Archdiocese of Birmingham

St Maria Goretti
Catholic Academy

MATHS CALCULATION POLICY

All Saints Catholic Collegiate

Approval and review

Committee to approve policy	Achievement and Standards Committee
Date of Board / Academy Committee Approval	March 2019
Chair of Board / Academy committee – Name	Ray Chadwick
Signature	
Head teacher/principal	Mrs Cooper
Signature	
Policy review period	12 months
Date of policy review	Autumn 2020

Version Control

Version	Date Approved	Changes	Reason for Alterations

Calculation Policy

This policy sets out how and when written calculation methods should be introduced and how they link with mental strategies.

Written methods are structured annotations of calculations as opposed to mental methods which include working out in your head or informal jottings

Written methods are complementary to mental methods and should not be seen as separate from them. **It is important for children to look first at the problem and them to decide which is the most efficient method to use.**

When children are face with a calculation, no matter how large or difficult the numbers are, they should ask themselves:

- Can I do this is my head?
- What is the approximate size of the answer?
- If I can't do it in my head, what do I need to write down?
- Will a written method be helpful?

Where a child uses a written method, they need to be encouraged to notice whether an alternative mental method may be more efficient.

Children must become confident and secure in mental methods as well as written methods and make choices as to which method is the most efficient method to use. Daily maths occurs outside the lesson which gives children opportunities outside maths lessons to develop mental maths skills and apply fundamental Maths concepts.

The Principles of a Maths lesson

Maths lessons should:

Provide opportunities for Assessment for Learning.

Have effective deployment of support staff.

Make links to mental maths strategies throughout the lesson.

Give opportunities for children to share, discuss and explain different methods

Include key vocabulary which impacts on learning

Extend children's learning and understanding through carefully chosen questions by teacher and support staff

Make links to previous learning

Challenge and extend children through carefully planned activities.

Provide a range of resources to support children where needed and develop independence

Addition and Subtraction

EYFS

Children are expected to say which number is one more or one less than a given number and to add and subtract two single-digit numbers and count on or back to find the answer.

Their experiences should be a mixture of practical, oral and mental work. They may make some use of written forms to record in pictures, words or symbols; explain verbally, read records by teacher and to help with steps in their working. Talking about what they have done is an expectation as a precursor to written recording.

For addition children will be taught to record an outcome when 2 groups are combined. For subtraction, taking away, children will find out how many are left after some objects are removed.

YEAR 1

Children should be taught to read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs. Add and subtract one-digit and two-digit numbers to 20, including zero and solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations. They should also solve missing number problems such as 7 = ? – 9

Children should initially use objects for calculations, moving on to pictorial methods including number tracks, labelled number lines and then to written methods.

Children should be encouraged to use explain and discuss different methods for the same calculation.

When adding two 2 –digit numbers children should understand how to partition numbers into tens and ones

Eg 12 + 13 = 10 + 2 + 10 + 3

= 10 + 10 + 2 + 3

= 20 + 5

= 25

It is important to see a range of ways to record mental strategies

Children should use a number track to show addition and subtraction.

The transition from a number track to a number line is important. On number tracks the spaces are marked and the child will place a counter on a square with a number on and move forward or backward a number of spaces. On number lines the points are marked allowing for fractions to be placed between whole numbers eg a half.

Children should progress to using partly marked or completely unmarked number lines to illustrate their methods.

Children should use the bar method and part/whole method to solve missing number problems

YEAR 2

Children continue to use concrete objects and pictorial representations to solve addition and subtraction problems using mental and written methods.

They should apply this to different contexts such as number, quantities and measure.

They should mentally recall addition and subtraction facts up to 100 including adding and subtracting

- a two-digit number and ones
- a two-digit number and tens
- two two-digit numbers
- adding three one-digit numbers

It is expected that children understand that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot.

The use of empty boxes should be used for missing numbers and children should understand the inverse operation to solve missing number problems (early algebra) and the meaning of the equals sign to balance calculations.

By the end of year 2 it is expected that children are beginning to record addition and subtraction problems in columns using the expanded columnar layout using their understanding of partitioning and place value. At this stage children are not expected to use the regrouping method for subtraction or carrying for addition. They are expected to explain and discuss their chosen methods.

YEAR 3

Children use recording of addition and subtraction using pictorial forms to support their mental calculations and use equations alongside these to explain steps.

Children should be taught to add and subtract numbers mentally including:

- a three digit number to a one digit number
- 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

  The condensed forms of columnar addition and subtraction encourages children to look at the digits and not the number as a whole. Children need to be introduced to the expanded form of the vertical layout first.

  Eg 200 + 80 + 7
  40 + 5
  200+ 120 + 12 = 332

  Or 200
  80 + 40 = 120
  7 + 5 = 12
  332

Working from right to left conflicts with mental strategies of starting with the biggest value digits and working from left to right.

Adding from left to right.

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  287
+  45
 200
 120
  12
 332
```

Adding from right to left

```
  287
+  45
  12
 120
 200
 332
```

Addition where digits are carried should be progressive:

- carrying of 10 ones to one ten
- carrying of 10 tens to one hundred
- carrying from the ones to the tens and tens to the hundreds

This should be explained using concrete objects and the expanded written method to ensure children have a thorough understanding of partitioning numbers and place value.

Subtraction where regrouping is required should also be done progressively using concrete objects and the expanded method to ensure children have a thorough understanding of place value and partitioning:

- regrouping of one ten into 10 ones
- regrouping of one hundred into 10 tens
- regrouping of both

After introducing children to situations where carrying and regrouping are necessary, children should be encouraged to discuss why doing the working right to left is a more efficient method.

Children should be taught to identify when a calculation is too complicated to solve mentally and a formal method that lines up the hundreds, tens and ones is more efficient. There are still cases with large numbers when a mental strategy is more appropriate.

Children will progress to adding more than two numbers. For mental addition of adding a string of numbers children need to be taught to recognise numbers that go together eg bonds to ten.

It is expected that once addition and subtraction is secure they proceed to add units of money where decimal points are lined up.

YEAR 4

Children will use formal methods of columnar addition and subtraction where appropriate with numbers with up to 4 digits.

As for year 3, addition where digits are carried should be progressive as should subtraction with regrouping. Children need to be introduced to the expanded form of the vertical layout first in order to look at the digits and secure their understanding of place value and partitioning.

Children should be taught to identify when a calculation is too complicated to solve mentally and a formal method that lines up the hundreds, tens and ones is more efficient. There are still cases with large numbers when a mental strategy is more appropriate.

It is expected that children carry out addition and subtraction problems in a range of contexts including money and measure identifying the most efficient methods.

YEAR 5

Children should use condensed columnar form of addition and subtraction where appropriate. They should be encouraged to choose the most efficient method to solve an addition or subtraction. Children experience addition and subtraction in a range of contexts with decimal notation including measure and money.

Children will be taught to convert units to the same unit in order to be able to add or subtract them.

Children will be taught to add strings of numbers, including decimals with different numbers of decimals places by lining up the digits.

YEAR 6

Children are expected to use condensed columnar form for addition and subtraction to solve multi step problems.

Children are expected to know the order of operations using brackets.

Multiplication and Division

The correct interpretation of 2x6 is 2 multiplied by 6 or 2 +2+2+2+2+2. Since multiplication obeys the commutative rule (axb = bxa) this will give the same result.

The statement 12÷3 can be interpreted as share 12 objects between 3 or how many groups of 3 are in 12. Both are correct but it should be read as 12 divided by 3 so children recognise it is not the same as 3÷12. Saying 12 divided into 3 can be confusing

EYFS

Children are expected to solve problems, including doubling, halving and sharing. The idea of multiplication and division includes counting patterns and equal groupings. Children are introduced to rhymes and stories counting forwards or backwards in different intervals. Children are expected to use concrete objects to double and to share equally. Activities are expected to be recorded using a mixture of pictures, tally marks and symbols.

YEAR 1

Children are expected to be able to count in 2s, 5s and 10s

Children are taught to understand multiplication and division through doubling numbers and quantities and to find simple fractions of objects.

Multiplication will be explained by repeated addition of a number and repeated subtraction to model the inverse. This can be represented on number lines. Children repeatedly jump forward the number of times needed.

Children are introduced to arrays of concrete objects then as pictures and dots.

YEAR 2

It is an expectation that children recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables. All teachers are expected to promote the use of fluency cards for children to say, know and use the 2,5 and 10 times tables. Any children who are not on track to achieve the expectations for their year group, must have appropriate interventions put in place to support them in learning the expected times tables. Fluency cards must be passed up to the next class at the end of the year.

It is essential that children understand that multiplication is commutative and division is not. Children should apply this to multiplication tables eg 5x2 is the same as 2 x 5. They are taught that for every multiplication there are 2 corresponding division facts eg 5 x 3 = 15 15 ÷5 = 3 and 15 ÷3 = 5

Multiplication and division are represented as arrays of objects, pictures or dots. Division is seen as the inverse of multiplication.

Multiplication is represented on a number line jumping forward in single steps of the multiplier. Once confident, children will begin to solve problems - involving bigger numbers-more effectively by jumping in multiples of the divisor.

Children calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs.

Children identify that sometimes there is a remainder.

YEAR 3

It is an expectation that children recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables (plus 2,5,10). All teachers are expected to promote the use of fluency cards for children to say, know and use the 3, 4 and 8 times tables. Any children who are not on track to achieve the expectations for their year group, must have appropriate interventions put in place to support them in learning the expected times tables. Fluency cards must be passed up to the next class at the end of the year.

Children calculate mentally using efficient methods eg the most efficient method to calculate 4 x 12 x 5 is to do 4 x 5 first and then 20 x12. They recognise 30 x 40 can be written as 3 x 10 x 4 x 10 and rearranged as 3 x 4 x 10 x 10

Children use multiplication and division facts to calculate related facts eg

3 x 2=6, 6÷3=2 and 6÷2= 3 can be used to derive 30 x 2 = 60, 60 ÷30 = 20 and 60÷20 = 30

Children are taught using concrete objects, such as place value counters, and pictures including number lines, to multiply and divide two-digit numbers by one-digit numbers progressing to the formal method of short multiplication and division.

Multiplication of larger numbers involves the splitting of the calculation into smaller parts. Repeated addition will be seen as inefficient

The grid method is used as an introduction to partitioning using place value. Children should compare the grid method and the vertical method for a two-digit number by a one-digit number (ncetm video https://www.ncetm.org.uk/resources/40530)

Progression of short multiplication:

- no carrying
- Carrying of ones to the tens column
- Carrying of tens to the hundreds column (recognising where the hundreds column is)

Progression of short division:

- each digit is a multiple of the divisor eg 96 ÷3
- there is a remainder eg 86 ÷ 4
- regrouping of one ten into ten ones eg 96÷4

Children need to use concrete objects and pictures to be secure when regrouping for division and carrying for multiplication. They will be taught how to regroup or carry using concrete resources such as place value counters, progressing to pictorial representations before progressing to formal methods.

Children are encouraged to identify when to use a formal method or when to use mental maths eg for 28 x2 the mental method of doubling would be used

Children are expected to use the associated vocabulary of dividend, divisor and quotient for division.

YEAR 4

It is an expectation that children recall and use multiplication and division facts for all the multiplication tables to 12x12. All teachers are expected to promote the use of fluency cards for children to say, know and use all times tables. Any children who are not on track to achieve the expectations for their year group, must have appropriate interventions put in place to support them in learning the expected times tables. Fluency cards must be passed up to the next class at the end of the year.

Children are taught to recognise and use factor pairs and commutativity in mental calculations

Children are taught to multiply two-digit and three-digit numbers by a one-digit number using concrete resources and pictorial representations before progressing to a formal written.

Children need to be secure that 48 x 6 = (40 x6) + (8 x 6)

4 8	
X 6	
4 8	8 x 6
2 4 0	40 x 6
2 8 8	

(This can be done starting with 40 x 6 first)

Progression in short multiplication:

- no carrying
- carrying of ten ones to the tens column
- Carrying of ten tens to the hundreds column

Pupils practise to become fluent in the formal written method of short division

Progression in short division:

- Regroup one ten into ten ones
- Regroup one hundred into ten tens

Children are encouraged to identify when to use a formal method or when to use mental maths to solve multiplication and division problems.

YEAR 5

Children continue to use to use multiplication tables and related division facts to maintain fluency.

Children should identify factors of numbers and prime factors of numbers.

Children are taught to multiply and divide whole numbers and those involving decimals by 10, 100 and 1000 using concrete objects and pictorially as a precursor to mental methods.

Children progress to multiply numbers up to 4 digits by a one-or two-digit number, including long multiplication for two –digit numbers, using the same vertical methods they established for multiplying by a single digit. When multiplying by a 2-digit number children use the expanded methods:

Eg 24 x 16 = (20 x 10) + (20 x6) + (4 x 10) + (4 x 6)

2 4	
X 1 6	
2 4	4 x 6
1 2 0	20 x 6
4 0	4 x 10
2 0 0	20 x 10
3 8 4	

Children need to recognise where mental methods may be more efficient eg 36 x 25 = (36 ÷4) x100 = 9 x 100 = 900
Multiplication calculations will be extended to multiply numbers with 2 decimal places such as in the context of money.

Children use a formal method of short division to divide numbers up to 4 digits by a one-digit number and interpret remainders appropriately for the context.

Progression in short division:

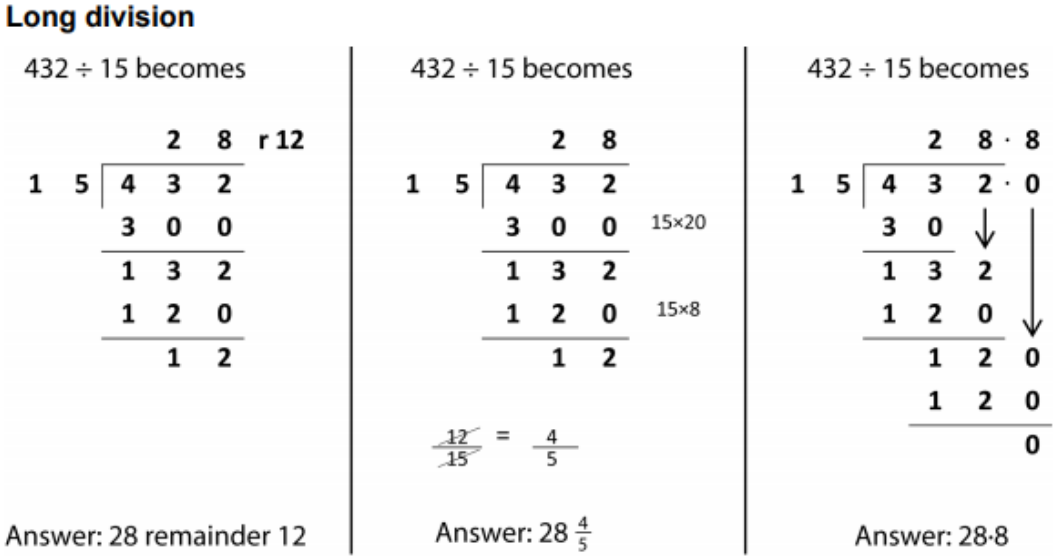
- Regroup one ten into ten ones
- Regroup one hundred into ten tens
- Regroup one hundred into ten thousands
- Mixed regrouping

YEAR 6

Children continue to use to use multiplication tables and related division facts to maintain fluency.

Children multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication.

They divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders. To divide by a two-digit divisor, children need to select the most effect approach for each task, including whether to use the standard long division method. Children are taught to interpret remainders as remainders, fractions or decimals appropriate to the context.



Children are taught to identify where known facts can be used to multiply and divide decimals

eg 5.4 x 2 = (54 x 2)÷10

Children are expected to know the order of operations using brackets.