



St Monica's Catholic Primary School
...a small school where big things happen...



Maths and Calculation Policy

Reviewed: October 2018

Introduction

This policy is a statement of the aims, principles and strategies for the teaching and learning of Mathematics. It will be reviewed every two years.

Rationale: WHY TEACH MATHEMATICS?

Mathematics equips pupils with a uniquely powerful set of tools to understand and adapt to change the world. These tools include logical reasoning, problem-solving skills and the ability to think in abstract ways.

Mathematics is important in everyday life, many forms of employment, science and technology, medicine, the economy, the environment and development and in public decision-making. Different cultures have contributed to the development and application of mathematics. Today, the subject transcends cultural boundaries and its importance is universally recognised. Mathematics is a creative discipline. It can stimulate moments of pleasure and wonder when a pupil solves a problem for the first time, discovers a more elegant solution to that problem, or suddenly sees hidden connections.

Aims for Mathematics

In St. Monica's we value every pupil and the contribution they can make to learning. As a result we aim to ensure that every child achieves success and that all are enabled to develop their skills in accordance with their level of ability. As mathematics is essential for daily living, we aim, in our teaching of mathematics, to develop children's understanding of Number, Geometry, Measurement, Statistics, Ratio & Proportion, Algebra and Problem-solving techniques and to make mathematics an enjoyable, worthwhile and relevant experience for all our pupils.

For Mathematics and Numeracy our aims are:

- to encourage the effective use of mathematics;
- to develop the ability to think clearly, confidently and logically;
- to develop in pupils personal qualities of perseverance, confidence, independence and co-operation with others;
- to enable all pupils to experience success and pleasure through practical activities;
- to raise standards within the school;
- to enable pupils to communicate effectively through the medium of mathematics;
- to foster an understanding of mathematics through a process of enquiry and experiment;
- to encourage mastery of basic mathematical skills and knowledge;
- to encourage the use of ICT to support the teaching and learning about mathematics;
- to encourage parents to become involved in their children's learning;
- to promote the ability and inclination to solve problems; and to develop financial capability;
- to extend each child to his/her fullest potential, building on previous experiences and recognizing individual capabilities;
- to give opportunities for the children to use a wide range of mathematical tools, equipment and aids;
- to use and effect the current thinking of the National Curriculum to helping producing a balanced scheme of work which provides for all children at their own level;
- to ensure our children will come to regard mathematics not as just another subject that ought to be learnt but as an enjoyable activity for all regardless of sex, culture or ability (SMSC).

Procedure

1. Our mathematical teaching will involve investigative activities, mostly child centred, using the knowledge, skills, interests and questions which children bring into the classroom as starting points. These starting points will be extended as further lines of development.
2. Where appropriate, activities should be real and open-ended involving the children in direct experience to investigate, discover and solve problems.
3. The daily Maths lesson will include:

A Mental and Oral Starter: Warm-up, practice and recall of skills involving the whole class.

A Main Teaching Activity: Direct teaching through demonstrating, modelling and discussion. Teachers use a variety of visual, aural and kinesthetic resources and mathematical language during this part of the daily Maths lesson. Children participate actively in activities related to the learning objective.

A Plenary: Reference is made to the learning objective of the lesson.

All mathematics lessons are based upon common objectives for the class. Within each part of the Mathematics lesson, there is suitable differentiation to meet the needs of the whole class, groups and individual children, including where appropriate, expectations relevant to different year groups. Teachers employ a range of strategies to ensure inclusion.

4. Co-operative as well as independent work should be encouraged and related to the immediate environment.
5. Children must be involved in evaluation and Target setting.
6. Every member of the teaching staff, the class room assistants, the Maths Coordinator and the Headteacher must know and understand their individual roles in the implementation of the Numeracy Curriculum.
7. Every teaching staff must take part in the Auditing of Maths in our school so as to know our weaknesses and strengths and use them to inform future planning at the end of each term, by completing questionnaires.
8. All teachers are required to provide half-termly gap analysis to Numeracy Coordinator to ensure effective half-termly target settings.

Scheme of Work

This is based on the Numeracy Curriculum. This acts as a starting point for extending children's experience and giving them skills they need to ensure that they make good progress. There is a need to expose our children to other vast mathematical experiences. In St. Monica's we currently use Busy Ants (Collins), Raising Stars as well as elements of Primary Advantage (bar modelling methods) to provide children with a varied range of strategies. There is a need to balance exact with open-ended tasks, balance knowledge, skills and understanding with problem solving.

Cross curricular links may be made whenever appropriate. Examples include the use of measurement in the science, model making and design, the use of graphs of all kinds in topic work, geometric patterns in art, use of space and understanding with problem-solving.

Planning

Includes: Yearly overview, Weekly/Topic paper planning, Daily flipchart planning Effective learning is more likely to take place when the teacher's planning is thorough. **Yearly overview** explains the topics covered within a year in each year group.

Weekly/Topic paper planning is a general overview of the lesson with key elements: Our Learning Intention, Success Criteria, Brief Mental Oral Starter, and Main Teaching in bullet points, Brief Activity, Brief Plenary and Evaluation

Daily flipchart planning is seen as the mean of delivering a Maths lesson. It must include: Our Learning Intention, Success Criteria, Mental Oral Starter – objective and activity, Main teaching using Think Aloud and Think-Pair-Share, Activity – differentiated, Extension, Plenary and Homework

We recognize the importance of establishing a secure foundation in mental calculation and recall of number facts before standard written methods are introduced. Teachers use a variety of published schemes such as, Target Maths, Raising Stars and others to deliver the curriculum. We use the Mathematical Dictionary when planning, to help determine the appropriate terminology to use in our teaching; children are expected to use it in their verbal and written explanations. Mathematics contributes to many subjects and it is important the children are given opportunities to apply and use Mathematics in real contexts.

We endeavour at all times to set work that is challenging, motivating and encourages the pupils to talk about what they have been doing.

Interactive White Boards are used to provide excellent opportunities for teachers and children to experience the world of Maths in a truly visual and interactive way and there is no doubt that their use enhances both the teaching and learning of Maths at St. Monica's.

Record-keeping and Assessment

This should enable each teacher to see where an individual child is. Assessment should be based not only on written work but also on pictorial, construction and oral work, giving the children time and opportunity to talk about the work done, how it has been done and how difficult problems were approached. This is because mathematical discussion should be seen as an activity in its own right as well as a valuable part of other tasks.

“It is said that children are frequently expected to write mathematics before they have learned to imagine and to discuss, and those who do not easily make the connection are offered more pencil and paper work instead of the vital talk and discussion.” Anita Straker [Talking points in Mathematics]

Assessment is an integral part of teaching and learning and is a continuous process. It is the responsibility of the class teachers to assess all pupils in their class and record their progress. Accurate assessment allows us to identify learning priorities and plan relevant motivating experiences thus benefiting the pupils and ensuring progress. Information for assessment will be gathered in various ways including talking to the children, observing their work, marking their work, etc.

Daily assessments are made and plans annotated as appropriate. These assessments impact upon the next day's objectives.

Gap analysis Assessments are carried out half-termly format and teachers use these assessments to plan future work. Depending on the evaluation, changes may need to be made to subsequent medium term plans. All assessments feed into the end of term assessments of individual children which are recorded in DATA SETS.

More formal/summative assessments are carried out as follows:

Nursery and Reception: Children are assessed against the Early Learning Goals and an Early Years Profile is completed for all children.

Year 2 and Year 6: Children are assessed through the National SATS. Year 2 through teacher assessment and Year 6 through SATS tests and teacher assessments.

Years 3, 4, 5: Children sit Raising Stars, NSI and Nfer tests

The school's records will be:

1. Daily lesson evaluations
2. A half Termly Teacher's Assessment results.
3. A Termly Summative Assessment
4. The results of the whole school Arithmetic Maths (Friday lessons).
5. The pupils' working books.

Monitoring and evaluating

Monitoring and evaluating are integral parts of teaching and learning in our school and are the responsibility of all members of staff. The Coordinator oversees the progress towards fulfilling our aims. This is achieved through:

- coordinator visiting classes throughout the school;
- the evaluation of pieces of work (internal standardization) and the evaluation of assessment results;
- displays of work in classrooms;
- collecting a cross-section of exercise books;
- informal discussions with staff;
- discussions with pupils;
- team-teaching;
- formal mathematics meetings;
- regular reviews of the Numeracy Action Plan; and review of the teachers' planning carried out by the coordinator.

The evidence gathered through monitoring procedures is evaluated regularly in order to inform future planning and to ensure that the pupils' work is of a high standard.

Standards are evaluated against previous performance, individual potential and achievement in other schools, with the overall intention of raising standards through:

- The sharing of learning intentions and success criteria;
- Formative assessment (Assessment for Learning);
- Class/topic/end of term tests;
- End of key stage assessment results;
- Formal and informal assessment undertaken as part of normal classroom teaching;
- Observation of practical activities;
- Discussion with pupils including pupils' self-evaluation and assessment;
- Standardized test results;

Equal Opportunities in Mathematics

Racial Equality, Equal Opportunity and Inclusion

This policy, like all of our policies, recognizes the right of all children to be included in all aspects of the curriculum and to have their progress assessed. Within all classes there will be a range of abilities. Teachers will make every effort to promote inclusion of all pupils by using appropriate class management and assessment strategies and collaborative teamwork with other members of staff. All lesson planning should allow for differentiation of tasks so that they are suitable for all levels of ability in the class. Our framework is based on suitable learning

challenges, responding to each pupil's diverse learning needs and overcoming potential barriers to learning so that all stakeholders in all areas of school life can participate as fully as possible.

Gifted and Talented

Gifted and Talented children will be extended and motivated in lessons through challenging questions requiring depth of thought.

The school is committed to equal opportunity in all aspects of school life. Our aim is to offer all our pupils a mathematics curriculum that is differentiated to all pupils learning style and abilities, so that every child may reach his/her full potential. We believe that learning materials should have a global view and some understanding of history of mathematics can help support this philosophy.

Home/School Links, Information and Homework

Parents are kept informed of the progress of their children and how to support their education. They are also made aware of developments within the school and/or wider educational field. This is done through:

- meetings;
- written information;
- two interviews per year;
- well-chosen homework activities (see Homework Policy);
- informative and helpful remarks on marked work; and
- regular written reports and pupil profiles in June.

The school views parents as one of its most useful natural resources and home/school partnerships are nurtured as such. The involvement of parents with their children's progress is encouraged as much as possible. They are made to feel welcome to discuss any concerns about their children's progress. Staff are available for consultation in regard to individual difficulties in Mathematics and Numeracy as they arise but parents are formally invited to interview on two occasions. It is school policy to give written reports on pupils' progress at the end of the school year. Whenever appropriate, the school furnishes parents with information on methodology regarding topics with the potential to confuse e.g. subtraction by decomposition.

Homework is used to support the learning process through the school's Homework Policy by reinforcing work done in school and allowing pupils to further investigate a topic. Teachers ensure that the pupils are given a variety of tasks, which include practical, written activities and in some cases the rote learning of mathematical facts.

Staffing and Resources

- Staffing includes coordinator, all teachers, support staff, and parent helpers. (Coordinator is responsible to the Headteacher)
- Each class has some essential materials for practical mathematics e.g. some measuring equipment, Dienes, multi-link cubes etc.
- There are quite a few resource materials in the mathematics area (under Class 4

stairway).

- The learning environment must show evidence of Numeracy activity in each classroom: work related vocabulary, Pupil's work and other visual aids to Numeracy learning must be displayed regularly, E.g. Target boards, number lines, number squares.

A Global View

- a. It is vital that children are made aware of the existence of mathematics in other cultures. This can be achieved by:
- b. The use of multi-cultural games and equipment and also by making use of Maths from other Cultures Books in the school.
- c. Comparing number notation systems and counting, including finger play and counting rhymes.
- d. Finding out about foreign currencies and trading.
- e. Cooking, using recipes from other cultures.
- f. Collecting and creating traditional geometric shapes.

The history of Mathematics as it pertains to other cultures should be used to encourage all children especially those of ethnic minority origin.

Roles and responsibilities

Role of the Maths Link Governor

The full governing body retains responsibility for raising standards in mathematics; the role of the Link governor is to raise the profile of the subject. He or she should be a source of support and a critical friend to the school. The Governor's interest will give encouragement to teaching staff.

The Maths Link Governor might:

- Try to attend some INSET courses;
- Meet with the mathematics coordinator to discuss implementation of the Strategy;
- Talk with teachers and see some daily mathematics lessons
- Agree a section for the annual Governor's Report on Mathematics with the Headteacher and Coordinator;
- Work with the school to inform parents about and involve them in their children's mathematics.
- Feedback to the Governing Board on their findings.

Role of the Headteacher

The role of the Headteacher is crucial in ensuring that the school is successful in raising levels of attainment in mathematics.

The Headteacher's role is to:

- Lead, manage and monitor the implementation of the Numeracy Curriculum, including

monitoring teaching plans and the quality of teaching in classrooms;

- With the numeracy governor, keep the governing body informed about the progress of the strategy;
- Support an audit of mathematics throughout the school, by the coordinator;
- Agree on action plan for achieving the school's targets with the whole staff and governing body;
- Support an open evening or day for parents to inform them about the national numeracy Strategy and ways in which they could support it.
- Support the coordinator, SENCO and staff in putting the numeracy curriculum in place;
- Deploy the support staff, with the help of the SENCO, to maximise support for the strategy;
- Ensure that mathematics remains a high priority in the school's development work;

Role of the mathematics Co-ordinator

Coordinator will be expected to:

- Team-Teach demonstration lessons;
- Ensure teachers are familiar with the Numeracy Curriculum and help them to plan lessons;
- Lead by example in the way they teach in their own classroom;
- Prepare, organise and lead INSET, with the support of the Headteacher;
- Carry out the audit and agree the action plan with the HT, staff governors;
- Work co-operatively with SENCO in providing advice and support for staff;
- Observe colleagues teaching from time to time, with a view to identifying the support they need;
- Attend courses provided by Learning Trust;
- With the Headteacher's support organise and lead workshop for parents about the Numeracy Curriculum;
- Discuss regularly with the Headteacher and numeracy governor the progress of implementing the curriculum in the school;

Role of the SENCO/other key teachers

Full involvement of the SENCO in mathematics is essential if standards are to be raised. The role of the SENCO should include:

- Support and work co-operatively with the coordinator to implement the Curriculum;
- Lead INSET for staff on special needs issues, based upon support materials provided by Strategy; Advise staff how best to support children with varying needs during mathematics lessons so that they meet the expectations of early teaching programmes;
- Help to ensure that children who are capable of catching up with their peer group do so as quickly as possible;
- Advise staff on the inclusion of mathematical objectives in IEPs for children with special difficulties in mathematics;

Role of additional adults and classroom assistants

The role of support staff is to help make sure that each child plays a full part in every lesson. They will need to be briefed about their particular role in any lesson so that they know not only what children are to do but also what children are to learn.

During any whole-class oral work, support staff or additional adults should position themselves close to any children who need special help and provide this discreetly, for example, they can:

- Support and encourage responses, e.g. from shy and reticent children;
- Support a child with visual impairment by using a hand-held white board to reproduce what is on the main board;
- Sign or translate core vocabulary or phrases;
- Keep children on task;
- Help children to use specific individual resources, e.g. personal number cards, table-top number lines, or individualised ICT resources linked to a child's IEP.

They should also observe carefully the responses of the children they will be working with later in the lesson to inform the support they will give.

In group work, additional adults can:

- Support individual children or groups;
- Explain tasks;
- Keep children focused;
- Help maintain pace;
- Remind children of teaching points and help them interpret instructions correctly;
- Question children and encourage their participation (the class teacher will need to suggest the questions and prompts that would be appropriate, and any particular children whom they should focus on.)
- Emphasise the correct use of mathematical vocabulary
- Look for and note any common difficulties that children have, or mistakes that they make, so that the class teacher can address these in the plenary and in future lessons;
- Use a number line and or 100-square, visual or practical aids, or a computer with suitable software, especially when helping children with difficulties or misunderstandings;

For the Plenary, and during it, additional adults can:

- Prepare children to give feedback on the work they have been doing;
- Prompt children as they go along and help them explain their strategies;
- Monitor the responses of particular children.

Calculation Policy

Introduction

This calculation policy has been written in line with the programmes of study taken from the revised National Curriculum for Mathematics (2014). It provides guidance on appropriate calculation methods and progression. The content is set out in yearly blocks under the following headings: addition, subtraction, multiplication and division.

Statements taken directly from the programmes of study are listed in bold at the beginning of each section.

A separate mental maths section outlines mental calculation strategies, including the use of jottings, vocabulary to be developed and the key number facts that children will need to know.

Children will use mental methods as their first port of call when appropriate, but for calculations that they cannot do in their heads, they will need to use an efficient written method accurately and with confidence.

Rationale:

At St. Monica's we strive to enable children to become fully numerate young people who not only have confidence in mathematics but are developing real enjoyment for the subject. Many methods are available to teach children and through this policy we intend to provide clarity on how we believe children will best understand the process of calculation in addition, subtraction, multiplication and division.

Aims

- enable our children to become confident, numerate young people
- provide clarity to teachers, teaching assistants and parents
- simplify the process and methods of calculation
- provide a clear link between written and mental calculation

This policy contains guidelines upon which to base the modelling of written calculation in the relevant year groups. It is not expected that teachers simply teach from this document without first establishing through assessment at what stages the children are at. Children should not be made to go onto the next stage if they are not ready or they are not confident. For the purposes of differentiation, methods from years above or below can be used.

- Children are encouraged to approximate or estimate their answers before calculating.

- Children are encouraged to check their answers after calculation using an appropriate (inverse) strategy.
- Skills for estimating, rounding and checking using inverse operations will be taught as ongoing skills and will be built into plans.
- Children are encouraged to consider if a mental calculation would be appropriate before using written methods.
- Calculations should always be presented horizontally so that children can decide if a mental calculation would be more appropriate.
- The use of maths equipment and a practical, creative approach to teaching Maths is encouraged throughout all year groups.

Addition

PROGRESSION THROUGH CALCULATIONS FOR ADDITION

MENTAL CALCULATIONS

These are a selection of mental calculation strategies:

Mental recall of number bonds

$$6 + 4 = 10 \quad _ + 3 = 10 \quad 25 + 75 = 100 \quad 19 + _ = 20$$

Mental recall of doubles Use near doubles

$$6 + 7 = \text{double } 6 + 1 = 13$$

Addition using partitioning and recombining

$$34 + 45 = (30 + 40) + (4 + 5) = 79$$

Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 + 57 = 143 \text{ (by counting on in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

Add the nearest multiple of 10, 100 and 1000 and adjust

$$24 + 19 = 24 + 20 - 1 = 43 \quad 458 + 71 = 458 + 70 + 1 = 529$$

Use the relationship between addition and subtraction

$$36 + 19 = 55 \quad 19 + 36 = 55 \quad 55 - 19 = 36 \quad 55 - 36 = 19$$

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

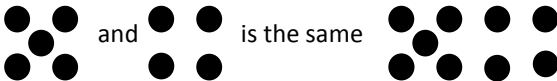
Points to remember:

Use the language 'calculation' not 'sum' ('sum' means 'plus' or 'total'.)

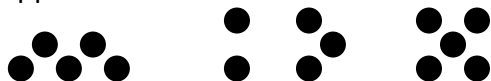
Use the language 'digit' not 'number' (number is the amount or quantity)

Addition vocabulary to be used through all stages:

add, addition, more, plus, increase, sum, total, altogether, score, double, near double, How many more to make...?, How many more/fewer is.. than...?, How much more/less is...?, is the same as, equals, sign, tens boundary, hundreds boundary, units boundary, tenths boundary, inverse

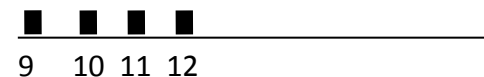
Addition Stage One		
<u>Concrete</u>	<u>Towards Written Calculation</u>	<u>Expected Written Method</u>
- Manipulate a range of real objects.  - Rearrange partition and recombine groups of real objects. - Notice and compare size of groups.	- Adults model representations of pupils' ideas on paper - Children's own jottings based on real objects 	- Adults model conventional number representations - Variety of maths symbols displayed in the environment.
Addition Stage Two		
<u>Concrete</u>	<u>Towards Written Calculation</u>	<u>Expected Written Method</u>
- Manipulate apparatus that represent real objects e.g. cubes, Base 10, Cuisenaire, bead strings  - Place objects in a line and on a number line. - Estimate and check size of groups - Rearrange, partition and recombine groups of objects and noticing what	- Children's jottings reflect abstract representations of objects e.g. tallies, spots  - Adults model abstract representations $2 + 3 = 5$ 	- Adults model horizontal recording of calculation and vocabulary $5 + 4 = 9$ $9 = 4 + 5$ - Adults model = as 'the same as' 

happens.



- Use pennies to calculate money

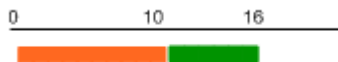
- Represent Multilink, Base Ten, Cuisenaire on a number line



Addition Stage Three

Concrete

- Use Cuisenaire and Base Ten/Bar model on a number line



- Use Cuisenaire and Base Ten/ Bar model to represent two digit numbers



- Use £10 notes, £1, 10p and 1p coins to calculate money

Towards Written Calculation

- Use place value cards to partition two digit numbers.



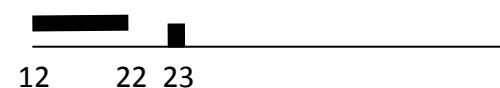
- Represent Base Ten and Cuisenaire on paper

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Expected Written Method

- Represent Multilink, Base Ten/Bar model, Cuisenaire on a number line

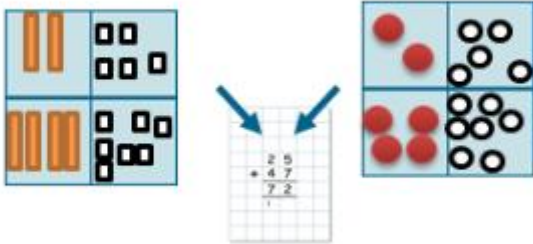


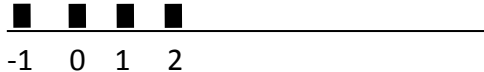
- Record calculations horizontally and 'read' using correct vocabulary

$$5 + 4 = 9$$

$$12 + 11 = 23$$

- Children begin to add two digit numbers vertically with apparatus

		
Addition Stage Four		
<u>Concrete</u> ○ Use Cuisenaire and Base Ten/ Bar model to represent two and three digit numbers  ○ Begin to introduce decimals and fractions using real objects  ○ Use coins and notes to calculate money to the value of £1	<u>Towards Written Calculation</u> ○ Use place value cards to represent two and three digit numbers  ○ Represent Base Ten and Cuisenaire on paper 	<u>Expected Written Method</u> ○ Children begin to record by partitioning and recombining numbers $52 + 43 = 95$ $50 + 40 = 90$ $2 + 3 = 5$ $90 + 5 = 95$ ○ Adults begin to model vertical addition $\begin{array}{r} 52 \\ +43 \\ \hline 95 \end{array}$
Addition Stage Five		
<u>Concrete</u> ○ Use Base Ten /Bar model and Cuisenaire to exchange once 10 is reached	<u>Towards Written Calculation</u> ○ Use place value cards to represent decimal numbers and money	<u>Expected Written Method</u> ○ Children use vertical addition to bridge 10 $\begin{array}{r} 69 \\ +23 \\ \hline 92 \end{array}$

○ Use Cuisenaire and Base Ten/ Bar model to represent fractions and decimals to one decimal place  ○ Use coins and notes when calculating money totals	 ○ Use coins to represent money	92 ○ Children begin to use number lines to calculate using negative numbers  ○ Children vertical addition to calculate amounts of money without bridging 10						
Addition Stage Six								
<u>Concrete</u> Bar Model Models and Images for Problem Solving (although the bar model will not specifically be used to model negative integer addition, children should be given more experience in multi-step problem solving with addition). Aaron's score <table><tr><td>60</td><td>8</td></tr></table> = ? (68) Bart's score <table><tr><td>?</td><td>(60)</td></tr></table> Carl's score <table><tr><td>60</td><td>13</td></tr></table> = ? (73) } = 201 201 - 21 = 180 3 units = 180 180 ÷ 3 = 60 1 unit = 60 60 + 8 = 68 60 + 13 = 73 The total of the scores from Aaron's, Bart's, and Carl's tests was 201. Aaron scored 8 points more than Bart. Carl scored 13 points more than Bart. What was each of their scores?	60	8	?	(60)	60	13	<u>Towards Written Calculation</u>	<u>Expected Written Method</u> ○ Children are proficient in using vertical addition for whole numbers and decimals 12.53 +19.28 11 31.81
60	8							
?	(60)							
60	13							

Subtraction

PROGRESSION THROUGH CALCULATIONS FOR SUBTRACTION

MENTAL CALCULATIONS

These are a selection of mental calculation strategies:

Mental recall of addition and subtraction facts

$$10 - 6 = 4 \quad 17 - _ = 11 \quad 20 - 17 = 3 \quad 10 - _ = 2$$

Find a small difference by counting up

$$82 - 79 = 3$$

Counting on or back in repeated steps of 1, 10, 100, 1000

$$86 - 52 = 34 \text{ (by counting back in tens and then in ones)}$$

$$460 - 300 = 160 \text{ (by counting back in hundreds)}$$

Subtract the nearest multiple of 10, 100 and 1000 and adjust

$$24 - 19 = 24 - 20 + 1 = 5 \quad 458 - 71 = 458 - 70 - 1 = 387$$

Use the relationship between addition and subtraction

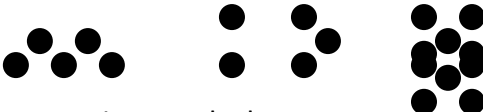
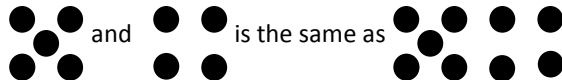
$$36 + 19 = 55 \quad 19 + 36 = 55 \quad 55 - 19 = 36 \quad 55 - 36 = 19$$

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Subtraction vocabulary to be used through all stages:

subtract, take away, minus, decrease, leave, how many are left/left over?, difference between, half, halve, How many more/fewer is../than...?,

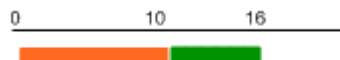
How much more/less is...?, is the same as, equals, sign, tens boundary, hundreds boundary, units boundary, tenths boundary, inverse

Subtraction Stage One		
<u>Concrete</u> ○ Manipulate a range of real objects.  ○ Rearrange partition and recombine groups of real objects. ○ Notice and compare size of groups.	<u>Towards Written Calculation</u> ○ Adults model representing ideas on paper ○ Children's own jottings based on real objects 	<u>Expected Written Method</u> ○ Adults model conventional number representations ○ Variety of maths symbols displayed in the environment.
Subtraction Stage Two		
<u>Concrete</u> ○ Manipulate apparatus that represent real objects e.g. cubes, Base Ten/Bar model, Cuisenaire, bead strings  ○ Place objects in a line and on a number line. ○ Estimate and check size of groups ○ Rearrange partition and recombine groups of objects and noticing what happens.  ○ Use pennies to calculate money	<u>Towards Written Calculation</u> ○ Children's jottings to reflect abstract representations of objects e.g. tallies, spots ○ Adults model abstract representations $5 - 3 = 2$ 	<u>Expected Written Method</u> ○ Adults model horizontal recording of calculation and vocabulary $9 - 4 = 5$ $5 = 9 - 4$ ○ Adults model = as 'the same as' 

Subtraction Stage Three

Concrete

- Use Cuisenaire and Base Ten/Bar model on a number line



- Use Cuisenaire and Base Ten/Bar model to represent two digit numbers



- Use £10 notes, £1, 10p and 1p coins to calculate money

Towards Written Calculation

- Use place value cards to partition two digit numbers.



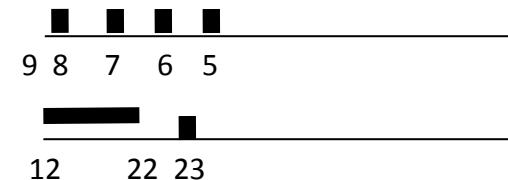
- Represent Base Ten and Cuisenaire on paper

23



Expected Written Method

- Represent Multilink, Base Ten, Cuisenaire on a number line



- Record calculations horizontally and 'read' using correct vocabulary

$$9 - 5 = 4$$

$$23 - 11 = 12$$

- Children begin to subtract two digit numbers with apparatus

$$45 - 23 = 22$$



Subtraction Stage Four

Concrete

- Use Cuisenaire and Base Ten/Bar model to represent two and three digit numbers



- Begin to introduce the subtraction of decimals and fractions using real objects



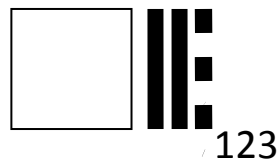
- Use coins and notes to calculate money to calculate money to the value of £1

Towards Written Calculation

- Use place value cards to represent two and three digit numbers



- Represent Base Ten and Cuisenaire on paper



Expected Written Method

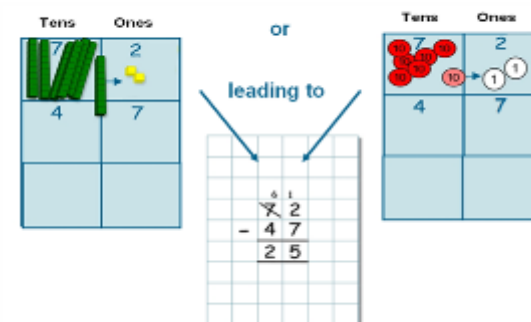
- Children begin to record by partitioning the second number

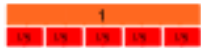
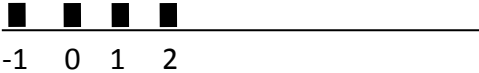
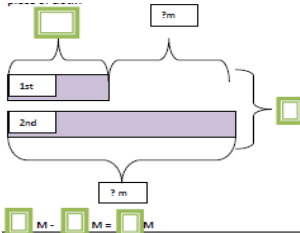
$$93 - 47 = 52$$

$$93 - 7 = 86$$

$$86 - 40 = 46$$

- Adults model vertical subtraction



Subtraction Stage Five		
<u>Concrete</u> ○ Use Base Ten/Bar model and Cuisenaire to exchange once 10 is reached ○ Use Cuisenaire and Base Ten/ Bar model to represent fractions and decimals to one decimal place  ○ Use coins and notes when calculating money totals	<u>Towards Written Calculation</u> ○ Use place value cards to represent decimal numbers and money  ○ Use coins to represent money	<u>Expected Written Method</u> ○ Children use vertical addition to bridge 10 $\begin{array}{r} ^5 ^1 \\ 63 \\ - 29 \\ \hline 34 \end{array}$ ○ Use number lines to calculate using negative numbers 
Subtraction Stage Six		
<u>Concrete</u> Bar Model Models and Images for Problem Solving A piece of cloth 4m long is cut into two pieces. The first piece is 1.25m long. How much longer is the second piece of cloth? 	<u>Towards Written Calculation</u> ○ Using place value cards to represent two and three digit numbers and money ○ Representing money as decimals ○ Representing Base Ten and Cuisenaire on paper  1121	<u>Expected Written Method</u> ○ Children proficient in using vertical subtraction for whole numbers and decimals $\begin{array}{r} ^1 ^1 ^4 ^1 \\ 22.53 \\ - 19.28 \\ \hline 03.25 \end{array}$

Multiplication

PROGRESSION THROUGH CALCULATIONS FOR MULTIPLICATION

MENTAL CALCULATIONS

These are a selection of mental calculation strategies:

Doubling and halving: Applying the knowledge of doubles and halves to known facts. e.g. 8×4 is double 4×4

Using multiplication facts: Tables should be taught regularly from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the week. All children should know these by heart by:

Year 2- 2 times table, 5 times table, 10 times table

Year 3- 2 times table, 3 times table, 4 times table, 5 times table, 6 times table, 10 times table

Year 4- Derive and recall all multiplication facts up to 10×10

Years 5 & 6- Derive and recall quickly all multiplication facts up to 10×10 .

Using and applying multiplication facts: Children should be able to utilize their tables knowledge to derive other facts.

e.g. If I know $3 \times 7 = 21$, what else do I know?

$30 \times 7 = 210$, $300 \times 7 = 2100$, $3000 \times 7 = 21\ 000$, $0.3 \times 7 = 2.1$ etc

Use closely related facts already known

$$13 \times 11 = (13 \times 10) + (13 \times 1)$$

$$= 130 + 13$$

$$= 143$$

Multiplying by 10 or 100

Knowing that the effect of multiplying by 10 is a shift in the digits one place to the left.

Knowing that the effect of multiplying by 100 is a shift in the digits two places to the left.

Partitioning

$$23 \times 4 = (20 \times 4) + (3 \times 4)$$

$$= 80 + 12$$

=102

Use of factors

$$8 \times 12 = 8 \times 4 \times 3$$

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Multiplication vocabulary to be used through all stages:

lots of, groups of, times, product, multiply, multiplied by, multiple of, once, twice, three times, four times, five times,... ten times, repeated addition, array, row, column, double, halve, group in pairs, threes... tens, factor, quotient, inverse

Use of factors

$$378 \div 21 \quad 378 \div 3 = 126 \quad 378 \div 21 = 18 \quad 126 \div 7 = 18$$

Use related facts

Given that $1.4 \times 1.1 = 1.54$

What is $1.54 \div 1.4$, or $1.54 \div 1.1$?

MANY MENTAL CALCULATION STRATEGIES WILL CONTINUE TO BE USED. THEY ARE NOT REPLACED BY WRITTEN METHODS.

Division vocabulary to be used through all stages:

lots of, groups of, times, product, multiply, multiplied by, multiple of, once, twice, three times, four times, five times,... ten times, repeated addition, array, row, column, double, halve, share, share equally, one each, two each, three each..., group in pairs, threes... tens, equal groups of, divide, divided by, divided into, divisible by, remainder, factor, quotient, inverse

Division

PROGRESSION THROUGH CALCULATIONS FOR DIVISION

MENTAL CALCULATIONS

These are a selection of mental calculation strategies:

Doubling and halving: Knowing that halving is dividing by 2

Deriving and recalling division facts

Tables should be taught regularly from Y2 onwards, either as part of the mental oral starter or other times as appropriate within the week. All children should know these by heart by:

Year 2- 2 division table, 5 times table, 10 times table

Year 3- 2 times table, 3 times table, 4 times table, 5 times table, 6 times table, 10 times table

Year 4- Derive and recall division facts for all tables up to 10×10

Years 5 & 6 - Derive and recall quickly division facts for all tables up to 10×10

Using and applying division facts

Children should be able to utilize their tables knowledge to derive other facts.

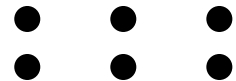
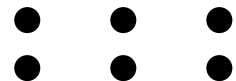
e.g. If I know $3 \times 7 = 21$, what else do I know?

$21 \div 7 = 3$ so $210 \div 7 = 30$, $210 \div 3 = 70$, $210 \div 70 = 3$ etc

Dividing by 10 or 100

Knowing that the effect of dividing by 10 is a shift in the digits one place to the right.

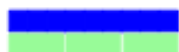
Knowing that the effect of dividing by 100 is a shift in the digits two places to the right.

Division Stage One		
<u>Concrete</u> ○ Manipulate a range of real objects.  ○ Rearrange, partition and recombine groups of real objects. ○ Sort and group sets of objects	<u>Towards Written Calculation</u> ○ Adults model representing ideas on paper ○ Children's own jottings based on real objects 	<u>Expected Written Method</u> ○ Adults model conventional number representations ○ Variety of maths symbols displayed in the environment.
Division Stage Two		
<u>Concrete</u> ○ Introduce language and concepts of division in real life contexts e.g. pairing up socks, sharing sweets, grouping objects	<u>Towards Written Calculation</u> ○ Children count in multiples of 2, 3, 5 and 10 and recognise why these patterns in counting occur using Cuisenaire, 100 squares, number lines ○ Children's jottings to reflect abstract representations of objects e.g. tallies, spots  ○ Adults model abstract representations 	<u>Expected Written Method</u> ○ Adults model horizontal recording of calculation and vocabulary related to groups of and lots of $15 \div 5 = 3$ $15 \div 3 = 5$

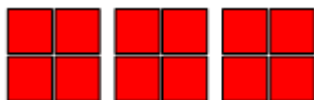
Division Stage Three

Concrete

- Share and group using abstract apparatus e.g. cubes, Cuisenaire, Bar Model, bead strings e.g. how many 3's are in 9?



How many equal groups can you put 12 cubes into?



- Make arrays with different pieces of equipment to show relationship between multiplication and division e.g. cubes, peg boards, Cuisenaire, Bar Model

3 x 4

4 x 3



$$12 \div 4 = 3 \quad 12 \div 3 = 4$$

Towards Written Calculation

- Children count in multiples of all numbers to 10 and recognise why these patterns occur using Cuisenaire, 100 squares, number lines
- Children begin to use abstract notation to answer problems e.g. spots, tallies
II II II II
- Children begin to use their knowledge of multiplication facts to recall division facts to 12x12

Expected Written Method

- Children record calculations horizontally and 'read' using correct vocabulary for numbers that can be divided exactly.

$$15 \div 5 = 3$$

$$15 \div 3 = 5$$

- Children record calculations horizontally and 'read' using correct vocabulary for division questions involving a remainder

$$16 \div 5 = 3 \text{ r}1$$

$$16 \div 3 = 5 \text{ r}1$$

Division Stage Four

Concrete

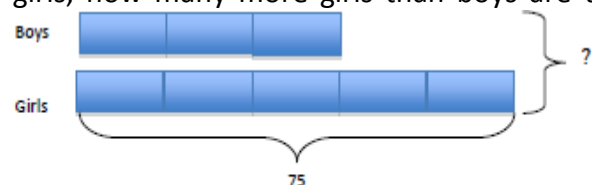
- Children explore exchange of counters for division

Hundreds	Tens	Ones
100	10 10 10	1 1 1 1 1 1 1 1

Bar Model

Models and Images for Skills and Problem Solving
To find the sum.

There are $\frac{3}{5}$ as many boys as girls. If there are 75 girls, how many more girls than boys are there?



5 units = 75
1 unit = $75 \div 5 = 15$
8 units = $8 \times 15 = 120$

Towards Written Calculation

- Children proficient in using their knowledge of multiplication facts to recall division facts
- Children partition numbers to divide

$$\begin{aligned} \text{e.g. } 84 \div 6 &= \\ 60 \div 6 + 24 \div 6 &= \\ 10 + 4 &= 14 \end{aligned}$$

Expected Written Method

- Adults model using the bus shelter method alongside the partitioning method

$$81 \div 3$$

Partition 81 into 60 + 21

$$60 \div 3 = 20$$

$$21 \div 3 = 7$$

$$20 + 7 = 27 \text{ so } 81 \div 3 = 27$$

$$\begin{array}{r} 27 \\ 3 \overline{)81} \end{array}$$

- Children should interpret remainders in different ways according to the context, as fractions, decimals or by rounding

$$\text{e.g. } 98 \div 4 = 24 \text{ r } 2 = 24 \frac{1}{2} = 24.5$$

Division Stage Five

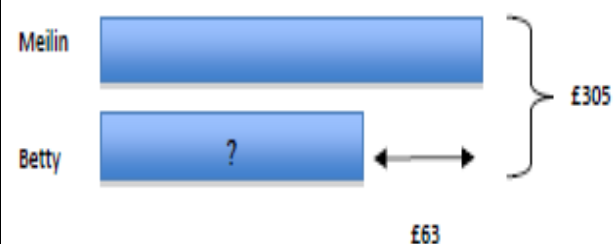
Concrete

Bar Model

Models and Images for Problem Solving

To find the smaller quantity

Merlin and Betty saved £305 altogether. Betty saved £63 less than Meilin. How much did Betty save?



$$£305 - 63 = 242$$

$$242 \div 2 = 121$$

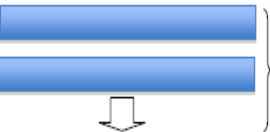
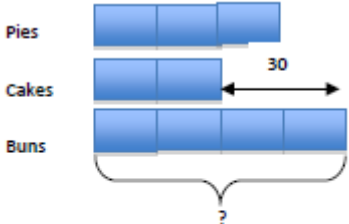
Betty saved £121

Towards Written Calculation

- Children proficient in recalling division facts

Expected Written Method

- Children proficient in using the bus shelter method to divide whole numbers and numbers with up to 2 decimal places by a single digit
- Children begin to divide whole numbers by a two-digit number

Division Stage Six		
<u>Concrete</u> Bar Model Models and Images for Problem Solving Part-Whole Model Before  After  Part-Whole Model (ratio) The ratio of the number of pies to the number of cakes to the number of buns is 3:1:4. If there are 30 more buns than cakes, how many buns are there?  3 units=30 1 unit=30÷3=10 4 units=4×10=40 There are 40 buns.	<u>Towards Written Calculation</u>	<u>Expected Written Method</u> ○ Children proficient in using long division to solve problems