Mathematics Calculation Policy

Revised January 2023 (draft)

"Mathematical proficiency requires a focus on core knowledge and procedural fluency so that pupils can carry out mathematical procedures flexibly, accurately, consistently, efficiently and appropriately. Procedures and understanding are developed in tandem."
NCETM 2014

How we teach mathematics

Mathematics Policy

At Eastfield Infants' and Nursery Academy and Lacey Gardens Junior Academy we recognise that mathematics is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. Therefore, we recognise the importance of a high quality mathematics curriculum. The following policy guides the planning, teaching and assessment of the subject.

This policy should be read in conjunction with other policies and documentation including:

- Curriculum
- Teaching and Learning
- Academic Guidance
- Assessment
- Target Setting
- Intervention
- Equal Opportunities
- School progressions for calculation.
- Linked Learning
- Marking and feedback

Intent

Here at Laceyfield Louth, we believe mathematics is an essential element of everyday life and that mathematical thinking supports learning across the curriculum. We deliver mathematics in a way to fuel our children with the knowledge and understanding to make progress in their learning. As children progress through the school, we aspire for all children to make sense of numbers and patterns in the world around them and discover new connections. They will learn to explain their thinking and become more able to manipulate mathematical ideas to be able to solve problems. We want our children to understand the value of mathematics in life beyond school (in our economy, society and culture) and to know how to use it as a tool in life. We aspire for all children to be confident to recall key facts that help support learning in real-life contexts and across different subject areas.

We believe language is the key to success. We want our children to say, 'I can do that' and 'I can find a solution' because they are resilient and confident in their mathematical ability.

Purpose

The aims of Mathematics are:

- to promote enjoyment and enthusiasm for learning through practical activity, exploration and discussion
- for children to become **fluent** in the fundamentals of mathematics so that they are able to recall and apply their knowledge rapidly and accurately
- for children to be able to **reason mathematically** by following a line of enquiry, hypothesising about relationships and generalisations, and developing an argument, justification or proof using mathematical language
- for children to be able to **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication
- for children to be able to demonstrate and develop effective learning behaviours such as: perseverance, collaboration, questioning and organisation
- to develop children's understanding of the importance of Mathematics in everyday life

Our Aims:

- Consistency across school
- Ensure full coverage of the curriculum – depth and breadth
- A cyclical approach to teaching maths – children can build on previous skills
- Children enjoy doing maths
- Every child CAN succeed – 'Positive Mindset'
- Children who can articulate about maths – fluent mathematicians!
- Mathematical vocabulary based
- Creative curriculum
- Children are prepared for tests (End of Key Stage tests and Year 4 times table test)
- Sticky learning – children don't forget previously taught learning
- Use of CPA across school

- Fluency, thinking, conceptual understanding, procedural understanding and problem solving – basically skills for life!

Teaching and Learning

Mathematics is taught as a discrete lesson every day. In KS2, we follow the 'same day intervention approach', whereby teachers deliver the input, the children answer 6/7 diagnostic questions, the questions are marked whilst the children are in assembly and after, the intervention or deeper thinking tasks will take place. Where possible, all children engage in the objectives specified in the National Curriculum for their year group. Where this is not possible, teachers are expected to differentiate appropriately.

<u>In KS1 each maths lesson looks like…</u>

1. Quick maths (for fluency and facts)
2. Learning cycle including steps to success
3. Independent task - mixture of varied fluency, problem solving and reasoning
4. Demo and review
5. Same Day Intervention / Deeper thinking task– It's not a catch up, it's a keep up!

<u>In KS2 each maths lesson looks like…</u>

1. Quick maths (for fluency and facts)
2. Learning cycle including steps to success
3. Diagnostic task – mixture of varied fluency, problem solving and reasoning
4. Same Day Intervention / Deeper thinking task– It's not a catch up, it's a keep up!

The fundamentals

- ✓ A belief that every child can and will achieve mastery
- ✓ Bespoke Laceyfield medium term plan
- ✓ A focus on task design – everything is done on purpose
- ✓ Blue partner/ Green Partner
- ✓ Quick maths for fluency
- ✓ Knowledge organisers for each unit
- ✓ Same Day Intervention (KS2)
- ✓ All children will reason and problem solve
- ✓ Whole Class Choral Response
- ✓ Learning question and steps to success (created with the class)
- ✓ No ability groupings
- ✓ S planning
- ✓ Conceptual and procedural variation
- ✓ Demo and review phase
- ✓ Up-to-date working walls
- ✓ Concrete – Pictorial – Abstract
- ✓ Use of resources including pictorial in all year groups
- ✓ A focus on 'grown up mathematical' vocabulary
- ✓ Pace, productivity, progress
- ✓ Bar modelling

  Children use Times Tables Rockstars

Planning

- Teachers use the Laceyfield Bespoke medium term plans alongside the Ready to Progress Criteria**.** This highlights when each strand should be taught throughout the year. This plan provides adequate time to be spent on each unit in order for children to achieve depth.

- We also believe in a cyclical approach to teaching maths as we strongly believe children learn best when small steps are continuously revisited, built on and deepened. Therefore, most units are revisited in the summer term.
- The Ready To Progress document is used to inform planning and ensure the curriculum is prioritised
- Teachers use Whiterose to break each objective down into small steps.
- A large range of resources are used from various websites including NCETM, I See Reasoning, Whiterose, Classroom Secrets and Master the Curriculum in order to design tasks to suit the children's needs.
- Short term planning will be flexible and responsive to the children's needs that are identified through every day formative assessment - this is usually done in the form of a 'S-Plan.'
- When introducing a new concept to children in all year groups it is important that teachers use the following planning cycle, where applicable: 1) Practical exploration of the concept with resources. 2) Visual representations used to aid the transition from practical to written activities. 3) Abstract application. 4) Opportunities to reason with and apply the new skills learnt in an unfamiliar or challenging context.
- Although mental maths tests have been removed from the Year 6 assessments, mental capabilities are still vital for expected arithmetic standards set out within the National Curriculum. This should be reflected in mental maths teaching within lessons (quick maths).

Teaching

1. With an increased emphasis on written calculation within the National Curriculum, it is important that teachers consistently follow agreed progressions for the teaching of calculation and that the method for written calculation is developed alongside the use of practical resources (e.g. straws and counters) to ensure a secure conceptual understanding.
2. Resources to support children should be available in every classroom and the children should be taught how to self-select equipment that could support their learning.
3. Teachers should adopt a flexible grouping policy which either utilises mixed ability partners or partners who have been matched to the specific lesson and previous assessment.
4. Teaching Assistants should contribute to the children's learning within the lesson in the way identified on the teacher's planning.
5. Staff will all have high expectations of all children and ensure that they are challenged at an appropriate level and that they can achieve their full potential.
6. Each classroom should have a maths 'working wall' which will be updated regularly. Items on the wall should help to support children with independent learning and could include: Reminders about key vocabulary, a WAGOLL of how to solve a particular problem, steps to success, examples of children's successful work, celebration of mistakes or evidence of the learning journey completed throughout a lesson or maths unit.

Key Vocabulary

It is important that teachers model correct mathematical language and use this at all times.
The four mathematical operations should be referred to as ‘addition’, ‘subtraction’, ‘multiplication’ and ‘division’. There are two models of subtraction, take-away and difference, and two models of division, sharing and grouping. It is important that children understand the distinction between these models.
‘Borrowing’ is an incorrect term to use when referring to the exchanging of digits when completing column subtraction as it implies that the digit will be given back. The process is known as ‘exchange’ and the correct terminology must be used.
‘Carrying’ of digits is correct terminology when referring to formal written methods and must be used.
The Key Stage 1 and 2 Programmes of Study for Maths details the formal written methods of columnar addition and subtraction, long and short multiplication and long and short division in appendix 1.
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/335158/PRIMARY_national_curriculum_-_Mathematics_220714.pdf

Assessment

Maths is assessed regularly through various means.

Teachers gather ongoing evidence during lessons, through the use of assessment for learning techniques, observations and marking and feedback which contributes to their assessment of children against the criteria set out in the National Curriculum which demonstrates the age-related expectations for each year group. In KS2, we also assess children every term using Whiterose Maths end of unit formal assessments. They formalise these assessments at key assessment points by completing a point in time assessment criteria sheet for each child, supported by the delivery of progress tests in Maths and teacher assessments. In KS1, cold tasks are used to support teacher assessments alongside fluency based quick maths activities. The amount of criteria the child is successfully demonstrating, with secure application, translates into an overall judgement which gives a view of how well the child is progressing towards meeting age-related expectations and / or their individual targets (see assessment policy for more detailed information).

Cross Curricular Learning

We are strong believers that the Eastfield Infants' and Nursery Academy and Lacey Gardens Junior Academy Curriculum should equip children for real life. We therefore aim to integrate measure and statistics into our 'topiclearning' where possible. This ensures that the maximum amount of time is spent rehearsing, using and applying the skills learned in core subjects in order that these are secure and well embedded for children who in turn grow to appreciate the transference and, crucially, the importance of these skills.

Monitoring and Review

The mathematics leaders have a responsibility for monitoring the standard of the children's work and the quality of the teaching in mathematics. The mathematics leaders are also responsible for supporting colleagues in the teaching of Mathematics, for being informed about current developments in the subject and for providing a strategic lead and direction for the subject in the school. The mathematics leaders will keep an up to date record of the subject policy, causal chains, an action plan for improving the subject, relevant and analysed school data, evidence of subject monitoring and any other information relevant to the subject or role. Once per term we allocate special time for the vital task of monitoring and evaluation as part of school self-evaluation procedures.

Progression in Mental Calculation

These objectives have been adapted from 'Teaching Children to Calculate Mentally' (2010), which was based on the old primary frameworks so additional elements from the 2014 curriculum have been included.

Addition and Subtraction

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 1 • number pairs with a total of 10, e.g. 3 + 7, or what to add to a single-digit number to make 10, e.g. 3 + ☐= 10 • addition facts for totals to at least 5, e.g. 2 + 3, 4 + 3 • addition doubles for all numbers to at least 10, e.g. 8 + 8	• add or subtract a pair of single-digit numbers, e.g. 4 + 5, 8 – 3 • add or subtract a single-digit number to or from a teens number, e.g. 13 + 5, 17 – 3 • add or subtract a single-digit to or from 10, and add a multiple of 10 to a single-digit number, e.g. 10 + 7, 7 + 30	• reorder numbers when adding, e.g. put the larger number first • count on or back in ones, twos or tens • partition small numbers, e.g. 8 + 3 = 8 + 2 + 1 • partition and combine tens and ones

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 2 • addition and subtraction facts for all numbers up to at least 10, e.g. 3 + 4, 8 – 5 • addition and subtraction facts for all numbers to 20 fluently, e.g. 13 + 4, 18 - 7 • number pairs with totals to 20 • all pairs of multiples of 10 with totals up to 100, e.g. 30 + 70, or 60 + ☐= 100 • what must be added to any two-digit number to make the next multiple of 10, e.g. 52 + ☐= 60 • addition doubles for all numbers to 20, e.g. 17 + 17 and multiples of 10 to 50, e.g. 40 + 40	• add or subtract a pair of single-digit numbers, including crossing 10, e.g. 5 + 8, 12 – 7 • add any single-digit number to or from a multiple of 10, e.g. 60 + 5 • subtract any single-digit number from a multiple of 10, e.g. 80 – 7 • add or subtract a single-digit number to or from a two-digit number, including crossing the tens boundary, e.g. 23 + 5, 57 – 3, then 28 + 5, 52 – 7 • add or subtract a multiple of 10 to or from any two-digit number, e.g. 27 + 60, 72 – 50 • add 9, 19, 29, … or 11, 21, 31, … • subtract mentally a two-digit number from another two-digit number when there is no regrouping required (e.g. 74 − 33) • add three single digit numbers eg 6 + 1 + 4	• reorder numbers when adding • partition: bridge through 10 and multiples of 10 when adding and subtracting • partition and combine multiples of tens and ones • use knowledge of pairs making 10 • partition: count on in tens and ones to find the total • partition: count on or back in tens and ones to find the difference • partition: add a multiple of 10 and adjust by 1

Year 3 • addition and subtraction facts for all numbers to 20, e.g. 9 + 8, 17 – 9, drawing on knowledge of inverse operations • sums and differences of multiples of 10, e.g. 50 + 80, 120 – 90 • pairs of two-digit numbers with a total of 100, e.g. 32 + 68, or 32 + □ = 100 • addition doubles for multiples of 10 to 100, e.g. 90 + 90	• add and subtract groups of small numbers, e.g. 5 – 3 + 2 • add or subtract a two-digit number to or from a multiple of 10, e.g. 50 + 38, 90 – 27 **• add or subtract any pair of two-digit numbers, including crossing the tens and 100 boundary, e.g. 47 + 58, 91 – 35** (from Y4) *• add and subtract numbers mentally, including:* *o a three-digit number and ones* *o a three-digit number and tens* *o a three-digit number and hundreds*	•count on or back in hundreds, tens, ones, tenths **• reorder numbers when adding** **• identify pairs totalling 10 or multiples of 10** **• partition: add tens and ones separately, then recombine** **• partition: count on in tens and ones to find the total** **• partition: count on or back in tens and ones to find the difference** **• partition: add or subtract 10 or 20 and adjust** **• partition: count on or back in minutes and hours, bridging through 60 (analogue times)**

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 4 • sums and differences of pairs of multiples of 10, 100 or 1000 • addition doubles of numbers 1 to 100, e.g. 38 + 38, and the corresponding halves • what must be added to any three-digit number to	**• add or subtract a near multiple of 10, e.g. 56 + 29, 86 – 38** • find a small difference by counting up, e.g. 72 – 68, 211 - 196 **• add or subtract two-digit or three-digit multiples of 10, e.g. 120 – 40, 140 + 150, 370 – 180** • add or subtract a near multiple of 10 or 100 to any two-digit or three-digit number, e.g. 235 + 198 (from Y5) • add or subtract a pair of two-digit numbers or three-digit multiples of 10, e.g. 38 + 86, 620 – 380, 350+ 360 (from Y5)	• count on or back in hundreds, tens, ones, tenths and hundredths • partition: add tens and ones separately, then recombine • partition: subtract tens and then ones, e.g. subtracting 27 by subtracting 20 then 7 • subtract by counting up from the smaller to the larger number

make the next multiple of 100, e.g. 521 + □ = 600 • pairs of fractions that total 1		• partition: add or subtract a multiple of 10 and adjust, e.g. 56 + 29 = 56 + 30 – 1, or 86 – 38 = 86 – 40 + 2 • partition: double and adjust • use knowledge of place value and related calculations, e.g. work out 140 + 150 = 290 using 14 + 15 = 29 • partition: count on or back in minutes and hours, bridging through 60 (analogue and digital times)
Year 5 • sums and differences of decimals, e.g. 6.5 + 2.7, 7.8 – 1.3 • doubles and halves of decimals, e.g. half of 5.6, double 3.4 • what must be added to any four-digit number to make the next multiple of 1000, e.g. 4087 + □= 5000 • what must be added to a decimal with units and tenths to make the next whole number, e.g. 7.2 + □= 8	• find the difference between near multiples of 100, e.g. 607 – 588, or of 1000, e.g. 6070 – 4087 • add or subtract any pairs of decimal fractions each with units and tenths, e.g. 5.7 + 2.5, 6.3 – 4.8 • add or subtract a near multiple of 10 or 100 to any three-digit or four-digit number, e.g. 235 + 198 • add or subtract a multiple of 10, 100 or 1000 to a four or five-digit number, not crossing boundary, e.g. 12,462 - 2300	• count on or back in hundreds, tens, ones and tenths • partition: add hundreds, tens or ones separately, then recombine • subtract by counting up from the smaller to the larger number • add or subtract a multiple of 10 or 100 and adjust • partition: double and adjust • use knowledge of place value and related calculations, e.g. 6.3 – 4.8 using 63 – 48 • partition: count on or back in minutes and hours, bridging through 60 (analogue and digital times)

Recall:	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:**

Children should be able to derive and recall:		Children should understand when to and be able to apply these strategies:
Year 6 • addition and subtraction facts for multiples of 10 to 1000 and decimal numbers with one decimal place, e.g. 650 + □ = 930, □– 1.4 = 2.5 • what must be added to a decimal with units, tenths and hundredths to make the next whole number, e.g. 7.26 + □= 8	• add or subtract pairs of decimals with units, tenths or hundredths, e.g. 0.7 + 3.38 • find doubles of decimals each with units and tenths, e.g. 1.6 + 1.6 • add near doubles of decimals, e.g. 2.5 + 2.6 • add or subtract a decimal with units and tenths, that is nearly a whole number, e.g. 4.3 + 2.9, 6.5 – 3.8 •Calculate mentally, using efficient strategies such as manipulating expressions using commutative and distributive properties to simplify the calculation (e.g. 53 – 82 + 47 = 53 + 47 – 82 = 100 – 82 = 18) •Use their knowledge of the order of operations to carry out calculations involving the 4 operations, e.g. 4 x 2 + 3 x 5	• count on or back in hundreds, tens, ones, tenths and hundredths • use knowledge of place value and related calculations, e.g. 680 + 430, 6.8 + 4.3, 0.68 + 0.43 can all be worked out using the related calculation 68 + 43 • use knowledge of place value and of doubles of two-digit whole numbers • partition: double and adjust • partition: add or subtract a whole number and adjust, e.g. 4.3 + 2.9 = 4.3 + 3 – 0.1, 6.5 – 3.8 = 6.5 – 4 + 0.2 • partition: count on or back in minutes and hours, bridging through 60 (analogue and digital times, 12-hour and 24-hour clock)

Multiplication and Division

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 1 • doubles of all numbers to 10, e.g. double 6 • odd and even numbers to 20	• count on from and back to zero in ones, twos, fives or tens	• use patterns of last digits, e.g. 0 and 5 when counting in fives
Year 2 • doubles of all numbers to 20, e.g. double 13, and corresponding halves • doubles of multiples of 10 to 50, e.g. double 40, and corresponding halves • multiplication facts for the 2, 5 and 10 times-tables, and corresponding division facts • odd and even numbers to 100	• double any multiple of 5 up to 50, e.g. double 35 • halve any multiple of 10 up to 100, e.g. halve 90 • find half of even numbers to 40 • find the total number of objects when they are organised into groups of 2, 5 or 10	• partition: double the tens and ones separately, then recombine • use knowledge that halving is the inverse of doubling and that doubling is equivalent to multiplying by two • use knowledge of multiplication facts from the 2, 5 and 10 times-tables, e.g. recognise that there are 15 objects altogether because there are three groups of five

Year 3 • multiplication facts for the 2, 3, 4, 5, 8 and 10 times-tables, and corresponding division facts • doubles of multiples of 10 to 100, e.g. double 90, and corresponding halves	• double any multiple of 5 up to 100, e.g. double 35 • halve any multiple of 10 up to 200, e.g. halve 170 • multiply one-digit or two-digit numbers by 10 or 100, e.g. 7 × 100, 46 × 10, 54 x 100 • find unit fractions of numbers and quantities involving halves, thirds, quarters, fifths and tenths • double any two-digit number, e.g. double 39 (from Y4) • multiply a multiple of 10 to 100 by a single-digit number (linked to the tables they know), e.g. 40 × 3 (from Y4) • multiplication and division facts (for example, using 3 × 2 = 6, 6 ÷ 3 = 2 and 2 = 6 ÷ 3) to derive related facts (for example, 30 × 2 = 60, 60 ÷ 3 = 20 and 20 = 60 ÷ 3).	• partition: when doubling, double the tens and ones separately, then recombine • partition: when halving, halve the tens and ones separately, then recombine • use knowledge that halving and doubling are inverse operations • recognise that finding a unit fraction is equivalent to dividing by the denominator and use knowledge of division facts • recognise that when multiplying by 10 or 100 the digits move one or two places to the left and zero is used as a place holder •Using doubling, they connect the 2, 4 and 8 multiplication tables. • use knowledge of multiplication facts and place value, e.g. 7 x 8 = 56 to find 70 x 8, 7 x 80 (from Y4)

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 4 • multiplication facts to 12 × 12 and the corresponding division facts • doubles of numbers 1 to 100, e.g. double 58, and corresponding halves	• double any multiple of 10 or 100, e.g. double 340, double 800, and halve the corresponding multiples of 10 and 100 • halve any even number to 200 • find unit fractions and simple non-unit fractions of numbers and quantities, e.g. 3/8 of 24 • multiply and divide numbers to 1000 by 10 and then 100 (whole-number answers), e.g. 325 × 10, 42 × 100, 120 ÷ 10, 600 ÷ 100, 850 ÷ 10 • multiply numbers to 20 by a single-digit, e.g. 17 × 3	• use understanding that when a number is multiplied or divided by 10 or 100, its digits move one or two places to the left or the right and zero is used as a place holder • use partitioning and the distributive law to multiply, e.g.13 × 4 = (10 + 3) × 4 = (10 × 4) + (3 × 4) = 40 + 12 = 52

• doubles of multiples of 10 and 100 and corresponding halves • fraction and decimal equivalents of one-half, quarters, tenths and hundredths, e.g. 3/10 is 0.3 and 3/100 is 0.03 • factor pairs for known multiplication facts	• identify the remainder when dividing by 2, 5 or 10 • give the factor pair associated with a multiplication fact, e.g. identify that if 2 x 3 = 6 then 6 has the factor pair 2 and 3 •multiply together three numbers	•combine their knowledge of number facts and rules of arithmetic to solve mental and written calculations for example, 2 x 6 x 5 = 10 x 6 = 60. •Pupils practise mental methods and extend this to three-digit numbers to derive facts, (for example 600 ÷ 3 = 200 can be derived from 2 x 3 = 6).

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 5 • squares to 12 × 12 • division facts corresponding to tables up to 12 × 12, and the related unit fractions, e.g. 7 × 9 = 63 so one-ninth of 63 is 7 and one-seventh of 63 is 9 • decimal and percentage equivalents of one-half, one-quarter, three-quarters, tenths and hundredths • factor pairs to 100 •**p**rime numbers up to 20.	• multiply and divide two-digit numbers by 4 or 8, e.g. 26 × 4, 96 ÷ 8 • multiply two-digit numbers by 5 or 20, e.g. 320 × 5, 14 × 20 • multiply by 25 or 50, e.g. 48 × 25, 32 × 50 • double three-digit multiples of 10 to 500, e.g. 380 × 2, and find the corresponding halves, e.g. 760 ÷ 2 • find the remainder after dividing a two-digit number by a single-digit number, e.g. 27 ÷ 4 = 6 R 3 • multiply and divide whole numbers and decimals by 10, 100 or 1000, e.g. 4.3 × 10, 0.75 × 100, 25 ÷ 10, 673 ÷ 100, 74 ÷ 100 • multiply pairs of multiples of 10, e.g. 60 × 30, and a multiple of 100 by a single digit number, e.g. 900 × 8 • divide a multiple of 10 by a single-digit number (whole number answers) e.g. 80 ÷ 4, 270 ÷ 3 • find fractions of whole numbers or quantities, e.g. 23 of 27, 45 of 70 kg • find 50%, 25% or 10% of whole numbers or quantities, e.g. 25% of 20 kg, 10% of £80	• multiply or divide by 4 or 8 by repeated doubling or halving • form an equivalent calculation, e.g. to multiply by 5, multiply by 10, then halve; to multiply by 20, double, then multiply by 10 • use knowledge of doubles/halves and understanding of place value, e.g. when multiplying by 50 multiply by 100 and divide by 2 • use knowledge of division facts, e.g. when carrying out a division to find a remainder • use understanding that when a number is multiplied or divided by 10 or 100, its digits move one or two places to the left or the right relative to the decimal point, and zero is used as a place holder

	• find factor pairs for numbers to 100, e.g. 30 has the factor pairs 1 × 30, 2 × 15, 3 × 10 and 5 × 6	• use knowledge of multiplication and division facts and understanding of place value, e.g. when calculating with multiples of 10 • use knowledge of equivalence between fractions and percentages, e.g. to find 50%, 25% and 10% • use knowledge of multiplication and division facts to find factor pairs

Recall: **Children should be able to derive and recall:**	**Mental calculation skills:** **Working mentally, with jottings if needed, children should be able to:**	**Mental methods or strategies:** **Children should understand when to and be able to apply these strategies:**
Year 6 • squares to 12 × 12 • squares of the corresponding multiples of 10 • equivalent fractions, decimals and percentages for hundredths, e.g. 35% is equivalent to 0.35 or 35/100	• multiply pairs of two-digit and single-digit numbers, e.g. 28 × 3 • divide a two-digit number by a single-digit number, e.g. 68 ÷ 4 • divide by 25 or 50, e.g. 480 ÷ 25, 3200 ÷ 50 • double decimals with units and tenths, e.g. double 7.6, and find the corresponding halves, e.g. half of 15.2 • multiply pairs of multiples of 10 and 100, e.g. 50 × 30, 600 × 20 • divide multiples of 100 by a multiple of 10 or 100 (whole number answers), e.g. 600 ÷ 20, 800 ÷ 400, 2100 ÷ 300 • multiply and divide two-digit decimals such as 0.8 × 7, 4.8 ÷ 6 • find 10% or multiples of 10%, of whole numbers and quantities, e.g. 30% of 50 ml, 40% of £30, 70% of 200 g • simplify fractions by cancelling • identify numbers with odd and even numbers of factors and no factor pairs other than 1 and themselves	• partition: use partitioning and the distributive law to divide tens and ones separately, e.g.92 ÷ 4 = (80 + 12) ÷ 4 = 20 + 3 = 23 • form an equivalent calculation, e.g. to divide by 25, divide by 100, then multiply by 4; to divide by 50, divide by 100, then double • use knowledge of the equivalence between fractions and percentages and the relationship between fractions and division • recognise how to scale up or down using multiplication and division, e.g. if three oranges cost 24p:one orange costs 24 ÷ 3 = 8p four oranges cost 8 × 4 = 32p • Use knowledge of multiplication and division facts to identify factor pairs and numbers with only two factors

Progression in written calculations

Each strategy is first taught through concrete representations before moving on to pictorial and then abstract representations. This will ensure that pupils develop depth of understanding. However, if a pupil is struggling with an abstract or pictorial representation when they move onto a new stage of calculation (e.g. progressing from using column subtraction for whole numbers to decimals), they should be moved back to an abstract or pictorial representation to support their understanding before returning to the abstract. Concrete and pictorial representations should be used in all age groups.

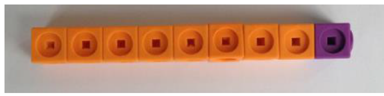
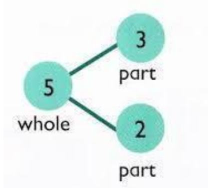
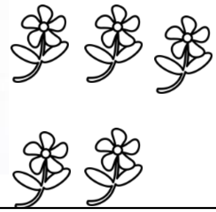
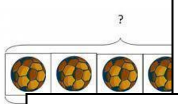
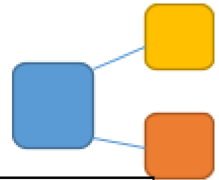
Calculation strategies – matched to year group expectations.

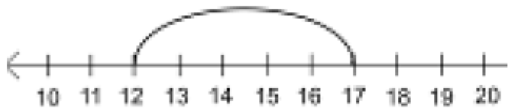
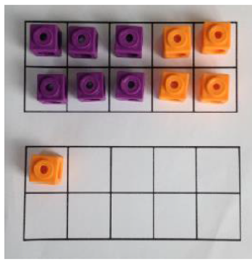
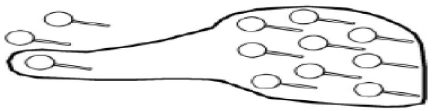
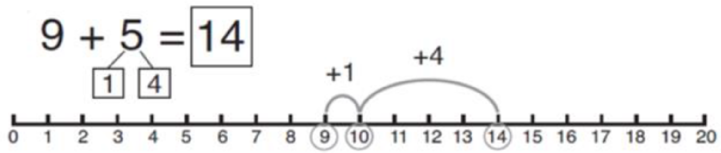
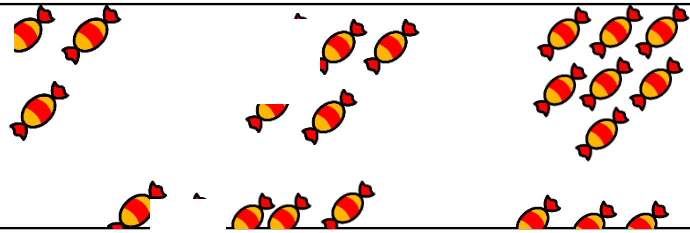
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Addition	Combining two parts to make a whole: part whole model. Starting at the bigger number and counting on. Regrouping to make 10.	Adding three single digits. Column method – grouping and regrouping. Use concrete and pictorial representations with base 10. No abstract representations in Y2.	Column method-regrouping. (up to 3 digits)	Column method-regrouping. (up to 4 digits)	Column method-regrouping. (with more than 4 digits) (Decimals- with the same amount of decimal places)	Column method-regrouping. (Decimals- with different amounts of decimal places)

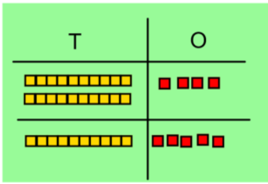
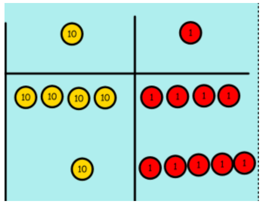
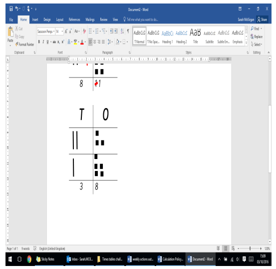
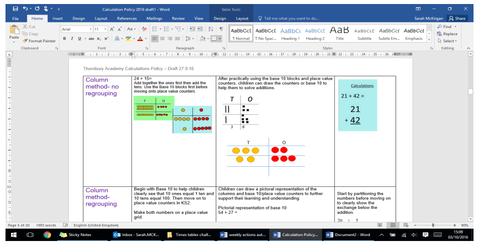
Subtraction	Taking away ones Counting back Find the difference Part whole model Make 10	Counting back Find the difference Part whole model Make 10 Column method – grouping and regrouping. Use concrete and pictorial representations with base 10. No abstract representations in Y2.	Column method with regrouping. (up to 3 digits)	Column method with regrouping. (up to 4 digits)	Column method with regrouping. (with more than 4 digits) (Decimals- with the same amount of decimal places)	Column method with regrouping. (Decimals- with different amounts of decimal places)
Multiplication	Doubling Counting in multiples Arrays (with support)	Doubling Counting in multiples Repeated addition Arrays- showing commutative multiplication	Counting in multiples Repeated addition Arrays- showing commutative multiplication Grid method	Column multiplication (2 and 3 digit multiplied by 1 digit)	Column multiplication (up to 4 digit numbers multiplied by 1 or 2 digits)	Column multiplication (multi digit up to 4 digits by a 2 digit number, this includes a decimal number multiplied by a whole number).
Division	Sharing objects into groups Division as grouping	Division as grouping Division within arrays	Division within arrays Division with a remainder Short division (2 digits by 1 digit- concrete and pictorial)	Division within arrays Division with a remainder Short division (up to 3 digits by 1 digit)	Short division (up to 4 digits by a 1 digit number interpret remainders appropriately for the context)	Short division Long division (up to 4 digits by a 2 digit number- interpret remainders as whole numbers, fractions or round)

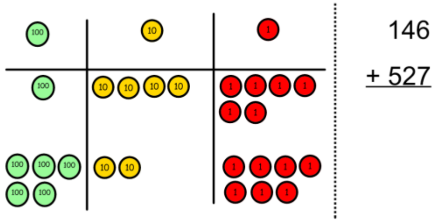
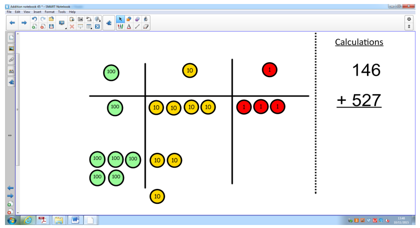
Progression in Calculations

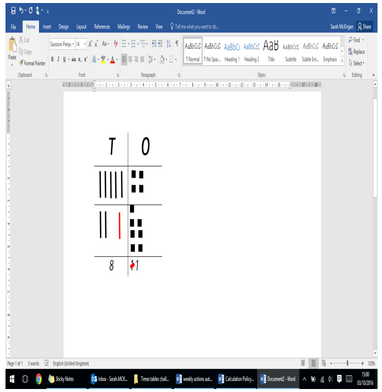
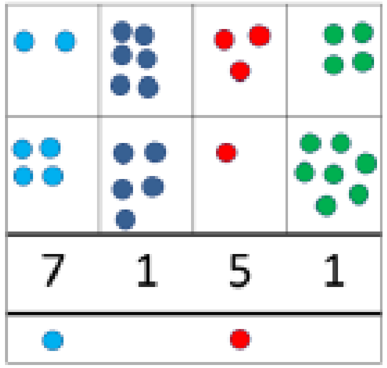
Addition

Objective and Strategies	Concrete	Pictorial	Abstract
ning two parts to make a whole: part- whole model	  	   	4 + 3 = 7 10= 6 + 4 

Starting at the bigger number and counting on	 Start with the larger number on the bead string and then count on to the smaller number 1 by 1 to find the answer.	12 + 5 = 17  Start at the larger number on the number line and count on in ones or in one jump to find the answer.	5 + 12 = 17 Place the larger number in your head and count on the smaller number to find your answer
Regrouping to make 10.	6 + 5 = 11  Start with the bigger number and use the smaller number to make 10.	 up or partition the 3 + 9 =  	7 + 4= 11 If I am at seven, how many more do I need to make 10. How many more do I add on now?
Adding three single digits	4 + 7 + 6= 17 Put 4 and 6 together to make 10. Add on 7.		

	 Following on from making 10, make 10 with 2 of the digits (if possible) then add on the third digit.		4 + 7 + 6 = $\boxed{10}$ + $\boxed{7}$ 10 = $\boxed{17}$ Combine the two numbers that make 10 and then add on the remainder.
Column method- no regrouping	24 + 15= Add together the ones first then add the tens. Use the Base 10 blocks first before moving onto place value counters.  	After practically using the base 10 blocks and place value counters, children can draw the counters or base 10 to help them to solve additions.  	Calculations 21 + 42 = 21 + 42
Column method- regrouping	Begin with Base 10 to help children clearly see that 10 ones equal 1 ten and 10 tens equal 100. Then move on to place value counters in KS2.	Children can draw a pictoral representation of the columns and base 10/place value counters to further support their learning and understanding. Pictorial representation of base 10	Start by partitioning the numbers before moving on to clearly show the exchange below the addition.

<table>
<tr>
<td></td>
<td>Make both numbers on a place value grid.

Add up the units and exchange 10 ones for one 10.

Add up the rest of the columns, exchanging the 10 counters from one column for the next place value column until every column has been added.

As children move on to decimals, money and decimal place value counters can be used to support learning.</td>
<td>54 + 27 =

Pictorial representation of place value counters
2634 + 4517 =
</td>
<td>20 + 5
40 + 8
60 + 13 = 73

536
+ 85
621
1 1

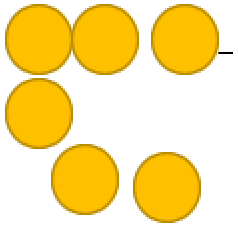
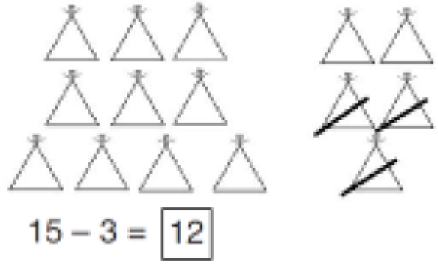
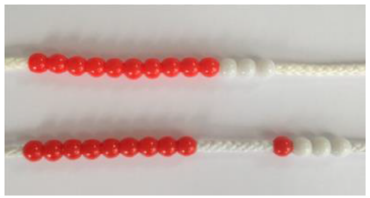
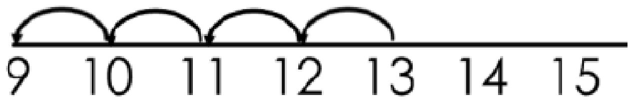
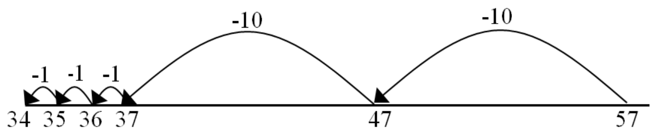
As the children move on, introduce decimals with the same number of decimal places and different. Money can be used here.

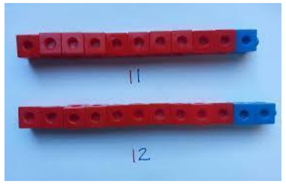
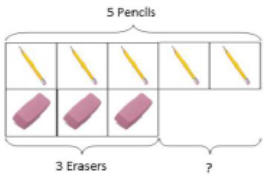
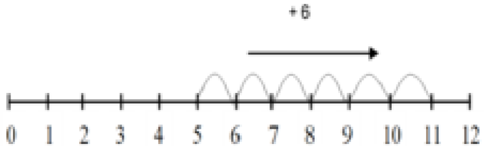
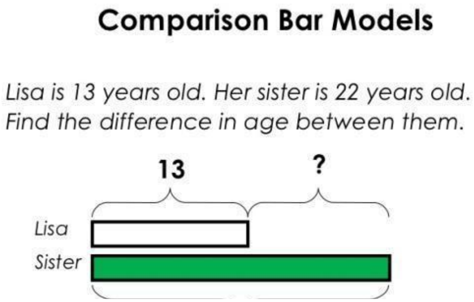
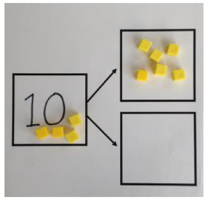
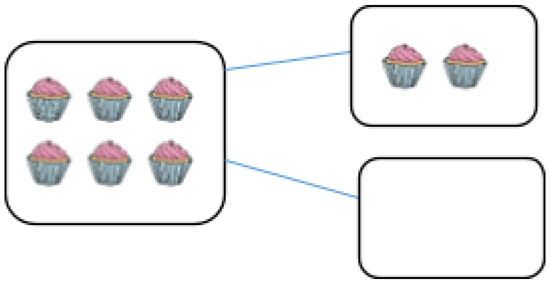
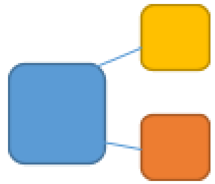
72.8
+ 54.6
127.4
1 1

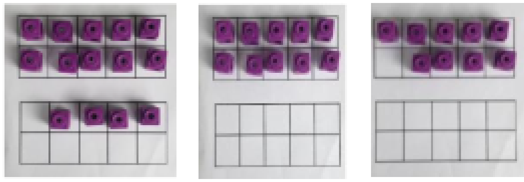
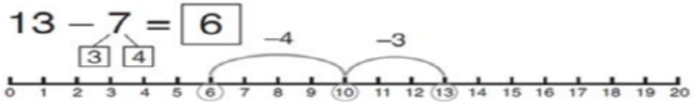
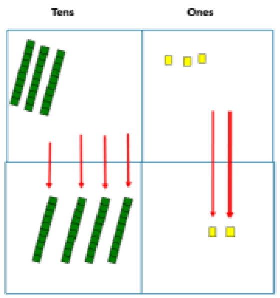
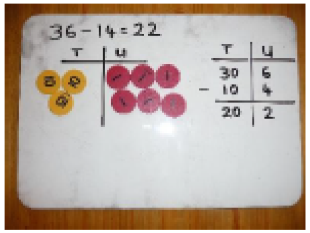
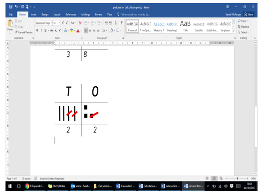
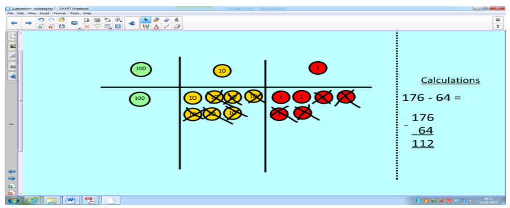
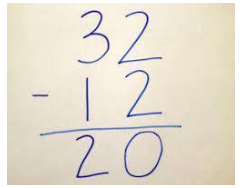
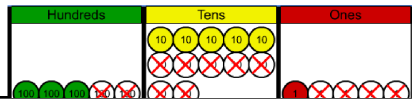
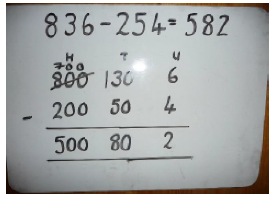
2 3 . 5 9
7 . 5 5
3 1 . 1 4
1 1 1

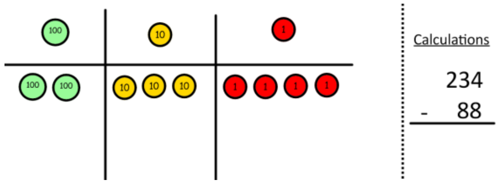
2 3 . 3 6 1
9 . 0 8 0
5 9 . 7 7 0
+ 1 . 3 0 0
9 3 . 5 1 1
2 1 2</td>
</tr>
</table>

Subtraction

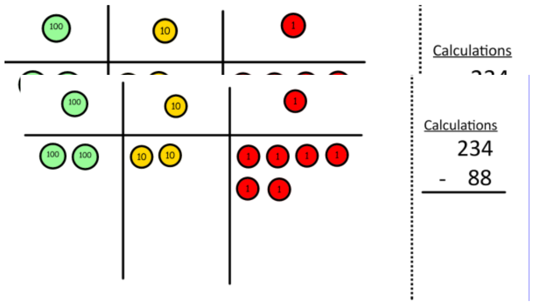
Objective and Strategies	Concrete	Pictorial	Abstract
away ones	Use physical objects, counters, cubes etc to show how objects can be taken away.  – 2 = 4 	Cross out drawn objects to show what has been taken away. 	18 -3= 15 8 – 2 = 6
Counting back	Make the larger number in your subtraction. Move the beads along your bead string as you count backwards in ones. 13 – 4  Use counters and move them away from the group as you take them away counting backwards as you go. 	Count back on a number line or number track  Start at the bigger number and count back the smaller number showing the jumps on the number line.  This can progress all the way to counting back using two 2 digit numbers.	Put 13 in your head, count back 4. What number are you at? Use your fingers to help.

Find the difference	Compare amounts and objects to find the difference.  Use cubes to build towers or make bars to find the difference  Use basic bar models with items to find the difference	 Count on to find the difference. Draw bars to find the difference between 2 numbers. 	Hannah has 23 sandwiches, Helen has 15 sandwiches. Find the difference between the number of sandwiches.
Part Part Whole Model	 Link to addition- use the part whole model to help explain the inverse between addition and subtraction. If 10 is the whole and 6 is one of the parts. What is the other part? 10 - 6 =	Use a pictorial representation of objects to show the part part whole model. 	 Move to using numbers within the part whole model.
Make 10	14 – 9 =		16 – 8= How many do we take off to reach the next 10?

	 Make 14 on the ten frame. Take away the four first to make 10 and then takeaway one more so you have taken away 5. You are left with the answer of 9.	 Start at 13. Take away 3 to reach 10. Then take away the remaining 4 so you have taken away 7 altogether. You have reached your answer.	How many do we have left to take off?
Column method without regrouping	 Use Base 10 to make the bigger number then take the smaller number away. Show how you partition numbers to subtract. Again make the larger number first. 	Draw the Base 10 or place value counters alongside the written calculation to help to show working. 43 – 21 = 22  	47 − 24 = 23 40 + 7 − 20 + 4 20 + 3 This will lead to a clear written column subtraction. 
Column method with regrouping	Use Base 10 to start with before moving on to place value counters. Start with one exchange before moving onto subtractions with 2 exchanges. Make the larger number with the place value counters	Draw the counters onto a place value grid and show what you have taken away by crossing the counters out as well as clearly showing the exchanges you make. 	

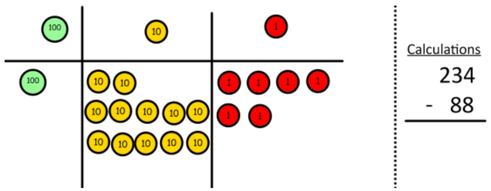
<table>
<tr>
<td></td>
<td>


Start with the ones, can I take away 8 from 4 easily? I need to exchange one of my tens for ten ones.



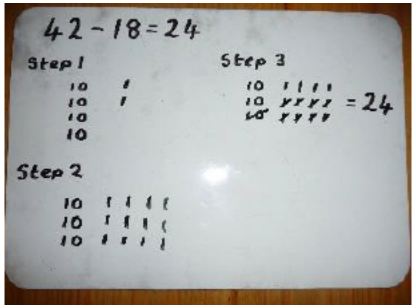
Now I can subtract my ones.

Now look at the tens, can I take away 8 tens easily? I need to exchange one hundred for ten tens.

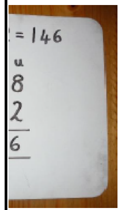


Now I can take away eight tens and complete my subtraction
</td>
<td>
When confident, children can find their own way to record the exchange/regrouping.

Just writing the numbers as shown here shows that the child understands the method and knows when to exchange/regroup.



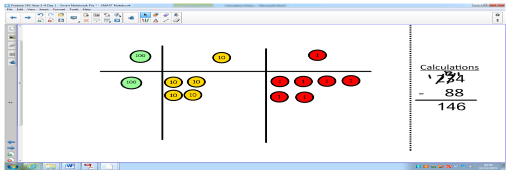
</td>
<td>
Children can start their formal written method by partitioning the number into clear place value columns.



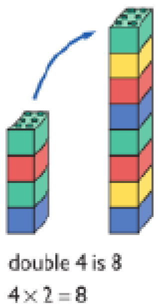
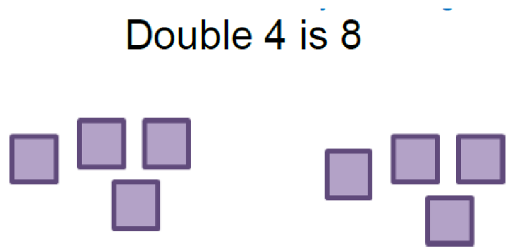
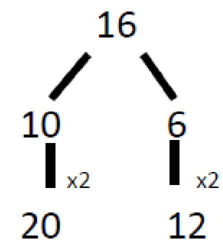
Moving forward the children use a more compact method.

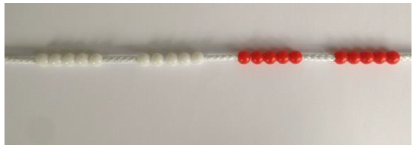
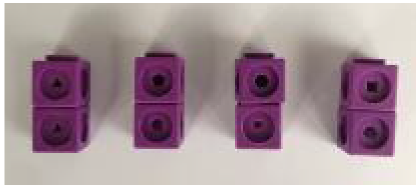
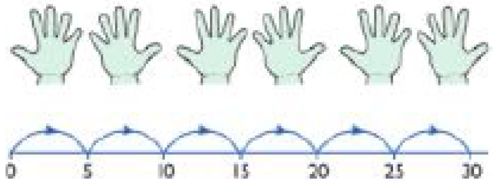
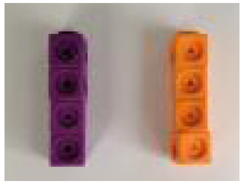
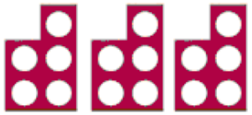
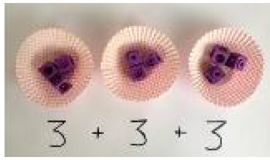
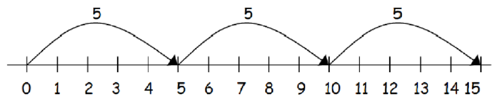
This will lead to an understanding of subtracting any number including decimals.

$$\begin{array}{cccccc} & 2 & \overset{5}{\cancel{6}} & \overset{12}{\cancel{3}} & . & \overset{1}{0} \\ - & & 2 & 6 & . & 5 \\ \hline & 2 & 3 & 6 & . & 5 \end{array}$$
</td>
</tr>
</table>

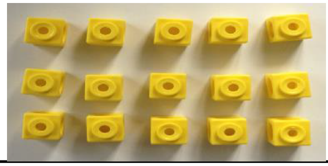
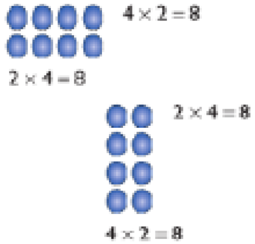
	 Show children how the concrete method links to the written method alongside your working. Cross out the numbers when exchanging and show where we write our new amount.		

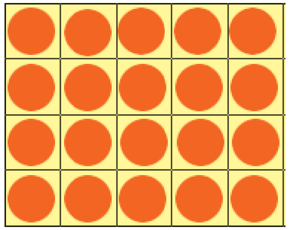
Multiplication

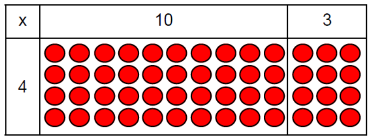
Objective and Strategies	Concrete	Pictorial	Abstract
ng	Use practical activities to show how to double a number. 	Draw pictures to show how to double a number. 	 Partition a number and then double each part before recombining it back together.

ng in multiples	  Count in multiples supported by concrete objects in equal groups.	 Use a number line or pictures to continue support in counting in multiples.	Count in multiples of a number aloud. Write sequences with multiples of numbers. 2, 4, 6, 8, 10 5, 10, 15, 20, 25, 30
ted addition	  	There are 3 plates. Each plate has 2 star biscuits on. How many biscuits are there?  2 add 2 add 2 equals 6  5 + 5 + 5 = 15	Write addition sentences to describe objects and pictures.  2 + 2 + 2 + 2 + 2 = 10

<table>
<tr>
<td>- showing commutative multiplication</td>
<td>Create arrays using counters/ cubes to show multiplication sentences.

</td>
<td>Draw arrays in different rotations to find commutative multiplication sentences.


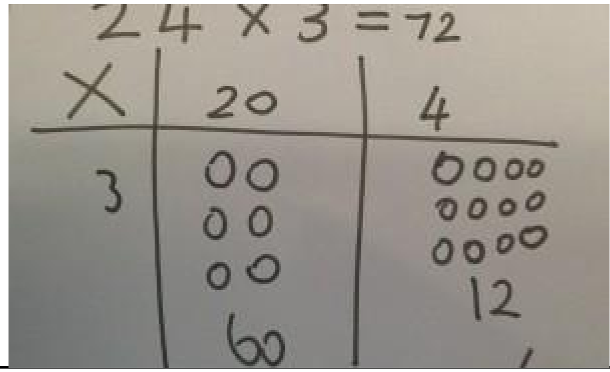

Link arrays to area of rectangles.</td>
<td>Use an array to write multiplication sentences and reinforce repeated addition.

5 + 5 + 5 = 15
3 + 3 + 3 + 3 + 3 = 15
5 x 3 = 15
3 x 5 = 15</td>
</tr>
<tr>
<td>lethod</td>
<td>Show the link with arrays to first introduce the grid method.


4 rows of 10
4 rows of 3

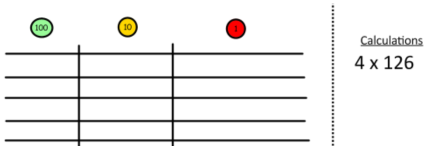
Move on to using Base 10 to move towards a more compact method.

4 rows of 13</td>
<td>Children can represent the work they have done with place value counters in a way that they understand.

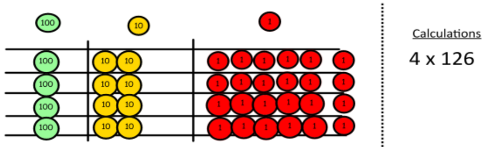
They can draw the counters, using colours to show different amounts or just use circles in the different columns to show their thinking as shown below.

</td>
<td>Start with multiplying by one digit numbers and showing the clear addition alongside the grid.
<table><tr><td>×</td><td>30</td><td>5</td></tr><tr><td>7</td><td>210</td><td>35</td></tr></table>210 + 35 = 245

Moving forward, multiply by a 2 digit number showing the different rows within the grid method.</td>
</tr>
</table>

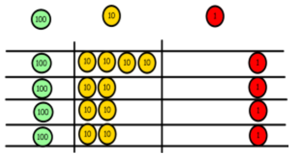
Move on to place value counters to show how we are finding groups of a number.We are multiplying by 4 so we need 4 rows.



Fill each row with 126.



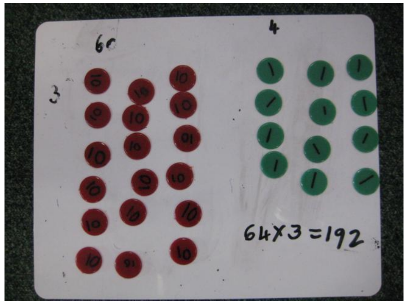
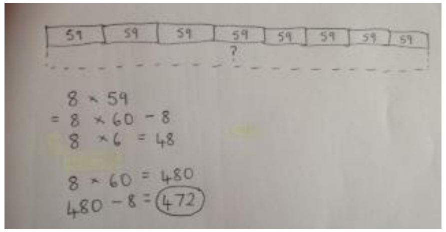
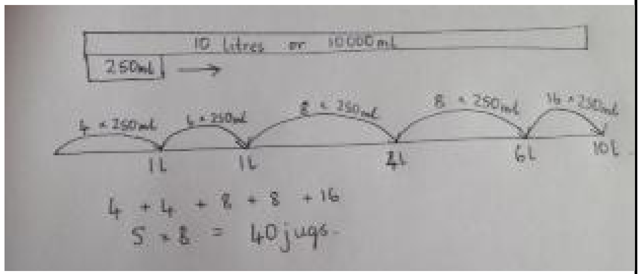
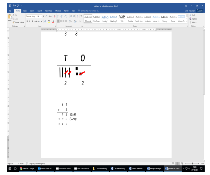
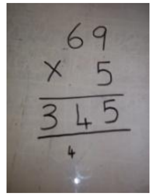
Add up each column, starting with the ones making any exchanges needed.

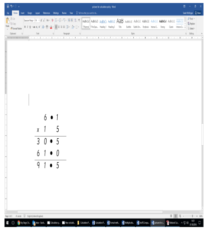


Then you have your answer.

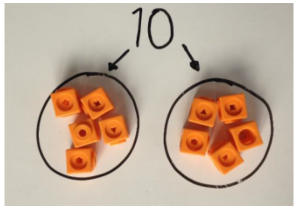
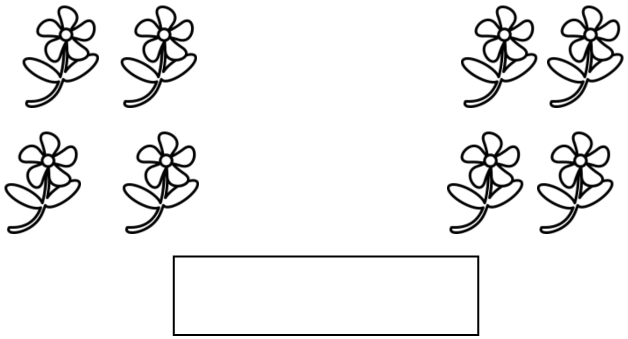
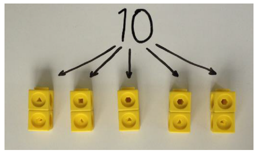
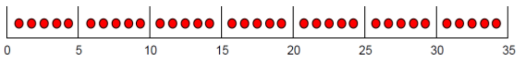
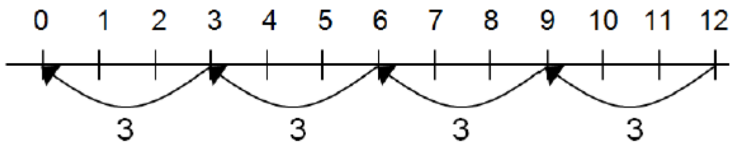
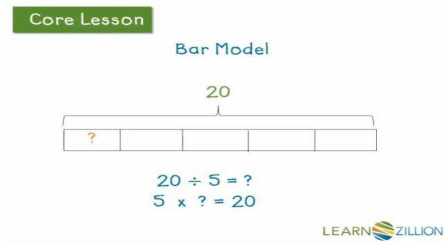
	10	8
10	100	80
3	30	24

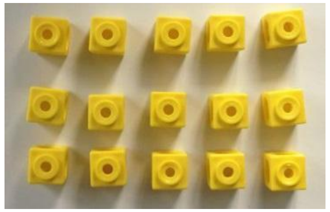
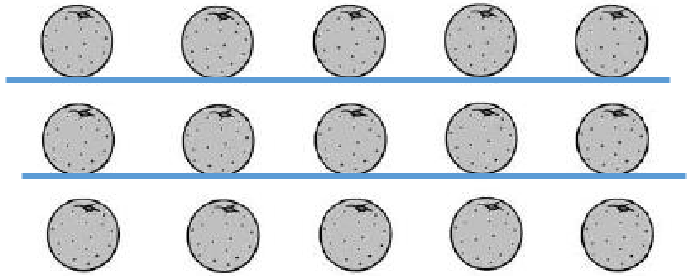
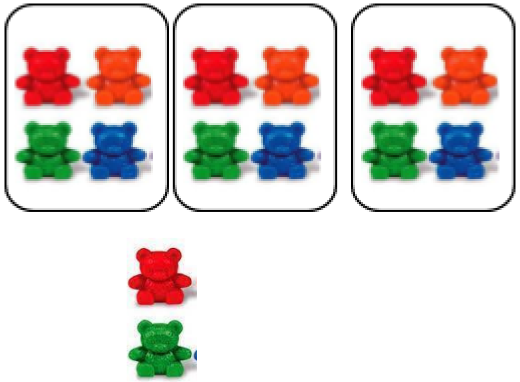
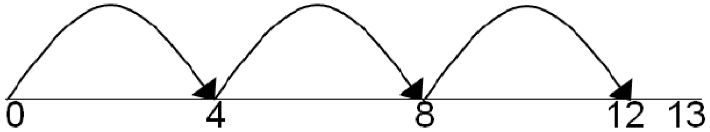
X	1000	300	40	2
10	10000	3000	400	20
8	8000	2400	320	16

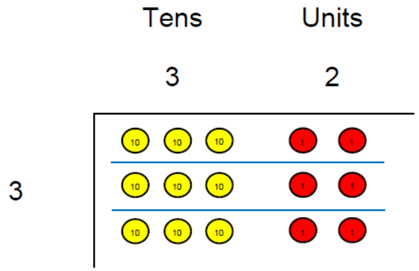
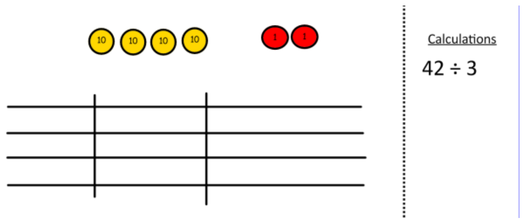
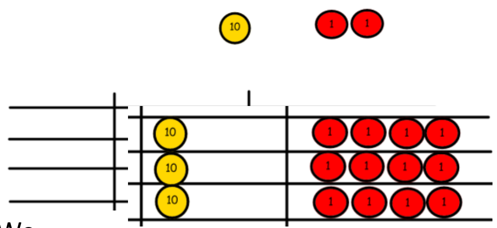
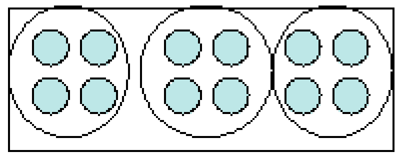
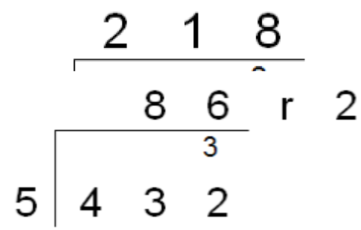
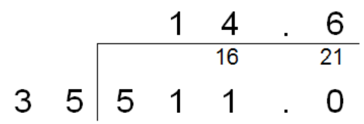
n multiplication	Make links to grid method Children can continue to be supported by place value counters at the stage of multiplication.  It is important at this stage that they always multiply the ones first and note down their answer followed by the tens which they note below.	Bar modelling and number lines can support learners when solving problems with multiplication alongside the formal written methods.  	Start with short multiplication, reminding the children about lining up their numbers clearly in columns. If it helps, children can write out what they are solving next to their answer. This moves to the more compact method.   Long multiplication 32 x 24 8 (4 x 2) 120 (4 x 30) 40 (20 x 2) 600 (20 x 30) 768 1 2 1 2 4 × 2 6 7 4 4 2 4 8 0 3 2 2 4 1 1 6.1 x 15 =

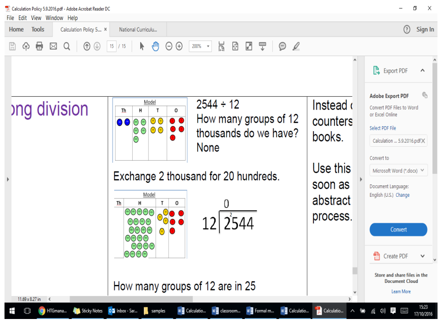
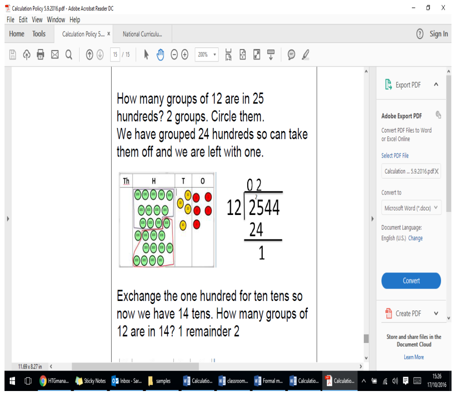
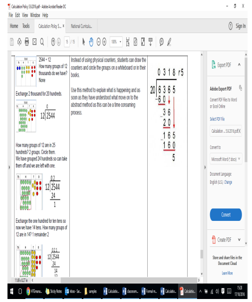
			6 • 1 x 1 5 3 0 • 5 6 1 • 0 9 1 • 5

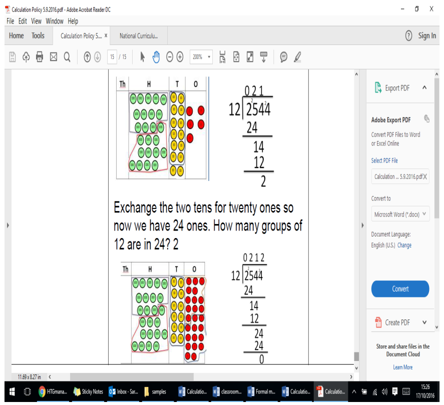
Division

Objective and Strategies	Concrete	Pictorial	Abstract
g objects into groups	 I have 10 cubes, can you share them equally in 2 groups? 	Children use pictures or shapes to share quantities. 	Share 9 buns between three people. $9 \div 3 = 3$
n as grouping	Use cubes, counters, objects or place value counters to aid understanding. I have 10 cubes. How many lots of 2 can you make?  How many 5s are there in 35? 	Use a number line to show jumps in groups. The number of jumps equals the number of groups.  Think of the bar as a whole. Split it into the number of groups you are dividing by and work out how many would be within each group. 	$28 \div 7 = 4$ How many 7s are there in 28?

n within arrays	 Link division to multiplication by creating an array and thinking about the number sentences that can be created. Eg 15 ÷ 3 = 5 5 x 3 = 15 15 ÷ 5 = 3 3 x 5 = 15	 Draw an array and use lines to split the array into groups to make multiplication and division sentences.	Find the inverse of multiplication and division sentences by creating four linking number sentences. 7 x 4 = 28 4 x 7 = 28 28 ÷ 7 = 4 28 ÷ 4 = 7
n with a remainder	14 ÷ 3 = Divide objects between groups and see how much is left over 	Jump forward in equal jumps on a number line then see how many more you need to jump to find a remainder.  Draw dots and group them to divide an amount and clearly show a remainder. 	Complete written divisions and show the remainder using r. 

division	Use  place value counters to divide using the bus stop method alongside  42 ÷ 3= Start with the biggest place value, we are sharing 40 into three groups. We can put 1 ten in each group and we have 1 ten left over.  We exchange this ten for ten ones and then share the ones equally among the groups.	Students can continue to use drawn diagrams with dots or circles to help them divide numbers into equal groups.  Encourage them to move towards counting in multiples to divide more efficiently.	Begin with divisions that divide equally with no remainder.  Move onto divisions with a remainder. Finally move into decimal places to divide the total accurately. 

	We look how much in 1 group so the answer is 14.		
ivision		Instead of using physical counters, students can draw the counters and circle the groups on a whiteboard or in their books. Use this method to explain what is happening and as soon as they have understood what move on to the abstract method as this can be a time consuming process.	

	Th H T O 0 2 1 12 2544 24 14 12 2 Exchange the two tens for twenty ones so now we have 24 ones. How many groups of 12 are in 24? 2 Th H T O 0 2 1 2 12 2544 24 14 12 24 24 0		