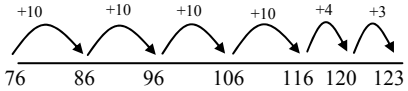
Sharmans Cross Junior School – Routes through calculation

Addition

Year 2/3

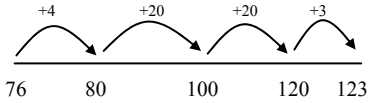
Examples of mental methods children should be using, supported by informal jottings.

- Use of number line to support counting on.



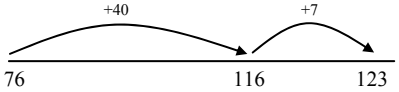
- Encourage children to start with the larges number
- Use knowledge of bonds to 100 to make larger jumps.

Start at 76, partition 47 into 'manageable jumps'



76 + 47 = 123

- Leading onto



- Make links with number sentences (as shown below) where both numbers are partitioned.
  76 + 47
  70 + 6 + 40 + 7
  70 + 40 + 6 + 7
  110 + 13
  123
- The 'number sentence approach' will then lead into an **expanded written method.**
- Introduce the expanded layout for TU + TU, adding the tens first.

47	67	83
+ 76	+ 24	+ 42
110	80	120
13	11	5
123	91	125

- Discuss how adding the units first gives the same answer, and practise this.

Year 4

- Practise and consolidate addition of two 2-digit numbers using **expanded written method.**
- Extend to HTU +TU
- Continue to use the expanded layout for HTU + HTU, adding the units first.

368	267
+ 493	+ 85
11	12
150	140
700	200
861	352

- Using similar methods, ad several numbers with different numbers of digits. For example, find the total of:

83, 256, 4, 57

Make links to compact method, using as appropriate to ability.

47	47
+ 26 →	+ 26
13	73
60	1
73	

- Extend to decimals

Using methods similar to those above, begin to add two or more three – digit sums of money, with or without adjustment from the pence to the pounds. Know that decimal points should line up under each other, particularly when adding or subtracting mixed amounts such as £3.59 + 78p
For example:

£4.21 + £3.87
£2.24 + £5.23 + £1.36

Extend to using decimals in context such as measure.

Year 5

- Extend the expanded method to include addition of ThHTU + HTU + ThHTU +ThHTU eg.

7587	
+ 675	
12	} Add mentally
150	
1100	
7000	
8262	

- Extend method to numbers with at least four digits.
- Use similar methods; add several numbers with different numbers of digits. For example, find the total of:

58, 671, 9, 468, 2187

- Continue to share compact method as appropriate to ability sharing how both methods relate to each other.

47	47
+ 26 →	+ 26
13	73
60	1
73	

- 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 + 350cms. For example:

£6.72 + £8.56 + £2.30
72.5km + 54.6km

- Decimals in different contexts should be fed throughout the year and not just in the summer term

Year 6

- Link the expanded method with the compact method first with no'carries' and then with one 'carry'

47	47
+ 26 →	+ 26
13	73
60	1
73	

"7and 6 is 13, which is 10 and 3 units. 3 in the units and 1 ten in the tens column. 20 and 40 is 60; add the extra 10 which is 70. The answer is 73"

- Extend the compact method to include TU + TU and HTU + HTU where ' two carries ' are required, referring back to the expanded layout first.

47	368
+ 76	+ 493
123	861
1 1	1 1

- If children are able, extend compact6 method to addition of ThHTU
- Extend method to numbers with any number of digits.
- Using similar methods, add several numbers with different numbers of digits. For example, find the total of:

42, 6432, 786, 3, 4681

42
6432
786
+ 3
4681
11944

- 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. For example:

124.9 + 7.25
401.2 + 26.85 + 0.71

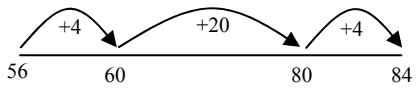
Sharmans Cross Junior School – Routes through calculation

Subtraction

Year 2/3

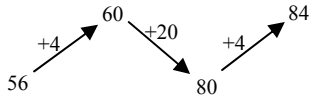
- Use a number line to count on to find a difference.

e.g. 84 – 56 56 + 4 + 20 + 4 = 84



- Use the zig-zag method to count on to find a difference.

e.g. 84 – 56



4 + 20 + 4 = 28
Therefore… 84 – 56 = 28

- Begin to record calculations in preparation for an efficient standard method.

↓ Beginning of expanded method

No exchange required

$$\begin{array}{r} 76 \\ -\,42 \\ \hline \\ \hline \end{array} \qquad \begin{array}{r} 70+6 \\ -\,40+2 \\ \hline \\ \hline \end{array} \quad = 34$$

Year 4

- Introduce the expanded layout for subtraction (HTU – HTU) using partitioning, where no exchange is required.

Example 1: 563 – 241

	500	+	60	+	3
—	200	+	40	+	1
	300	+	20	+	2

- Consolidate alongside compact efficient written method (column subtraction) using as appropriate to ability.of two digit subtracting two digit numbers where no exchange is required as appropriate to ability.

	63
-	41
	22

- Extend the expanded layout (HTU – HTU) where one exchange is required. Adjustments between T and U, or adjustments between H and T.

Example 2: 563 – 248

	500	+	~~60~~	+	~~3~~
—	200	+	40	+	8
	300	+	10	+	5

- Begin to consolidate alongside compact efficient written method (column subtraction) which include exchanges using as appropriate to ability.

	~~6~~ 5 ~~3~~ 13
-	48
	15

- Subtract numbers with different numbers of digits. For example, find the difference between:

671 and 58, 46 and 518

- Extend to decimals (these should be taught throughout the year). Using methods similar to those above, begin to find the difference between two three-digit sums of money, with or without 'adjustment' from the pence to the pounds. Know that decimal points should line up under each other.

Year 5

- Recap expanded method and compact method using as appropriate to ability. where one exchange is required (HTU – TU or HTU)

- Extend the expanded layout (HTU – HTU) where two exchanges are required.

		400	~~50~~ 150	13
		~~500~~	~~60~~	~~3~~
—		200	70	8
		200	80	5

Continue using expanded method alongside compact method as appropriate to ability with ThHTU

- Subtract numbers with different numbers of digits. For example, find the difference between:

764 and 5821, 4567 and 893

- Extend to decimals using both expanded and compact method as appropriate to ability.

Using the chosen method, find the difference between two decimal fractions with up to three digits and the same number of decimal places. Know that decimal points should line up under each other. For example:

£9.42 – 6.78
72.5 km – 4.6 km

Year 6

- Practise and consolidate use of compact method alongside expanded method as appropriate to ability for subtraction involving ThHTU, larger numbers and decimals.

				~~5~~ 5 ~~6~~ 13			~~4~~ 4 ~~15~~ 15 ~~7~~ 13	
	563			~~5~~ 5 ~~6~~ 13			~~4~~ 4 ~~15~~ 15 ~~7~~ 13	
-	241		-	248		-	278	
	322			315			285	

- Subtract numbers with different numbers of digits. For example, find the difference between:

782 and 4387

- Extend to decimals

Using the chosen method, subtract two or more decimal fractions with up to three digits and either one or two decimal places. Know that decimal points should line up under each other. For example:

324.9 – 7.25
14.24 – 8.7

Sharmans Cross Junior School – Routes through calculation

Multiplication

Year 3

- Know by heart multiplication facts for 2, 5, and 10 times table and begin to know facts for 3 and 4 times tables.

- To begin to understand that digits shift one/two place/s to the left when multiplying by 10/100

  3
  30
  300

- Multiply a 2 digit multiple of 10 up to 50 by 2,3,4,5, or 10
  E.g. 40 x 4
  10 x 4 = 40
  20 x 4 = 80
  40 x 4 =160

  or 30 x 3
  3 x 3 = 9
  30 is 10 times bigger than 3, therefore the answer will be 10 times bigger.
  30 x 3 = 90

- Partition numbers, using place value cards to support this.

- Multiply a 2-digit number by 2,3,4, or 5 using a strategy of their choice.

For example

- Partioning – using distributive law.
  e.g 12 x 4 → (10 x 4) + (2 x 4)
  = 40 + 8 = 48

43 x 5 → 200 + 15 = 215

This would lead onto the Grid method

x	20	8	
3	60	24	84

Year 4

- Consolidate use of grid method for TU x U

Grid layout, expanded working.

x	30	8	
7	210	56	266

- Extend to numbers where answer bridges 100

38 x 6

x	30	8	
6	180	48	= 228

Add mentally

- Introduce expanded method for TU x U

38		
x 6		Distributive
180	(30 x 6 = 180)	law
48	(8 x 6 = 48)	
228		

- Show the link between the grid layout and the vertical expanded method.

38	
x 7	
210	(30 x 7 = 210)
56	(8 x 7 = 56)
266	

Compact TU x U calculations (short multiplication)

38		
x 7		- only use if the child is secure and ready to move on.
210		
56		
266		
5		

Should the children find any stage too difficult, refer back to previous stage allowing the children to choose the method they feel most secure with.

E.g. if the expanded method is too difficult to grasp allow the child to use the grid method.

Year 5

- Extend grid method to multiplying HTU x U

x	300	40	6	
9	2700	360	54	3114

- Show links with expanded method.

346	
x 9	
2700	(300 x 9)
360	(40 x 9)
54	(6 x 9)
266	

- Show the link between expanded method and compact method for HTU x U

346
x 9
3114
4 5

- Introduce grid method for TU x TU

x	50	6	
20	1000	120	1120
7	350	42	392
			1512

- Extend compact method to TU x TU

36		36		36		1440
+ 42		+ 40		+ 2		+ 72
		1440		72		1512

36	
x 42	
1440	(36 x 40)
72	(36 x 2)
1512	

- Encourage these stages to be done mentally.
  E.g. 36 x 2, 36 x 40, 1440 +72

- Multiply a decimal fraction such as 0.6 by a single digit number (mental strategy)
  Respond to oral questions like;
  0.4 x 9 0.7 x 8
  Work mentally to complete written questions like;
  0.7 x 5 = □ 0.2 x □ = 1.8 □ x 9 = 5.4
  Then explain method in writing.

Year 6

- Extend to compact method

- Consolidate expanded method for TU x TU

- Extend to compact method

56	
x 27	
1120	(56 x 20)
392	(56 x 7)
1512	
1	

- Apply chosen method (for some children this may be grid, for others expanded or compact) to ThHTU x U

- Extend to simple decimals with one decimal place. Multiply by a single digit, approximating first. Know that decimal points should line up under each other.

  4.9 x 3 is approximately 5 x 3 = 15

  4.9 x 3 4.0 x 3 = 12.0
  0.9 x 3 = 2.7
  14.7

- Multiply a number with two decimal places by a single digit, approximating first. Know that decimal points should line up under each other.

  4.92 x 3 is approximately 5 x 3 = 15

  4.92 x 3 4.00 x 3 = 12.00
  0.90 x 3 = 2.70
  0.02 x 3 = 0.06
  14.76

- Introduce multiplication of HTU x TU using expanded method

- Extend to compact method.

352
x 27
352 x 20 7040
352 x 7 2464
9504
1

Should the children find any stage too difficult, refer back to previous stage allowing the children to choose the method they feel most secure with.

E.g. if the expanded method is too difficult to grasp allow the child to use the grid method.

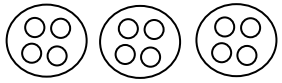
Sharmans Cross Junior School – Routes through calculation

Division

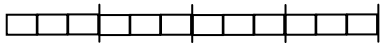
Year 3

- Continue to give children experience sharing using practical apparatus (leads into fractions)

E.g. '12 sweets ÷ 3 one for you, one for you…'

12 ÷ 3 = 

- Teach how to find answers to divisions using grouping e.g. counting up in multiples of the divisor.
- To calculate 12 ÷ 3, empty number lines or counting sticks could be used to provide this visual image:



- Questions that could be asked include:
- How many 3s make 12?
- How many jumps of 3 to get to 12?
- Alternatively model with multilink cubes/counters etc, taking away groups of 3 at a time
- Show how these practical methods can be recorded using the vertical expanded layout for short division.

12 ÷ 3

12	
- 3	(1 x 3)
9	
- 3	(1 x 3)
6	
- 3	(1 x 3)
3	
-3	(1 x 3)
0	

4 'threes' have been subtracted

- Develop the idea of division as repeated Subtraction – 'Chunking'
- Begin to find remainders after simple division
- E. g 17÷ 3 = 5 rem 2

Year 4

- Explain that subtracting the divisor repeatedly can be inefficient when we move onto larger numbers. It is easier to start taking away 'chunks' of the divisor.
- Get the children to brainstorm chunks they know first to develop a bank of known or derived facts to work from, E.g. 5 x 5 = 25, 10 x 5 = 50 etc

	72	
-	50	(10 x 5)
	22	
-	20	(4 x 5)
	2	

Answer: 14 remainder 2

- Encourage the children to estimate the answer first.
- For example, 72÷ 5 lies between 50 ÷ 5 = 10 and 100÷ 5 = 20

Year 5

Extend short division to include HTU ÷ U, subtracting 10th multiple of the divisor first.

- Begin to familiarise children with the notation used for division.
- Begin to record answers on top of division notation
- Extend short divisions tackled to include HTU ÷ U, subtracting the 10th multiple of the divisor first.

6	196	32	r 4
-	60	(6 x 10)	
	136		
-	60	(6 x 10)	
	76		
-	60	(6 x 10)	
	16		
-	12	(6 x 2)	
	4		

10 groups of 6 is formally recorded as 6 x 10 However, children may record this as 10 x 6

Provided they have a firm understanding of the procedure

- Extend short division to taking away larger chunks.

6	196	32	r 4
-	180	(6 x 30)	
	16		
-	12	(6 x 2)	
	4		

- Encourage children to estimate answers first.
- Get the children to brainstorm chunks they know first to develop a bank of known or derived facts to work from.
E.g. 10 x 5 = 50, therefore 20 x 5 = 100

Year 6

- Introduce long division (HTU ÷ TU)
- Encourage children to estimate answers first.
- Get the children to brainstorm chunks they know first to develop a bank of known or derived facts to work from.

36	972	27	
-	720	(20 x 36)	
	252		
-	252	(7 x 36)	
	0		

36	972	27
-	720	
	252	
-	252	
	0	

- To assist with calculation, encourage children to use written methods for multiplication where appropriate.
- Extend to decimals.

Extend to decimals with up to two decimal places. Approximate first. Know that decimal points should line up under each other

87.5 ÷ 7 is approximately 80 ÷ 8 = 10

7	87.5	12.5	
-	70.0	(10 x 7)	
	17.5		
-	14	(2 x 7)	
	3.5		
-	3.5	(0.5 x 7)	
	0.0		