Year 6

Addition & Subtraction

- **Strategies from previous years should continue to be developed and children should continue to practice these at regular intervals and apply to larger numbers and mixed operations**
- **Children should be able use mental methods to identify common factors, common multiples and know prime numbers to 10**

DEVELOPING MENTAL FLUENY STRATEGIES

Need to know
Quick recall of number bonds to 100 and be able to apply to other calculations including decimals, e.g. 4.3 + ? = 5

Children should understand why it is more efficient to reorder numbers when adding to put the largest number first. They should then use knowledge of number bonds and bridging.

Knowledge of number bonds and bridging
1240 + 180 becomes 1300 + 120 = 1420
£12.14 + £8.36 becomes £12.20 + £8.30 = £20.50
1½ + 3/4 bridge to 2 and add remaining ¼

Partition both numbers then add and recombine.
2430 + 1870 = 2000 + 1000 + 400 + 800 + 30 + 70
= 3000 + 1200 + 100
= 4300

Sequencing ~ partitioning just the smaller addend.
1320 + 459 becomes 1320 + 400 + 50 + 9
1720 + 50 + 9
1770 + 9
1779

Doubles and near doubles
1550 + 1530 = double 1500 + 50 + 30
= 3000 + 80 = 3080

2 ¾ + 2 ½ = double 2 ½ + ¼ = 5 1/4

Compensating ~ adding a close multiple of 10 (e.g. 18, 19, 21, 22)
273 + 19 becomes 273 + 20 = 293 - 1 = 292
2.4 + 0.8 becomes 2.4 + 1 = 3.4 - 0.2 = 3.2

Deriving new facts from known
15 + 6 = 21 therefore 1.5 + 0.6 = 2.1

Bridging through ten and multiples of ten should also be use when subtracting.
142 - 23 becomes 142 -2 -21 = 140 - 21 = 119

Counting on to find the difference.
Count on because the minuend and subtrahend are close together
3641 - 2991 = 5001 - 1997 =
0.63 - 0.48 =

Partition before count back if minuend and subtrahend are further apart
836 - ? = 800
464 - 129 becomes 464 - 100 = 364 364 - 20 = 344 344- 4 - 5 335

Compensating- subtracting a close multiple of 10, 100 or 1 (e.g. 18, 19,101, 1.9)

£4.38 - £1.98 becomes £4.38 - £2.00 = £2.38 + £0.02 = £2.40

Year 6

Addition - children will be calculating ThHTO + ThHTO and decimals - using the formal written method of columnar addition when appropriate.

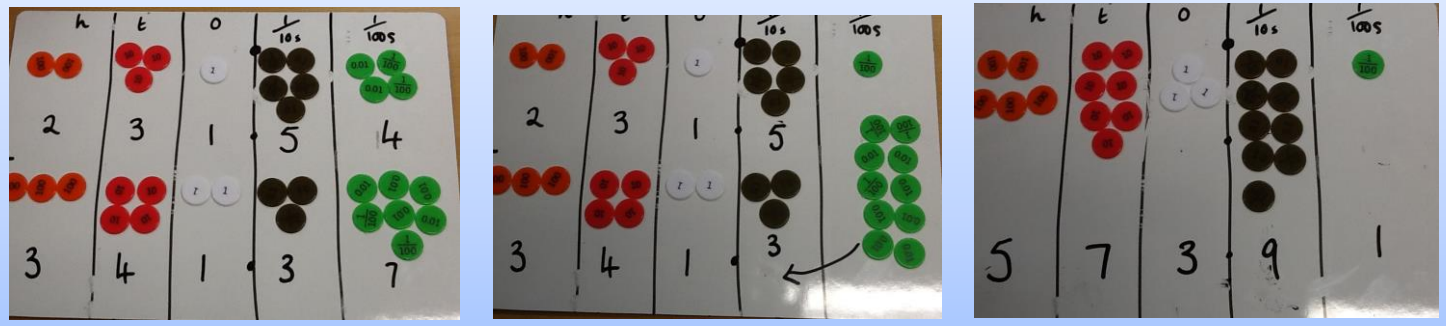
NB ENSURE THAT CHILDREN ARE SECURE WITH THE METHODS FROM THE PREVIOUS YEARS GUIDANCE *BEFORE* MOVING ON
Children should now be progressing to working with numbers with mixed number of digits e.g. 10ThThHTu + ThHTO; TO.t + O.th
Ideally children should be using formal columnar methods.

- Use models, images and make connections between different methods using **SAME/DIFFERENT** approach. Use range of resources e.g. Dienes, counters, addition squares, place value cards and other resources to ensure that children have a secure knowledge of place value to 2 decimal places. Place stress on children understanding the value of a digit and what happens when this is exchanged. Ensure that children are taught from the start to line up decimal calculations correctly and can explain the rationale behind this. Children should use column method as Year 4 - with the least significant different first.

FORMAL ADDITION

PLACE VALUE COUNTERS

231.54 + 342.37 Modelled using place value counters to show column addition



12.03 + 3.6

Estimation: *my answer will be less than 13 + 4* i.e. 17

12.03
+3.60
15.63

Addition of Mixed numbers 11.92 + 3.3 + 0.6

Estimation 15

11.92
3.30
0.60
15.82
1

Estimation should be strongly encouraged and when estimating children should be rounding and giving an approximate answer.

Stress should be placed from the word go on children lining calculation up with decimal point in vertical line. Another strategy to support children's' understanding is to place a zero - when it has no value - . e.g. 12.03 + 3.6

Year 6

Subtraction - 10ThThHTo - ThHTO; TU.t - U.th

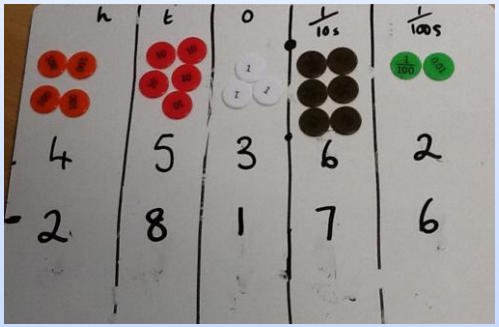
SUBTRACTION

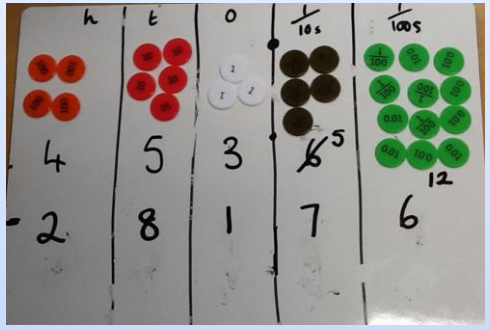
Children should be using formal column method for subtraction with numbers more than 4 digits and mixed numbers of digits etc. 10ThThHTo – ThHTO; TU.t – U.th.

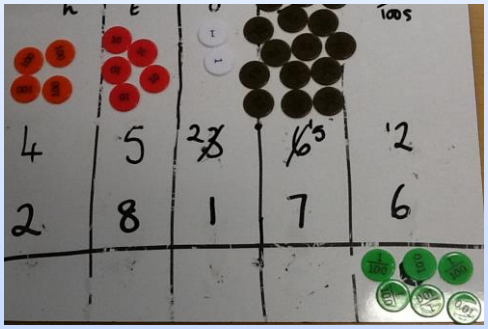
IF CHILDREN NOT READY THEN REPEAT METHODS and CONSOLIDATE MAETHODS FROM PREVIOUS YEAR(s) as appropriate.

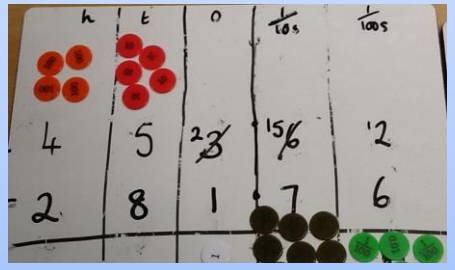
E.g. Expanded method – no carrying; expanded with exchanging and decomposition; formal written with no decomposition; formal written with decomposition.

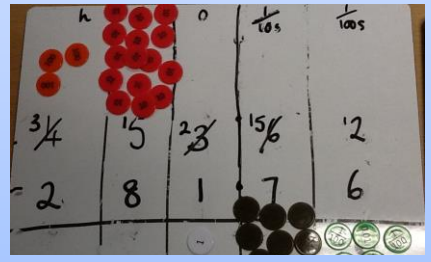
CHILDREN should be encouraged to check answers using inverse operation or alternative method.

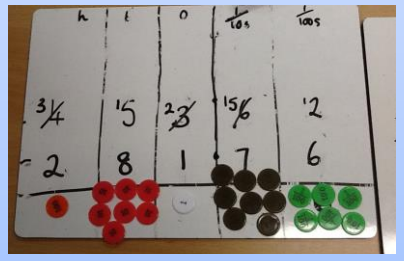


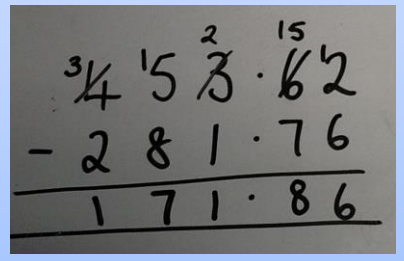












$$\begin{array}{r} 12\,13\,4.\,9\,0\,9\,0 \\ -\quad 8.3\,2\,7 \\ \hline 1\,5.\,6\,7\,3 \end{array}$$

Year 6

Multiplication and Division

- Developing mental fluency in multiplication and division.

DEVELOPING MENTAL FLUENY

Need to know

2 distinct characteristics:
Quantitative value: knowing and using the fact that e.g. 624 is 600 and twenty four
Columnar value: know that the 6 is in the 100s column and the 2 is in the tens column and the 4 is in the ones column.

Multiplication facts (including squares) to 12 x 12.

Factor pairs
e.g. factor pairs of 12 = 1,12, 2,6,3,4,
therefore 1 x 12, 2 x 6, 3 x 4 = 12
Terms factor, multiple and prime, square and cube numbers and use them to construct equivalent statements (for examples 4 x 35 = 2 x 2 x 35; 3 x 270 = 3 x 3 x 9 x 10 = 9^2 x 10

Multiples of 2,3,4,5,6,8 10 ,25 and 50

Divisibility/multiple rules
e.g. multiple of 3 if *'addition of digit roots sum to multiple of 3'*
48= 4 + 8 = 12 therefore 48 multiple of 3.
Multiple of 6 is even and digit roots sum to multiple of 3 e.g. 72 = even = 7 + 2 = 9 therefore 72 multiple of 6.

Need to know

2 distinct characteristics:
Quantitative value: knowing and using the fact that e.g. 624 is 600 and twenty four
Columnar value: know that the 6 is in the 100s column and the 2 is in the tens column and the 4 is in the ones column.

Division facts (+ square roots) derived from multiplication tables to 12 x 12

Factor pairs
e.g. factor pairs of 12 = 1,12, 2,6,3,4,
therefore 12 is divisible by1,12,2,6,3,14,

Multiples of 2,3,4,5,6,8 10 , 25 and 50

Divisibility/multiple rules
Divisibility rules:
e.g. *An even dividend divided by 2 will give a quotient which is even.*
An even whole number with a divisor of 6 will give a whole number quotient if dividend is an even number and the digit roots sum to a multiple of 3.
486 ÷ 6 486 even; 4+ 8 + 6 = 18 multiple of 3 therefore divisible by 6.

DEVELOPING MENTAL FLUENY

Recall prime numbers to 19.
Use multiplication facts to identify if a number from 1 to 100 is a prime number.

Recognise multiplication as **repeated addition** –E.g. plant growth is 3cm per day therefore over 7 even days plant will be 21cm
Use above for approximation – operating first with all the digits that have the greatest value (left to right)
e.g. 42 x 4 ≠160
123 x 4 ≠ 480
Children should have implicit understanding of commutative law
e.g. a = 1, b = 2 , c = 3
a x b = b x a i.e. 1 x 2 = 2 x 1
Associative law
(a x b) x c = a x (b xc)
(1 x 2) x 3 = 1 x (2 x 3)
Distributive law
a x (b + c) = a x b + a x c
1 x (2 +3) = 1 x 2 + 1 x 3
Can also be expressed as a(b + c) = ab + ac
Pupils use equals sign to indicate equivalence including in missing number problems : e.g. 35 = 5 x ?

Use prime numbers to decide if a number up to 100 is divisible by more than 0, 1, and itself.

Recognise division as **repeated subtraction but not always discrete.** E.g. Plant growth over one week is 21 cm therefore daily growth is approx. 3cm.
Use above for approximation – operating first with all the digits that have the greatest value (left to right)
e.g. 168 ÷4 ≠ 40
469÷4 ≠ 110

Children should know that
commutative law, associative law and distributive law are **not applicable** for division
a = 1, b= 2 ,c = 3
i.e. Commutative law
a ÷b is not equal to b÷a
Associative law
a ÷b ÷c is not equal to (1÷ 2÷3)
Distributive law
A ÷(b ÷c) is not equal to 1 ÷(2÷3)

STRATEGIES SHOULD ALSO INCLUDE THE FOLLOWING.

Place value:
Use place value knowledge to multiply by 10,100 or 1000.e.g. 10 x 18 = 180
Use place value to derive unknown facts e.g. 3 x 40 = 120 therefore 3 x 400 = 3 x 40 x 10 = 1200, 30 x 40 = 3 x 4 x 100.

Doubling and halving :
Use doubling/halving to calculate unknown facts
E.g. to multiply by 4 – double and double again.
To multiply by 5, multiply by 10 and halve.
60 x 4 = 120 therefore 30 x 4 = 60
To multiply 25 e.g. 16 x 25 - divide 16 by 4 and times answer by 100; e.g. (16 ÷4) x 100 = 400 : 17 x 25 =(17 ÷4) x 100 = 425
Using related facts
e.g. 19 x 4 = 20 x 4 (- 4) = 76
Partitioning: Use partitioning to find partial products then sum

e.g. 25.3 x 6 =

25 x 6 + 0.3 x 6

150 + 1. 8 = 151.8

Place value
Use place value to divide by 10,100 or 100 e.g. 360 ÷9 = 40 therefore 360 ÷ 90 = (360 ÷9) x 10 = 40
Use place value to derive unknown facts e.g. 60 ÷5 = 12 therefore 600 ÷5 = 120

Doubling and halving :
Use doubling and halving to calculate unknown facts.
E.g. to divide by 4 – halve and halve again.
280 ÷4 = 280 ÷2 ÷2 = 70
To divide by 2.5. ÷5 and double quotient .
Partitioning:
Use partitioning to find partial quotients then sum

e.g. 1248 ÷6 =

1200 418

(1200 ÷ 6) + (48 ÷6)

200 + 6 = 206

Year 6

Multiplication - ThHTO x O and T) x TO, HTO x TU TO.t x O

Children should be working with calculations to : ThHTO x O and T) x TO, HTO x TU TO.t x O . Use same different model when teaching. Children need to use estimation - this is particularly helpful to ascertain where decimal point goes in final answer. With long multiplication - children should understand that a 0 is added to show that the number acting as an operator is a multiple of ten. Children should identify that in column methods - you start from the right (i.e. lowest value) - however this is not necessary in grid method. Please see methods shown in Year 5 to progress to formal long multiplication from short multiplication. Year 5 methods should be reviewed before moving onto long multiplication with use of manipulatives to demonstrate.

MODELS TO WRITTEN

Use of grid method to support written

	3000	500	60	7	
20	60000	10000	1200	140	71340
4	12000	2000	240	28	14268
				Total	85608

3567
x24
14268
71340
85608

Build on children's understanding: demonstrate multiplication of a decimal number alongside its whole number equivalent

326	3.26
× 8	× 8
2400	24.00
160	1.60
48	0.48
2608	26.08

£ 6.23
x 27
43.61
1 2
124.60
£ 168.21
1

Compact methods for multiplication are efficient but often do not make the value of each digit explicit. When introducing multiplication of decimals, it is sensible to take children back to an expanded form such as the grid method where the value of each digit is clear, to ensure that children understand the process.

x	8	0.4	0.06
11	88	4.4	0.66

= 93.06

8.46
X 11
93.06

Year 6

Division - ThHTO ÷ O and HTO ÷ TO

DIVISION

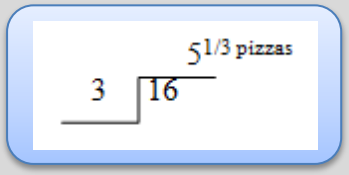
Children will be progressing to using formal written methods for long and short division and expressing remainders as fraction, decimals, rounding up/down or leaving depending on the context of the problem.

Previous strategies for teaching short division formal method should be used. Please see Year 5 models and use of manipulatives.

Children should then do short division with decimal answer.

Key teaching points: estimation; making decision as regards to remainder prior to calculating. .
Examples to use:

16 pizzas shared equally between 3 people =

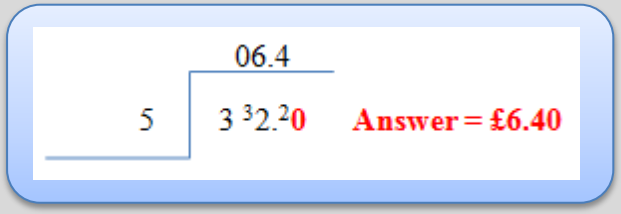


£16.00 shared between 4 people = £4.00
16 children going on trip – car takes four. How many cars need? 4 Cars
Car takes 4 people, 17 people going on trip – how many cars needed? 5 cars

Bus stop method to 1 decimal place

Refer to Year five models for formal short division method. Use place value counters to teach how to use short division method where answer will include decimals. Ensure children know what answer represent in terms of units e.g. mass, capacity, length, money

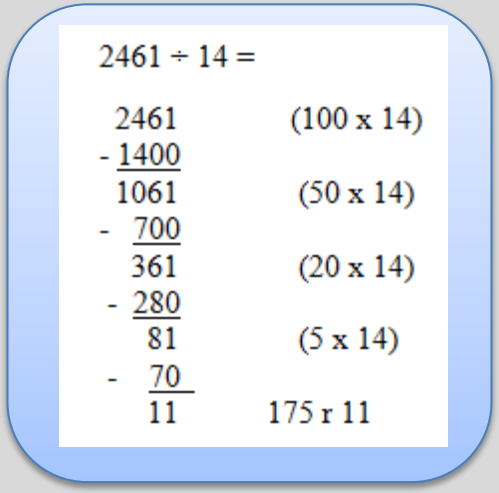
£32 is shared equally between 5 children. How much will each receive?



Children should then be taught formal long division. It is very important that children use chunking method alongside – children need to be able to identify differences (e.g. chunking you have a choice as to how many lots can be taken of whereas in formal method you are applying table facts. Children should also use estimation to ensure that their answer is reasonable. Children should not go onto formal long division until they are secure with chunking and table facts.

12461 ÷ 14 = 175r11

LONG DIVISION | CHUNKING



Same/difference? What are some of the similarities/differences with these methods?