

# **Bitterne C of E Primary School**



# **Policy for Mathematics**

Headteacher  
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Last review- March 2019

Next review – March 2021

**Signed by Chair of Governors**

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# **The Nature of Maths at Primary School.**

'The responsibility of mathematics education is to enable all pupils to develop conceptual understanding of the mathematics they learn, its structures and relationship, and fluent recall of mathematical knowledge and skills to equip them to solve familiar problems as well as tackling creatively the more complex and unfamiliar ones that lie ahead.' *Page 6 Mathematics: made to measure May 2012.*

"Teachers to use their subject and pedagogical expertise to provide high quality teaching and curricular experiences in order to secure the best possible learning and outcomes for their pupils" *Confident Mathematicians: A View from Ofsted, July 2016, Surrey Plus Maths Hub*

'Teachers should use every relevant subject to develop pupils' mathematical fluency. Confidence in numeracy and other mathematical skills is a precondition of success across the national curriculum.' *Page 9 NC 2014*

"Since mastery is what we want pupils to acquire (or go on acquiring), rather than teachers to exhibit, we use the phrase 'teaching for mastery' to describe the range of elements of classroom practice and school organisation that combine to give pupils the best chances of mastering mathematics.

And mastering maths means acquiring a deep, long-term, secure and adaptable understanding of the subject. At any one point in a pupil's journey through school, achieving mastery is taken to mean acquiring a solid enough understanding of the maths that's been taught to enable him/her move on to more advanced material." *NCETM Mastery Explained – What Mastery Means (2019) – also see The Essence of Maths Teaching for Mastery, NCETM (2016).*

## **Mission Statement and Vision:**


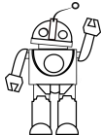


**At Bitterne CE Primary School, we believe that every child should that the opportunity to reach their full potential in mathematics through education of the highest quality within a positive and caring environment.**

**We strive to ensure that the children's learning of maths equips them with skills and values that will enable them to positively contribute to the modern British society in which they live.**

**The school motto is 'Inspire, Believe, Achieve' and we want every child to be excited by the learning opportunities that they have in mathematics and to build confidence so they can develop a life-long love for maths.**

## Fluency, Reasoning and Problem Solving at Bitterne CE Primary School

There are three key areas required to gain a deep mathematical understanding:

Area of Mathematical Understanding	Definition, from the National Curriculum	Symbol used in planning	Examples of Learning Activities
<b>Fluency</b>	To become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.	 Skills Snake	- Learning and practising a new skill - Becoming accurate in the skill: getting it right all of the time. - Setting a method out correctly. - Applying known mental facts to a more complex method.
<b>Reasoning</b>	To reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language	 Reasoning Robot	- Always, Sometimes, Never – explanations using because - Spot the difference - Odd one out/Talk-it, Solve-it - Concept cartoons- who is right? - True or False - Predictions with reasoning - Proving or disproving rules
		 Prove-it Penguin	- Using the known skill or known facts to solve a similar problem. - Adapting known facts to solve a question.
<b>Problem Solving</b>	To 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.	 Problem Solving Parrot	- Solving a problem or investigation by breaking it down into smaller steps - Making a prediction in the context of the problem using evidence. - Choosing the correct method - Estimating - Systematic Application. - Reviewing what I have found out

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.

### A 'Mastery' approach

At Bitterne CE Primary School, we follow a mastery model. There are two key sources of information which support our planning and this approach:

- Our planning is informed (but not dictated) by the White Rose Maths Hub scheme for learning. Teachers can use or adapt activities for fluency, reasoning and mastery are adapted for tasks within each learning journey.

- Our planning is also supported by the National College for the Excellence in the Teaching of Mathematics (NCETM). The curriculum progression tool and Mastery assessment information are adapted by teachers to ensure this mastery approach is evident in classes.

The principles of a mastery approach are:

- Rejecting the principle that some people ‘just can’t do maths’: every student can succeed through hard work and belief
  - Depth before breadth: differentiation is achieved by emphasising deep knowledge through individual support and intervention
  - Intelligent practice and consolidation to build fluency and understanding of underlying concepts in tandem
  - Precise questioning to test knowledge and assess pupil progress
  - Most pupils are progressing through the curriculum at the same pace
  - Methodical curriculum design supported by carefully crafted lessons intervention
  - It is recognised that practice is a vital part of learning, but the practice used is intelligent practice that both reinforces pupils’ procedural fluency and develops their conceptual understanding
  - A blend of resources to foster deep conceptual and procedural knowledge, e.g. the use of concrete and pictorial apparatus, making connections across mathematical facts and concepts
  - Developing Mathematical thinking and language through talk tasks
  - High expectations that all pupils are capable of achieving high standards in Maths
  - Key facts such as multiplication tables and addition facts within 10 are learnt to automaticity to avoid cognitive overload in the working memory and enable pupils to focus on new concepts.
  - Creating an atmosphere and culture where children are unafraid to grapple with Mathematics
  - Challenge comes through more complex problem solving, not a rush to new content
- (The Ofsted-Proof Guide..., Third Space Learning (2016) and The Essence of Mastery Teaching, NCETM (2016)).

### **Concrete, Pictorial, Abstract**

At Bitterne CE Primary School, we use the Singapore maths research to help inform our practice. Children are given the opportunity to learn using a concrete, pictorial and abstract approach (CPA). This approach allows children to gain conceptual understanding in a gradual, systematic approach, and is based on research by psychologist Jerome Bruner. The suggestion is that there are three steps or representations that are required for children to develop a deep conceptual understanding in maths. This approach will be adapted to the children at Bitterne CE Primary School to suit their needs, as Merttens (Director within the Hamilton Trust) claims, “that the importation of the CPA heuristic lock, stock and barrel is not advisable” due to differences in the cultural and educational systems between Great Britain and Singapore.

Across all stages of concrete, pictorial and abstract, teachers will use their professional judgement to identify whether varied fluency, reasoning or problem solving tasks should be used to develop

the children's knowledge and understanding in mathematics. It is not expected that all three stages should be applied across each step of a learning journey, but children should have access to the most appropriate resources required for their learning.

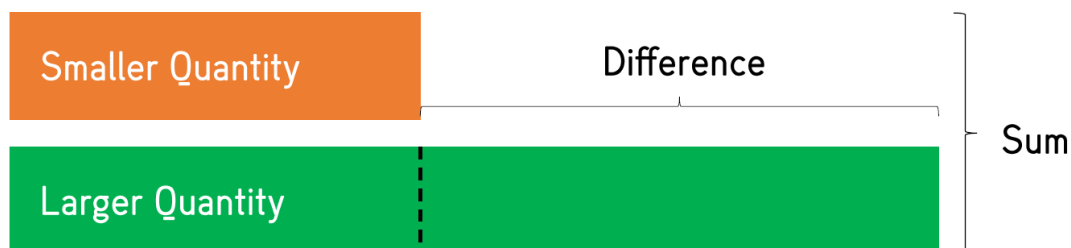
### **Concrete**

Using concrete resources allows the opportunity for informal play. This will only have any validity if the 'concrete' part really is physical and not another form of pictorial (Merttens, Mathematics Teaching 228, Journal of the Association of Teachers of Mathematics). This should take place at the beginning of all learning. All children, regardless of ability or age, should have access to practical resources appropriate to their understanding. Many practical resources lend themselves to be used at a wide variety of attainment levels to support a mathematical concept. The impact is that it gives pupils the opportunity to investigate a concept first and then make connections when formal methods are introduced through teaching. It also allows the pupil to become familiar with the resources and what they are representing.

### **Pictorial**

This stage is vital for allowing children to show their understanding of a concept taught. It is essential that all children gain a clear visual understanding of what the mathematical concept looks like. It supports children in sufficiently understanding the process they need to go through in order to solve mathematical statements. Potential examples of these are:

- when regrouping, the pupil will need to draw dienes or place value counters and then show the regrouping of a number through crossing out and re-drawing, reinforcing the concept.
- in bar modelling when given the statement  $23+21$  and draws one bar much greater than the other, it highlights how the pupils hasn't sufficiently understood that there is not much difference between the two numbers and therefore he bars will be similar in length, with one being only slightly shorter.



*An example of the Comparison Bar Model, The Bar Model Company (2018)*

### **Abstract**

The abstract stage often runs alongside the concrete, pictorial stage as children need to read mathematical statements and use the concrete resources or pictorial representations to show their understanding of the mathematical statement. When teaching addition, for example, using dienes or drawing dienes the children do this alongside the formal written column method, which is abstract. (Information adapted from Maths: No Problem, 2016).

# **The Mathematics Curriculum**

The National Curriculum 2014 sets out the programmes of study for each year group. However, within each key stage, there is flexibility to introduce content earlier or later as appropriate. The school will ensure children's knowledge is deepened through high quality investigations for higher attaining children, rather than moving them onto the next year's curriculum.

## **Planning for maths**

The **planning for maths** should follow the National Curriculum programmes of study for each year group.

The planning for maths should follow the agreed format across the school. It should outline the 'Learning Journey' over a unit with a clear expected outcome. The learning will be progressive and ensure the children are taught the skills, knowledge and understanding needed over the unit so that by the end of the unit good progress is evident.

The planning should identify the development of the mathematics.

**The planning should not be over detailed or bureaucratic.** The teacher must keep in mind that the planning is a working document that will change as the unit progresses as a result of assessment for learning. By the end of a unit, the planning will have annotations on it where barriers for individuals, groups or the whole class have been identified and addressed.

SLT and the Maths Leader will monitor that the planning follows the agreed format but will not expect the audience for the planning to be anyone other than the teacher themselves. SLT and the Maths Leader will, however, be looking at the **impact of planning on the learning** in a lesson or over time in the books. It may be that in lesson observations, the planning is not studied in detail as it is the learning in the class at the time as a result of the planning that will be judged. Where the learning in a lesson or over a unit could be improved, there will be a discussion with the teacher to help understand the planning thought process for all groups .

All planning should dedicate appropriate time to children **working in maths for a sustained period of time** for both teacher structured work and independent work. The productivity of the children over time is a key element of work scrutiny. It generally follows that good teaching with high expectations results in at least good productivity and therefore greater evidence of progress.

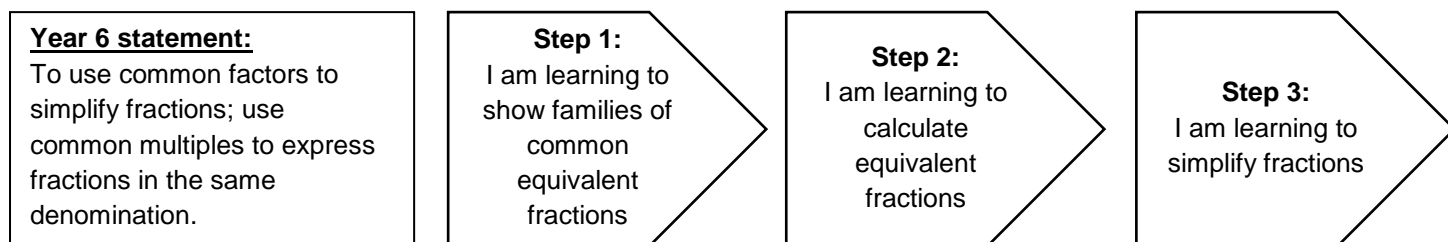
**All** steps in the mathematics learning journey should allow **all** children to become **fluent, reason** effectively and **solve problems** that are appropriate to their next steps. These statements do not reflect the learning journey. It is expected all children (including those with an SEND) to have opportunities to reason and problem solve at their level.

Ofsted indicate that the best informed teachers and subject leaders know the aims, give increased emphasis to reasoning and problem solving across the mathematics curriculum while using practical apparatus and images to support pupils' conceptual understanding (An Ofsted-Proof Guide... Third Space Learning (2016)). Reasoning and Problem solving should feature as a regular aspect of the learning journey for each skill taught: not just as an end of unit expectation. However, the children may use a combination of the skills taught to create an end of unit "final product", which may be a detailed investigation, application of knowledge, or this may take some other form.

## **Learning Intentions and Success Criteria**

**Learning Intentions and success criteria** are an important tool, when used effectively, to ensure the thread of learning is clear to the children. It also helps them to know what their next step in the lesson is.

The learning intention should take the expected outcome from the national curriculum and break it down into achievable steps of learning. These will start with “I am learning to...” Some of these steps may be taken from the year group below, if it is required to diminish the difference to age related expectation quickly. For example:



For each of the steps to learning, there will be appropriate success criteria, linked to the skill that is being taught.

We use two types of success criteria in maths:

- **Process Success Criteria:** This is a step-by-step guide of how to complete a skill. Each statement usually starts with an imperative verb. Process Success Criteria has been proven to have a positive impact on progress on children, as it raises the independence and confidence of children. For some aspects of maths, however, Process Success Criteria has a more limited impact (such as some areas of shape).
- **Outcome Success Criteria:** This is a differentiated success criteria which outlines how the skill becomes more complex. This is useful in encouraging children to understand what the expectation of the year group is. It also helps them to understand how the skill is becoming more complex.

Typically, children will be given process success criteria to help them independently become fluent in a skill. The preparation of tasks will allow the increase of difficulty of the deepening of mathematical understanding. The vast majority of children should be working on age appropriate success criteria.

There is no expectation that teachers will prepare further second success criteria for reasoning or problem solving learning activities. However, teachers will identify in their planning whether a process success criteria is required to illustrate what effective reasoning or efficient problem solving will look like. Furthermore, appropriate scaffolding or models of good investigations (WAGOLLs – what a good one looks like) should be provided to give children clear structure and support in ensuring their success.

On occasions, it may be that the teacher will deliberately not reveal the learning intentions at the start of a lesson and the pupils will be challenged to articulate what they have learnt later in the lesson.

**Guided maths groups-** Within the maths lesson, there should be opportunities for the teacher or TA to work with a small group in order to support the learning or provide challenge. These groups can be planned based on the assessment information from the previous day, or they can be groups formed during a lesson where the teacher judges that a focus group would move the children’s learning on. At all times, the groups for maths will be flexible depending on what the children need. Teaching Assistants should work with a variety of ability groupings over a week.

**Presentation in Maths**

The children should be taught how to present their written maths work to a high standard and encouraged to take a pride in their work in line with current school presentation guidelines.

**Setting or mixed ability in maths**

Mathematics; made to measure reports that ‘outstanding learning and progress occurred more often in mixed-attainment primary classes than in those set by ability. However, the most able pupils in nearly a quarter of primary schools were insufficiently challenged, often because they were set very similar work to their middle- attaining peers before moving to extension tasks.’ (page 18).

Furthermore, the Education Endowment Fund (EEF) publications regarding the cost versus impact show that mixed-ability primary classes are more effective (2019):

Toolkit Strand ^	Cost v	Evidence Strength ^	Impact (months) ^
<b>Mastery learning</b> Moderate impact for very low cost, based on moderate evidence.	£ £ £ £ £	🔒 🔒 🔒 🔒 🔒	+5
<b>Peer tutoring</b> Moderate impact for very low cost, based on extensive evidence.	£ £ £ £ £	🔒 🔒 🔒 🔒 🔒	+5
<b>Setting or streaming</b> Negative impact for very low cost, based on limited evidence.	£ £ £ £ £	🔒 🔒 🔒 🔒 🔒	-1

One of the key features of the ‘mastery’ approach is whole class teaching. The decision on the structure of the maths lessons must be based on the learning of the children so that sets or mixed ability or a combination may be appropriate to support or extend the learning. For the vast majority of lessons at Bitterne CE Primary School, mixed-attainment groups will be used.

**Coaching and maths**

Every teacher and teaching assistant has access to high quality coaching for maths. This can be planned or informal and may take one of the following forms:

- A planned coaching session in class – this may involve coaching how to model an aspect of maths or establishing best practice
- Coaching in planning – this might be for the learning journey, aspects of fluency, reasoning and problem solving, or how to support different groups effectively.



## **Use of ICT**

Calculators should not be used as a substitute for good written and mental arithmetic. They should only be introduced near the end of KS2 to support pupils' conceptual understanding and exploration of more complex number problems, if written and mental arithmetic are secure. NC 2014.

ICT should be used widely in maths to support learning. This could be linked to use of databases, branching keys, angles etc.

The old NNS ITPs still provide a very visual model that supports teaching and learning in maths. They are saved on the server in the maths section. These can be accessed by all children using the ipads, which can be booked out from the office.

## **Maths in Early Year Foundation Stage**

Children typically learn through a mix of free-choice play and more focused activities with adults both inside and outside. The provision will be mathematically rich and tailored to the needs of different groups of children, including challenge for those higher attaining children and support for the lower attaining children. Adults will use mathematical language and questioning effectively to develop the children's vocabulary and thinking. The transition to Year 1 ensures that towards the end of Year R there are increased opportunities for more structured sessions, as appropriate, and at the start of Year 1 there is still some 'free flow' provision.

## **Maths across the curriculum**

**Expectation- Children will be able to demonstrate the independent application of taught maths skills across the entire curriculum.**

Children will have opportunities for maths activities linked to other subjects in the curriculum. There are significant links between science and the statistical element of maths in terms of the analysis of experiments, which should be utilised by class teachers. Other examples could feature measuring time, distance, mass etc. in a science experiment, interpreting graphs in science or their non-fiction reading, accurate measuring in Design Technology etc.

## **Resources and strategies for maths**

There are a wide variety of practical resources stored in the school. Some of these are:

- Dienes blocks (some allocated to every class, as well)
- Place value counters
- Shapes, including 3D shapes, shape stamps, clixi, geo-boards
- Clocks, including clock stamps
- Multi-link cubes
- Numicon

Furthermore, each class is expected to have an up-to-date learning wall in use, which the children can interact with and use appropriately. Teachers are expected to display the formal written methods for the year group they are teaching in. As well as this, they are expected to display the definitions of fluency, reasoning and problem solving, as confirmed by the school team. Other aspects of the working wall include information that would help the children to solve mathematical problems, as well as having answers up for the children to refer to in order to check their success.

Furthermore, each year group should be organised in a way that children know what maths resources they can independently select. This could take the form on either an individual learning

pack for maths, or a resource zone (with certain resources (e.g. dienes) within the classroom and certain resources (e.g. bead strings) shared between the classes). This will allow the children to build independence and greater understanding of their own mathematical learning style.

### **Links to reading**

Please refer to the Policy for English (Reading). Children should experience a wide range of reading and this includes in their maths. This may be reading and understanding problems, reading and interpreting data.

### **Links to writing**

Children should be introduced to key mathematical vocabulary in a progressive way across the school. The vocabulary should be modelled precisely by all staff and children should be expected to accurately use the vocabulary when speaking and in their written work.

There should be examples of written work in maths where the children are explaining their thinking, reasoning or justifying their results. The writing should follow the non-negotiables for writing and should be of the same standard as the writing in English books.

### **Links to speaking and Listening and spoken language.**

'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.' *Page 89 NC 2014*

All adults model and develop children's speaking and listening by talking to children, asking questions, modelling new vocabulary and helping children to express their ideas orally.

There should be planned opportunities to develop skills in speaking and listening.

All adults in school should be good role models for the correct use of the correct use of mathematical vocabulary. .

## **Assessment of Maths- see current guidelines for assessment**

### **Marking and feedback**

The maths should always be marked in accordance with the 'Marking and Feedback Policy'. Not every piece of work requires formal marking, but teacher should be assessing the children's learning during and after each lesson.

Where more formal written feedback is used, there should be a tick, tip and time given for talkback activities to respond to the marking. The tip should be the next step to improve the maths work. During sustained period of mathematical working, the adults should be pen marking the work already done and giving advice on how to improve further in the lesson.

During the lesson, teachers should be questioning to check or probe the child's understanding, identifying and tackling misconceptions and adapting planning for individuals, groups or the class accordingly. This would be noted down in the form of 'live marking', where the teacher would evidence their impact through a comment, question or written scaffolds.

## **Inclusion in maths**

Children whose progress in maths is identified as slow at **pupil progress meetings** have a range of strategies put in place to accelerate progress. Changes to the 'Quality First Teaching' are made with a focus on these children. Further intervention may be planned, as appropriate.

## **Gender and maths**

The achievement of girls in maths should be at least equal to that of boys. The school tracks the progress of boys and girls in maths and adjusts the curriculum and focus to ensure girls close any gap to the boys, or vice versa.

## **SEND children**

*For additional guidance, please check in accordance with the 'Inclusion policy'.*

All SEND children will be assessed regularly using the school's SEND Progression of Skills document. This for children who are working towards the year group expectations, but who is currently working below age-related expectation. Teachers should plan to diminish the gap to year group expectation rapidly. This should be tracked on the SEND Progression of Skills document in a year group colour. Teachers should use their professional judgement to identify which steps are essential in order to achieve this and ensure the difference to age-related expectation is diminished rapidly.

Certain children will have been identified by the Inclusion Leader and class teacher who require their own learning journey. This must be consistent for these children. Additionally, after each mathematical unit of work, the class teacher is to assess how successfully the SEND child has diminished the difference and annotate this on their SEND Progression of Skills document. These will be monitored at half-termly intervals by the Maths leader and Inclusion leader.

## **Disadvantaged children**

*For additional guidance, please check in accordance with the 'Inclusion policy'.*

All Disadvantaged children will be set half-termly targets using the Progression of Skills tracking document. These will be monitored by the Senior Leadership Team. Teachers should use their professional judgement to identify which steps are essential in order to achieve age-related expectation. These targets should be evident in the planning. Children's workbooks will evidence how these gaps have been diminished.

## **All children**

*For additional guidance, please check in accordance with the 'Assessment policy'.*

At the end of each term, teachers will upload their assessments to Target Tracker. These will be based on a variety of sources but predominantly be sourced from the teacher's assessments and observations. All children will have opportunities to work independently on their maths. These will be indicated with an 'I' to show it is independent work, which should cover the fluency, reasoning and problem solving aspects of the 2014 Maths curriculum. At the end of each term, each child will complete a White Rose reasoning and arithmetic assessment. This is to ensure children are familiar with test procedure and give teachers additional evidence to use in their assessment.

After each half-termly or termly assessment, the strengths and weaknesses of pupils in each class will be analysed by the class teacher. This analysis is then fed to the Maths leader who will identify

strengths and weaknesses in the teaching of maths across the school, and arrange corresponding CPD workshops.

In addition, the areas of weakness within a particular class will form the base of the term's/half-term's maths targets. These targets will be either taken from a prior assessment or from a specifically-designed pre-assessment, mid-term assessed and assessed at the end of the chosen length of time for the targets. The teacher will update these targets using AfL within the maths sessions. The teacher must integrate these class foci into the learning journey and ensure that workshops diminish the gaps.

### **Maths targets at home- please refer to the Homework Policy**

For Year R, **TO COMPLETE**

For **Year 1** and 2, every child has a 'Maths at Home' target. This is a target to improve their speed and accuracy with mental maths. Strong mental maths is a key foundation to making progress in all areas of maths. The stages are Life in the Sea, Live in the Savannah and the Super Maths Challenges.

From Year 2 to Year 6, the school have invested in providing all children with a Times Tables Rockstar account (link: <https://trockstars.com/>)

It is expected that children are set the appropriate tables linked to their learning requirement. Teachers will set weekly homework to ensure that they are learning their tables at home using Times Tables Rockstars at least three times a week. The progress of the children will be monitored by the teachers and additional support given when required. Teachers will ensure they are monitoring their class regularly and will offer support or guidance to those children who are not learning their tables every week. The maths lead conducts a half-termly celebration collective worship where children's progress and outcomes are celebrated. This includes being the fastest mathematicians, most accurate mathematicians, the most hard-working mathematicians or the best improved mathematicians.

### **Judging Age-Expectation and Moderating Maths**

Ofsted guidance for assessment states that evidence must indicate that:

- students are making progress which is appropriate for their age and ability and that students are sufficiently challenged
- develop an assessment system that is consistent with their own curriculum and supports effective teaching and learning in their school
- data must be succinct and effective
- Ofsted will make allowances for schools who are at different stages in developing a new approach following the removal of levels

A range independent maths tasks will be used to make an overall maths judgement. The evidence must be robust, reliable and recent. The majority of evidence should be taken within the last term to ensure the child still understands and can apply the skills. However, where required, teachers can use evidence from a previous unit, for example where the aspect of maths has not been returned to.

## **Pupil views in maths**

The pupils will be asked regularly - what makes their learning in maths so successful. This can be done orally or through a written survey. The Maths Leader will analyse and report to staff and governors on the children's perception of their learning in maths. This information will support the termly RAP.

## **Leadership of Maths**

### **The role of the Maths Leader (see Maths leadership overview)**

- Should have a clearly communicated and ambitious vision for maths, securely based on accurate evaluation of the school's strengths in writing and areas to develop.
- Should be relentless in ensuring that the maths in the school follows this policy, which will result in greater consistency in the teaching and learning for maths.
- Undertake regular monitoring activities for maths ( observe writing lessons, pupil conference, data analysis, work sample etc)
- Provide self-evaluation for maths each term and support termly RAP.
- Liaison within cluster
- To make links with maths across the curriculum.

This policy will be reviewed every 2 years or sooner as appropriate.

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