St Augustine's Junior School

Year 3-6 Calculation Policy.

Calculation Policy Pages 17-34

This part calculation policy summarises the methods used in calculation for addition, subtraction, multiplication and division and ensures that the calculation elements of the National Curriculum are covered.

Many of the calculation methods included in this policy for years 3 to 6, have been implemented from previous national Government guidance documents for schools/education, and guidance/training for schools from local governing bodies/relevant bodies, as well as the latest National Curriculum. For links to these, see page 35. These methods have been included in previous calculation policies at St Augustine's (by previous Leadership) and these methods have been maintained by current leadership, as they are methods that are well known by the children and staff at St Augustine's. They have also been maintained as they are effective methods of calculation and ensure objectives for the National Curriculum are covered. This policy will be reviewed yearly by the current Maths Lead.

In Maths, children will be taught the methods in this calculation policy. Not only do the children need to learn the methods, they also need to be able to demonstrate a greater understanding of mathematical ideas using a range of different ways (visually, verbally, using mathematical images and using maths manipulatives (equipment). Children will need to show their understanding in a richer way than just applying the methods outlined in this policy. This may be: proving their answers are correct; explaining how they know an answer is correct; seeking to find links and using mathematical vocabulary to support their answers with confidence. The methods in this policy should be taught alongside all of the above and are used with those elements to enrich a greater understanding of the maths. Children also need to be able to choose methods from this policy selectively, dependent on the problem they are solving. They need to understand which method would be most effective and applicable to the question they are solving.

Addition and Subtraction

Year 3, Year 4, Year 5, Year 6

Teaching methods for addition and subtraction

Year 3 /Year 4	Year 5/Year 6
Continue to use equipment/ apparatus to support the teaching of these methods.	**Continue to use equipment/ apparatus to support the teaching of these methods.**
Mental methods addition 1. Mental addition (number line). 2. Mental addition (without a number line)	**Mental methods addition** 1. Mental addition (without a number line)
Mental methods subtraction 1. Count backwards on a number line. 2. Difference/gap on a number line. 3. Difference/gap without a number line.	**Mental methods subtraction** 1. Difference/gap without a number line.
Written methods addition 1. Expanded written method. 2. Column method without expansion.	**Written methods addition** 1. Column method without expansion.
Written method of subtraction 1. Expanded written method. 2. Column method without expansion.	**Written method of subtraction** 1. Column method without expansion.

ADDITION AND SUBTRACTION: YEAR 3 AND 4

Add and subtract numbers mentally, including: a three-digit number and ones / a three-digit number and tens / a three-digit number and hundreds

Add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction

Estimate the answer to a calculation and use inverse operations to check answers

Solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction as in money £ and p

Add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate

Estimate and use inverse operations to check answers to a calculation

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

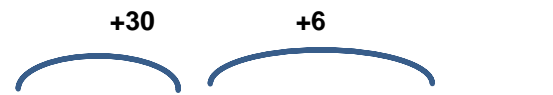| Mental Recall/Jottings:	Written Methods with representations
Continue to use equipment/ apparatus to support the teaching of these methods.	**Continue to use equipment/ apparatus to support the teaching of these methods.**
Mental methods addition 1. **Mental addition with number line** **42+36 = 78** +30 +6	**Written methods addition** 1. **Expanded written method (to begin with, where understanding of column is not secure)** 2 4 6 1 3 4 + _____ 1 0

42	72	78

OR

+6   +30

42   48   78

124 + 86 = 210

80   6
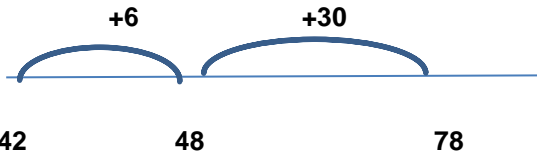
124 + 80 = 204

204 + 6 =210

OR

124 + 86 = 210

80   6

124+ 6 = 130

130 + 80 = 210

Mental methods subtraction

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7 0

3 0 0
_____
3 8 0

4 2 5

2   5 6 +
_____
6 8 1
_____
1

Written method of subtraction

245- 157 = 88

$$100 \quad 1 \; 30 \quad 1$$
$$245 = 200+ 40+ \; 5$$
$$157= \; 100+ 50+ \; 7$$
$$\overline{\qquad 0+ \; 80 + 8}$$
_____

245- 157= 88

$$13 \quad 1$$
$$1 \; 2 \; \cancel{4} \; 5$$
$$1 \; 5 \; 7 \; -$$
$$\overline{0 \quad 8 \quad 8}$$

In Year 4: Use the written method with decimals in the context of money

£ 32.50 + £ 21.75 = £54.25

1. Count backwards on a number line

$82 - 33 = 49$

	-1	-1	-1		-10		-10		-10	

49 50 51 52   62   72   82

OR   -3   -30

49   52   82
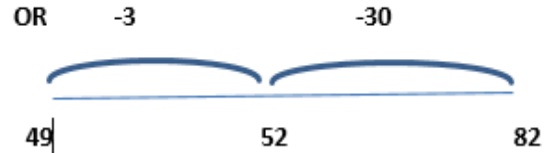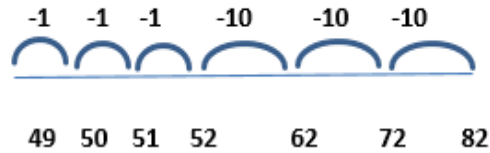
2. Difference/gap on a number line.

$71 - 37 = 34$

+3   +30   +1

37   40   70   71
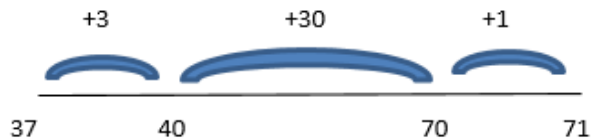
3. Difference /gap without a number line.

Question 122 – 76 = 46

76 (+4) =80 (count to next ten)

80 (+20) = 100 (count to next hundred)

100 (+ 22) =122 (stop at start number)

Now total (the jumps)=46

£32.50

+ £21.75

 £54.25

1

£ 42.50 - £ 13.35 = £ 29.15

 £ ^{3}4^{1}2.^{4}5^{1}0

-£ 1 3. 3 5

 £   2 9.15

ADDITION AND SUBTRACTION: YEAR 5 AND 6

Year 5 National Curriculum Objectives (Place Value up to 1,000,000)

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

Add and subtract numbers mentally with increasingly large numbers add and subtract whole numbers with more than 4 digits, including using formal written methods

Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy.

Year 6 National Curriculum Objectives (Place Value up to 10, 000,000)

perform mental calculations, including with mixed operations and large numbers.

use their knowledge of the order of operations to carry out calculations involving the four operations

use estimation to check answers to calculations and determine, in the context of a problem, levels of accuracy

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

solve problems involving addition, subtraction, multiplication and division

Mental Recall/Jottings:	Written Methods with representations

Continue to use equipment/ apparatus to support the teaching of these methods.

Mental Methods Addition

346 + 87 = 433

346 + 87 = 433	OR	(add the units first)
80 7		
346 + 80 = 426		346 + 87 = 433
426 + 7 = 433		346+ 7= 353
		353 + 80 = 433

Mental Methods Subtraction:

2.   **Difference/gap without a number line.**

Example:

Question: 452– 76 = 46

76 (+4) (count to next ten)

80 (+20) = 100(count to next hundred)

100 (352) =452 (stop at start number)

Now total (the jumps)=376

Continue to use equipment/ apparatus to support the teaching of these methods.

Written methods addition

1.   **Column method without expansion. (Exchange along the base)**

43,892+15, 464=59, 356

```
 4 3 8 9 2

 1 5 4 6 4  +
 _____

 5 9 3 5 6
 _____

   1 1
```

Written method of subtraction

2.   **Column method without expansion. (Exchange along the top numbers.**

24,5624- 12,3796=121,828

```
            4  15  1 1  1
   2 4 5 6 2 4
   1 2 3 7 9 6 -
   _____
   1 2 1 8 2 8
   _____
```

Multiplication and Division

Year 3, Year 4, Year 5, Year 6

Multiplication and division Calculation Year Overview

Year 3/Year 4	Year 5 /Year 6

Mental methods of multiplication
 	
1. Practise counting in rote :
  2, 10 and 5's, 3, 4, 8 (YEAR 3) /Up to 12 x 12(YEAR 4)
2. Use the mathematical language for multiplication e.g. lots of, groups of, multiply, doubling. (YEAR 3).
  Know further mathematical vocabulary, such as commutative, multiples etc. (YEAR 4)
3. Using practical objects to solve multiplication calculations e.g. arrays with counters, numicon times table square.
4. Mental method of multiplying with (Line).
5. If secure using a line, children use mental method of multiplying without a line.
 	
Grid method may be used as a checking tool only or a mental jotting.
	Mental methods of multiplication
	
	1. Practise counting in rote of multiplication tables up to 12x12.
	2. Using the mathematical language for multiplication e.g. lots of, groups of, multiply, doubling, product, multiples, factors, squared, cubed .
	3. Where needed, use practical objects to solve multiplication calculations e.g. arrays with counters, numicon times table square.
	4. Mental method of multiplication without a line.
	
	Grid method may be used as a checking tool only or a mental jotting.

Formal Written Methods of Multiplication 1. Expanded column method 2. Formal written method with no expansion.	**Formal Written Methods of Multiplication** 1. Formal written method with no expansion.

Mental Methods of Division
 	
1. Use the mathematical language of division e.g. divide by, share equally, halve, group (factor in year 4)
  1. Link multiplication facts to solve division calculations.
  2. Using practical objects share them out equally, times table square.
  3. Mental method of division with a line .
  4. Mental method of division without a line.
	Mental Methods of Division Use the mathematical language of division e.g. divide by, share equally, halve, group, factor, divisor. (In year 6, factor, divisor, quotient, dividend).
	
	1. Link multiplication facts to solve division calculations : inverse, movement of equals sign and its meaning.
	2. Where needed to reinforce learning, use practical objects share them out equally, times table square.
	3. Mental method of division without a number line.

Written Methods of Division 1. Children must be secure in the mental method before moving them onto formal written methods 2. If secure, move learning onto formal written methods of division (Bus stop). Dividing should be short division by one digit. Answers should be given in remainder or as a fraction remainder. In Year 4 ,Long division may start to be taught after short division. Remainders given in remainder or as a fraction remainder.	**Written Methods of Division** 1. Formal written methods of division (Bus stop). Dividing should begin with short division. Remainders given in remainder then move onto fraction remainder or if secure as a decimal equivalent answers up to hundredths. Formal written methods of division (Bus Stop). Long division when dividing by a 2digit number. Remainders should be given as a fraction answer or decimal equivalent.

Multiplication and division

Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.

Write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, (using the symbols for X ÷ and =) including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods. Materials such as arrays, repeated addition, mental methods and multiplication and division facts are used.

Solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems.

Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.

Year 4 National Curriculum Objectives

recall multiplication and division facts for multiplication tables up to 12 × 12

multiply two-digit and three-digit numbers by a one digit number using formal written layout

use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

recognise and use factor pairs and commutativity in mental calculations

solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as (n) objects are connected to (m) objects

Mental Methods	Written Methods
Multiplication	**Multiplication**

Multiplication

Children to learn times tables facts, in sequence and out of sequence and be able to recall corresponding facts.

3, 4 and 8 multiplication tables (Year 3)
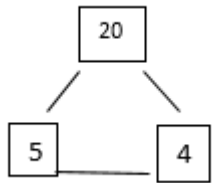
(up to 12x12 for Year 4)

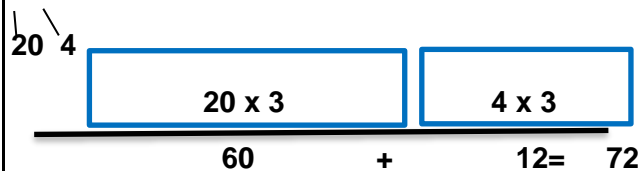Use jottings to help represent their answers in multiplying.

5x4=20   20 ÷ 4 = 5   4x5=20   20 ÷ 5 = 4

```
      20
     /  \
    5    4
```

Mental method of multiplication, with line

24x3=72

```
20  4
```

20 x 3	4 x 3

60   +   12=   72

Multiplication

Formal Written Method for Multiplication (column)

```
    3 8
    8  x
  _____
  3 0 4
    6
```

Formal Written Method for Division (column)

```
        1   8        r 1
   4  |  7  ₃3  ₁    4
```

24x3= still entails partitioning the number being multiplied and multiplying each partitioned amount by 3. (No line needed)
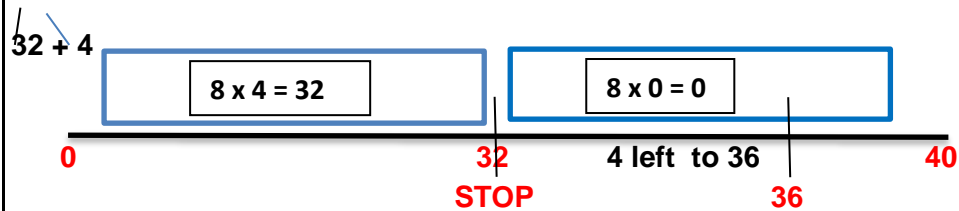
$$24 \text{ X } 3 = 72$$

20 X 3 = 60   **20   4**

4 X 3 = 12

60+12 = 72

36 ÷ 8 =

32 + 4

| 8 x 4 = 32 | | 8 x 0 = 0 |

0   32   4 left to 36   40

                          STOP   **36**

  Use the 8 times table to help you get as near to 36 as possible, but use the multiple that is before the number you are dividing 8 by.

8 x 4 =32.   8x 5 =40 (so this is too much)

So use 8 x 4 = 32 and count up to 36 giving a remainder of 4

4r 4   4r 1

So the answer =   **8**   **OR**   **2**

Mental method of division, without line

36 ÷ 8 = 4 r4

32 4

First, aim to get as near to 36 as possible, using the 8 times table (as above)

8x**4** = 32   8x**5** = 40

So it has to be be 8x**4** =32

So the answer is **4**

Then count to the number you needed in the question (**36**)

From 32 = **4.** This is the remainder.

36÷ 8 =   **4 r4**   OR 4 **4**   OR   4 **1**

                            8   **2**

Multiplication and division

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Know facts and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers: establish whether a number up to 100 is prime and recall prime numbers up to 19

Recognise and use square numbers and cube numbers, and the notation

Multiply and divide numbers mentally drawing upon known facts

Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

Solve problems involving multiplication and multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context

Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes

Year 6 National Curriculum Objectives (using numbers up to 10, 000, 000)

Identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers.

Know facts and use the vocabulary of prime numbers, prime factors and composite (nonprime) numbers: establish whether a number up to 100 is prime and recall prime numbers up to 19

Recognise and use square numbers and cube numbers, and the notation

Multiply and divide numbers mentally drawing upon known facts

Use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers

Solve problems involving multiplication and multiply and divide whole numbers and those involving decimals by 10, 100 and 1000

Multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers

Divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context

Solve problems involving multiplication and division including using their knowledge of factors and multiples, squares and cubes

Year 5/6 Mental Methods	Year 5/6 Written Methods
Know number facts (including decimal facts)	**Multiplication**

Know number facts (including decimal facts)

6 x 4= 24

Also knowing that…

4 x 6 = 24	240 ÷ 4 = 60	40 x 6 = 240	0.6 x 4 = 2.40
24÷6 = 4	240÷ 60 =4	400 x 6 = 2400	0.4 x 6 = 2.40
24 ÷ 4 = 6	60x 4 = 240	600 x 4 = 2400	

Know facts and use the vocabulary of prime numbers

2 , 5 , 7, 11, 13, 17, 19

Know that 1 is not a prime number and why.

Use numbers to the power of another number

EG: 2 squared (Understand how this creates an answer that is square)

EG: 3 cubed   (understand how this relates to volume)

Multiplying and dividing whole numbers and decimals by 10, 100 and 1000

Use place value for this to show how the digits move and the number becomes greater/larger or smaller.

123 X 100 = 12,300

4356 ÷ 10 = 435.6

Multiplication

==**Formal Written Method for Multiplication (column)**==

```
    3 8
    8  x
  -------
  3 0 4
  6
```

```
    1 4 5
    2 1  x
  ---------
  1 4  5
  2 9 0 0      +
  ---------
  3 0  4  5
```

==**Formal Written Method for Division (Short division) when dividing by a 1 digit number.**==   73 ÷ 4 = 18 r 1   Or 18 .25

```
        1    8        r 1
  4  |  7  ₃3  ₁    4
```

OR

```
        1   8 .  2   5
  4  |   7  ₃3 .₁0  ₂0
```

24x3= still entails partitioning the number being multiplied and multiplying each partitioned amount by 3. (No line needed)

$$24 \times 3 = 72$$

20   4

$20 \times 3 = 60$

$4 \times 3 = 12$

$60 + 12 = 72$

$$248 \div 8 = 31$$

240   8

Step 1 partition the dividend (240) into multiples of 8

240 is in the 8 times table $8 \times 30 = 240$

8 is in the 8 times table $8 \times 1 = 8$

When the dividend is reached or chunked (chunking), you total the factors 30 +1 = 31

$243 \div 12 = 22.16$

```
              2  2 . 1  6
  12  |    2  6  6 . 0   0
           - 2  4
           _____
              2  6
           -    2  4
           _____
                 2  0
              -  1  2
           _____
                    8  0
                    7  2
```

Continue until you have nothing

left or an answer to 2dp

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Links/ References for Further Guidance on these Calculation Methods.

Current Publications

https://www.gov.uk/government/collections/national-curriculum (Crown Copyright)

See Crown Copyright Publications for Newer Publications (search calculation)

http://publications.education.gov.uk
www.standards.dcsf.gov.uk

Older Publications (For information only and for further examples of mental calculation)

- http://webarchive.nationalarchives.gov.uk/20110221122841/http://nationalstrategies.standards.dcsf.gov.uk/ (Crown Copyright search calculation)

- Teaching Children to Calculate mentally (National Strategies Crown Copyright)

- www.educationengland.org.uk/documents/pdfs/2006-primary-national-strategy.pdf (Crown Copyright)

See Crown Copyright Publications for older Publications (search calculation).

http://publications.education.gov.uk

www.standards.dcsf.gov.uk