Middlestown Junior, Infant & Nursery School

Calculations Policy

Updated: September 2014

Next Review Date: September 2015

INTRODUCTION

At Middlestown Junior, Infant and Nursery School our main aim in maths is for children to enjoy the subject and be happy, confident mathematicians.

This calculation policy clarifies the methods that will be taught in School. It has been written to allow consistency and progression and reflects a whole school agreement.

Although the main focus of this policy is on written recording, the ability to calculate mentally is of great importance.

Within our school, we ensure that children are taught 'Key Skills' (see Appendices), are challenged weekly with mental maths tests (KS2) and big maths (KS1/2), also each child complete a 'Dr, Dr' problem-solving question in order to select and practice the 4 operations (in accordance to the expectations of the maths requirements)

At the beginning of the year, each child will take their 'key skills' home so that parents understand the fundamentals of their needs. Along with these the parents will have a selection of games that they can use to improve their child's skills.

The implementation of this policy is the responsibility of the Headteacher and all the teaching staff.

WHOLE SCHOOL CALCULATION STRATEGIES

Calculations strategies are ideally used to solve a problem in a context. Calculation strategies should be initially taught, practised and then applied to problems.

In Upper Key Stage 2, SATs question examples may also be used to give children examples of how this might appear when being tested.

Problem Solving

Throughout school, the 5 stage problem solving method is used.

The 5 steps used in problem solving are:

1. Identify important numbers and words.
2. Decide which operation to use.
3. Write the calculation.
4. Which strategy will you use? Work out the answer.
5. Check your answer. Is it sensible?

This strategy is displayed in every classroom.

ADDITION

Early addition in the Foundation Stage begins with children combining sets and ***counting all*** of the items in that set. As their counting skills improve they will be taught to ***count on*** from the largest number.

In Year 1 children will consolidate count all and count on strategies as well as using a number track to aid counting on. Numicon is also used to consolidate the children's knowledge of number.

In Year 2 children will consolidate count all and count on strategies as well as using a number lines, number squares and fingers.

Basic skills for partitioning

Oral counting in 1s, 10s, 100s, 1000s, orally combining numbers
E.G '70 +3 is 73' , being able to say what is 1 more/ less, 10 more/ less than, 100 more/ less than any number, use a count on strategy or hundred square to find for example 20 more than 40, 30 less than 90

Partitioning method

In Lower Key Stage 2 the expectation is that children will add using the partitioning method.

E.G. 23 + 12= 35

20 + 3
10 + 2
30 + 5

386 + 245= 631

300 + 80 + 6
200 + 40 + 5
500 120 11

Arrow cards can be used to support partitioning, in all year groups. As children progress through Key Stage 2 the expectation will be that they will use more efficient methods based upon the same basic principles.

In mental maths Informal jottings may be used to accompany mental strategy.

Column Method

In upper Key Stage 2, the expectation is that children will add using the column method. Ensuring the children understand the value of the number they are carrying.

E.G. **23 + 12= 35**

```
  23
+12
  35
```

386 + 245= 631

```
  386
+ 245
  631
```

In mental maths Informal jottings (such as partitioning) may be used to accompany mental strategy.

Addition of decimals

These follow the same principles of partitioning and addition of like numbers, however it is vital that children are taught to use zero as a place holder and that setting out in books adheres to the place of each number. In upper Key stage 2, they will use the column method to add decimals.

E. G 12.6 + 1.5 = 14.1

```
  12.0 +  0.6
   1.0  +  0.5
  13.0     1.1
```

12.8 + 7.3 = 20.1

```
  12.8
+ 7.3
  20.1
```

SUBTRACTION

Children should be taught and constantly reminded that subtraction or taking away results in a number or set reducing in size. This is a crucial self check strategy.

A subtraction problem may involve:

1. **Taking away**
E.G. Ben has 9 sweets and he eats 4. How many has he got left?

Early years subtraction would involve children starting with 9 sweets and practically taking away 4 to see how many remain.

As children develop, it is still appropriate for them to use fingers, but they will progress to using number lines and eventually will count back accurately in their heads to reach 5.

2. The **difference** between the numbers
E.G. Sam has 7 sweets and Ben has 10. How many **more** sweets has Ben got?

Children need to recognise from an early age that taking away and comparing two numbers both give the same numerical answer.

It is vital however that children understand and use the comparative language associated with subtraction and difference. E.G. More and less greater than, less/ fewer than.

Also that the **inverses** exist

E.G 10-7= 3, 10 is 3 more than 7, and that, **7 is 3 less than 10**
10-3=7, **10 is 7 more than 3,** and that, **3 is 7 less than 10**

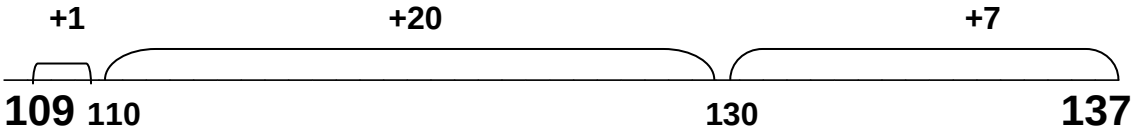
Children need to use accurate comparative language to describe the ways in which numbers relate to each other. **This aspect of number must not be underestimated, even at upper Key Stage 2**

Number Line Method

Number lines provide an excellent practical model to show the relationship between numbers. Children should be able to draw their own number lines from Year 2 to Year 4. This involves a number of basic skills. Firstly using a ruler properly and setting out appropriately. Each number line draw should be of an appropriate length and an appropriate gap being left between each number line so that it can be used accurately. In KS1 some children may be provided with drawn number lines.

E.G Sam is 109 cm tall and Katie is 137 cm tall. How much taller is Katie than Sam?

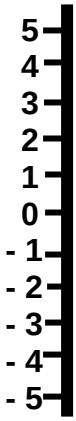
Each number line should start from the lowest number they are working with. For example, in the following question the number line would start at 109 and end at 137.

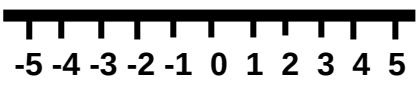


20 + 7 + 1 = 28

Encourage children to use a size of jump to the appropriate to the size of number being added. Numbers should be written below the line and jumps should be drawn above the line. The amount of each jump should be written above its jump.

Scales, such as thermometers, are number lines. Children need to recognise this which ever way it is illustrated. Children should be taught that number lines follow the convention of the number system; positive numbers to the right, negative to the left.





Children should be taught that number lines work both ways and that when two numbers are close together; it is always easier to find the difference by counting on, not counting back. **E.G. 82 - 79**

Some situations very obviously lend themselves to one aspect rather than another.
e.g. 5002 – 4998 = 4 lends itself to counting on, whereas 5002 – 4 = 4998 lends itself to taking away by counting back.

Column Method

In upper Key Stage 2, the expectation is that children will add using the column method. Ensuring the children understand the value of the number they are borrowing.

E.G 169 - 45 =

```
  169
-  45
  124
```

263 - 139

```
  2 5 6 13
- 1  3  9
  1  2  4
```

Sometimes there is zero in which you cannot borrow from. So the borrowing continues to the left, the zero then become 10 which you can borrow from. When it is borrowing from it then becomes 9.

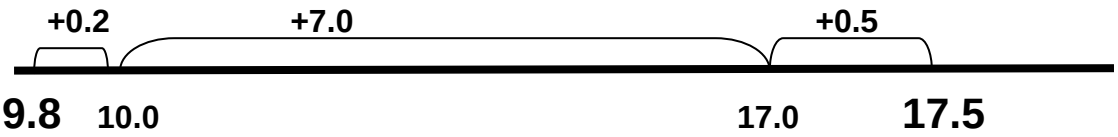
E.G 703 - 184 =

```
  6 9 10 13
- 1  8  4
  5  1  9
```

Subtraction of decimals

These follow the same principles, lower key stage children using a number line and upper Key stage 2, they will use the column method to add decimals. Children must a concrete knowledge of making the next whole one. Using money to represent decimals can add children to see the relationship.

E. G Number Line **17.5 - 9.8 =**



7.0 + 0.2 + 0.5 = 7.7

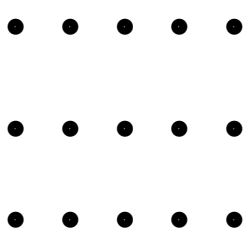
E. G Column Method **17.5 - 9.8 =**

$$\begin{array}{r} {}^{0}\cancel{1}\,{}^{16}\cancel{7}\,.\,{}^{1}5 \\ -\quad 9\,.\,8 \\ \hline 7\,.\,7 \end{array}$$

MULTIPLICATION

Multiplication is the repeated grouping of objects or numbers. It is **repeated addition E.G** 5 + 5 + 5, three lots of 5 or 3 x 5. Early multiplication should involve children counting in 2s, 5s, 10s. The use of a counting stick**,** coins and arrays are particularly good models for children to build up their counting and language skills before they are introduced to the more formal x sign.

E.G.



3 lots of 5 ***5 10 15*** ***5 lots of 3***

This can be rotated to show **3** rows of **5** or **5** rows of **3. It is important that children learn that 5 x 3 is also 3 x 5.** This can allow them to view calculations in simpler more familiar forms: **E.G** 4x7 would require repeated addition of 7 whereas 7 x4 can be derived from 7x2.

Repeated doubling is an important strategy for multiplication by 2, 4, 8, 16, 32, etc. If children can double efficiently, they can deduce other facts from simple principles, particularly with larger numbers **E.G** 13x8.

Multiplication by 5 can also utilise the basic skill of **halving and multiplying** by 10.

E.G. 45 x5 45x10 = 450 half of 450 is 225

To complement these strategies, it is vital that children know their timetables by heart. The expectations are:

Year 1: 2, 5, 10
Year 2: 2, 3, 4, 5, 10
Year 3: 2, 3, 4, 5, 6, 8, 9, 10, 11
Year 4: All 12 times tables

In Upper Key stage 2 children should be able to answer a times tables question within 3 seconds to enable fast and efficient calculations.

Grid Method

In Key Stage 2, children are taught the **Grid Method** as the written method for multiplication calculations with larger numbers.

Both written and mental calculation strategies for multiplication are built on **partitioning**.

E.G. 24 x 7 = 20x7
4x7

In order to be understood, children should also be taught the importance of multiplication and place value; that if **3x7 = 21** then **30x7 is 210.**

E.G. 36 X 7

X	**30**	**6**	
7	**210**	**42**	**252**

210 + 42 = 252

If the addition sum cannot be completed mentally then the child follows the correct written addition method for their year group.

How to draw a grid

The number of lines to be drawn in the grid is simply: a **two**-digit number multiplied by a **one** digit number - **two** lines down and **one** line across. For multiplication of a three-digit by a single digit number, the grid needs another cell. Children must use rulers to draw the grids.

E.G. 325 X 3

X	300	20	5	
3	900	60	15	**975**

900 + 60 + 15 = 975

Multiplication of a two-digit number by a two-digit number is similar.

E.G. 24 X 25

X	20	4	
20	400	80	**480**
5	100	20	**120**

480 +120 480 +100 +20 =600

Children need to be reminded that written methods such as the grid method are only appropriate for calculations which cannot be done mentally.

Multiplication of decimals

Children must have concrete knowledge of the decimal point and place value. From lower key stage 2 children use a multiplication grid to multiple decimals. They must remove the decimal point and put it back into its place.

E.G 6 x 12.4 becomes 6 x 124

x	100	20	4
6	600	120	24

600 + 120 + 24 = 744 becomes **74.4**

E.G Lucy bought 3 pairs of trousers. One pair of trousers cost £24.13. How much did they cost altogether?

3 x £24.13 becomes 3 x 2413

X	2000	400	10	3
3	6000	1200	30	9

6000 + 1200 + 30 + 9 = 7239 becomes **£72.39**

REMEMBER: *If the decimal begin multiplied is to 2 decimal places then the answer must be 2 decimal point and if it has 1 decimal place then the answer must have 1 decimal place*

DIVISION

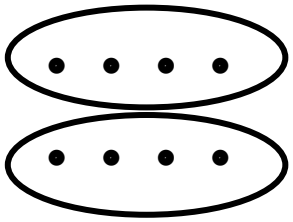
In the Foundation stage and Key stage 1, children will experience sharing objects out equally into groups. They will learn about odd and even numbers and they will learn that not all numbers can be shared equally into groups.

In Key Stage 1, division problems can involve either **'sharing'** or **'grouping/chunking'** and children need to learn to differentiate between them.

E.G. 4 sweets shared between 2 children, each child gets 2 sweets each.

4 ÷ 2 = 2

They should also be taught the links between multiplication and arrays.



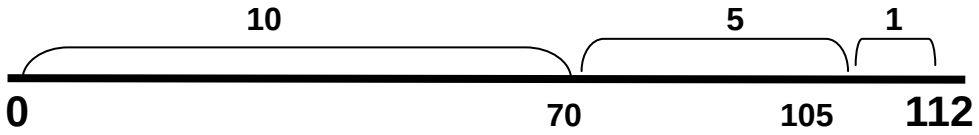
E.G. 8 sweets shared between 5 children. But 8 sweets cannot be shared equally between 5 children

Division calculations are best done in context allowing children to investigate the link between multiplication and division.

Chunking Number Line

In order to use chunking the children should be have secure knowledge of their times tables and should be able to complete simple divisions as 18÷ 3 mentally. In Lower Key Stage 2, children will begin to use a number line and will use simple chunks to divide. The children should be able to recognise from the number being divided what is a sensible chunk to take. The number line always begins with zero and ends in the number being divided, the chucks must be written above and the children will be encouraged to take size of jumps appropriate to the size of number.

E.G 112 ÷ 7



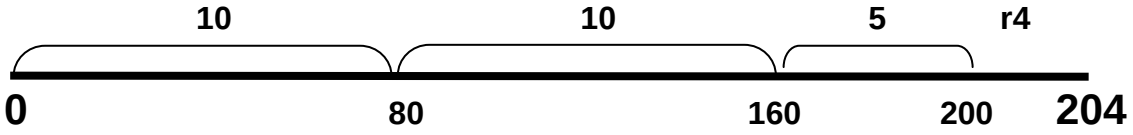
10 + 5 + 1 = 16

The chunks are then added together- (the numbers above the chunks) so there are 16 chunks of 7 in 112.

Dividing with a remainder

Following the fundamentals in Key stage one of 8 sweets not being able to shared by 5, the children should be able to understand a remainder. The same method is followed as a division without remainder.

E.G 204 ÷ 8



10 + 10 + 5 = 25
204 ÷ 8 = 25 r 4

Bus Stop Method

In Upper Key stage 2, the children are taught the bus stop method. It allows children to apply their mental times tables divided the placed numbers with the whole number being divided. The children must have a clear understanding of remainders as that is carried to make the next number.

E.G. 168 ÷ 7

$$\begin{array}{r} 0\,2\,4 \\ 7\overline{)\,1^{1}6^{2}8} \end{array}$$

E.G. 456 ÷ 9

$$\begin{array}{r} 0\;\;5\,0\;r6 \\ 9\overline{)\,4\,^{4}5\,6} \end{array}$$

NOTE: *When dividing by 4 children won't always have to show their method, if they can mentally half the number and half again.*

Dividing Decimals

In Upper Key Stage 2 children will use the bus stop method to divide decimals (including money). The division is completed with the decimal point still in place.

E.G. 16.8 ÷ 7 =

$$\begin{array}{r} 0\ 2\ .\ 4 \\ 7\ \overline{)\ 1\ {}_{1}6\ .\ {}_{2}8} \end{array}$$

E.G. 19.3 ÷ 8 =

$$\begin{array}{r} 0\ 2\ .\ 4\ r1 \\ 8\ \overline{)\ 1\ {}_{1}9\ .\ {}_{3}3} \end{array}$$

E.G. £16.32 ÷ 6 =

$$\begin{array}{r} 0\ 2\ .\ 7\ 2 \\ 6\ \overline{)\ 1\ {}_{1}6\ .\ {}_{4}3\ {}_{1}2} \end{array}$$

Negative Numbers

Children need to have a clear understanding of negative numbers, knowing where they would come across them in real life circumstances and where they may be seen. I.E.Temperature and bank statements. Children must understand that negative numbers are below zero and that the further away from zero the number is, the smaller that number is.

To begin with children should use a number line to help them add and subtract with negative numbers. To help them understand the concepts when adding and subtracting below zero.

The children should use the following rules for interpreting sums:

+ and + } Positive
- and -

- and + } Negative
+ and -

E.g. 6 - -5 = 6 + 5 = 11 7 + - 9 = 7 - 9 = -2

These rules only apply when the two signs are next to each other. For example, -8 + 7 = , doesn't need to be changed.

When multiplying and dividing with negative numbers these rules apply:

+ X + } Positive
- X -
+ ÷ +
- ÷ -

+ X - } Negative
- X +
- ÷ +
+ ÷ -

E.g. 6 x -8 = -48 - 9 x -10 = 90 - 18 ÷ - 3 = 6

Therefore children can use apply their known formal methods when working with negative numbers; whilst applying these rules.