# Benfieldside Primary School – Mental Calculation policy
# November 2022

## Introduction

In order to ensure that every child in our school achieves their maximum potential in numeracy this policy for mental calculation sets out the school's ethos on the teaching and benefits of mental calculations as well as highlighting the strategies to be taught.

From Reception onwards children in our schools will be introduced to the process of mental calculation through activities that are hands on, practical and connected to mathematical facts and strategies. This will lead to a wider range of more efficient and formal mental calculations for all four number operations by the end of Key Stage 2.

The overall aim is that when children leave our school they:

- have a secure knowledge of place value, number facts and a good understanding of the four operations.
- are able to apply this knowledge and understanding to carry out calculations mentally for all four operations when **solving real life problems** incorporating single digit to large numbers.
- make use of physical resources, diagrams and informal notes to help record steps when using mental methods that generate more information than can be kept in their heads.

## Rationale

The purpose of this policy is to outline the progression of mental calculation strategies as taught in our school from Year 1 to Year 6. Mental maths is taught daily, during the mastering number aspect of the lesson, in KS1. Mental maths is regularly revisited during the Flashback 4 sessions taught 4 days a week in KS1 and KS2. This involves practise in the quick recall of times tables, number facts,

the solving of problems and discussion of effective strategies for carrying out mental calculations.

We aim to establish a secure understanding of mental calculation strategies appropriate to each child's age and stage of mathematical development.

All mental calculation strategies are based on a secure understanding of place value. Teachers give a high emphasis to place value when it arises in long and short term planning and regularly include aspects of place value in flash back 4 questions and conceptual links during all aspects of numeracy lessons.

Children's own mental calculation strategies are valued. Children are encouraged to share their strategies with each other and with the teacher. Teachers encourage children to use an efficient, accurate and reliable strategy for each calculation.

Following key stage and whole school meetings, the staff at Benfieldside Primary have identified strategies and techniques from The National Curriculum for Mathematics, White Rose documents and NCETM materials, which we believe provides a structured and systematic approach to teaching calculation skills.

**Progression in Mental Mathematics Strategies**

This policy highlights the agreed strategies to be used within school and across year groups. Strategies show natural progression but are not necessarily age specific. Although teachers need to use long term planning to ensure suitable age related coverage, teachers have to use their own assessments and professional judgment to ensure techniques used are appropriate for the individual needs and abilities of their students. Therefore, sometimes teachers will need to look at the previous or subsequent strategies as opposed to solely using age related strategies or techniques.

## Mental Addition and Subtraction

- Initial mental addition and subtraction will require a physical aid such as base 10, numicon, a number line, number square, a ten frame or the child's fingers. When a child is capable of completing calculations mentally, the physical aid can be removed but the child can still be encouraged to make informal jottings if they require.
- Initial calculations will be one more than/one less than, this will progress to two more than/two less than, ten more than/ten less than etc.

## Mental addition

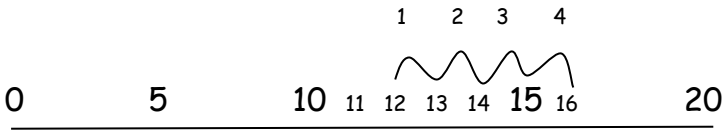
From the start the commutative law of addition should be enforced, so the children are happy to start with the largest number when working with initial number sentences.

- **Numbers under 10**
  Children will initially find it easier to work out answers on their fingers or use physical resources such as ten frames or numicon.

e.g. 5 + 2 = 7

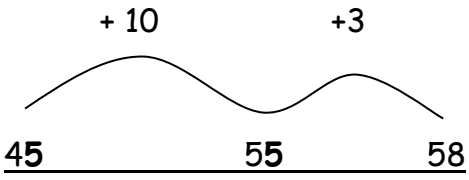
- **Adding single digit numbers**

e.g. 12 + 4 = 16 and 4 + 12=16

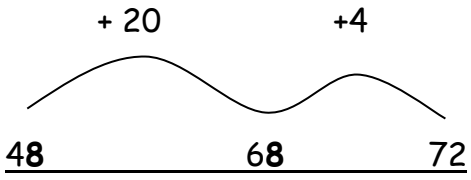


- **<u>Adding Tens and Ones</u>** (this method should only be introduced when the children have a secure knowledge of the place value of adding tens
  e.g. 4<u>5</u> + 30 = 7<u>5</u> – the ones stay the same, so you're left with 4 +3 = 7 in the tens.

e.g's 45 + 13 = 58

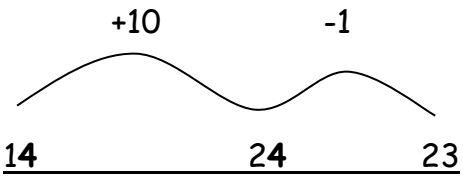



48 + 24 = 72

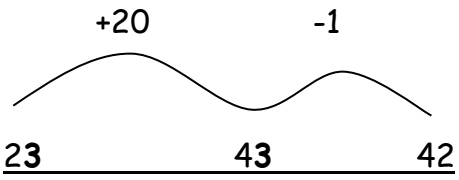



- **<u>Adding near multiples of 10 (9, 19 etc)</u>**
  -> you've added on one to many so you have to take it back off.

e.g's. 14 + 9 = 23

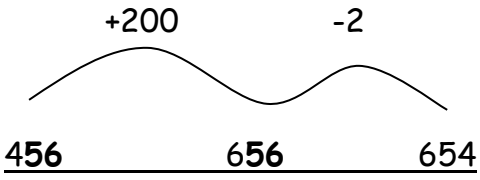



23 + 19 = 42

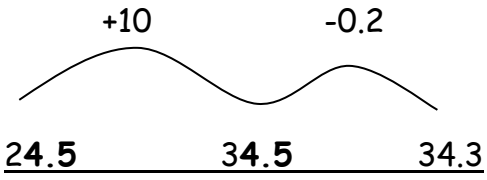



- The same techniques can be used when working with large and decimal numbers as long as a secure knowledge of place value has been developed first.

e.g's 456 + 198 = 654




24.5 + 9.8 = 34.3



## Mental Subtraction

From the start children should be made aware that subtraction is not commutative, but is the difference between the smallest and biggest number.

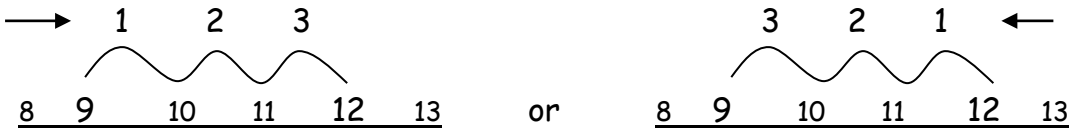
- **Numbers under 10**

Initially when working with numbers under 10 children will find it easier to use their fingers or physical resources.

7 - 2 = 5

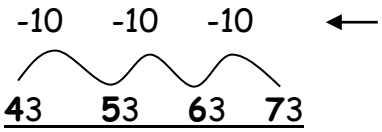
- **Subtracting single digit numbers**
  - Counting on from the smallest to the biggest (this method can still be used when working with large numbers that have similar numerical values, e.g. 465 – 457 = 8)
  - Counting back from the biggest to the smallest

e.g. 12 – 9 = 3



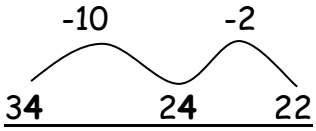

- **Subtracting tens**

  This method should be linked to subtracting ones and place value sessions.
  73 - 30 = 73 - 10 - 10 - 10 = 43 (enforce the ones digit stays the same)

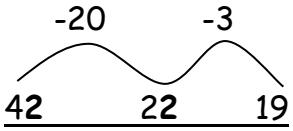


- **Subtracting tens then ones** (this method should only be introduced when the children have a secure knowledge of the place value of subtracting tens)
  E.g. 17<u>4</u> - 20 = 15<u>4</u> – the ones stay the same, so you're left with:
  17 tens – 2 tens = 15 tens (150)

e.g's 34 - 12 = 22

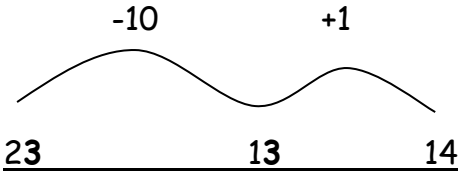



42 – 23 = 19

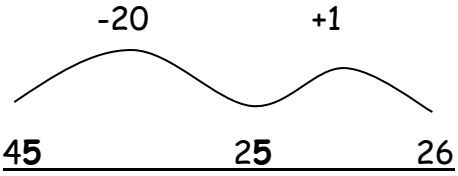



- **Subtracting near multiples of 10 (9, 19 etc)**
  **->** you've subtracted one to many so you have to add it back on.

e.g's. 23 - 9 = 14

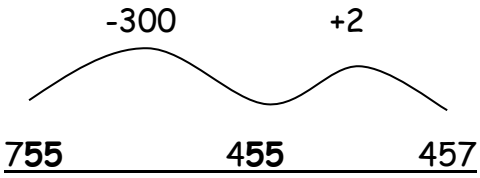



45 - 19 = 26




- The same techniques can be used when working with large and decimal numbers as long as a secure knowledge of place value has been developed first.

e.g's 755 - 298 = 457




£32.75 - £9.99 =£22.76

**Mental Multiplication**

Initial multiplication skills begin with practising counting on in different steps – 2's, 5's and 10's in year 1, it can be linked to number rhymes and songs, in order to hold the attention of the children.

These skills are developed further over the following years - the children are expected to be able to count on in 2's, 3's, 4's, 5's 6's, 7's, 8's, 9's, 10's, 25's, 50's, 100's and 1000's by the end of year 4.

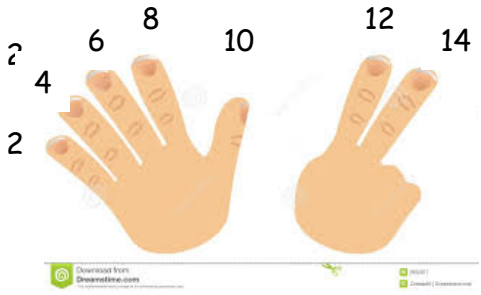
As well as learning to count on in steps, the children are expected to have regular opportunities to rote learn times table facts – the curriculum states these should be introduced in year 2 and by the end of year 4 the children are expected to know times table facts up to 12 x 12. However, as a school we believe that times table facts can be introduced from year 1 for those children who are capable and any of the times tables can be introduced to children in different year groups if their ability allows.

From an early stage the commutative law of multiplication should be enforced, so that children can use knowledge they already possess to help learn new facts or solve problems, i.e. use knowledge of 5 times table to calculate 5 x 7.

- **Using objects to count sets**

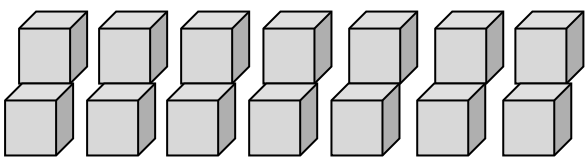
Initially children will require physical objects to help them visualise and understand multiplication.

e.g's



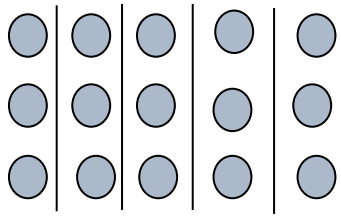

7 x 2 = 14

Ask the child to put up seven fingers and count across the fingers in two's (repeated addition)



Put out 7 pairs of multilink and ask the child to count across in two's. Initially the child may have to count the blocks individually.

Link this into making arrays for other multiplication facts
e.g. 3 x 5 = 15



When children know times table facts, they can apply this knowledge with their knowledge of place value to quickly answer mental calculations.

- **Multiplying by 10/100 etc**

- You **DON'T** just add a zero(es) on the end.
- Your answer has to be bigger.
- The number of zeroes indicates how many places the digits have to move along the place value chart.
  e.g's 24 x 10 = 240 (one zero so move one place and the zero goes in the empty space)
  35 x 100 = 3500 (2 zeroes so move 2 places and the zeroes go in the empty spaces)
  7.3 x 10 = 73.0 (1 zero so move 1 place, .0 doesn't have a value so you don't need it)
  24.5 x 100 = 2450.0 (2 zeroes so move 2 places, don't need the .0)

- **Multiples of 10**

- If you know the times tables fact, use your knowledge of place value.
- forget about the zeroes (the place holders) and add them on at the end.

e.g's 2 x 4 = 8 can be used to calculate 20 x 4 = 2 x 4 x 10 = 8**0**
15 x 4 = 60 can be used to calculate 15**0** x 4**0** = 15 x 4 x 1**00** = 6000

- **Decimal numbers**

- If you know the times table fact, forget about the decimal point and compensate at the end.

e.g.'s 7 x 3 = 21 so 0.**7** x 3 = 2.1 15 x 3 = 45 so 1.5 x 3 = 4.5

- **Tens and ones multiplied by ones (applying knowledge of PV)**

E.g's

| | |
|---|---|
| 24 x 4 = 96 | 73 x 6 = 438 |
| 24 = **20 + 4** | 73 = **70 + 3** |
| **20 x 4 = 80** | **70 x 6 = 420** |
| **4 x 4 = 16** | **3 x 6 = 18** |
| **80 + 16 = 96** | **420 + 18 = 438** |

- **Quick facts**

  ➔ Multiplying by 2 = double.
  ➔ Multiplying by 4 = double and double again.
  ➔ Multiplying by 5 = times by 10 then half (e.g. 48 x 5 = 240,
  48 x 10 =480, half of 480 =24)
  ➔ Multiplying by 8 = double, double and double again.
  ➔ Multiplying by 9 = x by 10 then take 1 lot off (e.g. 46 x 9 = 416
  46 x 10 = 460, 460 -46 =416)
  ➔ Multiplying by 20 = double then times by 10 (e.g 6.5 x 20 = 130,
  6.5 x 2 = 13, 13 X 10 = 130)

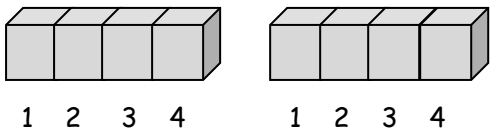
## Mental Division

From the outset division should be related to multiplication. Children should be made aware it is not commutative and it means how many times one number goes into the other.

- **Using objects to split into sets**

Initially children will require physical objects to help them visualise and understand division.

e.g. 8 ÷ 2 = 4




Ask the child to split the blocks into two equal groups. Place a block in one group and then the other until all the blocks are gone.

- **Dividing by 10/100 etc**

- You **DON'T** just take off a zero(es) from the end.
- Your answer has to be smaller.
- The number of zeroes indicates how many places the digits have to move along the place value chart.

  e.g's 120 ÷ 10 = 12.0 (one zero so move one place but you don't need the .0)
  2300 ÷ 100 = 23.00 (2 zeroes so move 2 places but you don't need the .00)
  64 ÷ 10 = 6.4 (1 zero so move 1 place)
  43.5 ÷ 100 = 0.435 (2 zeroes so move 2 places, put the zero in the empty space)

- **Dividing by multiples of 10**

- If you know the times tables fact, forget about the zeroes (the place holders) and then re-compensate at the end.

e.g's 12 ÷ 4 = 3 can be used to calculate 12**0** ÷ 4 = 12 ÷ 4 x 10 = 30
42 ÷ 7 = 6 can be used to calculate 42**00** ÷ 7**0** = 42 ÷ 7 x (100 ÷ 10) = 60

- Compensation of numbers can be used with division of multiples of 10

e.g's 3200 ÷ 40 = 320 ÷ 4 = 32 ÷ 4 x 10 = 80

- **Decimal numbers**

- If you know the times table and associated division fact, forget about the decimal point and compensate at the end.

e.g.'s 18 ÷ 3 = 6 so 1.8 ÷ 3 = 0.6 45 ÷ 3 = 15 so 4.5 ÷ 3 = 1.5

- **Quick facts**

  - ➔ Dividing by 2 = Half.
  - ➔ Dividing by 4 = Half and Half again.
  - ➔ Dividing by 5 = share by 10 then double (e.g. 120 ÷ 5 = 24,
    120 ÷ 10 =12, double 12 =24)
  - ➔ Dividing by 8 = Half, half and half again.
  - ➔ Dividing by 20 = share by 10 and then half (e.g 720 ÷ 20 = 36,
    720 ÷ 10 = 72, 72 ÷ 2 = 36)

**Monitoring of Mental Calculations**

Mental calculations will be monitored by the numeracy co-ordinator and SMT in a variety of ways at different points in the year, including: monitoring of plans; pupil interviews; lesson observations and where appropriate question level analysis of formal assessments.