Addition and Subtraction

- **Do they understand place value in 3 digit numbers?**
  Can they explain that in 628, the value of the 2 is 20, and the value of the 6 is 600?

- **Can they partition 3 digit numbers into H, T and U?**
  Can they explain that 357 is made up from 300 + 50 + 7?

- **Do they know by heart + and - facts to 20?**
  This is a desirable skill as opposed to an essential skill. Knowledge of these facts will make calculations more efficient.

- **Can they add/subtract mentally any pair of 2 digit numbers, using a strategy of their choice?**
  Can the children add 24 + 36 using a strategy such as partitioning and recombining or counting on?
  Can the children subtract 56 - 37 using a strategy such as counting on or counting back?

- **Do they have a good understanding of addition and subtraction?**
  Do they understand that more than 2 numbers can be added together? Do they understand that addition can be done in any order but subtraction cannot? Do they have a good understanding of the vocabulary related to addition and subtraction?

- **Can they explain their strategy orally and record it using informal jottings?**
  Through their explanations, do they show an understanding of the mathematics behind the strategies they use a opposed to simply applying the rules?

Addition

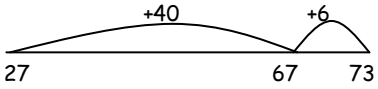
Year 2/3

- **Secure Year 2 mental methods**

- Children should be able to add some pairs of 2 digit numbers mentally reasonably comfortably and record their **mental** method

  e.g. 27 + 46
  20+ 40 = 60
  7 + 6 = 13
  60 + 13 = 73

  or



- **Then introduce expanded written** - same thing, but different layout

  27
  + 46
  60 (adding tens mentally)
  13 (adding units mentally)
  73 (recombining tens & units)

Adding the most significant digits first, links directly to what happens mentally. This stage needs to be modelled and explained to the children but they may not spend much time practising this method before going on to the next stage.

- **Change to adding the least significant digits first** saying, 'Does it matter if we add the units first? Let's try.'

  27
  + 46
  13 (adding units mentally)
  60 (adding tens mentally)
  73 (recombining tens & units)

Year 4

- **Begin starting with larger numbers**
  Use example below order changed

- **Increase to 3 digit numbers adding mentally, least significant digit first to reinforce understanding of place value.**

  e.g. 274
  + 148
  12 (adding units mentally)
  110 (adding tens mentally)
  300 (adding hundreds mentally)
  422 (recombining hundreds, tens & units)

- **Throughout the teaching of these methods introduce the children to:**

  Adding several amounts e.g. Find the total of 83+256+4

  Addition of decimals—begin to add 2 or more 3 digit sums of money. Know that the decimal points should line up under each other, particularly when adding mixed amounts

  e.g. £4. 21
  +£3.87
  8p
  £1.00
  £7.00
  £8.08

- **Introduce compact written method**

  27
  + 46
  73
  1

'7+6 = 13, which is 10 and 3, 3 in the units, put the 1 in the tens column. 20 and 40 is 60 add the extra 10 is 70. The answer is 73.'

Year 5

Recap compact written method

- **Compact written method**

  27
  + 46
  73
  1

'7+6 = 13, which is 10 and 3, 3 in the units, put the 1 in the tens column. 20 and 40 is 60 add the extra 10 is 70. The answer is 73.'

- **Extend to 3 digit numbers**

  274
  + 148
  422
  1 1

'4 and 8 = 12, which is 10 and 2. Write the 2 in the units and put '1' in the tens, 70 and 40 = 110 add the extra 10 is 120, Write the 2 tens in the tens column and put the '1' hundred in the hundreds. 200 and 100 = 300 add the extra 100 is 400. The answer is 422.

- **Extend to ThHTU + HTU**

- Extend to decimals.
  Using the chosen method, add two or more decimal fractions with up to three digits and the same number of decimal places. Know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts such as 3.2m + 350cm. For example:
  £6.72 + £8.56 + £2.30
  72.5km + 54.6km

Year 6

If able

ThHTU
+ThHTU

- **Introduce adding several numbers with different number of digits**

  e.g. 7654
  52
  654
  8

- **Extend to decimals**

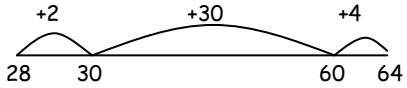
- Extend to decimals
  Using the chosen method, add two or more decimal fractions with up to four digits and either one or two decimal places. Know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts, such as 14.5kg + 750g

  E.g. 124.9 + 7.25
  401.2 + 26.85 + 0.71

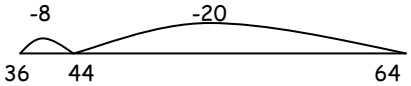
Subtraction

Year 2/3

- Children need to be able to subtract a 2 digit number from a 2 digit number mentally and record their method.



e.g. 64-28
64-30=34
34+2=36



- They should also be able to partition numbers in tens and units
e.g. 64 = 60 + 4
and a multiple of ten and a teens number
e.g. 64 = 50 + 14
- Extend to HTU using number line
HTU - TU
HTU - HTU
- Introduce vertical layout. Ensure the examples do not require exchange:

68	→	60	8
-24	→	-20	4
44		40	4

Year 4

- **Recap introduction of vertical layout**
Provide e.g. Where exchange is necessary.

		50	
64	→	~~60~~	$^{1}4$
-28	→	-20	8
36		30	6

Introduce expanded written methods - this can be usefully supported using multibase apparatus.
"4 subtract 8 is difficult but we can make it easier by using 10 from the 60 (leaving 50) and making 14 by adding the 10 to the 4. 14 subtract 8 is 6, 50 subtract 20 is 30. Put together the 30 and 6. The answer is 36.

- **Increase to three digit numbers**

			60	
274	→	200	~~70~~	$^{1}4$
-157	→	-100	50	7
117		100	10	7

"4 subtract 7 is difficult. We can make it easier by using 10 from 70 (leaving 60) and making 14 by adding the 10 to the 4. 14 subtract 7 is 7. 60 (which is left in the tens) subtract 50 is 10. 200 subtract 100 is 100. The answer is 117.

- Using similar methods, begin to find the difference between two 2-digit sums of money. Know that the decimal points should line up underneath each other.

			80	
£8.95	→	800	~~90~~	$^{1}5$
-£4.38	→	-400	30	8
£4.57		400	50	7

Year 5

- **Recap expanded method HTU**

			60	
274	→	200	~~70~~	$^{1}4$
-157	→	-100	50	7
117		100	10	7

- Extend to include exchanges from hundreds to tens, and from hundreds to tens to units. E.g.

		200	90		
306	→	~~300~~	^{1}~~00~~	$^{1}6$	
-148	→	-	40	8	
		100			
158		100	50	8	

"6 subtract 8 is difficult. We can make it easier by using 10 from the tens column. Oh, there aren't any tens so we'll move to the hundred column, 300 are there, subtract 100 leaving 200. We'll put that hundred in the tens column and then move ten into the units column . . ."

- When children are confident, introduce compact method - begin with two 2-digit numbers. E.g.

$^{5\,1}$
64
-28
36

"4 subtract 8 is difficult. Take 10 from 60 and add it to the 4. 14 subtract 8 is 6. Subtract 20 from 50 to get 30. The answer is 36."

- Subtracting decimal numbers with up to 3 digits and the same number of decimal places. Know that the decimal points should be aligned. E.g. 72.5 - 4.6

Year 6

- **Recap compact method for TU-TU. Extend for HTU-TU** (ensure digits are aligned)
- Increase to three digit numbers e.g.

$^{6\,1}$
273
-157
116

"3 subtract 7 is difficult. Take 10 from 70 and add it to the 3. 13 subtract 7 is 6. 60 subtract 50 is 10. 200 subtract 100 is 100. The answer is 116."

- Continue to use this compact method for subtractions involving larger numbers (ThHTU) e.g.

$^{3\,1}$
6467
-385
6082

- **Extend to decimals.** Using the chosen method, subtract 2 or more decimal fractions with up to 3 digits and either 1 or 2 decimal places e.g. 14.24kg –8.7kg. Encourage the children to use zero as a place holder.

$^{3\,1}$
14.24kg
-8.70kg
5.54kg

Multiplication and Division

- **Can children partition numbers into multiples of 100, multiples of 10 and units?**
  Do children know that 387 is 300 + 80 + 7?

- **Do they understand 0 as a place holder?**
  Do children understand that for example, when 7 is multiplied by 10, 0 is used to hold the place and show that nothing is there?

- **Can they multiply mentally one-, two– or three– digit numbers by 10, then 100 and explain the effect?**
  Do children understand that when multiplying by 10 or 100, digits move to the left of the decimal point and when dividing by 10 or 100 digits move to the right of the decimal point?

- **Do they know by heart multiplication facts for at least the 2, 3, 4, 5 and 10 times tables?**
  This knowledge is desirable as opposed to essential , as knowledge of these facts will make calculations more efficient?

- **Do they know the outcome of multiplying by 0?**
  Do children understand that when a number is multiplied by 0, the answer will be 0?

- **Can they multiply mentally, say, 14 by 5 using a strategy of their choice?**
  Could children partition 14 into 10 and 4, multiply each part by 5 and recombine? Or multiply by 10 and halve?

- **Can they explain their strategy orally and by using informal jottings?**
  Through their explanations, do they show an understanding of the mathematics behind the strategies they use as opposed to simply applying the rules?s

Multiplication

Year 2/3

Multiplication by 10 and 100

- Children should be reasonably comfortable with multiplying single digit numbers by single digit numbers (they might not have instant recall of all multiplication facts but should be able to derive some facts reasonably quickly).
- Understanding that digits move one/ two place(s) to the left, use of a zero(s) to hold the place(s).
- They should be able to use single digit multiplication facts e.g. 3x4 to calculate single digit x multiple of 10 e..g. 0 x 4 and partition numbers into tens and units.
- Doubling multiples of 5 and 10.
- Multiplying 2 digit multiples of 10 by 2, 3, 4, 5 or 10.
- Multiplying 2 digit numbers by 2, 3, 4 or 5 without crossing the 10s boundary.
- Partitioning - using the distributive law e.g. $12 \times 4 \rightarrow (10 \times 4) + (2 \times 4)$
  $40 + 8 = 48$
- $43 \times 5 \rightarrow 200 + 15 = 215$
- Grid layout - same method slightly different layout
- $17 \times 3 =$

x	10	7	
3	30	21	=51

Add mentally

Year 4

Revise Grid layout

- **Grid layout** - same method slightly different layout

17×3

x	10	7	
3	30	21	=51

- **Extend to numbers where the answer bridges 100.**

38×6

x	30	8	
6	180	48	=228

Add mentally

- Ensure that place value cards are used throughout teaching.

- **Extend to 2 digit by multiple of 10**

42×30

x	40	2	
30	1200	60	=1260

Add Mentally

Year 5

Recap - 2 digit by multiple of 10

- **Extend to 2 digit by 2 digit**

34×27

x	30	4	
20	600	80	680*
7	210	28	238*
			918

* add these mentally if possible

- **Extend to 3 digit**

HTU x U

x	300	50	4
6	1800	300	24

$354 \times 6 = 2124$

- Work mentally to complete written questions e.g.
  $0.7 \times 5 =$
  $0.2 \times ? = 1.8$

- **Introduce multiplying with one decimal place.**
- **Decimal fractions**
  e.g. $3 \times 2.6 =$

- **Lots of oral work - to 1 decimal place.**

x	2	0.6	
3	6	1.8	= 7.8

Year 6

- **Recap**

34×27

x	30	4	
20	600	80	680*
7	210	28	238*
			918

- **Same calculation different layout**

34×27 (introduce vertical layout)

34	
27	
210	(7 x 30)
28	(7 x 4)
600	(20 x 30)
80	(20 x 4)
918	

MORE ABLE PROGRESS TO COMPACT METHOD

- **Compact method - same calculation different layout**

34×27

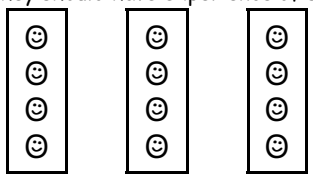
34	
X 27	
238	(7 x 34)
680	(20 x 34)
918	

- **Decimals** Approximate first - multiply number to 2dp by a single digit number.
  2.53×4
  $2 \times 4 = 8.00$
  $0.5 \times 4 = 2.00$
  $0.03 \times 4 = \underline{0.12}$
  10.12

Division

Year 2/3

- Division by 10 and 100
- Children should be able to divide numbers by 10 and 100 mentally, understanding the place value implications. They should be able to halve numbers and be beginning to understand relationship between x & ÷ such that division facts can be derived from multiplication ones.
  10 ÷ 2 = 5, 5 x 2 = 10
- **Sharing**
  They should have experience of sharing



- **Grouping**
  And of grouping (repeated subtraction)
  12 ÷ 3 = "how many 3's make 12?"
  They should be able to work out examples such as 12 ÷ 3 by rephrasing as how many 3's make 12 then counting up in multiples of 3 to 12: 3, 6, 9, 12. 4 x 3 =12

  The idea of repeated subtraction: 'how many ___ make ___' is carried through to the formal written method - 'chunking' - which is repeated subtraction of the divisor and multiples of the divisor
- **Model with a simple calculation to link to mental**
  12 ÷ 3

12		
-3	(1 x 3)	4 'threes' have been taken away.
9		
-3	(1 x 3)	
6		
-3	(1 x 3)	
3		
-3	(1 x 3)	
0		

Year 4

- **Revise vertical layout, taking only one chunk each time.**

12		
-3	(1 x 3)	4 'threes' have been taken away.
9		
-3	(1 x 3)	
6		
-3	(1 x 3)	
3		
-3	(1 x 3)	
0		

- **Introduce the idea of remainder i.e. not reaching 0 at the end linked to table facts.**
- Working alongside subtraction and tables work in mental oral starter.
- Increase size of numbers so that chunking written method is more efficient than counting up. subtract any 'chunk' that the child knows but suggest the 10th multiple as a known fact.
  E.g. 68 ÷ 4 = 'how many 4's make 65?'
- A useful task is to get the children to brainstorm chunks they know first - a bank of known or derived facts to work from. This will enable children to remove larger chunks at a time.
  E.g. 2 x 4 = 8
  4 x 4 = 16
  10 x 4 = 40

56		
-40	(10 x 4)	How many 4's have been subtracted ? = 14
16		
-16	(4 x 4)	

- **Introduce remainder to above** e.g. 73 ÷ 5 How many 5's make 73?

73 ÷ 5 = 14r.3

73	
-50	(10 x 5)
23	
-20	(4 x 5)
3	

Year 5

- **Extend short division (division by a single digit) to include HTU ÷ U. Use divisors that are being focused on in the multiplication work.** E.g. 256÷7
- Encourage children to estimate first and to brainstorm 'chunks' of the divisor to develop a bank of known and derived facts.
  E.g. 10x7=70, therefore 20x7=140
  and 30x7=210

256	
-70	(10x7)
186	
-140	(20x7)
46	
-42	(6x7)
4	

256÷7=36r.4

- **Now introduce the compact form for short division by encouraging children to take larger chunks.**
- **Familiarise children with the notation of division (the roof) and record the answer on top.**

36 r.4	
) 256	
-210	(30x7)
46	
-42	(6x7)
4	

Year 6

- **Introduce extended long division (division by a number greater than 9)**
  Again brainstorm facts first e.g.

27	
36) 972	
-360	(10x36)
612	
-360	(10x36)
252	
-180	(5x36)
72	
-72	(2x36)
0	

- **Then compact it by removing larger chunks - Compact Long Division**

27r.1	
36) 973	
-720	(20x36)
253	
-180	(5x36)
73	
-72	(2x36)
1	

- **Then introduce this division method with decimals - depends on place value.**
  Brainstorm facts first e.g.

12.5	
7) 87.5	
-70	(10x7)
17.5	
-14.0	(2x7)
3.5	
-3.5	(0.5x7)
0	