x 4. ▪ Double numbers up to 50. Double multiples of 5 up to 50. ▪ Halve even numbers to 100. Halve odd numbers to 20.	Lots of, sets of groups, array, multiples, pattern, odd, even, grouping, sharing, double, half, doubling, halving, share by, multiplication facts/tables, division facts, repeated addition, repeated subtraction. Partition, recombine, commutative, inverse. Whole number/integer. Remainder.

Concepts and written methods - MULTIPLICATION

- Record number sentences using the x and = sign. Continue using a range of equations as in Y2 but with appropriate numbers. See below.

  10 x 8 = □   □ x 4 = 20   3 x □ = 15
  8 x 10 = □   20 = 5 x □   5 x 2 = □
  □ = 4 x 4   □ x 5 = 20   5 x 6 = □

- Arrays and repeated addition – continue to understand multiplication as repeated addition and continue to use arrays.

  e.g. 3 x 4 is represented as 3 rows of 4 objects.

  ☺☺☺☺
  ☺☺☺☺   3 x 4 = 12
  ☺☺☺☺

- Use arrays to help them understand that multiplication and division are inverse operations.
- Continue to use number lines to show repeated addition, where necessary.
- Continue to use partitioning and their place value knowledge to double numbers to 50.

  e.g. double 48 or 48 x 2.

  40 + 8
  ↓   ↓
  80 + 16 = 96

- **Partitioning** methods - leading into **grid** and **column** methods.

  e.g. 46 x 4 = (40 x 4) + (6 x 4)
  (160) + (24) = 184

- Develop their understanding of the **grid method** to multiply 2 and 3-digit numbers by a single digit. Again, place the single digit number along the 1st row to make it easier to add the partial products.

  e.g. 46 x 4

x	4
40	160
6	24
	184

- Begin **expanded column method** for multiplication. Leading to reduced recording.

  e.g. 46 x 4

```
 40 + 6          4 6
 x    4        x   4
     24           24
    160          160
    184          184
```

Concepts and written methods - DIVISION

- Understand and record number sentences using the ÷ and = signs. Continue using a range of equations but with appropriate numbers. See below.

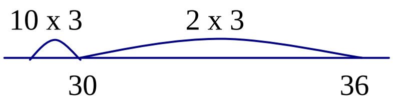
  16 ÷ 2 = □   □ ÷ 8 = 2
  16 ÷ □ = 8   2 = 16 ÷ □
  □ ÷ 2 = 8   8 = 16 ÷ □

- Understand division as **sharing** and **grouping**.

  18 ÷ 3 can be modelled as:

  Sharing – 18 is shared equally between 3 – see Y1 diagram.
  Grouping – How many 3s make 18? This is repeated subtraction – groups of 3 are repeatedly taken away from 18. Continue to record grouping as counting on along a number line.

  e.g. **36** ÷ 3



  The above is called partitioning the dividend i.e. **36** into 30 and 6, to aid division. It could be written as –

  e.g. **36** ÷ 3 = (**30** ÷ 3) + (6 ÷ 3)
  = 10 + 2
  = 14

- Understand simple **remainders**. Again, use the number line to show this or other practical apparatus e.g. cubes or a bead string or bead bar.

  Rounding up or down in context:
  Remainders in real life context. If focus is to use all of dividend then rounding up. If focus is to complete sets of the divisor, then round down.
  Round up – e.g. The football team are going to a match by car. There are 13 players in the team. 4 players can get into each car. How many cars are needed? Round up to 5.
  Round down – e.g. How many complete boxes of 4 cakes can be filled from 30 cakes? Round down to 7 and 2 cakes left over.

- Begin **short division** i.e. the 'bus stop' method, including remainders. Express remainders as whole numbers.

  e.g. 5 2 ÷ 3

  1 7 R 1
  3) 5 ^{2}2

- **Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.**

YEAR 4

ADDITION AND SUBTRACTION

Mental calculation

- Add any two 2-digit numbers by partitioning or counting on.
- Rapidly recall number bonds to 100 [complements] and to £1.
- Add to the next hundred, pound and whole number e.g. 234 + 66 = 300 and 3.4 + 0.6 = 4.
- Perform additions relying upon their place value knowledge e.g. 300 + 8 + 50 + 4000 = 4358.
- Add multiples and near multiples of 10, 100 and 1000.
- Add £1, 10p and 1p to amounts of money.
- Use place value knowledge and number facts to add 1, 2, 3 and 4-digit numbers, where a mental calculation is appropriate e.g. 4004 + 156 by knowing that 6 + 4 = 10 and that 4000 + 150 = 4160.
- Subtract any two 2-digit numbers.
- Perform subtractions relying upon their place value knowledge e.g. 4736 – 706 = 4030.
- Subtract multiples and near multiples of 10, 100 and 1000.
- Subtract by counting up e.g. 503 – 368 is done by starting at 368 and counting up to 370, 400, 500 and finally 503. Add the jumps [or differences] to find the answer i.e. 2 + 30 + 100 + 3 = 135.
- Subtract, when appropriate, by counting back or taking away, using place value knowledge and number facts.
- Subtract £1, 10p or 1p from amounts of money.

Vocabulary

Put together, add, altogether, total, plus, double, take away, subtract, distance between, more than, less than, greater, fewer, find the difference, difference between, count on/back, count up, pairs, facts, calculate, digit, number, thousands, hundreds, tens, ones, place, value, partition, recombine, equals.

Concepts and written methods - ADDITION

- Continue using a range of equations to develop their knowledge in algebra but with larger numbers. See below.

  76 + 58 = □   □ + 58 = 134

  76 + □ = 58   ◇ + □ = 134
- Estimate and use inverse operations to check answers to a calculation and to solve missing number problems.
- Partition into tens and units and then recombine. Either partition both numbers or partition the 2nd [smaller] number only.

  e.g. 46 + 25 = 40 + 20 + 6 + 5
  = 60 + 11
  = 71

  e.g. 35 + 67
  67 + 35 = 67 + 30 + 5
  = 97 + 5
  = 102
- Add a near multiple of 10 but use appropriate numbers e.g. + 59, + 81. Give access to a number line or a hundred square, to support calculations.
- Use a **compact column addition** method, to add up to 4-digit numbers.

```
e.g.  47 + 76              e.g. 1765 + 4388
       47                        1765
     + 76                      + 4388
      123                        6153
      1 1                        1 1
```

  Revert to the expanded column method if they experience any difficulty.
- Use **column addition** to add any pair of two-place decimal numbers including amounts of money.

```
e.g.   £4.21 + £3.87
         £ 4.21        Leading to reduced recording      £ 4 . 2 1
       + £ 3.87                                        + £ 3 . 8 7
              8                                          £ 8 . 0 8
           1.00                                             1
           7.00
         £ 8.08
```

Concepts and written methods - SUBTRACTION

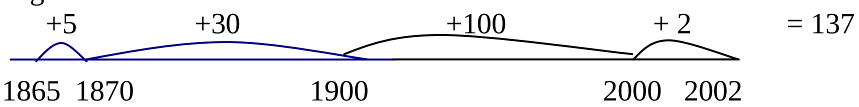
- Record number sentences using the – and = sign. Continue using a range of equations but with appropriate numbers e.g. 80 - Δ - □ = 5
- Recognise that addition and subtraction are inverse operations and use this to check calculations and solve missing number problems, as above.
- Show that addition of two numbers can be done in any order and subtraction of one number from another cannot.
- Continue to subtract near multiples of 10 by subtracting and adjusting by 1. Give access to a number line, bead bar or a hundred square, to support their calculations.

  e.g. 276 – 39

  276 – 40 = 236

  236 + 1 = 237
- Use of counting up, from the smallest number, to find the difference between 2 numbers up to 4 digits. Make use of a number line.

  e.g. 2002 – 1865



- Use expanded column method to subtract two numbers up to 4-digits.

  e.g.

  2387 = 2000 + 300 + 80 + 7

  \- 264 = + 200 + 60 + 4

  2000 + 100 + 20 + 3 = 2123

  Extend to decomposition in preparation for a compact standard column subtraction. Continue to use practical apparatus to aid their understanding of decomposition e.g. multibase materials.

  e.g.

  81 = 80 + 1 = 70 + 11

  \- 57 50 + 7 50 + 7

  20 + 4 = 24
- Use compact column subtraction, including involving carrying.

  e.g. 3952 – 1475

  8 14 1

  3 ~~9~~ ~~5~~ 2

  \- 1 4 7 5

  2 4 7 7
- Use column subtraction to subtract any pair of two-place decimal numbers including amounts of money.

  e.g. £32.85 - £21.75

  £ 3 2. 8 5

  £ 2 1. 7 5

  £ 1 1. 1 0

  Leading to involving carrying.

  e.g. £42.50 - £13.35

  3 1 4 1

  £ ~~4~~ 2. ~~5~~ 0

  \- £ 1 3. 3 5

  £ 2 9 . 1 5

- **Solve addition and subtraction 2-step problems, deciding which operations and methods to use and why.**

YEAR 4

MULTIPLICATION AND DIVISION

Mental calculation	Vocabulary
▪ Rapidly recall and use multiplication facts up to 12 x 12. ▪ Recognise factors of 2-digit numbers. ▪ Multiply whole numbers and one-place decimals by 10, 100 and 1000. ▪ Multiply multiples of 10, 100 and 1000 by single-digit numbers e.g. 300 x 6 = 1800. ▪ Use place value knowledge and number facts in mental multiplication e.g. 36 x 5 is half of 36 x 10. ▪ Partition 2-digit numbers to multiply by a single-digit number mentally e.g. 4 x 24 can be done as 4 x 20 and 4 x 4. ▪ Multiply near multiples using rounding e.g. 33 x 19 as 33 x 20 – 33. ▪ Find doubles to double 100 and beyond by partitioning. ▪ Begin to double amounts of money e.g. £35.60 doubled = £71.20. ▪ Rapidly recall and use division facts up to 144 ÷ 12. ▪ Divide whole numbers by 10, 100 and 1000 to give a whole number answer or an answer with one decimal place. ▪ Divide multiples of 100 by single-digit numbers by using division facts e.g. 3200 ÷ 8 = 400. ▪ Use place value knowledge and number facts in mental division e.g. 245 ÷ 20 is double 245 ÷ 10. ▪ Halve even numbers to 200 and beyond by partitioning. ▪ Begin to halve amounts of money e.g. half of £52.40 = £26.20.	Lots of, sets of groups, array, multiples, pattern, odd, even, grouping, sharing, double, half, doubling, halving, share by, multiplication facts/tables, division facts, repeated addition, repeated subtraction. Partition, recombine, commutative, inverse. Whole number/integer. Remainder. Factors, factor pairs. Dividend, divisor, quotient.

Concepts and written methods - MULTIPLICATION

- ❑ Record number sentences using the x and = sign. Continue using a range of equations but with appropriate numbers.
- ❑ Arrays and repeated addition – continue to understand multiplication as repeated addition and continue to use arrays.

  e.g. 3 x 4 is represented as 3 rows of 4 objects.

  ☺☺☺☺
  ☺☺☺☺ 3 x 4 = 12
  ☺☺☺☺

- ❑ Use arrays to help them understand that multiplication and division are inverse operations.
- ❑ Continue to use number lines to show repeated addition, where necessary.
- ❑ Continue to use partitioning and their place value knowledge to double numbers.

  e.g. double 98 or 98 x 2.

  90 + 8
  ↓ ↓
  180 + 16 = 196

- ❑ Continue partitioning methods - leading into grid and column methods.

  e.g. 86 x 4 = (80 x 4) + (6 x 4)
  (320) + (24) = 344

- ❑ Develop their understanding of the grid method to multiply 2 and 3-digit numbers by up to a 2-digit number.

  e.g. 46 x 24

x	20	4	
40	800	160	960
6	120	24	144
			1104 1

Here, the partial products in each row are added horizontally. Finally, the two sums at the end of each row are added to find the total product.

- ❑ Secure their understanding of the expanded column method for multiplication.

  e.g. 46 x 4 Leading to reduced recording.

40 + 6			4 6
x 4			x 4
24			24
160			160
184			184

- Begin short multiplication, to multiply a 2-digit or 3-digit number by a single-digit number.

  e.g.
```
   46
x   4
  184
   2
```

Concepts and written methods - DIVISION

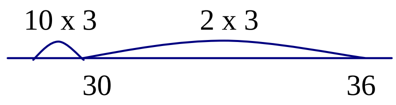
- Understand and record number sentences using the ÷ and = signs. Continue using a range of equations but with appropriate numbers.
- Understand division as **sharing and grouping**.

  18 ÷ 3 can be modelled as:

  Sharing – 18 is shared equally between 3 – see Y1 diagram.

  Grouping – How many 3s make 18? This is repeated subtraction – groups of 3 are repeatedly taken away from 18. Continue to record grouping as counting on along a number line.

  e.g. **36** ÷ 3



  The above is called partitioning the dividend i.e. **36** into 30 and 6 to aid division. It could be written as –

  e.g. **36** ÷ 3 = (**30** ÷ 3) + (**6** ÷ 3)
  = 10 + 2
  = 14

- Give **remainders** as whole numbers. Again, use the number line to show this or other practical apparatus e.g. cubes or a bead string or bead bar.

  Rounding up or down in context:

  Remainders in real life context. If focus is to use all of dividend, then rounding up. If focus is to complete sets of the divisor, then round down.

  Round up – e.g. The football team are going to a match by car. There are 13 players in the team. 4 players can get into each car. How many cars are needed? Round up to 5.

  Round down – e.g. How many complete boxes of 8 cakes can be filled from 66 cakes? Round down to 8 as there will be a 9^{th} box with only 2 cakes in it.
- Use short division method, i.e. the ‘bus stop’, to divide a 2-digit or 3-digit number by a single-digit number. Express remainders as whole numbers.

  e.g. 432 ÷ 5
```
     8   6     R 2
5 ) 4  3  ³2
```

- **Solve 2-step problems involving multiplying and dividing, including integer scaling problems and harder correspondence problems such as n objects are connected to m objects.**

YEAR 5

ADDITION AND SUBTRACTION

<table>
<tr><th>Mental calculation</th><th>Vocabulary</th></tr>
<tr><td>

Rapidly recall number bonds to 100 [complements] and numbers to the next whole number e.g. 3.4 + 0.6 = 4.
Add to the next 10 from a decimal number e.g. 13.6 + 6.4 = 20.
Add numbers with two significant digits only using mental strategies
e.g. 3.4 + 4.8 = 8.2 or 23,000 + 47,000 = 70,000.
Add 1 or 2-digit multiples of 10, 100, 1000, 10,000 and 100,000
e.g. 8000 + 7000 or 600,000 + 700,000.
Add near multiples of 10, 100, 1000, 10,000 and 100,000 to other numbers
e.g. 82,472 + 30,004.
Add decimal numbers which are near multiples of 1 or 10, including money
e.g. 6.34 + 1.99 or £34.59 + £19.95.
Use place value knowledge and number facts to add two or more numbers, including money and decimals e.g. 3 + 8 + 6 + 4 + 7 or 0.6 + 0.7 + 0.4 or 2,056 + 44.
Subtract numbers with two significant digits only using mental strategies e.g. 6.2 – 4.5 or 72,000 – 47,000.
Subtract 1 or 2-digit multiples of 100, 1000, 10,000 and 100,000 e.g. 8000 – 3000 or 600,000 – 200,000.
Subtract 1 or 2-digit near multiples of 100, 1000, 10,000 and 100,000 from other numbers e.g. 82,472 – 30,004.
Subtract decimal numbers which are near multiples of 1 or 10, including money e.g. 6.34 – 1.99 or £34.59 - £19.95.
Use counting up subtraction, with knowledge of number bonds to 10 or 100 or £1, to perform mental subtractions e.g. £10 - £3.45 or 1000 – 782.

</td><td>Put together, add, altogether, total, plus, double, take away, subtract, distance between, more than, less than, greater, fewer, find the difference, difference between, count on/back, count up, pairs, facts, calculate, digit, number, thousands, hundreds, tens, ones, place, value, partition, recombine, equals.
Rounding.</td></tr>
</table>

Concepts and written methods - ADDITION

- Continue using a range of equations to develop their knowledge in algebra but with larger numbers. See below.

  □ + 62 = 189   189 - □ = 62   189 = □ + 62

  □ = 127 + 62   62 + □ = 189   ◇ + □ = 189
- Estimate and use inverse operations and rounding to check answers to calculations.
- Add the nearest multiple of 10 or 100 and then adjust. Give access to a number line or a hundred square, to support their calculations.
- Use a compact column addition method to add up to and over 4-digit numbers. Extend to adding several numbers with different numbers of digits.

```
e.g.  1765 + 4388              e.g.   275 + 54 + 3245
        1765                              2 7 5
     +  4388                                5 4
        6153                         +  3 2 4 5
         1 1                            3 5 7 4
                                          1 1
```

- Use column addition to add any pair of two-place decimal numbers including amounts of money.

```
e.g.    £4.21 + £3.87
          £ 4 . 2 1
        + £ 3 . 8 7
          £ 8 . 0 8
             1
```

- Begin to add numbers with up to 3 decimal places.

```
e.g.    25.356 + 346. 28
            2 5 . 3 5 6
        + 3 4 6 . 2 8
          3 7 1 . 6 3 6
            1     1
```

- Revert to an expanded method if required. Choose the most efficient method in any given situation.

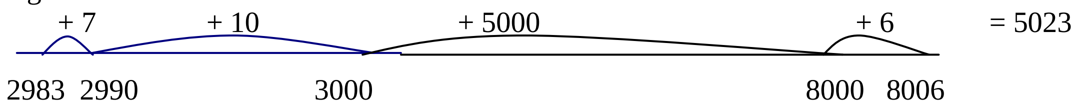
Concepts and written methods - SUBTRACTION

- Record number sentences using the – and = sign. Continue using a range of equations but with appropriate numbers.
- Estimate and use inverse operations and rounding to check answers to calculations.
- Subtract the nearest multiple of 10 or 100 and then adjust by 1. Give access to a number line, bead bar or a hundred square, to support their calculations.

  e.g. 276 – 99

  276 – 100 = 176
  176 + 1 = 177
- Use of counting up, from the smallest number, to find the difference between 2 numbers, where appropriate. Make use of a number line.

  e.g. 8006 – 2983



- Use **expanded column method** to subtract two numbers up to 5 digits, where required.

  e.g.

$$\begin{array}{rcl} 2387 & = & 2000 + 300 + 80 + 7 \\ -\ \ \underline{264} & = & \underline{\qquad\quad + 200 + 60 + 4} \\ & & 2000 + 100 + 20 + 3 = 2123 \end{array}$$

  Extend to **decomposition,** when subtracting numbers up to 5 digits. Continue to use practical apparatus to aid their understanding of decomposition e.g. multibase materials.

  e.g.

$$\begin{array}{rcccl} 81 & = & 80 + 1 & = & 70 + 11 \\ -\ \underline{57} & & \underline{50 + 7} & & \underline{50 + \ \ 7} \\ & & & & 20 + \ \ 4 = 24 \end{array}$$

- Use **compact column subtraction**, including involving carrying.

  e.g. 3952 – 1475

$$\begin{array}{r} {}^{8}\,{}^{14}\,{}^{1} \\ 3\ \cancel{9}\ \cancel{5}\ 2 \\ -\ \underline{1\ 4\ 7\ 5} \\ \underline{2\ 4\ 7\ 7} \end{array}$$

- Use column subtraction to subtract any pair of two-place decimal numbers, including amounts of money.

  e.g. £32.55 - £21.35

$$\begin{array}{r} £\ 3\ 2.\ 5\ \ 5 \\ -\ \underline{£\ 2\ 1.\ 3\ \ 5} \\ \underline{£\ 1\ 1.\ 2\ \ 0} \end{array}$$

  Leading to involving carrying.

  e.g. £42.50 - £13.35

$$\begin{array}{r} {}^{3}\,{}^{1}\ \ {}^{4}\,{}^{1} \\ £\cancel{4}\,2.\cancel{5}\,0 \\ \underline{-\,£\,1\,3.\,3\,5} \\ \underline{£\,2\,9\,.\,1\,5} \end{array}$$

  e.g. 9.076 – 3.142

$$\begin{array}{r} {}^{8}\ \ {}^{1} \\ \cancel{9}\,.\,0\,7\,6 \\ \underline{3\,.\,1\,4\,2} \\ \underline{5\,.\,9\,3\,4} \end{array}$$

- Choose the most efficient method in any given situation.

- **Solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.**

YEAR 5

MULTIPLICATION AND DIVISION

Mental calculation	Vocabulary
▪ Rapidly recall and use multiplication facts up to 12 x 12. ▪ Multiply whole numbers and one and two-place decimal numbers by 10, 100, 1000 and 10,000. ▪ Identify multiples and factors, including finding all factor pairs of a number, and common factors of 2 numbers. ▪ Use knowledge of factors and multiples in multiplication e.g. 43 x 6 is double 43 x 3 **or** 28 x 50 is half of 28 x 1000. ▪ Know which numbers are prime and recall prime numbers up to 19. Know that non-prime numbers are called composite numbers. ▪ Use knowledge of place value and rounding in mental multiplication e.g. 67 x 199 as 67 x 200 – 67. ▪ Use doubling and halving as a strategy in mental multiplication e.g. 58 x 5 = half of 58 x 10 **or** 34 x 4 is 34 doubled twice. ▪ Partition 2-digit numbers, including decimals, to multiply by a single-digit number mentally e.g. 6 x 27 as 6 x 20 (120) plus 6 x 7 (42) =162 **or** 6.3 x 7 as 6 x 7 (42) plus 0.3 x 7 (2.1) = 44.1 ▪ Double amounts of money by partitioning e.g. £37.45 doubled = £37 doubled (£74) plus 45p doubled (90p) = £74.90 ▪ Rapidly recall and use division facts up to 144 ÷ 12. ▪ Divide whole numbers by 10, 100, 1000 and 10,000 to give whole number answers or answers with 1, 2 or 3 decimal places. ▪ Use doubling and halving as mental division strategies e.g. 34 ÷ 5 can be done as (34 ÷ 10) x 2 ▪ Use knowledge of multiples and factors, and tests for divisibility, in mental division e.g. 246 ÷ 6 is 123 ÷ 3 **or** we know that 525 divides by 25 and by 3. ▪ Halve amounts of money by partitioning e.g. half of £75.40 is the same as half of £74 (£37.50) plus half of 40p (20p) = £37.70	Lots of, sets of groups, array, multiples, pattern, odd, even, grouping, sharing, double, half, doubling, halving, share by, multiplication facts/tables, division facts, repeated addition, repeated subtraction. Partition, recombine, commutative, inverse. Whole number/integer. Remainder. Factors, factor pairs, prime, composite, square and cube numbers, squared, cubed. Dividend, divisor, quotient.

Concepts and written methods - MULTIPLICATION

- Record number sentences using the x and = sign. Continue using a range of equations but with appropriate numbers.
- Arrays and repeated addition – continue to understand multiplication as repeated addition and continue to use arrays.

  e.g. 3 x 4 is represented as 3 rows of 4 objects.

  ☺☺☺☺
  ☺☺☺☺ 3 x 4 = 12
  ☺☺☺☺
- Use arrays to help them understand that multiplication and division are inverse operations.
- Use arrays to help them understand square numbers and appropriate practical apparatus e.g. interlocking cubes or multibase materials to understand cube numbers. Know square and cube numbers. Use place value knowledge and number facts to work out larger square numbers e.g. 20^2.
- Estimate and use inverse operations and rounding to check answers to calculations.
- If necessary, continue with the grid method to multiply 2 and 3-digit numbers by up to a 2-digit number. The recapping of this partitioning method will aid their understanding of short and long multiplication.

  e.g. 46 x 24

x	20	4	
40	800	160	960
6	120	24	144
			1104
			1

Here, the partial products in each row are added horizontally. Finally, the two sums at the end of each row are added to find the total product.

- Secure their understanding of **short multiplication**, to multiply a single-digit number by a number with up to 4 digits.

$$\begin{array}{r} 2\,4\,4\,6 \\ \underline{\times \quad\quad 4} \\ \underline{9\,7\,8\,4} \\ {\scriptstyle 1\;1\;2\;\;} \end{array}$$

- Use **short multiplication** to begin multiplying decimal numbers by a single-digit number.
  e.g. 24.4 x 4

```
     2 4 . 4
 x         4
     9 7 . 6
     1   1
```

- Use **long multiplication** to multiply a number with up to 4-digits by a 2-digit number.
  e.g. 1431 x 23

```
      1 4 3 1
  x       1 2
      2 8 6 2      (1431 x 2)
    1 4 3 1 0      (1431 x 10)
    1 7 1 7 2
      1
```

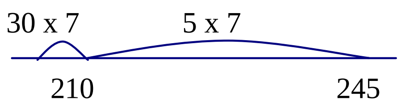
- Choose the most efficient method in any given situation.

Concepts and written methods - DIVISION

- Understand and record number sentences using the ÷ and = signs. Continue using a range of equations but with appropriate numbers, including those where they need to find the missing number e.g. 120 ÷ □ = 4
- Understand division as **sharing and grouping**.

  18 ÷ 3 can be modelled as:

  Sharing – 18 is shared equally between 3 – see Y1 diagram.
  Grouping – How many 3s make 18? This is **repeated subtraction** – groups of 3 are repeatedly taken away from 18. Continue to record grouping as counting on along a number line.
  e.g. **245** ÷ 7



  The above is called partitioning the dividend i.e. **245** into 30 and 5, to aid division. It could be written as –
  e.g. **245** ÷ 7 = (**210** ÷ 7) + (**35** ÷ 7)
  = 30 + 5
  = 35

- Give **remainders** as whole numbers, initially. Again, use the number line to show this or other practical apparatus e.g. cubes, a bead string or bead bar.
- When left with a remainder, round up or down, according to the context.
- Use **short division** method, i.e. the 'bus stop', to divide up to 4-digit numbers by numbers up to and including 12.
  e.g. 432 ÷ 5

```
        8   6       R 2
   5 ) 4   3  ³2
```

  e.g. 387 ÷ 12

```
         3   2       R 3   or   R 1/4   or   R 0.25
  12 ) 3   8  ²7
```

  As shown above, express the remainder [within the quotient (answer)] as a whole number, a fraction or a decimal.

- Begin to use **long multiplication** to divide up to 4-digit numbers by a 2-digit number.
  e.g. 432 ÷ 15

```
          2   8      R 12    or R 12/15    or R 4/5    or R 0.8
  15 )  4   3   2
        3   0   0      20 x 15
        1   3   2
        1   2   0       8 x 15
            1   2
```

  Here you are repeatedly subtracting 15 [the divisor] away from 432 [the dividend]. This is also known as 'chunking'. Again the remainder [within the quotient] can be expressed as a whole number, fraction or decimal.

- Choose the most efficient method in any given situation.
- **Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes.**

- **Solve problems involving using addition, subtraction, multiplication and division and use a combination of these.**

YEAR 6

ADDITION AND SUBTRACTION

Mental calculation

- Know complements to 100 and use these to derive related facts e.g. 3.46 + 0.54 = 4
- Rapidly derive complements to 1000.
- Add mentally small and large whole numbers using place value knowledge or number facts e.g. 34,000 + 8,000.
- Add multiples of powers of 10 and near multiples of the same e.g. 6345 + 199.
- Add negative numbers in a context, such as temperature, where the numbers make sense.
- Add two 1-place decimal numbers or two 2-place decimal numbers less than 1 e.g. 4.5 + 6.3 **or** 0.74 + 0.33
- Add positive numbers to negative numbers e.g. to calculate a rise in temperature or to continue a number sequence that includes negative numbers.
- Know complements to 100 and use these to perform mental subtraction by using counting up or complementary addition e.g. 1000 – 654 as 46 + 300.
- Use number bonds to 1 and 10 to perform mental subtraction of any pair of one-place or two-place decimal numbers using complementary addition, including money e.g. 10 – 3.65 as 0.35 + 6 = 6.35 **or** £50 **-** £34.29 as 71p + £15 = £15.71
- Use number facts or place value knowledge to perform mental subtraction of large numbers or decimal numbers with up to 2 places e.g. 467,900 – 3,005 as subtract 3,000 and then subtract the 5 = 464,895.
- Subtract multiples of powers of 10 and near multiples of the same.
- Subtract negative numbers in a context, such as temperature, where the numbers make sense.

Vocabulary

Put together, add, altogether, total, plus, double, take away, subtract, distance between, more than, less than, greater, fewer, find the difference, difference between, count on/back, count up, pairs, facts, calculate, digit, number, thousands, hundreds, tens, ones, place, value, partition, recombine, equals. Rounding.

Concepts and written methods - ADDITION

- Continue using a range of equations to develop their knowledge in algebra but with larger numbers. See below.

  □ + 1475 = 6924 ◇ + □ = 0.1

  6924 = 5499 + □ 91 + □ + 48 = 250
- Estimate and use inverse operations and rounding to check answers to calculations.
- Add the nearest multiple of 10, 100 or 1000 and then adjust. Give access to a number line or a hundred square, to support their calculations.
- Use a compact column addition method to add up to 5-digit numbers. Extend to adding several numbers with different numbers of digits.

  e.g. 275 + 54 + 3245

```
      2 7 5
        5 4
+   3 2 4 5
    3 5 7 4
     1 1
```

- Use column addition to add any pair of two-place decimal numbers including amounts of money.

  e.g. £4.21 + £3.87

```
   £ 4 . 2 1
 + £ 3 . 8 7
   £ 8 . 0 8
       1
```

Leading to addition of decimal numbers with up to 3 decimal places and numbers with a different number of decimal places.

e.g. 25.356 + 346. 28

```
     2 5 . 3 5 6
 + 3 4 6 . 2 8
   3 7 1 . 6 3 6
     1       1
```

- Choose the most efficient method in any given situation.

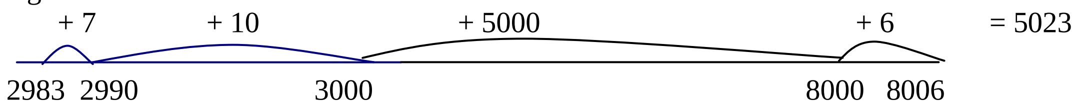
Concepts and written methods - SUBTRACTION

- Record number sentences using the – and = sign. Continue using a range of equations but with appropriate numbers.
- Estimate and use inverse operations and rounding to check answers to calculations.
- Subtract the nearest multiple of 10, 100 or 1000 and then adjust by 1. Give access to a number line, bead bar or a hundred square, to support their calculations.

  e.g. 3276 – 199
  3276 – 200 = 3076
  3076 + 1 = 3077

- Use of counting up, from the smallest number, to find the difference between 2 numbers, where appropriate. Make use of a number line. Use this method for subtracting from a multiple or near multiple of 1000.

  e.g. 8006 – 2983



- Recap the expanded **column method** to subtract two numbers up to 6 digits, where required.

  e.g.

  2 3 8 7 = 2000 + 300 + 80 + 7
  - 2 6 4 = + 200 + 60 + 4
  2000 + 100 + 20 + 3 = 2123

  Extend to **decomposition** when subtracting numbers up to 6 digits. Continue to use practical apparatus to aid their understanding of decomposition e.g. multibase materials.

  e.g.

  81 = 80 + 1 = 70 + 11
  - 57 50 + 7 50 + 7
  20 + 4 = 24

- Use **compact column subtraction**, to subtract numbers with up to **6 digits**, including involving **carrying**.

  e.g. 3952 – 1475

  8 14 1
  3 ~~9~~ ~~5~~ 2
  - 1 4 7 5
  2 4 7 7

- Use **column subtraction** to subtract any **pair of two-place decimal** numbers, including contexts such as money or measures.

  e.g. £82.55 - £21.25

  £ 8 2. 5 5
  + £ 2 1. 2 5
  £ 6 1. 3 0

  Leading to involving **carrying**.

  e.g. £42.50 - £13.35

  3 1 4 1
  £ ~~4~~ 2. ~~5~~ 0
  - £ 1 3. 3 5
  £ 2 9 . 1 5

  e.g. 9.076 – 3.142

  8 1
  ~~9~~. 0 7 6
  - 3 . 1 4 2
  5 . 9 3 4

- Subtract numbers with a different number of decimal places. Add place holders to assist with the process.

  e.g. 12.4 – 3.56

  11 13 1
  ~~1~~ ~~2~~ . ~~4~~ **0**
  - 3 . 5 6
  8 . 8 4

- **Solve addition and subtraction multi-step problems in contexts, deciding upon which operations and methods to use and why.**

YEAR 6

MULTIPLICATION AND DIVISION

Mental calculation

- Rapidly recall and use multiplication facts up to 12 x 12.
- Multiply whole numbers and decimals with up to three places by 10, 100 or 1000 e.g. 234 x 1,000 = 234,000 **or** 0.23 x 1,000 = 230.
- Identify common factors, common multiples and prime numbers and use factors in mental multiplication e.g. 326 x 6 can be done as 652 x 3 = 1956.
- Use their knowledge of place value and number facts in mental multiplication e.g. 40,000 x 6 = 240,000 **or** 0.03 x 6 = 0.18
- Use doubling and halving as mental multiplication strategies, including to multiply by 2, 4, 8, 5, 20, 50 and 25 e.g. 28 x 25 can be done as ¼ of 28 x 100 = 700.
- Use rounding in mental multiplication e.g. 34 x 19 can be done as 20 x 34, subtract 34.
- Multiply one and two-place decimals by numbers up to and including 10 using place value knowledge and partitioning e.g. 3.6 x 4 can be done as 12 + 2.4 = 14.4 **or** 2.53 x 3 can be done as 6 + 1.5 + 0.09 = 7.59
- Double decimal numbers with up to 2 places using partitioning e.g. 36.73 doubled is double 36 (72) plus double 0.73 (1.46) = 73.46
- Rapidly recall and use division facts up to 144 ÷ 12.
- Divide whole numbers by powers of 10 to give whole number answers or answers with up to three decimal places.
- Identify common factors, common multiples and prime numbers and use factors in mental division e.g. 438 ÷ 6 can be done as 219 ÷ 3 = 73
- Use tests of divisibility to aid mental calculation.
- Use doubling and halving as mental division strategies e.g. to divide by 2, 4, 8, 5, 20 and 25 e.g. 628 ÷ 8 can be done as 628 halved 3 times.
- Divide one and two place decimals by numbers up to and including 10 using place value knowledge e.g. 2.4 ÷ 6 = 0.4 **or** 0.65 ÷ 5 = 0.13 **or** £6.33 ÷ 3 = £2.11
- Halve decimal numbers with up to 2 places using partitioning e.g. half of 36.86 can be done as half of 36 (18) plus half of 0.86 (0.43) = 18.43

Vocabulary

Lots of, sets of groups, array, multiples, pattern, odd, even, grouping, sharing, double, half, doubling, halving, share by, multiplication facts/tables, division facts, repeated addition, repeated subtraction.
Partition, recombine, commutative, inverse.
Whole number/integer.
Remainder.
Factors, factor pairs, prime, composite, square and cube numbers, squared, cubed.
Dividend, divisor, quotient.

Concepts and written methods - MULTIPLICATION

- Record number sentences using the x and = sign. Continue using a range of equations but with appropriate numbers.
- Arrays and repeated addition – continue to understand multiplication as repeated addition and continue to use arrays.

  e.g. 3 x 4 is represented as 3 rows of 4 objects.

  ☺☺☺☺
  ☺☺☺☺ 3 x 4 = 12
  ☺☺☺☺

- Use arrays to help them understand that multiplication and division are inverse operations.
- Use arrays to help them understand square numbers and appropriate practical apparatus e.g. interlocking cubes or multibase materials to understand cube numbers. Know square and cube numbers. Use place value knowledge and number facts to work out larger square numbers e.g. 20^2.
- Estimate and use inverse operations and rounding to check answers to calculations.
- Use **short multiplication**, to multiply a single-digit number by a number with up to 4 digits.

  e.g.

$$\begin{array}{r} 2\ 4\ 4\ 6 \\ \underline{\text{x}\qquad 4} \\ \underline{9\ 7\ 8\ 4} \\ {\scriptstyle 1\ \ 1\ \ 2\ \ } \end{array}$$

- Use **long multiplication** to multiply a number with up to 4-digits by up to a 2-digit number.

  e.g. 1431 x 23

$$\begin{array}{rl} 1\ 4\ 3\ 1 & \\ \underline{\text{x}\qquad 2\ 3} & \\ 4\ 2\ 9\ 3 & (1431 \text{ x } 3) \\ \underline{2\ 8\ 6\ 2\ 0} & (1431 \text{ x } 20) \\ \underline{3\ 2\ 9\ 1\ 3} & \\ {\scriptstyle 1\quad 1\qquad\ } & \end{array}$$

- Use **short multiplication** to multiply a number with one or two decimal places by a single-digit number, including money.

e.g.
```
   2 4 . 4 6
x          4
  9 7 . 8 4
  1  1  2
```

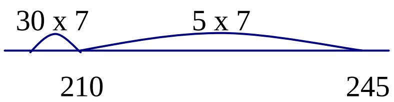
Concepts and written methods - DIVISION

- Understand and record number sentences using the ÷ and = signs. Continue using a range of equations but with appropriate numbers, including those where they need to find the missing number e.g.   2800 ÷ □ = 4
- Understand division as **sharing and grouping**.

18 ÷ 3 can be modelled as:

Sharing – 18 is shared equally between 3 – see Y1 diagram.
Grouping – How many 3s make 18? This is **repeated subtraction** – groups of 3 are repeatedly taken away from 18. If necessary, continue to record grouping as counting on in equal amounts/groups along a number line.

e.g. **245** ÷ 7



The above is called partitioning the dividend i.e. **245** into 30 and 5, to aid division. It could be written as –

e.g. **245** ÷ 7 = (**210** ÷ 7) + (**35** ÷ 7)
= 30 + 5
= 35

- Show **remainders** using the number line or other practical apparatus e.g. cubes, a bead string or bead bar.
- When left with a remainder, round up or down, according to the context.
- Use **short division** method, i.e. the 'bus stop' method, to divide up to 4-digit numbers by a 1-digit or 2-digit number.

e.g. 432 ÷ 5
```
       8   6     R 2
   5 ) 4   3  ³2
```

e.g. 387 ÷ 12
```
        3   2     R 3   or   R 1/3   or   R 0.33
   12 ) 3   8  ²7
```

As shown above, express the remainder [within the quotient (answer)] as a whole number, a fraction or a decimal.

- Where appropriate, use **long division** to divide up to 4-digit numbers by a 2-digit number.

e.g. 432 ÷ 15
```
15 ) 4  3  2
     3  0  0     (20 x 15)
     1  3  2
     1  2  0     (8 x 15)
        1  2
```

Here you are repeatedly subtracting 15 [the divisor] from 432 [the dividend]. This is also known as 'chunking'. Again the remainder [within the quotient] can be expressed as a whole number, fraction or decimal.

Answer = 2 8   R 12 or R 12/15 [or R 8/10 or R 4/5] or R 0.8

- Lead to **long division** set out as follows. Only use when children are secure with place value knowledge and are ready for this layout.
  e.g. 432 ÷ 15

```
        2  8 . 8
15 ) 4  3  2 . 0
     3  0
     1  3  2
     1  2  0
        1  2   0
        1  2   0
               0
```

- Use **long division** to divide a number with **one or two decimal places** by a number up to 12, using multiples of the divisor.
  e.g. 87.5 ÷ 7

```
7 )  8 7 . 5
     7 0 . 0        10 x 7
     1 7 . 5
     1 4 . 0         2 x 7
       3 . 5
       3 . 5       0.5 x 7
           0
                 Answer = 12  R 0.5  or  R ½
```

- Choose the most efficient method in any given situation.

- **Solve problems involving addition, subtraction, multiplication and division.**

Prepared/Revised By: Mrs Gill Roberts **Designation:** Principal	
Signature:	**Date:** 09.08.2016
Approved and Authorised By: SLT **Designation:** SLT	
Signature:	**Date:** 12.08.2016