Alexandra Primary School

Mathematics Policy

Calculation Policy and Key Aspects of Learning

‘Everyone can do Maths.’

J. Usher

Mathematics at Alexandra Primary School

Introduction

This policy outlines the purpose, nature and management of Mathematics within Alexandra Primary School.

This policy reflects the consensus of opinion of the whole teaching staff and has the support and agreement of the governing body.

The implementation of this policy is the responsibility of all members of staff.

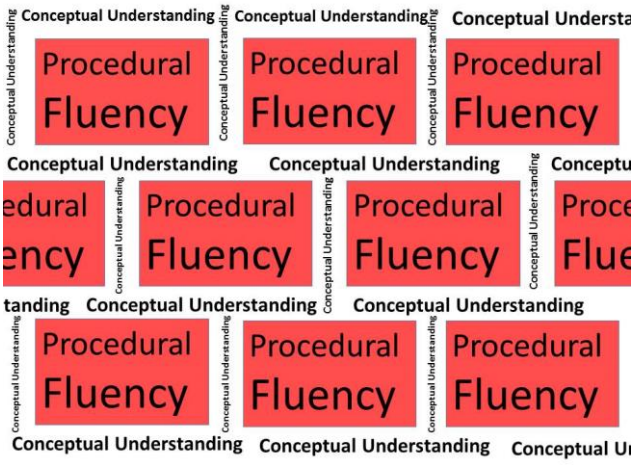
Curriculum Coverage - **Scheme of work - continuity and resources**

At APS we use the ***Abacus scheme of work across the school as the backbone of teaching and learning in mathematics.*** This ensures continuity across keys stages and ensures the appropriate mastery while avoiding unnecessary repetition. The use of Abacus as a framework for mathematics teaching across the school also makes sure that there is full curriculum coverage in line with the National Curriculum.

Given that across the school we use C-P-A as part of our daily lessons from reception up to Year 6 resourcing of manipulatives is particularly important as is the use of appropriate pictorial representations. Each class has a selection of physical resources to support this method of teaching as well as access to the additional resources provided by the Abacus scheme. Teachers are able and encouraged to use additional resources (e.g. text books etc.) to support differentiation within their own teaching.

Philosophy

We believe that it is important that our children develop a positive attitude towards mathematics and for them to see themselves as competent mathematicians. This is why when a pupil states that they don't understand or 'get' an aspect of mathematics we respond with 'yet'. We aim to develop *Arithmetic Proficiency* in every pupil. This is achieved through a balance of **procedural fluency** and **conceptual understanding**.



'Without the mortar of *conceptual understanding* the bricks of *procedural fluency* are easy to knock down'

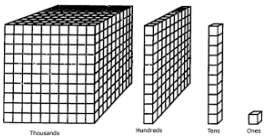
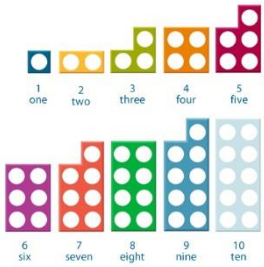
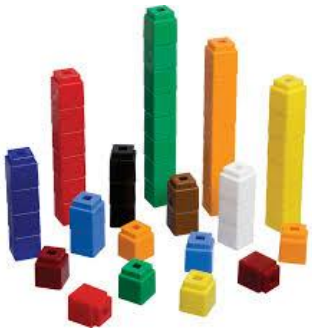
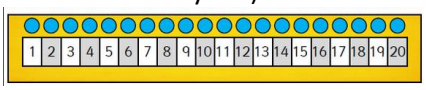
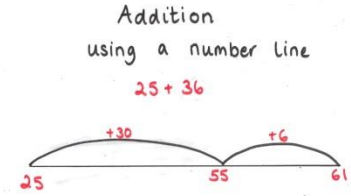
We therefore aim to develop their mathematical skills and knowledge so that they are able to apply them to a variety of curricular contexts and in the world around them.

This policy reflects the values and philosophy of Alexandra Primary School in relation to the teaching and learning of Mathematics. It sets out a framework within which all staff (both teaching and non-teaching) work.

Teaching Mathematics at Alexandra Primary School

In order that pupils have a deep and thorough understanding of the mathematical concepts that we teach, across the school we use C-P-A as part of our daily lessons from reception up to Year 6. The aim is not to move onto the abstract as quickly as possible but instead to instill and develop a deeper understanding of the mathematical concepts. In this way we may consolidate and practice skills by *continually referring back to both concrete manipulatives as well as pictorial representations*. Thus there should not be a rush onto the abstract and compact methods. Both concrete and pictorial should continue to be used throughout both KS1 and KS2.

Detail of which calculation methods (algorithms) should be focused on in each year group is specified in the calculation part of this policy. However it is important that conceptual understanding of the processes supports and underpins the procedural fluency of practiced algorithms.

Concrete →	**P**ictorial →	**A**bstract
Deines Cubes  Numicion  Cuisenaire Block  Unifix  *Any Manipulative For example Lego, pencils, crayons, buttons, counters, bead strings etc.	Arrays  3 x 4 4 x 3 Representations  100 40 3  5 or 5 x 2  6 x 4  12 ÷ 4	Number Tracks (This is number line with the numbers already on.)  Number Lines (A blank line usually drawn by the pupil.)  Algorithms Expanded x 30 2 20 600 40 4 120 8 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768 Compact 33 X 4 132 1

		At APS when carrying we write the carried digit below the line. This ensures consistency across the school and avoids confusion.

Language and Vocabulary

At Alexandra Primary both staff and pupils are expected to use the correct mathematical terminology from reception and right the way through the school to Y6. This means we abandon terms such as 'number sentence' and use the correct mathematical term 'equation'.

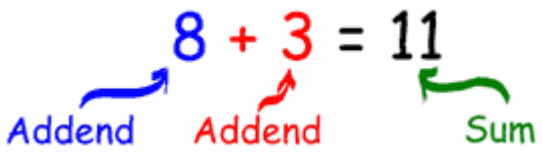
This will mean that as the vocabulary embeds across the school staff will have to research and model the correct terminology as well as expect and pupils to use the same.

When giving oral answers pupils will be expected to give full mathematical responses:

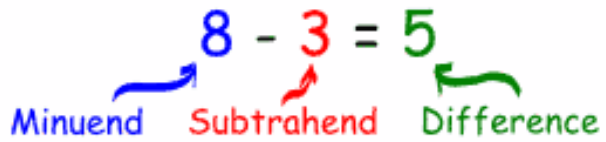
For example when answer the question 'What is 20 x 5?' The correct response would not simply be 100 but 'Twenty multiplied by five is one hundred.'

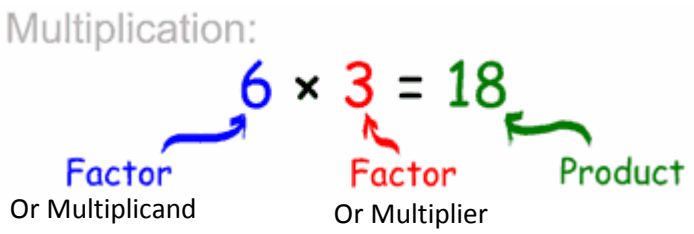
This supports conceptual understanding as well as procedural fluency (as well as language development for all pupils and understanding of English Mathematical vocabulary for EAL pupils.)

Addition

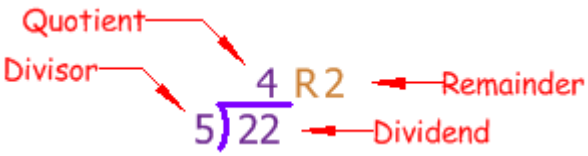


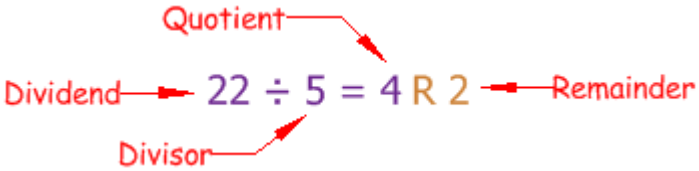
Subtraction





Division





<u>The National Curriculum</u>

<u>Purpose of study</u>

Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.

Aims

The national curriculum for mathematics aims to ensure that all pupils:

- become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils have conceptual understanding and are able to recall and apply their knowledge rapidly and accurately to problems
- **reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language
- can **solve problems** by applying their mathematics to a variety of routine and non- routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programmes of study are, by necessity, organised into apparently distinct domains, but pupils should make rich connections across mathematical ideas to develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge to science and other subjects.

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress to the next stage. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

<u>Information and communication technology (ICT)</u>

Calculators should not be used as a substitute for good written and mental arithmetic. ***They should therefore only be introduced near the <u>end of key stage 2</u> to support pupils' conceptual understanding and exploration of more complex number problems***, if written and mental arithmetic are secure. In both primary and secondary schools, teachers should use their judgement about when ICT tools should be used.

<u>Spoken language</u>

The national curriculum for mathematics reflects the importance of spoken language in pupils' development across the whole curriculum – cognitively, socially and linguistically. The quality and variety of language that pupils hear and speak are key factors in developing their mathematical vocabulary and presenting a mathematical justification, argument or proof. They must be assisted in making their thinking clear to themselves as well as others and teachers should ensure that pupils build secure foundations by using discussion to probe and remedy their misconceptions.

School curriculum

The programmes of study for mathematics are set out year-by-year for key stages 1 and 2. Schools are, however, only required to teach the relevant programme of study by the end of the key stage. Within each key stage, schools therefore have the flexibility to introduce content earlier or later than set out in the programme of study. In addition, schools can introduce key stage content during an earlier key stage, if appropriate. All schools are also required to set out their school curriculum for mathematics on a year-by- year basis and make this information available online.

Key stage 1

The principal focus of mathematics teaching in key stage 1 is to ensure that pupils develop confidence and mental fluency with whole numbers, counting and place value. This should involve working with numerals, words and the four operations, including with practical resources (e.g. concrete objects and measuring tools).

At this stage, pupils should develop their ability to recognise, describe, draw, compare and sort different shapes and use the related vocabulary. Teaching should also involve using a range of measures to describe and compare different quantities such as length, mass, capacity/volume, time and money.

By the end of year 2, pupils should know the number bonds to 20 and be precise in using and understanding place value. An emphasis on practice at this early stage will aid fluency.

Pupils should read and spell mathematical vocabulary, at a level consistent with their increasing word reading and spelling knowledge at key stage 1.

Lower key stage 2

The principal focus of mathematics teaching in lower key stage 2 is to ensure that pupils become increasingly fluent with whole numbers and the four operations, including number facts and the concept of place value. This should ensure that pupils develop efficient written and mental methods and perform calculations accurately with increasingly large whole numbers.

At this stage, pupils should develop their ability to solve a range of problems, including with simple fractions and decimal place value. Teaching should also ensure that pupils draw with increasing accuracy and develop mathematical reasoning so they can analyse shapes and their properties, and confidently describe the relationships between them. It should ensure that they can use measuring instruments with accuracy and make connections between measure and number.

By the end of year 4, pupils should have memorised their multiplication tables up to and including the 12 multiplication table and show precision and fluency in their work.

Pupils should read and spell mathematical vocabulary correctly and confidently, using their growing word reading knowledge and their knowledge of spelling.

Upper key stage 2

The principal focus of mathematics teaching in upper key stage 2 is to ensure that pupils extend their understanding of the number system and place value to include larger integers. This should develop the connections that pupils make between multiplication and division with fractions, decimals, percentages and ratio.

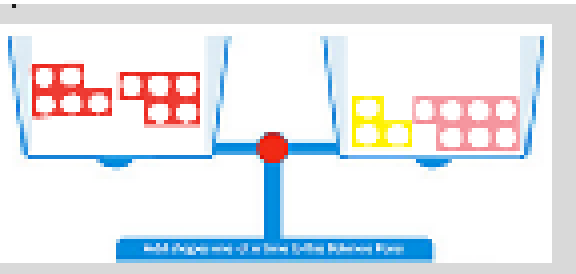
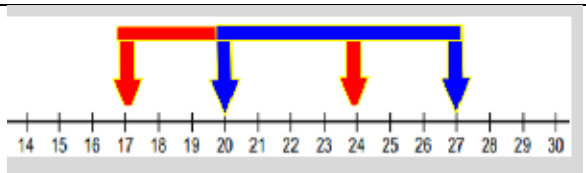
At this stage, pupils should develop their ability to solve a wider range of problems, including increasingly complex properties of numbers and arithmetic, and problems demanding efficient written and mental methods of calculation. With this foundation in arithmetic, pupils are introduced to the language of algebra as a means for solving a variety of problems. Teaching in geometry and measures should consolidate and extend knowledge developed in number. Teaching should also ensure that pupils classify shapes with increasingly complex geometric properties and that they learn the vocabulary they need to describe them.

By the end of year 6, pupils should be fluent in written methods for all four operations, including long multiplication and division, and in working with fractions, decimals and percentages.

Pupils should read, spell and pronounce mathematical vocabulary correctly.

Mental Calculation Strategies

Year Group	Mental Addition Strategies (+)	Mental Subtraction Strategies (-)
1	Children know by heart and reason with number bonds to 10 and 20 in several forms. **Partition small numbers (to make 10)** 8 + 3 = 8 +2 +1=11 **Partition, double and adjust** 5 + 6 = 5 + 5+ 1 = 11 **Partition smaller number only** 14 + 12 = 14 + 10 + 2 = 24 + 2 = 26	Children know by heart and reason with number bonds to 10 and 20 in several forms. **Partition smaller number and subtract.** 15-8=15-5-3=7
2	Children should understand why it is more efficient to reorder numbers when adding. They should then use knowledge of number bonds with bridging. 14 + 27 becomes 27 + 14 = 27 + 3 + 11 or 3 + 8 + 7 becomes to 3 + 7 + 8 (using knowledge of number bonds to 10) **Partition both numbers then add and recombine.** 42 + 36 = 40 + 30 2 + 6 = 70 + 8 = 78 **Sequencing - partitioning just one number.** 55 + 42 = 55 + 40 = 95 + 2 **Doubles and near doubles** 15 + 16 becomes double 15 + 1 **Compensating - adding a close multiple of 10 (e.g. 18, 19, 21, 22)** 23 + 19 becomes 23 + 20 – 1 = 42	**Bridging** through ten and multiples of ten should also be use when subtracting. 73 – 16 becomes 73 – 3 – 13 = 70 – 13 = 70 – 10 – 3 **Counting on or back** in tens and ones to find the difference. Count on because the numbers are close together 23 – 17 = 17 + 3 = 20 + 3 = 23 Count back if numbers are further apart 45 – 22 = 45 – 20 = 25 – 2 = 23 **Same difference** - changing the numbers by the same amount to make them more manageable - 24 - 17 becomes 27 – 20 (by adding 3 to each number)

	Balancing - changing the numbers to make them more manageable. Whatever you do to one number, you do the opposite to the other.  5 + 5 is equal to 6 add 4 is equal 7 add 3 14 + 9 becomes 13 +10 26 + 8 becomes 30 + 4 **Deriving new facts** 3 + 7 = 10 therefore 30 + 70 = 100 100—30 = 70 30 = 100—70 70 = 100 –	 **Compensating** - subtracting a close multiple of 10 (e.g. 18, 19, 21, 22) 65 – 18 becomes 65 – 20 + 2 = 47
3	Children should understand why it is more efficient to reorder numbers when adding. They should then use knowledge of number bonds with bridging. 14 + 27 becomes 27 + 14 = 27 + 3 + 11 or 3 + 8 + 7 becomes to 3 + 7 + 8 (using knowledge of number bonds to 10) **Partition both numbers then add and recombine.** 42 + 36 = 40 + 30 2 + 6 = 70 + 8 = 78 **Sequencing - partitioning just one number.** 55 + 42 = 55 + 40 = 95 + 2 **Doubles and near doubles** 15 + 16 becomes double 15 + 1 **Compensating - adding a close multiple of 10 (e.g. 18, 19, 21, 22)** 23 + 19 becomes 23 + 20 – 1 = 42 **Balancing** - changing the numbers to make them more manageable. Whatever you do to one number, you do the opposite to the other. 5 + 5 is equal to 6 add 4 is equal 7 add 3 14 + 9 becomes 13 +10 26 + 8 becomes 30 + 4 **Deriving new facts** 3 + 7 = 10 therefore	**Bridging** through ten and multiples of ten should also be use when subtracting. 73 – 16 becomes 73 – 3 – 13 = 70 – 13 = 70 – 10 – 3 **Counting on or back** in tens and ones to find the difference. Count on because the numbers are close together 23 – 17 = 17 + 3 = 20 + 3 = 23 Count back if numbers are further apart 45 – 22 = 45 – 20 = 25 – 2 = 23 **Same difference** - changing the numbers by the same amount to make them more manageable - 24 - 17 becomes 27 – 20 (by adding 3 to each number) **Compensating** - subtracting a close multiple of 10 (e.g. 18, 19, 21, 22) 65 – 18 becomes 65 – 20 + 2 = 47

	30 + 70 = 100 100—30 = 70 30 = 100—70 70 = 100 –	
4	**Need to know** Quick recall of number bonds to 100 and be able to apply to other calculations including decimals, e.g. 4.3 + ? = . 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** 48 + 7 = 48 + 2 + 5 = 50 + 5 = 55 58 + 47 becomes 58 +2 + 45 = 105 2.8 + 1.7 becomes 2.8 + 1.7 = 4.5 **Partition both numbers then add and recombine.** 145 + 123 = 100 + 100 40 + 20 5 + 3 = 200 + 60 + 8 = 268 **Sequencing - partitioning just the smaller addend.** 234 + 122 = 234 + 100 + 20 = 2 = 334 + 20 + 2 = 354 + 2 = 356 **Doubles and near doubles** 143 + 145 = double 140 + 8 = 288 6.2 + 6.3 = **Compensating - adding a close multiple of 10 (e.g. 18, 19, 21, 22)** 156 + 18 becomes 156 + 20 – 2 = 154 2 ½ + 1 ¾ becomes 2 ½ + 2 – ¼ **Balancing** - changing the numbers to make them more manageable. Whatever you do to one addend, you do the opposite to the other. 133 + 58 becomes 130 + 61 = 191 (subtracted 3 from 133 so added 3 to 58) 217 + 224 becomes 220 + 221 = 441 **Deriving new facts from known** Decimal add based on 3 + 7 = 10	**Bridging** through ten and multiples of ten should also be used when subtracting. 43 – 17 becomes 43 – 13 – 4 = **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 **Same difference -** changing the minuend and subtrahend by the same amount to make them more manageable by adding or subtracting. 421 – 189 becomes 420 – 188 = 232 321 – 189 becomes 332 – 200 = 132 (by adding 11 to each in order to deal with Hundreds number) **Compensating** - subtracting a close multiple of 10 (e.g. 18, 19, 21, 22) 72 – 19 = 72 – 20 + 1 = 52 + 1 = 53 97 – 58 becomes 87 – 60 + 2 =
5 & 6	**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.	**Bridging** through ten and multiples of ten should also be used when subtracting. 43 – 17 becomes 43 – 13 – 4 = **Counting on to find the difference.** Count on because the minuend and subtrahend are close together 3641 – 2991 = 5001 – 1997 =

	Knowledge of number bonds and bridging 156 + 45 becomes 156 + 4 + 41 = 160 + 41 = 201 12.3 + 6.8 becomes 12.3 + 0.7 + 6.1 = 19.1 1½ + 3/4 bridge to 2 and add remaining ¼ **Partition both numbers then add and recombine.** 145 + 123 = 100 + 100 40 + 20 5 + 3 = 200 + 60 +8 = 268 **Sequencing- partitioning just the smaller addend.** 234 + 122 becomes 234 + 100 + 20 = 2 = 334 + 20 + 2 = 354 + 2 = 356 **Doubles and near doubles** 143 + 145 = double 140 + 8 = 288 6.2 + 6.3 = double 6 + 0.5 = 6.5 **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 **Balancing** - changing the numbers to make them more manageable. Whatever you do to one addend, you do the opposite to the other. 2.7 + 1.5 becomes 3.0 + 1.2 = 4.2 (added 0.3 to 2.7 therefore subtracted from 1.5) **Deriving new facts from known** 4 + 8 = 12 therefore 0.4 + 0.8 = 1.2	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 **Same difference -** changing the minuend and subtrahend by the same amount to make them more manageable by adding or subtracting. 421 – 189 becomes 420 – 188 = 232 321 – 189 becomes 332 – 200 = 132 (by adding 11 to each in order to deal with Hundreds number) **Compensating** - subtracting a close multiple of 10 (e.g. 18, 19, 21, 22) 72 – 19 = 72 – 20 + 1 = 52 + 1 = 53 97 – 58 becomes 87 – 60 + 2 =

Mental Calculation strategies may need to be explicitly taught and revisited on a regular basis to ensure mathematical fluency. The above is an outline of the strategies that pupils should employ for mental addition and subtraction and in which year they should be introduced.

Alexandra - Year 1 Calculation Policy

Addition

AS1.1 & AS1.2 The + and = signs and missing numbers

Children need to understand the concept of equality before using the '=' sign. Calculations should be written either side of the equality sign so that the sign is not just interpreted as 'the answer'.

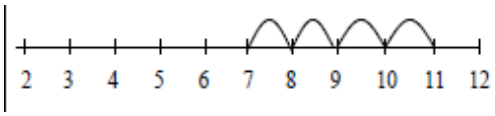
Example

2 = 1+ 1
2 + 3 = 4 + 1
3 = 3
2 + 2 + 2 = 4 + 2

Missing numbers need to be placed in all possible places.

3 + 4 = □ □ = 3 + 4
3 + □ = 7 7 = □+ 4
□ + 4 = 7 7 = 3 + □

NPV1.4, AS1.3 & AS1.4 Use of prepared number lines and concrete objects



Children are encouraged to record by drawing jumps on prepared lines.

Subtraction

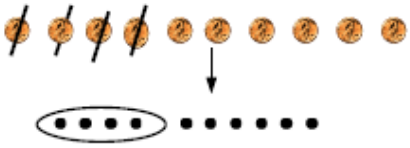
AS1.1 & AS1.2 The - and = signs and missing numbers

The notes opposite are relevant here.

7 - 3 = □ □ = 7 - 3
7 - □ = 4 4 = □ - 3

NPV1.4, AS1.3 & AS1.4 Use of pictures, marks and concrete objects

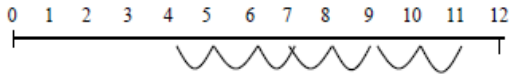
Sam spent 4p. What was his change from 10p?



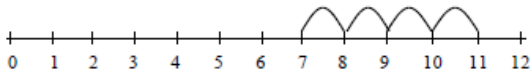
Number Lines

NPV1.4, AS1.3 & AS1.4 Example- Counting Back/Down

11 – 7



NPV1.4, AS1.3 & AS1.4 Example- Counting On/Up



The difference between 7 and 11

Children are encouraged to record by drawing jumps on prepared lines and constructing their own lines.

Multiplication

MD1.1, F1.1 & F1.2 Use of pictures and objects

There are 3 sweets in one bag.
How many sweets are there in 5 bags?

NPV1.2 Count in multiples of one, two, five and ten

Counting steps using bead string and on prepared number lines.

Counting in multiples using a range of objects, e.g. pairs of legs on animals; fingers in gloves etc.

NPV1.4 & MD1.1 Use of arrays

Counting in rows and columns

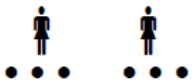
Division

MD1.1, F1.1 & F1.2 Use of pictures and objects or marks

12 children get into teams of 4 to play a game.
How many teams are there?

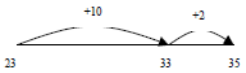
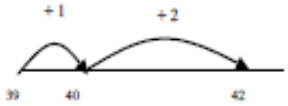
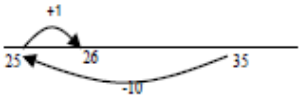
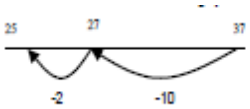
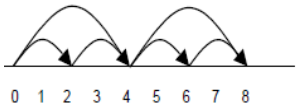
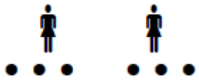
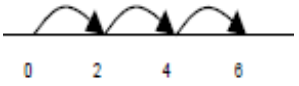
MD1.1 Sharing

6 sweets are shared between 2 people. How many do they have each?

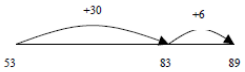
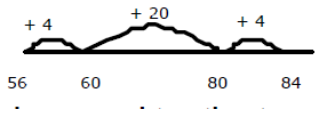


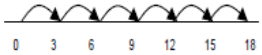
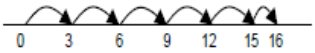
Make use of practical activities involving sharing, e.g. distributing cards when playing a game, putting objects onto plates, into cups, hoops etc.

 Two groups of three is six Three groups of two is six So 6 = 2 + 2 +2 or 6 = 3 + 3	

Alexandra - Year 2 Calculation Policy	
Addition	Subtraction
AS2.3 & AS2.8 The + and = signs and missing numbers Continue using a range of equations (See Year 1) but with appropriate, larger numbers as specified in Year 2 grade level standards, i.e. extend to 14 + 5 = 10 + □ and 32 + □ + □ = 100 35 = 1 + □ + 5. **AS2.6 Partition into tens and ones and recombine** 12 + 23 = 10 + 2 + 20 + 3 = 30 + 5 = 35 **AS2.6 Partitioning the second number only** 23 + 12 = 23 + 10 + 2 = 33 + 2 = 35  **AS4.2, AS2.5 & AS2.6** Example: Add 9 or 11 by adding 10 and adjusting by 1 35 + 9 = 44	**AS2.3 & AS2.8 The – and = signs and missing numbers** Continue using a range of equations (See Year 1) but with appropriate numbers in relation to Year 2 grade-level standards, i.e. extend to 14 + 5 = 20 - □ **AS2.6 Find a small difference by counting up** 42 – 39 = 3  **AS2.4, AS2.5 & AS2.6** **Example: Subtract 9 or 11 & begin to add/subtract 19 or 21** 35 – 9 = 26  **AS2.6 Use known number facts and place value to subtract** (Partition second number only) 37 – 12 = 37 – 10 – 2 = 27 – 2 = 25 
Multiplication	Division
MD2.1, MD2.2 & MD2.4 The x and = signs and missing numbers 7 x 2 = □ □ = 2 x 7 7 x □ = 14 14 = □ x 7 □ x 2 = 14 14 = 2 x □ **MD2.5 Use materials, arrays, repeated addition** **(including solving problems in context)**  4 x 2 or 4 + 4 2 x 4 Or repeated addition  2 + 2 + 2 + 2 **NPV2.2 & NPV2.6 Partitioning** ***15 x 2 OR***	**MD2.1, MD2.2 & MD2.4 The ÷ and = signs and missing numbers** 6 ÷ 2 = □ □ = 6 ÷ 2 6 ÷ □ = 3 3 = 6 ÷ □ □ ÷ 2 = 3 3 = □ ÷ 2 **MD2.5 Use materials, arrays, repeated addition (including solving problems in context)** ***Use of sharing and grouping*** ***Sharing*** 6 sweets are shared between 2 people. How many do they have each?  ***Grouping*** There are 6 sweets. How many people can have 2 each? (How many 2's make 6?) 

15 x 2 20 + 10 = 30 OR x | 10 | 5 2 | 20 | 10	**F2.1 Find and name fractions of length, shape and sets of objects and quantities** Use of diagrams- count all equal parts to determine denominator. Link to division into equal groups/parts.

Alexandra - Year 3 Calculation Policy	
Addition	Subtraction
The + and = signs and missing numbers Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers specified in the grade level standards. **AS3.1, AS3.2 & AS3.3 Progression in mental calculations with larger numbers** Calculate HTU + U Calculate HTU + TU Calculate HTU + HTU *Progress from no crossing of boundaries to crossing of boundary.* **Partition into tens and ones and recombine** Develop from Year 2- partitioning both numbers and recombining. Refine to partitioning the second number only: 36 + 53 = 53 + 30 + 6 = 83 + 6 = 89  **Add a near multiple of 10 to a two-digit number** Continue work from Year 2 but with appropriate numbers: 35 + 19 is the same as 35 + 20 – 1. **AS3.4 Formal methods of columnar addition to add numbers with up to three digits** 285 +73 8 150 200 358 **AS3.4 & M3.3 Extend to decimals in the context of money** £ 2.50 + £ 1.75 £ 2.50 + £ 1.75 £ 4.25 1 The expanded method should be used if children experience persisting difficulties. ***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**	**The - and = signs and missing numbers** Continue using a range of equations as in Year 1 and Year 2 but with appropriate larger numbers specified in the grade level standards. **Find a small difference by counting up** Continue from Year 2 but with appropriate numbers, e.g. 102 – 97 = 5 **AS3.1, AS3.2 & AS3.3 Subtract mentally a 'near multiple of 10' to or from a two-digit number, extending to three digit numbers** Continue as in Year 2 but with appropriate numbers e.g. 78 – 49 is the same as 78 – 50 + 1 **AS3.1, AS3.2 & AS3.3 Progression in mental calculations with larger numbers** Calculate HTU - U Calculate HTU - T Calculate HTU - H *Progress from no crossing of boundaries to crossing of boundary.* **Complementary addition** 84 – 56 = 28  **AS3.4 Formal methods of columnar subtraction to subtract numbers with up to three digits** See Appendix 1 examples in Year 5 and Year 6 section of this document. ***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Multiplication	Division
MD3.1 & MD3.2 The x and = signs and missing numbers Continue using a range of equations as in Year 2 but with appropriate numbers in relation to grade-level standards. **MD3.2 TU x U** Use known facts x3, x4, x8 (Year 3 grade-level standards) and x2, x5 and x10 (Year 2 grade-level standards). x | 30 | 5 2 | 60 | 10 x | 30 | 2 3 | 90 | 6 At Year 3, children progress to using more formal written methods. In this case, the grid method drawing on knowledge of place value, multiplication facts and their ability to recombine partitioned numbers to derive an answer. ***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**	**MD3.2 The ÷ and = signs and missing numbers** Continue using a range of equations as in Year 2 but with appropriate numbers in relation to grade-level standards. **MD3.2 TU ÷ U** **Grouping** How many 3s make 18?  **MD3.2 & MD3.3 Remainders** 16 ÷ 3 = 5 r1 Sharing – There are 16 sweets shared between 3, how many left over? Grouping – How many 3s make 16, how many left over?  Children with secure knowledge of multiplication facts and subtraction may progress to 'chunking' where TU are divided by U. ***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Alexandra - Year 4 Calculation Policy

Addition

The + and = signs and missing numbers
Continue using a range of equations as in Key Stage 1 and Year 3 but with appropriate numbers.

Partition into hundreds, tens and ones and recombine
Either partition both numbers and recombine or partition the second number only e.g.
358 + 73 = 358 + 70 + 3
= 428 + 3
= 431

Add or subtract the nearest multiple of 10 or 100, then adjust
Continue as in Year 2, 3 and 4 but with appropriate numbers
e.g. 458 + 79 = is the same as 458 + 80 – 1

AS4.1 Addition of numbers with at least four digits using formal method of columnar addition

```
 358
+ 73
 431
 1 1

 3587
+ 675
 4262
 1 1 1
```

At APS when carrying we write the carried digit below the line. This ensures consistency across the school and avoids confusion.

The formal, efficient method of columnar addition will involve crossing of boundaries (at the tens, hundreds and/or thousands). Take a systematic approach to teaching this looking at crossing each boundary in turn before mixed practice.
Revert to expanded method if children experience difficulties.

DF4.6 Extend addition to decimals (same number of decimals places) and adding several numbers (with different numbers of digits).

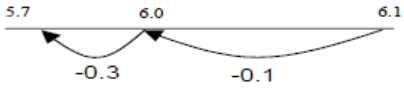
***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Subtraction

The – and = signs and missing numbers
Continue using a range of equations as in Key Stage 1 and Year 3 but with appropriate numbers.

Differences
Find a difference by counting up,
e.g. 8006 – 2993 = 5013.
This can be modelled on an empty number line.

DF4.6 Use known number facts and place value to subtract
6.1 – 0.4 = 5.7



AS4.1 Subtraction with at least four digits using formal method of columnar subtraction
For instance, 6467 – 2684 = 3783
Using expanded column subtraction where children experience difficulty with decomposition and need to 'see' this.

DF4.6 Extend subtraction to decimals (same number of
decimals places) and adding several numbers (with different numbers of digits)

***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Multiplication

The x and = signs and missing numbers
Continue using a range of equations but with appropriate numbers for Year 4.

MD4.5 TU x U (See Year 3) **and HTU x U** (Introduced in Year 4 grade-level standards).

Partition
23 x 4 = 92
23 x 4 = (20 x 4) + (3 x 4)
= (80) + (12)
= 92

Use the grid method of multiplication
23 x 7 is approximately 20 x 10 = 200

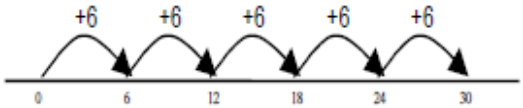
x	20	3
7	140	21

***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Division

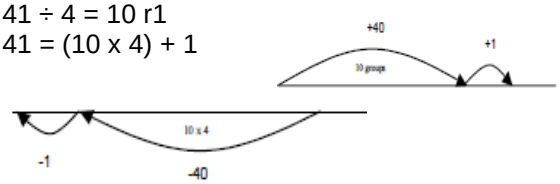
The ÷ and = signs and missing numbers
Continue using a range of equations but with appropriate numbers for Year 4.

MD4.3 Sharing and grouping
30 ÷ 6 can be modelled as:
Grouping – groups of 6 taken away and the number of groups counted e.g.



Sharing – sharing among 6, the number given to each person.

Remainders
Note three approaches below:
41 ÷ 4 = 10 r1
41 = (10 x 4) + 1



MD4.5 TU ÷ U
72 ÷ 5 lies between 50 ⎸5 = 10 and 100 ⎸5 = 20
72
- 50 (10 groups) or (10 x 5)
22
- 20 (4 groups) or (4 x 5)
2 Answer: 14 remainder 2

MD4.5 HTU ÷ U
Can progress from no remainder to remainders. Where remainders are involved, care needs to be taken to ensure they are interpreted correctly in context of problems.

256 ÷ 7 lies between 210 ⎸7 = 30 and 280 ⎸7 = 40
256
- 70 (10 groups) or (10 x 7)
186
- 140 (20 groups) or (20 x 7)
46
- 42 (6 groups) or (6 x 7)
4 (36 groups) or (36) Answer: 36 remainder 4

***From Year 3 onwards, teachers need to keep in mind the methods specified in grade-level standards for end of Key Stage 2 (See Year 5 and Year 6 Calculation Policy Document). Children should be developing their capacity to use formal written methods for all four number operations.**

Alexandra - Year 5 & 6 Calculation Policy

Addition & Subtraction

AS5.1 Columnar Addition & Subtraction

789 + 642 becomes

```
      7 8 9
    + 6 4 2
  -----------
    1 4 3 1
      1 1
```

Answer: 1431

874 – 523 becomes

```
      8 7 4
    – 5 2 3
  -----------
      3 5 1
```

Answer: 351

932 – 457 becomes

```
      8  12 1
      ~9 ~3  2
    – 4  5  7
  -----------
      4  7  5
```

932 – 457 becomes

```
        1  1
      9  3  2
    – ~4 ~5  7
      5  6
  -----------
      4  7  5
```

Answer: 475

Multiplication & Division

MD5.5 Short Multiplication (DfE, 2013, Appendix 1)

24 × 6 becomes

```
      2 4
    × 6
  -------
    1 4 4
      2
```

Answer: 144

342 × 7 becomes

```
      3 4 2
    × 7
  -------
    2 3 9 4
      2 1
```

Answer: 2394

2741 × 6 becomes

```
      2 7 4 1
    × 6
  -----------
    1 6 4 4 6
      4 2
```

Answer: 16 446

MD5.7 & ASMD6.2b Short Division (DfE, 2013, Appendix 1)

98 ÷ 7 becomes

```
      1 4
      2
  7 | 9 8
```

Answer: 14

432 ÷ 5 becomes

```
        8 6 r2
        3
  5 | 4 3 2
```

Answer: 86 remainder 2

496 ÷ 11 becomes

```
        4 5 r1
        5
1 1 | 4 9 6
```

Answer: $45\frac{1}{11}$

MD5.5 & ASMD6.1 Long Multiplication (DfE, 2013, Appendix 1)

24 × 16 becomes

```
      2
      2 4
```

124 × 26 becomes

```
    1 2
    1 2 4
```

124 × 26 becomes

```
    1 2
    1 2 4
```

ASMD6.2a Long Division (DfE, 2013, Appendix 1)

432 ÷ 15 becomes

```
        2 8 r 12
1 5 | 4 3 2
      3 0 0
      -----
      1 3 2
      1 2 0
      -----
        1 2
```

Answer: 28 remainder 12

432 ÷ 15 becomes

```
        2 8
1 5 | 4 3 2
      3 0 0   15×20
      -----
      1 3 2
      1 2 0   15×8
      -----
        1 2
```

$\frac{\cancel{12}}{\cancel{15}} = \frac{4}{5}$

Answer: $28\frac{4}{5}$

432 ÷ 15 becomes

```
        2 8 · 8
1 5 | 4 3 2 · 0
      3 0
      -----
      1 3 2
      1 2 0
      -----
        1 2 0
        1 2 0
        -----
            0
```

Answer: 28·8

Alexandra Non-negotiable and Key Learning for Mathematics

All pupils must completely achieve all aspects of the non-negotiables by the end of the academic year. These are Key Aspects of learning that if not achieved will cause further problems and disruptions to learning in subsequent years.

Nursery	
-	Match number objects to numerals up to 5
-	To recite numbers up to 10 in different contexts; eg, play, songs etc
Reception	
-	Children count reliably with numbers from one to 20.
-	Recognises numerals 1 to 10.
-	Count objects to 10 and begin to start counting beyond 10.

Year 1	
-	Count, read, write and order numbers to 100 in 10s
-	Count out objects, quantify and compare
-	Understand and carry out addition and subtraction with numbers to 10 and in 10s
-	Know addition facts and derive related subtraction facts to 10.
-	Describe and name common shapes and use the language of position and direction
-	Measure quantities and compare standard units

Year 2	
-	Count forwards and backwards in equal steps from any starting point and secure addition and subtraction number facts to 18, add and subtract 10 and 10s
-	Identify the value of the digit in two and three digit numbers and partition numbers into 1s, 10s and 100s
-	Carry out mental and written addition and subtraction calculations involving one and two-digit numbers; identify simple fractions as and part of set
-	Understand multiplication and division and carry out the operations in practical contexts
-	Recognise 2-D and 3-D shapes in different orientations and describe their properties
-	Use standard units to measure and relate units to intervals on a scale

Year 3	
-	Partition two and three digit whole numbers (integers) into units and powers of 10 and in other ways
-	Carry out calculations for addition and subtraction using mental (HTU + TU) and written methods (HTU + HTU) and known facts (number bonds)
-	Know multiplication facts (2, 3, 4, 5, 8, 10 times tables up to at least Silver) and be able to multiply one and two digit numbers by 10 and 100
-	Recognise unit fractions as part of a whole divided into equal parts and name and identify factions
-	Measure and record using metric units, identify and use right angles to compare angles
-	Draw and interpret bar charts and read partially numbered scales

Year 4	
-	Use decimal notation for tenths and hundredths and partition decimal numbers
-	Recall quickly addition, subtraction and multiplication facts (for all times tables up to silver level) and derive related division facts
-	Multiply and divide two-digit numbers by one-digit number using mental and written methods (short division) including division with remainders
-	Find fractions of quantities using division and multiplication; compare and order related fractions
-	Visualise shapes and interpret drawing of them; use decimal notation to record measures

-	Interpret scales, read and extract information in tables and charts ; read time to the nearest minute

Year 5	
-	Identify the value of each digit in numbers with two decimal places and use to multiply and divide by 10, 100 or 1000
-	Establish whether a number up to 100 is a prime recall prime numbers to 19
-	Carry out calculations for all four operations using mental and written methods (ThHTU x TU, ThHTU ÷ U, long X and short ÷)
-	Find fractions and percentages of numbers and quantities, scale numbers up or down
-	Measure and record using the full range of standard/metric units, draw shapes, use the coordinate system and measure angles
-	Interpret readings on partially numbered scales, read timetables and draw line graphs to show changes over time

Year 6	
-	Recall rapidly addition and multiplication facts and apply to calculations involving all four operations including: decimals, fractions and percentages
-	Calculate mentally with whole numbers and numbers with one decimal place; calculate simple percentages of whole numbers
-	Use the column method for all written calculations (+, -, x, ÷)
-	Express relationship between numbers and quantities as a fraction, percentage or ratio; add and subtract fractions with like denominators
-	Measure using standard metric units, compare readings on different scales, convert between units, identify conserved properties or transferred shapes
-	Organise and analyse data in tables, graphs and charts and describe trends and relationships; understand language or probability

Repetition & Consolidation KS1:

Over the course of a week's Mathematics learning the following areas must be covered either through starters or plenaries:

Place Value; Number bonds; Subtraction & Addition.

The reason for this is that if these areas are not fully understood pupils will not be able to make expected progress. The activities should be snappy and will revisit earlier concepts. Mastery of these key concepts is key if pupils are to access the curriculum fully.

Repetition & Consolidation KS2:

Over the course of a week's Mathematics learning the following five areas must be covered either through starters or plenaries:

Place Value; Number bonds & Times tables; Subtraction & Division; Fractions; Reading Scales.

The reason for this is that if these areas are not fully understood pupils will not be able to make expected progress. The activities should be snappy and will revisit earlier concepts. Mastery of these key concepts is essential if pupils are to access the curriculum fully.

Language and fluency:

Pupils must be expected to (and may have to be taught to) give verbal responses using mathematical sentences. For example: What is half of twenty? The correct response is: Half of twenty is ten. If the pupil simply responds with 10 then the correct response should be modelled and then repeated by the pupil. This will support pupils' speaking and listening skills as well as aiding development of fluency in Mathematics.

What is fluency in Mathematics? An example of mathematical fluency is how the pupils apply their knowledge and understanding of number. For example if the pupil can use the knowledge that 2 x 2 = 4 to answer the question 20 x 20 then they are becoming more fluent in Mathematics.

Expectations for presentation in Mathematics in Key Stage 2

Short form of Date – underlined using a ruler written in the top left hand corner

LI - written and underlined using a ruler

All lines drawn using a ruler

Squares will be used for a single digit (where appropriate)

Only pencil should be used in maths books

Expectations for presentation in Mathematics in Key Stage 1/Early Years

LI and SC stuck into books

From Y1 upwards – one digit per box

Only pencil used in maths books

Marking & Feedback

Staff and pupils will use the marking code indicated below (see Marking and Feedback Policy for further guidance).

Alexandra Primary School Marking Code

©	Capital letter Call Adam to take the register.
	Finger spaces
	Conjunctions or, and, but
	Adjectives beautiful, dangerous
	Full stop Yesterday I went to the shop.
	Look over your work to improve it.

?	What is missing? The boys really high. The boy jumped really high.
	Form your letters properly
50... → 100	Write more please.
R	Use a resource to help you. • Dictionary • Sounds and Phonic Mat • Word Mat • 100 Square • Multilink cubes
•	Check your answer.
✓	Well done you've got it.

Alexandra Primary School

Marking Code

P	You have worked in a pair/group	✓	I've done well
A	You have worked with an adult	•	I need to check my answer here
R	I have used resources to help me with my work	—	I need to check this part of my work carefully and edit
VF	An adult has spoken to me about my work	→	This is what I need to do next before starting my next piece of work
Pr	I need to improve my handwriting or presentation		

Sp I need to write out my spelling 3 times
Sp - with
1. with
2. with
3. with

Marked against your LI

I'm getting there! ✓
I've got it! ✓ ✓
I've excelled! ✓ ✓ ✓

Marking Guidelines

- All staff should use a green pen and model clean and legible writing when marking work.
- Children should be given time to respond to feedback using a purple pen or pencil.
- Staff may choose to use stamps and/or stickers to comment on effort of children e.g. well done, good effort etc.

JU & KB – updated July 2016