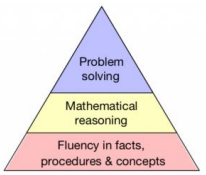
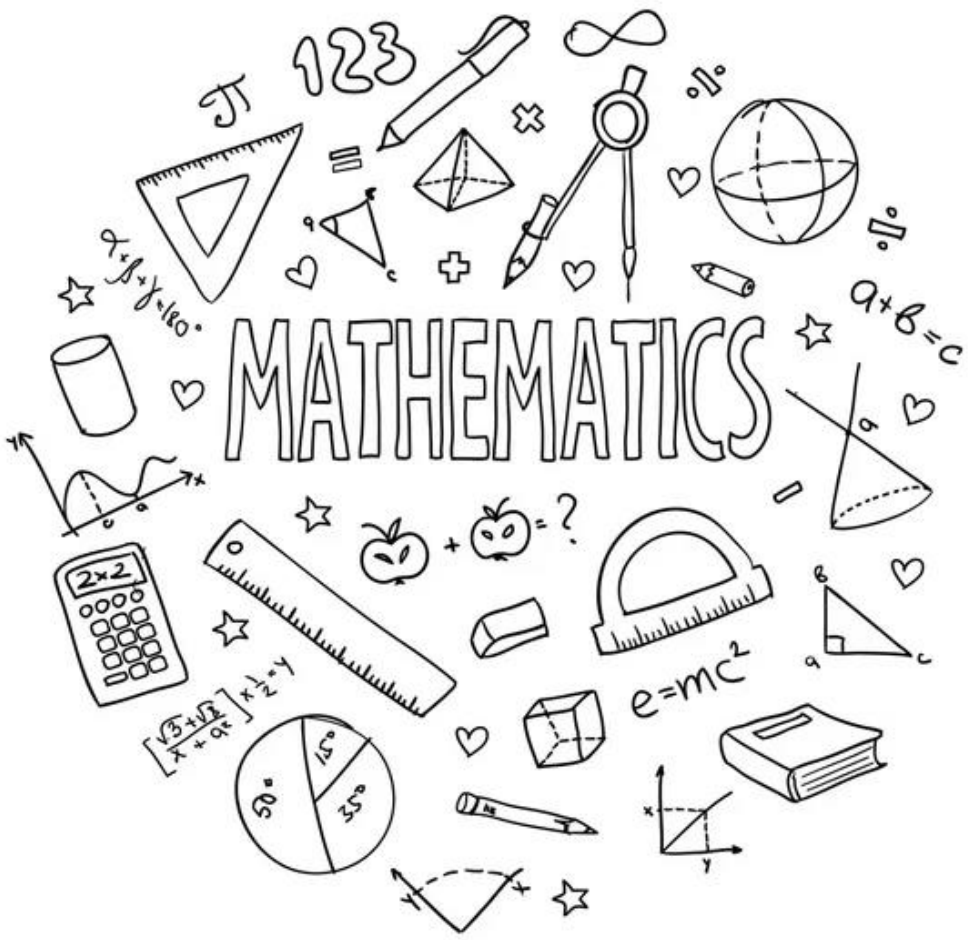
OUR APPROACH TO TEACHING MATHS AT RAINOW

Going beyond just knowing.





Whilst we recognise the importance of children being able to accurately and efficiently calculate, and quickly recall their FUNDAMENTAL FACTS, at Rainow, we seek to develop our pupil's problem-solving and reasoning skills: creating *mathematicians* over computers.

Mathematicians:

- ❑ Like maths.
- ❑ Are flexible with number.
- ❑ Have a good sense of number.
- ❑ Apply knowledge: If I know this, then I also know this…
- ❑ Use compensation / manipulation of numbers to complete problems.
- ❑ Choose the most efficient methods based on the numbers involved.
- ❑ Can find different ways to show their workings out.
- ❑ Think slowly, deeply and carefully.
- ❑ Work systematically/have a logical approach.
- ❑ Ask questions.
- ❑ Seek their own challenges.
- ❑ Spot patterns.
- ❑ Make links.
- ❑ Can explain how they know.
- ❑ Tries things out.
- ❑ Are not just interested in correct answers but think about the process.
- ❑ Get things wrong!
- ❑ Spot errors and correct them.
- ❑ Understand that learning can be tricky.
- ❑ Are resilient.

Do you show these qualities in maths lessons?

RAINOW MATHS MASTERY APPROACH

EXPECTATIONS FOR TEACHING & LEARNING

RECORDING IN BOOKS

- ❑ Prompt posters at front of book (age-appropriate)
- ❑ Mathematicians… page at front of book for personal target setting (KS2)
- ❑ Presentation should be neat and pride taken in their books.
- ❑ DUMTUM
- ❑ One digit per square
- ❑ Fold page and use the two columns to present work clearly when calculating (KS2).
- ❑ Show workings out – the process is more important than right answers.
- ❑ Write in order down the page (organised thinking).
- ❑ Whole sentences for answers to word problems. This reinforces what the question was asking for.
- ❑ Opportunities to reflect on learning. 'I now know…' 'I need to remember…'
- ❑ Write down thoughts/ideas whilst working. 'I wonder if…' 'I noticed that…'
- ❑ Explain what they know/how they did it.

- ❑ **Most work should be written directly into their books.**
- ❑ **Worksheets should be the minority – their own written work should be the majority.**

MAKE IT. DRAW IT. WRITE IT. PROVE IT. SAY IT.

- ❑ Some teacher modelled/guided examples followed by independent examples.
- ❑ Correct vocab should be taught, encouraged, and used.
  (Rainow prompt posters / Knowledge Organisers)

- ❑ Mistakes should be expected.
- ❑ Corrections/having another go should be evident.

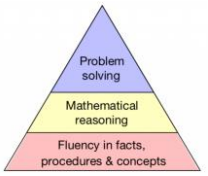
Feedback – timely/in the moment.
Can be mostly self-marked (SM).
Regular checks/acknowledgements from adults.

PLANNING

One-page MTP per topic based on coverage in Rainow LTP document. Small Steps approach.
Units of work should begin with knowledge (fluency). CPA approach.
Plenty of purposeful practise.
Building up to exploring problems and reasoning (applying) as an outcome at the end of the topic.

OUR APPROACH TO TEACHING *FLUENCY* AT RAINOW

Going beyond just knowing.



We are a Problem-solving School
Enriching maths

Fluency in maths is about developing number sense and being able to choose the most appropriate method for the task at hand; to be able to apply a skill to multiple contexts.

FROM https://nrich.maths.org/10624:
'Russell (2000) spells this out in more detail and suggests that fluency consists of three elements:

Efficiency - this implies that children do not get bogged down in too many steps or lose track of the logic of the strategy. An efficient strategy is one that the student can carry out easily, keeping track of sub-problems and making use of intermediate results to solve the problem.

Accuracy depends on several aspects of the problem-solving process, among them careful recording, knowledge of number facts and other important number relationships, and double-checking results.

Flexibility requires the knowledge of more than one approach to solving a particular kind of problem, such as two-digit multiplication. Students need to be flexible in order to choose an appropriate strategy for the numbers involved, and also be able to use one method to solve a problem and another method to check the results.

So fluency demands more of students than memorising a single procedure - they need to understand *why* they are doing what they are doing and *know when it is appropriate* to use different methods.'

TO BE TRULY FLUENT, A CHILD UNDERSTANDS THE MEANING OF THE OPERATIONS AND THEIR RELATIONSHIPS TO EACH OTHER, THEY HAVE A LARGE KNOWLEDGE BANK OF NUMBER FACTS, AND A DEEP UNDERSTANDING OF THE BASE TEN NUMBER SYSTEM.

Efficiency	Mental method (in my head)? Jottings? Written (column) method?
Accuracy	Estimate? Calculate. Check! Sense?
Flexibility	Is there another way? What else do I know? What else could I do?

DAILY RETRIEVAL PRACTICE could include:
WR Flashback 4, Arithmetic Ninja, Fluent in Five, Mathsbot games, TT Rockstars, Numbots, subitising.

ARITHMETIC / CALCULATING
Explicitly taught in lessons. A chance to apply FUNDAMENTAL FACTS.

Children in KS1 will be exposed to and encouraged to use a wide range of models and representations in line with the White Rose Maths small steps curriculum. It is essential, at this stage, that they develop a mental picture of the number system to use for calculation.

In KS2, specific methods will be taught in a progressive way, as per our Calculation Policy. **Pupils should still be encouraged to seek and use the most appropriate strategy though, which isn't always a formal column method.**

We value the IMPORTANCE of being able to instantly recall number facts alongside giving the children tools to help them generate them too.

LEARNING FUNDAMENTAL FACTS

'PLENTY OF PURPOSEFUL PRACTICE MAKES PERMANENT'

TEACHING

Alongside daily RETRIEVAL activities (recorded in books where appropriate) which encourage recall of all maths learning, build in daily opportunities for children to practise their current facts (5 minutes?).

REPRESENTATIONS

https://ttrockstars.com/mathsbot/tools/conceptTables?ng2=1
Part Whole / Bar Models?
Where are these facts on a hundred square?
Where are these facts found on a multiplication grid?
Number lines? Numicon? Arrays? Counters (subitising)

SOME WAYS TO PRACTISE:

Counting stick activities (https://www.youtube.com/watch?v=yXdHGBfoqfw)
Loop card games Pairs games Fizz Buzz game Bingo
Fact Families: https://www.topmarks.co.uk/number-facts/number-fact-families

DIVISIBILITY RULES

https://www.mathsisfun.com/divisibility-rules.html NEED EXPLICITLY TEACHING.

PATTERNS: Look at the digits when written out in order – what do they notice?

X2	Double (Divide = half) All multiples of 2 must be even (end in 0,2,4,6,8)
X3	Multiples of 3 are odd then even, and every other multiple of 3 is also a multiple of 6. The digits in multiples of 3 add up to a multiple of 3 (36 = 3 + 6, 111 = 1 + 1 + 1, etc.)
X4	DOUBLE and double again (Divide = halve and halve again) Multiples of 4 have a pattern of 4, 8, 2, 6, 0 in the ones place.
X5	Multiples of 5 have a pattern of 5, 0 in the ones place. Every other multiple of 5 is even; every other multiple of 5 is odd. Every range of 10 contains two multiples of 5. Every other multiple of 5 is halfway between a 10.
X6	Multiples of 6 have a pattern of 6, 2, 8, 4, 0 in the ones place. When a multiple of 2 and 3 overlap, you get a multiple of 6. All multiples of 6 are even numbers.
X7	Multiples of 7 have a pattern of 7, 4, 1, 8, 5, 2, 9, 6, 3, 0 in the ones place. Besides multiples of 9, **7's have the greatest variety of numbers represented in the ones place—hitting every digit from 0 to 9 along the way!** —> Have students continue the pattern beyond 119 to see how long it goes. The ones place is 3 less with each increasing multiple (7, 4, 1 (or 11), 8, 5, 2 (or 12), 9, etc).
X8	Double and double again (Divide = halve, halve and halve again) Multiples of 8 have a pattern of 8, 6, 4, 2, 0 in the ones place. All multiples of 8 are even. All multiples of 8 are multiples of 2 and 4.
X9	Multiples of 9 have a pattern of 9, 8, 7, 6, 5, 4, 3, 2, 1, 0 in the ones place. Multiples of 9 have a pattern of 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 in the tens place. All multiples of 9 are one less than 10 away from each other. (So, we can add 10, subtract 1 to find the next multiple of 9.) A multiple of 9 can be even or odd. 9 is odd, but the result of 9 x 2 (or 9 + 9) is even. Multiples of 9 alternate—odd, even, odd, even, etc. A multiple of 9 must also be a multiple of three because 9 is made up of 3 x 3.

	The digits in a multiple of 9 add up to a multiple of 9 (9, 18, 27, etc) . The digits of every multiple of 9 up to 90 add up to 9. As the tens digit increases by 1, the ones digit decreases by 1.
X10	All multiples of 10 have a zero in the ones place When multiplying by a 10, the other factor that was multiplied moves to the left one space (or one place value space to the left). All multiples of 10 are also multiples of 2 and 5. All multiples of 10 are also divisible by 5.
X11	The ones place and the tens place for all multiples of 11 under 100 are the same. The ones place increases by 1 each time and then starts again after 0. Each multiple is one less away from the next 10. 11 is 9 away from 20, 22 is 8 away from 30, 33 is 7 away from 40, and so on. After 110, the next multiple is 121 and the pattern starts again.
X12	All multiples of 12 are even and are multiples of 2, 3, 4, and 6 In the ones place, the pattern 2, 4, 6, 8, 0 repeats. This is because when you are adding 12, the tens increase each time, and the ones place counts by 2's

INSTANT RECALL vs METHODS OF GENERATING (Brain dumps)

We know that some children learn facts easily and for others, it is more of a struggle. It is important that we encourage all children to develop strategies to generate facts alongside being able to recall them quickly. Writing down lists of facts needed to solve a question (for example, multiples of the divisor) is a good strategy to free up working memory and to help them spot errors.

WHOLE-CLASS FOCUSED FACTS:

One (or two) facts at a time (whole fact family) for at least two weeks.
Take from year group documents.
Use data from Numbots/TTRS to pick out facts which are still an issue for the majority of the children.

SUGGESTED TEACHING SEQUENCE OF FACTS:

ADDITION/SUBTRACTION in order found on year group Fundamental Facts document.
MULTIPLICATION/DIVISION: in this order to make links between similar facts

X2, x4, x8
X10, x5
X3, x6, x9
X7, x11, x12

PERSONALISED TARGETS:

NUMBOTS (From Reception)
Children to work through the STORY levels at own pace. Teachers to monitor to ensure that progress in being made.

TIMES TABLES ROCKSTARS (From Year 2)
Children to work through the AUTO-TRAINING MODE in the GARAGE after assessment through playing a GIG. Teachers to monitor to ensure that adequate progress is being made. Once children have completed the GARAGE (12x12) teachers to set further multiplication tables to learn.
HEATMAPS could be shared/sent home to show current attainment and target facts.

HOMEWORK:

Should include Fundamental Fact practise and ongoing Numbots/TTRS daily practice.
Use whole-school PPT proforma for FFacts. (See Parent Guides to Fundamental Facts and Fluency Practice)

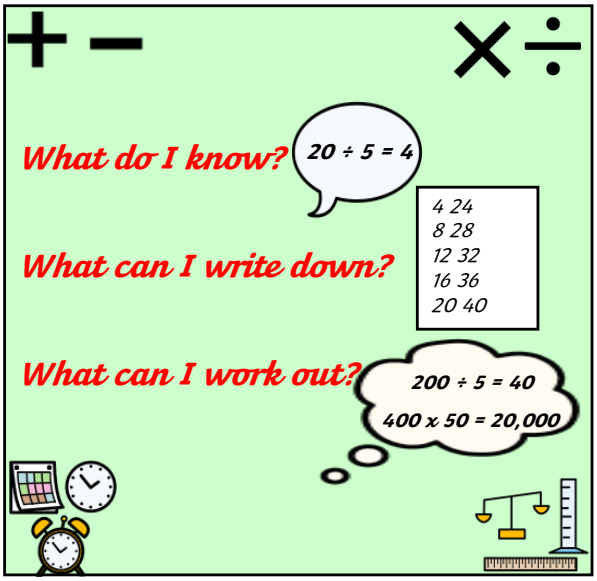
DEEPENING/CHALLENGE:

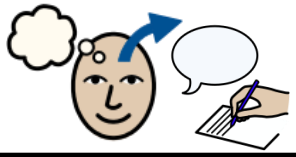
If I know this, what else do I know?
Work out related facts. Apply their knowledge.

Fluency & Fundamental Facts

Recall quickly and accurately.

Efficiency	Mental method (in my head)? Jottings? Written (column) method?
Accuracy	Estimate? Calculate. Check! Sense?
Flexibility	Is there another way? What else do I know? What else could I do?





CHILDREN WORKING BELOW ARE

We recognise that a minority of children will struggle with manipulation of numbers, recall of maths facts, and have a poor 'sense of number'. We aim to equip these children with tools/methods/strategies/shortcuts to help them retrieve information and encourage the use of one calculation method that they can be secure with through overlearning. Checking strategies are vital to these children because they are likely to not be able to judge whether their answer makes sense. These children will be identified because: they do not meet ARE, make slow progress over time, and will receive targeted interventions to close their gaps.

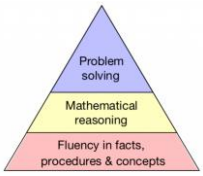
Precision Teaching techniques used after analysis of assessments.

Clear focus on facts that will be of use to them.

Explicit teaching and overlearning of written column methods (see policy). We need to equip them with a method that they can confidently use. They may not 'understand' in the depth that we are aiming for with other children, but instead, they need to be able to 'do' it.

OUR APPROACH TO TEACHING *PROBLEM SOLVING* AT RAINOW

Going beyond just knowing.



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National Curriculum 2014: *Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.*
The national curriculum for mathematics aims to ensure that all pupils:

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

'A problem is only a problem if you don't know what to do.' (NRICH)

WHAT IS PROBLEM SOLVING?

Problem solving generally refers to situations in which pupils do not have a readily-available method that they can use. Instead, they have to approach the problem flexibly and work out a solution for themselves. To succeed in this, pupils need to draw on a variety of problem-solving strategies which enable them to make sense of unfamiliar situations and tackle them intelligently. *(EEF)*

PROBLEM SOLVING SCHOOLS – the process of problem-solving

https://nrich.maths.org/5569 The problem-solving process can be described as a journey from meeting a problem for the first time to finding a solution, communicating it and evaluating the route.

COMPREHENSION	REPRESENTATION	PLANNING, ANALYSIS AND SYNTHESIS	EXECUTION AND COMMUNICATION	EVALUATION
This stage is about making sense of the problem by using strategies such as retelling, identifying relevant information and creating mental images. This can be helped by encouraging students to re-read the problem several times and record in some way what they understand the problem to be about (for example by drawing a picture or making notes).	This stage is about "homing in" on what the problem is actually asking solvers to investigate. Can they represent the situation mathematically? What is it that they are trying to find? What do they think the answer might be (conjecturing and hypothesising)? What might they need to find out before they can get started? Central to this stage is identifying what is unknown and what needs finding.	Having understood what the problem is about and established what needs finding, this stage is about planning a pathway to the solution. It is within this process that you might encourage pupils to think about whether they have seen something similar before and what strategies they adopted then. This will help them to identify appropriate methods and tools. Particular knowledge and skills gaps that need addressing may become evident at this stage.	During the execution phase, pupils might identify further related problems they wish to investigate. They will need to consider how they will keep track of what they have done and how they will communicate their findings. This will lead on to interpreting results and drawing conclusions.	Pupils can learn as much from reflecting on and evaluating what they have done as they can from the process of solving the problem itself. During this phase pupils should be expected to reflect on the effectiveness of their approach as well as other people's approaches, justify their conclusions and assess their own learning. Evaluation may also lead to thinking about other questions that could now be investigated.

In planning and executing a problem, problem solvers may need to:

- **select and use appropriate and efficient techniques and strategies to solve problems**
- **identify what further information may be required in order to pursue a particular line of enquiry and give reasons for following or rejecting particular approaches**
- **break down a complex calculation problem into simpler steps before attempting a solution and justify their choice of methods**
- **make mental estimates of the answers to calculations**
- **present answers to sensible levels of accuracy; understand how errors are compounded in certain calculations.**

During problem solving, solvers need to communicate their mathematics by:

- **discussing their work and explaining their reasoning using a range of mathematical language and notation**
- **using a variety of strategies and diagrams for establishing algebraic or graphical representations of a problem and its solution**
- **moving from one form of representation to another to get different perspectives on the problem**
- **presenting and interpreting solutions in the context of the original problem**
- **using notation and symbols correctly and consistently within a given problem**
- **examining critically, improve, then justifying their choice of mathematical presentation**
- **presenting a concise, reasoned argument.**

However, an alternative interpretation, and one which NRICH aims to exemplify, is that of Polya (1945). Problem solving in Polya's view is about engaging with real problems; guessing, discovering, and making sense of mathematics. (Real problems don't have to be 'real world' applications, they can be within mathematics itself. The main criterion is that they should be non-routine and new to the student.) Compared to the interpretation as a set of questions on a theme, Polya's is a much more challenging interpretation of problem solving for a teacher to come to terms with, but has the potential to be much more effective in developing young mathematicians who have an 'understanding of the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics and a sense of enjoyment and curiosity about the subject'. **For Polya, problem solving is:**

- ***Seeking solutions not just memorising procedures.***
- ***Exploring patterns not just memorising formulas.***
- ***Formulating conjectures, not just doing exercises.***

EEF TEACHING GUIDANCE/CONSIDERATIONS:

1. **Select genuine problem-solving tasks that pupils do not have well-rehearsed, ready-made methods to solve. Sometimes problem-solving is taken to mean routine questions set in context, or 'word problems', designed to illustrate the use of a specific method. But if students are only required to carry out a given procedure or algorithm to arrive at the solution, it is not really problem solving; rather, it is just practising the procedure.**

2. **Consider organising teaching so that problems with similar structures and different contexts are presented together, and, likewise, that problems with the same context but different structures are presented together. Pupils need to experience identifying similar mathematics that underlies different situations, and also to identify and interrogate multiple relationships between variables in one situation.**

3. **Teach pupils to use and compare different approaches. There are often multiple ways to approach a problem. Much can be learned by examining different solutions to the same problem and looking for similarities in solution approaches to different problems. Pupils will need to distinguish between superficial similarity (for example, two problems both about carrots) and deeper similarities, relating to mathematical structure, which make similar strategies effective (such as two problems in different contexts that are both about enlargement). Teach pupils to interrogate and use their existing mathematical knowledge to solve problems. Pupils should be encouraged to search their knowledge of similar problems they have encountered for strategies that were successful, and for facts and concepts that might be relevant.**

4. **Encourage pupils to use visual representations. Help students to make use of appropriate diagrams and representations that provide insight into the structure of a problem and into its mathematical formulation.**

5. **Use worked examples to enable pupils to analyse the use of different strategies. Worked examples, or 'solved problems', present the problem and a correct solution together, they remove the need to carry out the procedures required to reach the solution and enable pupils to focus on the reasoning and strategies involved. Worked examples may be complete, incomplete, or incorrect, deliberately containing common errors and misconceptions for learners to uncover. Analysing and discussing worked examples helps students develop a deeper understanding of the logical processes used to solve problems.**

6. **Require pupils to monitor, reflect on, and communicate their reasoning and choice of strategy. While working on a problem, encourage pupils to ask questions like, 'What am I trying to work out?', 'How am I going about it?', 'Is the approach that I'm taking working?', and 'What other approaches could I try?' When the problem is completed, encourage pupils to ask questions like, 'What worked well when solving this problem?', 'What didn't work well?', 'What other problems could be solved by a similar approach?', 'What similar problems to this one have I solved in the past?' Pupils should communicate their thinking verbally and in writing—using representations, expressions, and equations—to both teachers and other pupils.**

According to Jane Jones, former HMI and National Lead for Mathematics, in her presentation at the Jurassic Maths Hub:

- Problems do not have to be set in real-life contexts, beware pseudo contexts.
- Providing a range of puzzles and other problems helps pupils to reason strategically to approach problems, sequence unfolding solutions, and use recording to help their mathematical thinking for next steps.
- It is particularly important that teachers and TAs stress reasoning, rather than just checking whether the final answer is correct.
- Pupils of all ability need to learn how to solve problems – not just the high attainers or fastest workers.

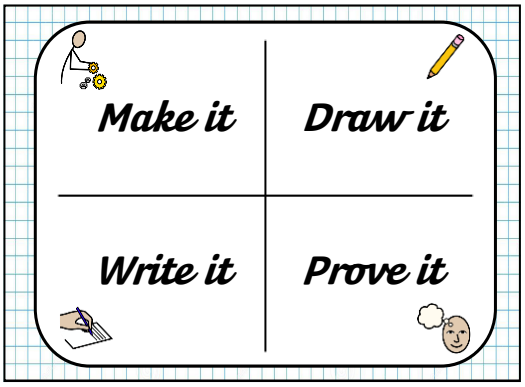
TEACHING STRATEGIES

PROBLEM SOLVING needs explicit teaching. (EEF)

A problem-solving strategy is a general approach to solving a problem. The same general strategy can be applied to solving a variety of different problems. For example, a useful problem-solving strategy is to identify a simpler but related problem. Discussing the solution to the simpler problem can give insight into how the original, harder problem may be tackled and the underlying mathematical structure. A strategy is different from an algorithm, which is a well-established sequence of predetermined steps that are executed in a particular order to carry out a commonly-required procedure. (EEF)

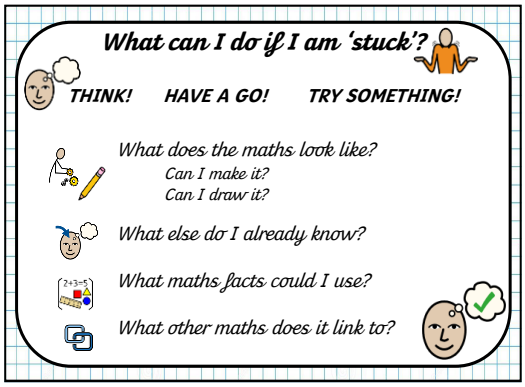
TYPES OF PROBLEMS

- **Conjecturing**
- **Spot the difference**
- **True or false?**
- **Correct/Not correct**
- **Odd one out**
- **Spot the mistake**
- **Open ended**
- **Find all possibilities**
- **Finding rules**



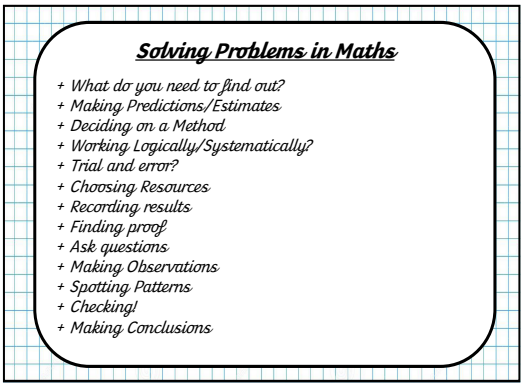
QUESTIONS TO ASK when presented with information

- ***What do I need to know?***
- ***What don't I need to know?***
- ***What do I know?***
- ***What don't I know?***
- ***What could it be?***
- ***What couldn't it be?***
- ***What can you answer?***
- ***What can't you answer yet?***



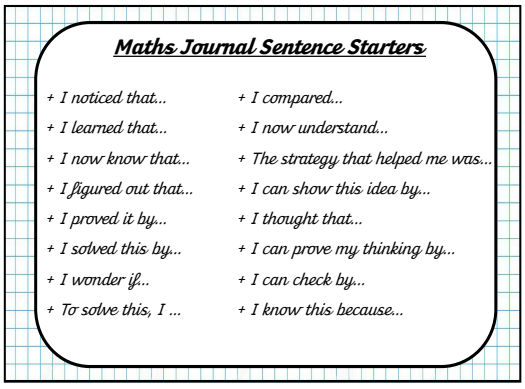
TYPES OF STRATEGIES / APPROACHES FOR SOLVING

- **Drawing a diagram (including branching tree)**
- **Drawing a table**
- **Acting it out / Use concrete resources**
- **Guessing and checking / Trial and improvement**
- **Creating an organised list**
- **Looking for patterns**
- **Using simpler numbers**
- **Working backwards**
- **Working systematically (use logical reasoning)**



MODELLED/GUIDED TEACHING

Worked examples
Teacher facilitation
Nudging

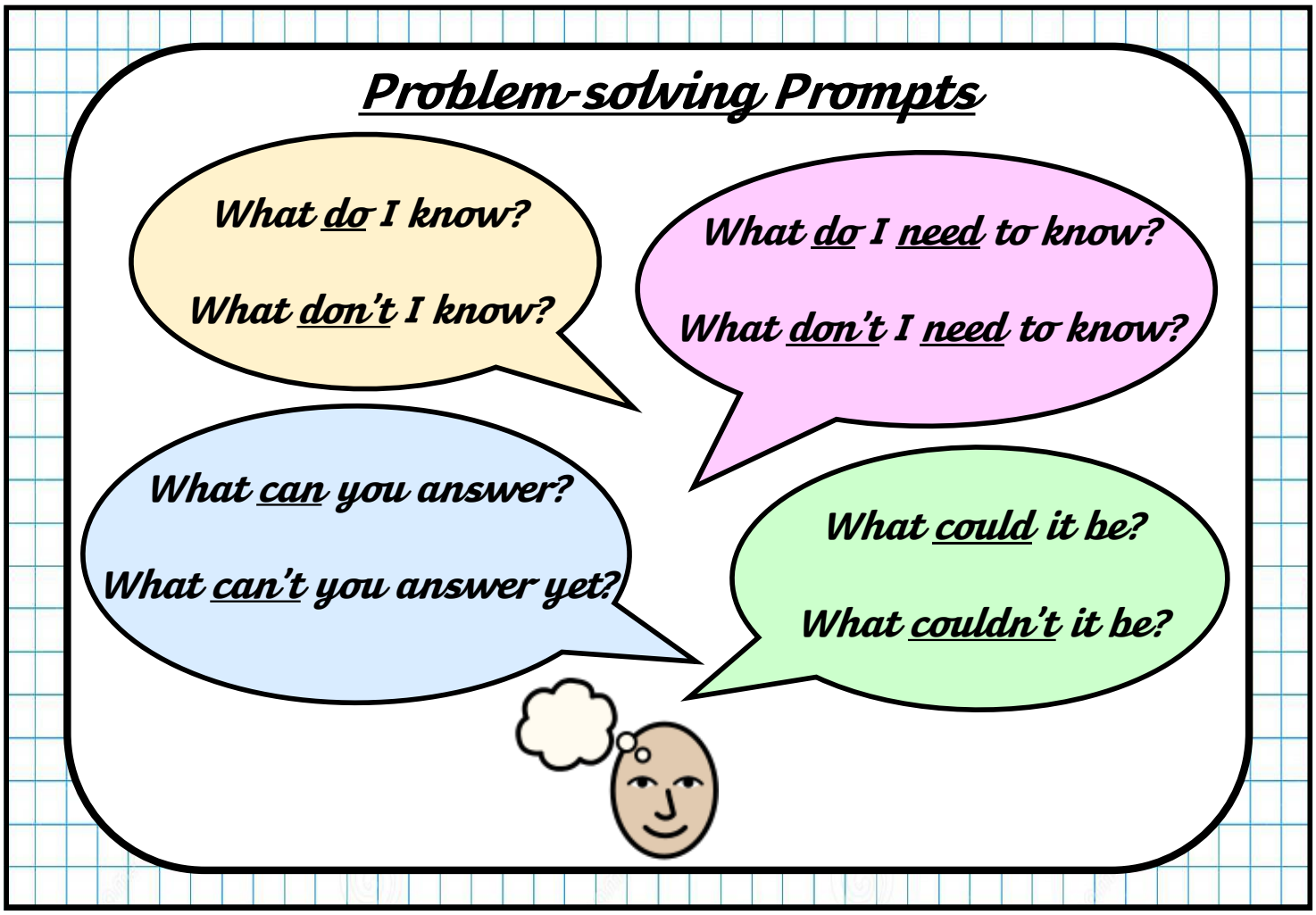


Gareth Metcalfe CPD takeaways

- **Raising the internal narrative**
- **Silent thinking time (Leaving gaps between question and response)**
- **Silent modelling time**
- **Slow reveal**
- **Act it out**
- **Simplify**

BAR MODELLING

A useful visual tool to demonstrate and uncover the maths involved. Not a method to solve answers.



TEACHING RESOURCES:

White Rose curriculum https://whiteroseeducation.com/resources/maths/primary

Twinkl Dive Deeper resources https://www.twinkl.co.uk/resources/white-rose-maths-resources

I See Problem Solving (Gareth Metcalfe) https://www.iseemaths.com/

Mr Bee Maths https://www.mrbeeteach.com/resoruces

NNS Challenges for the more able

https://webarchive.nationalarchives.gov.uk/ukgwa/20110202173247/https://nationalstrategies.standards.dcsf.gov.uk/node/85260

White Rose Barvember resources https://whiteroseeducation.com/resources/barvember

NCETM Teaching for Mastery https://www.ncetm.org.uk/classroom-resources/assessment-materials-primary/

NRICH https://nrich.maths.org/teachers/primary

Badger Problem Solving books

Maths No Problem text/workbooks

The Problem-solving Schools' Charter (NRICH)

Values and ethos

We have a shared belief that:

- Mathematical ability is not fixed: everyone can learn and make progress
- Problem-solving often involves taking wrong turns and making mistakes: every learner has the right to struggle and the right to enjoy success
- Everyone should have the opportunity to develop the skills and attitudes necessary to become confident problem-solvers
- Problem-solving can motivate learners to learn new mathematics, apply previous learning and make mathematical connections

Leadership and professional development

In our setting:

- Our staff promote positive attitudes towards problem-solving
- Time is set aside to discuss problem-solving in our meetings
- Our displays, newsletters, website, and social media content celebrate problem-solving for all
- Our monitoring system ensures that priority is given to problem-solving and mathematical thinking
- We engage with printed, online and face-to-face professional development opportunities offered by subject organisations

Curriculum, pedagogy and assessment

We are committed to:

- Regularly embedding non-standard problem-solving opportunities in our maths curriculum for all
- Ensuring that problems, and classroom support, offer opportunities for all to experience both struggle and success
- Allocating time to developing key problem-solving skills and positive attitudes
- Including non-standard problems in our internal/formative assessments
- Liaising with other subjects so that meaningful cross-curricular links can be made

Classroom culture

We aim to:

- Create a safe environment in which learners explore, take risks, and appreciate the value of learning from their mistakes
- Celebrate multiple approaches to solving problems and discuss the merits of the different strategies offered
- Provide frequent opportunities for individual and collaborative problem-solving, where learners are given both thinking time, and opportunities to share ideas and insights
- Celebrate the mathematical thinking of every learner

Problem-solving beyond the classroom/school

We encourage:

- Learners to engage with school Maths Club(s) and high quality maths books, ideally stocked by the school library
- Learners to take advantage of printed, online and off-site mathematical enrichment opportunities
- Parents and carers to engage with problem-solving through family homeworks and in-school events, while recognising that not every adult has had a positive experience of maths
- Our learners to appreciate, and learn more about, the achievements of a diverse range of mathematicians

https://nrich.maths.org/problem-solving-schools

OUR APPROACH TO TEACHING *REASONING* AT RAINOW

Going beyond just knowing.

Whilst we recognise the importance of children being able to accurately and efficiently calculate, and quickly recall their FUNDAMENTAL FACTS, at Rainow, we seek to develop our pupil's problem-solving and reasoning skills: creating *mathematicians* over computers.

"Mathematical reasoning, even more so than children's knowledge of arithmetic, is important for children's later achievement in mathematics." Nunes et al (2009)

National Curriculum 2014: *Mathematics is a creative and highly inter-connected discipline that has been developed over centuries, providing the solution to some of history's most intriguing problems. It is essential to everyday life, critical to science, technology and engineering, and necessary for financial literacy and most forms of employment. A high-quality mathematics education therefore provides a foundation for understanding the world, the ability to reason mathematically, an appreciation of the beauty and power of mathematics, and a sense of enjoyment and curiosity about the subject.*
The national curriculum for mathematics aims to ensure that all pupils:

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

WHAT IS REASONING?

Reasoning in maths is the process of applying logical thinking to a situation to derive the correct problem-solving strategy for a given question, and using this method to develop and describe a solution. Put more simply, mathematical reasoning is the bridge between fluency and problem solving. It allows pupils to use the former to accurately carry out the latter. (Third Space Learning) https://shorturl.at/aiBOZ

The aims of the National Curriculum are to develop fluency and the ability to reason mathematically and solve problems. Reasoning is not only important in its own right but impacts on the other two aims. Reasoning about what is already known in order to work out what is unknown will improve fluency; for example if I know what 12 × 12 is, I can apply reasoning to work out 12 × 13. The ability to reason also supports the application of mathematics and an ability to solve problems set in unfamiliar contexts. https://www.ncetm.org.uk/classroom-resources/pm-reasoning-skills/

Research by Nunes (2009) identified the ability to reason mathematically as the most important factor in a pupil's success in mathematics. It is therefore crucial that opportunities to develop mathematical reasoning skills are integrated fully into the curriculum. Such skills support deep and sustainable learning and enable pupils to make connections in mathematics.

Developing reasoning skills with young learners is a complex business. They need to learn to become systematic thinkers and also acquire the ability to articulate such thinking in a clear, succinct and logical manner. In many classrooms more progress is being made with developing the systematic thinking than with the elegant communication. There needs to be equal emphasis on both these aspects of reasoning and in both we need to consider progression. What would we expect from a novice reasoner as opposed to an expert reasoner? How can we help young learners to progress to expert level? https://nrich.maths.org/11336

Best practice for problem solving in a lesson, a unit, and a term:
When an adult first learns something new, we cannot solve a problem with it straight away. We need to become familiar with the idea and practise before we can make connections, reason and problem solve with it. The same is true for pupils. Indeed, it could take up to two years 'between the mathematics a student can use in imitative exercises and that they have sufficiently absorbed and connected to use autonomously in non-routine problem solving.' (Burkhardt, 2017). (Third Space Learning).

PROGRESSION IN REASONING

NRICH five-step progression in reasoning. Children are unlikely to move fluidly from one step to the other, rather flow up and down the spectrum settling on a particular step that best describes their reasoning skills at any one time.

DESCRIBING	EXPLAINING	CONVINCING	JUSTIFYING	PROVING
Simply tells what they did.	Offers some reasons for what they did. These may or may not be correct. The argument may yet not hang together coherently. This is the beginning of inductive reasoning.	Confident that their chain of reasoning is right and may use words such as, 'i reckon' or 'without doubt'. The underlying mathematical argument may or may not be accurate yet is likely to have more coherence and completeness than the explaining stage. This is called inductive reasoning.	A correct logical argument that has a complete chain of reasoning to it and uses words such as 'because', 'therefore', 'and so', 'that leads to'...	A watertight argument that is mathematically sound, often based on generalisations and underlying structure. This is also called deductive reasoning.

TEACHING RESOURCES

White Rose curriculum https://whiteroseeducation.com/resources/maths/primary

Twinkl Dive Deeper resources https://www.twinkl.co.uk/resources/white-rose-maths-resources

I See Reasoning (Gareth Metcalfe) https://www.iseemaths.com/

Mr Bee Maths KS1 and KS2 Reasoning books & https://www.mrbeeteach.com/resoruces

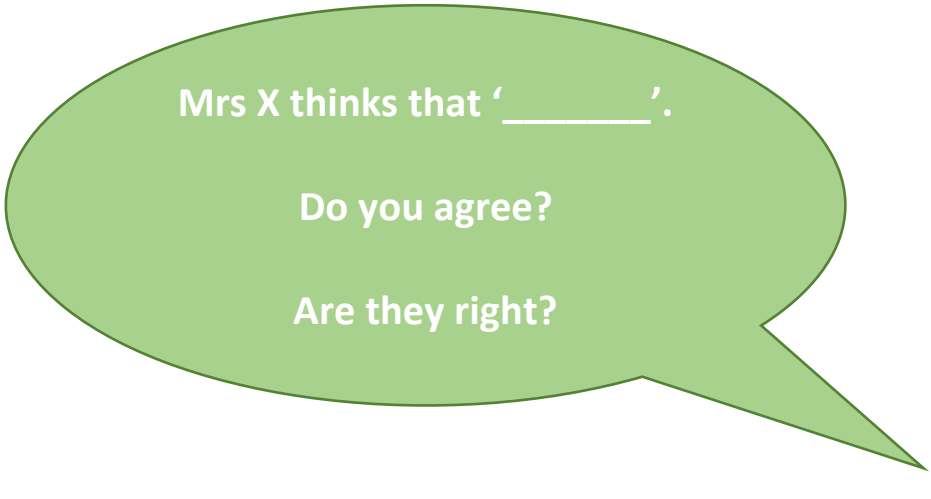
NCETM Teaching for Mastery https://www.ncetm.org.uk/classroom-resources/assessment-materials-primary/

https://www.ncetm.org.uk/classroom-resources/pm-reasoning-skills/

NRICH https://nrich.maths.org/teachers/primary & https://nrich.maths.org/11018

Maths No Problem text/workbooks

Posing a problem:



TEACHING REASONING

COMMUNICATION IS KEY:

Pupils need to learn to become **systematic thinkers** and also acquire the ability to **articulate** such thinking in a **clear, succinct and logical manner**. (NRich)

Pupils are highly unlikely to reason and discuss mathematics with any form of proficiency if we restrict their access to the many succinct, yet layered, terms which allow the accurate description of ideas and concepts with the most efficient exertion of effort.
(Kieran Mackle, Thinking Deeply About Maths)

ORACY

The ability to articulate ideas, develop understanding and engage with others through spoken language.

VOCABULARY

Agreed. Precise. Gives clarity. (Rainow maths posters/Knowledge Organisers)

https://www.ncetm.org.uk/media/hpihrj3s/national-curriculum-glossary.pdf

SENTENCE STEMS

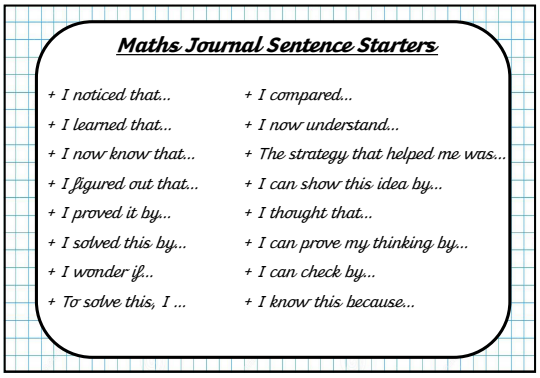
Give structure and scaffold. Remove some cognitive load.

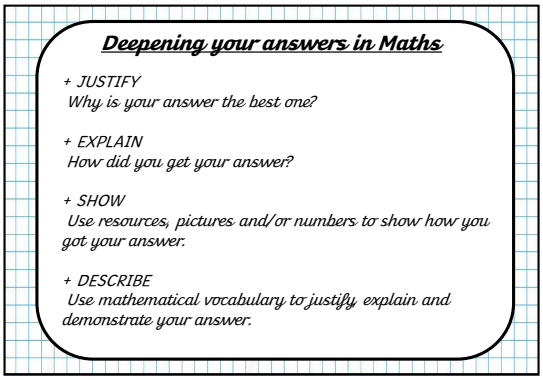
COMMENTARY

Concise. Describe their thinking and strategies.

JOURNALING

Exploring ideas. Explaining. Conjecturing. Identifying patterns.





Types of activity:

- Spot the mistake / Which is correct? Explain the mistake.
- True or false? Agree / Disagree?
- What comes next?
- Do, then explain
- Possible answers / Other possibilities
- What do you notice?
- Spot the pattern / Continue the pattern / Complete the pattern
- Make up an example / Write more statements / Create a question / Another and another
- Missing numbers / Missing symbols / Missing information/ Connected calculations
- Working backwards / Use the inverse / Undoing / Unpicking
- Hard and easy questions
- What else do you know? / Use a fact
- Fact families
- Convince me / Prove it / Generalising / Explain thinking
- Make an estimate / Size of an answer
- Always, sometimes, never
- Making links / Application
- Can you find?
- What's the same, what's different?
- Odd one out
- Another and another
- Ordering
- Testing conditions
- The answer is…
- Visualising
- How many ways?
- I know…so…

Reasoning Reminders

Describe

I can see that...

What did you do?
What do you notice?

Explain

...because...

Give an example.

Justify

I know that...

Facts? Rules?
Convince me.

Show

It looks like:

Representations?
Proof?

PROMOTING HIGH QUALITY TALK IN MATHEMATICS

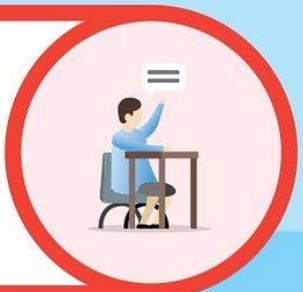
Education Endowment Foundation

Evidence indicates that high-quality talk can play an important role in supporting learning. This is reflected in multiple recommendations across the EEF's 'Improving Mathematics in the Early Years and Key Stage 1' and 'Improving Mathematics in Key Stages 2 and 3' guidance reports. The 'TOLD' acronym summarises four key principles for encouraging productive talk in mathematics lessons.

TAKE PART

To ensure that all pupils participate in high quality talk, we need to encourage engagement and support the development of listening skills where needed.

This can be achieved by directly inviting contributions from particular pupils. It may also be helpful to establish clear expectations around participation, and to prompt pupils' reflection on the participation of the group, and the quality of discussions.



OPPORTUNITIES

Encouraging children to work on shared problems and tasks can elicit collaboration and discussions around concepts, strategies and ideas. Using storybooks and games can also provide opportunities for rich mathematical discussions.

To maximise opportunities for learning, it is important to plan key questions and discussion points in advance. Open-ended questions such as '*How did you...?* or '*Why does this...?*' are particularly helpful in gathering a range of possible responses from pupils.

LINKS

Support pupils to elaborate upon their own responses, and those of their peers.

Helpful questions to encourage pupils to make links between responses include:

- *'Can you tell me a bit more about…?'*
- *'Can you give me an example to illustrate your point here?'*
- *'Who can build on what has been said here?'*

DEBATE:

Allow pupils to share and explain contrasting opinions and viewpoints.

Teachers can promote debate by:

- Prompting pupils to debate whether key statements are true, false, or sometimes true.
- Providing worked examples to encourage pupils to compare and contrast multiple approaches and strategies.

Further information and guidance can be found in the EEF's 'Improving Mathematics in the Early Years and Key Stage 1' and the 'Improving Mathematics in Key Stages 2 and 3' guidance reports.

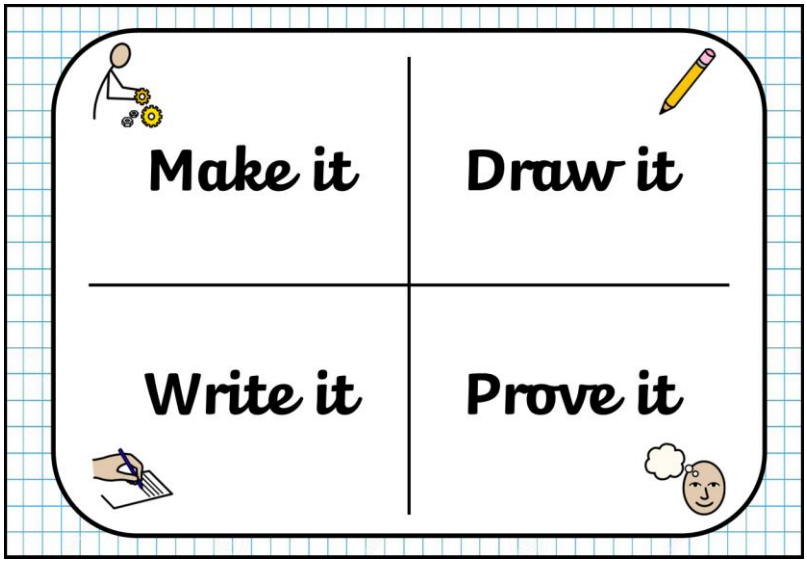
eef.li/early-maths

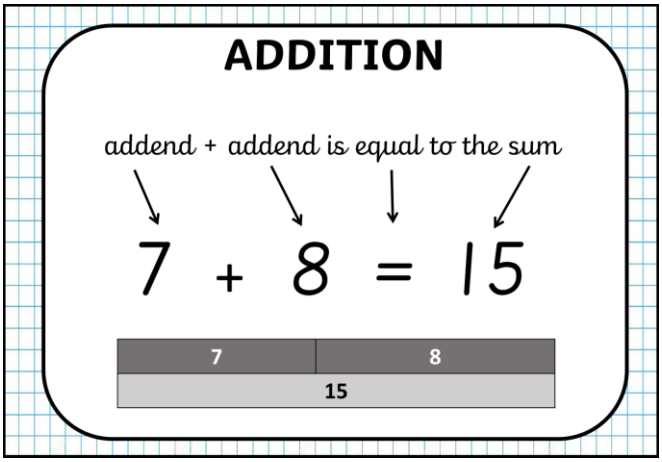
eef.li/maths-ks2-ks3

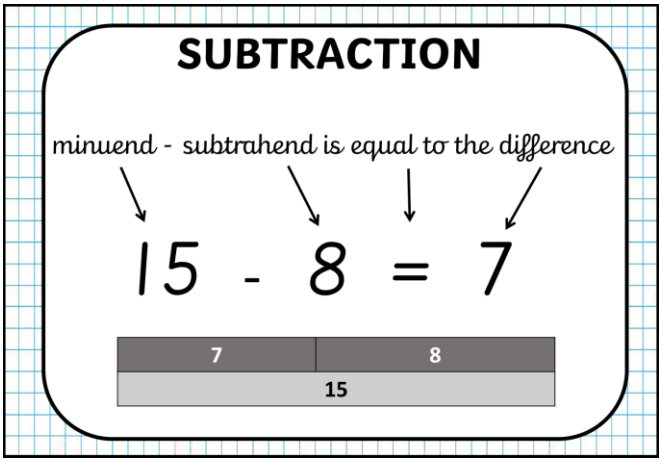
KS1 MATHS ENDPOINTS

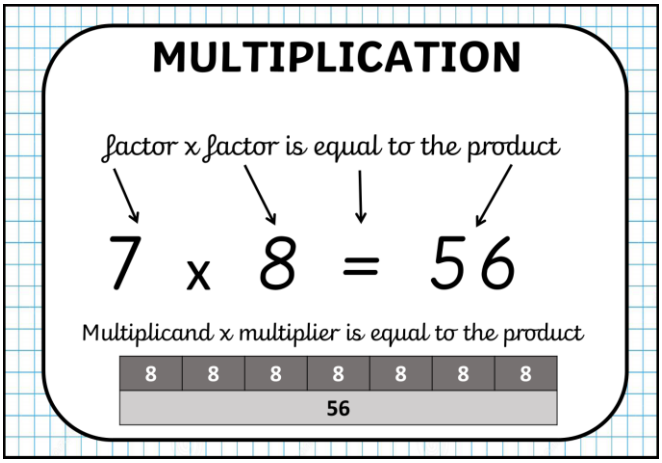
RAINOW ESSENTIALS

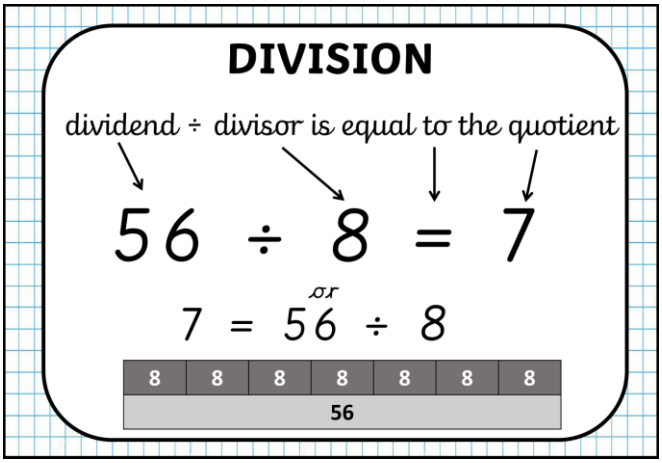
Children in KS1 will be exposed to and encouraged to use a wide range of models and representations in line with the White Rose Maths small steps curriculum. It is essential, at this stage, that they develop a mental picture of the number system to use for calculation.











RAINOW - MATHS ENDPOINTS – RECEPTION

https://whiteroseeducation.com/resources?year=reception&subject=maths

https://assets.whiteroseeducation.com/Resources/early-years/reception/Reception%20curriculum%20mapping.pdf

	I CAN STATEMENTS	RAINOW ESSENTIALS
NUMBER	Have a deep understanding of number to 10, including the composition of each number. Subitise (recognise quantities without counting) up to 5. Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.	
PATTERNS AND CONNECTIONS	Verbally count beyond 20, recognising the pattern of the counting system. Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity. Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.	**THE COUNTING PRINCIPLES** 1. The One-One principle 2. The Stable Order principle 3. The Cardinal principle 4. The Abstraction principle 5. The Order-Irrelevance principle
SPATIAL REASONING		

RAINOW - MATHS ENDPOINTS - YEAR 1

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
Number	Number & Place Value	I can count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number I can count, read and write numbers to 100 in numerals; count in multiples of twos, fives and tens I can identify one more and one less of a given number I can identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least I can read and write numbers from 1 to 20 in numerals and words.	Locate any number on a 1-100 grid or a beaded line 0-100 Recognise and compare objects according to height or length, weight or capacity, using appropriate mathematical language. E.g. the tree is taller than the bush COUNTING: Count to and across 100, forwards and backwards, from any single-digit or 2-digit number Count, read and write numbers to 100 in numerals Count in multiples of 2s, 5s, and 10s. (pre-requisite for learning multiplication facts)	
	Addition & Subtraction	I can read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs I can represent and use number bonds and related subtraction facts within 20 I can add and subtract one-digit and two-digit numbers to 20, including zero I can solve one-step problems that involve addition and subtraction, using concrete objects and pictorial representations, and missing number problems such as 7 = __ – 9.	Recognise the + and – and = signs, and use these to read and write additions and subtractions. Add and subtract 1-digit and 2-digit numbers to 20 CPA (Part/Part/Whole & Bar Models)	https://assets.whiteroseeducation.com/new-schemes/Addition%20and%20subtraction%20calculation%20policy%20July%202022%20v2.pdf
	Multiplication & Division	I can solve one-step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.	Multiply and divide (sharing/grouping) using CONCRETE/PICTORIAL and arrays (supported by teacher)	https://assets.whiteroseeducation.com/new-schemes/Multiplication%20and%20Division%20calculation%20policy%20July%202022.pdf
	Fractions	I can recognise, find and name a half as one of two equal parts of an object, shape or quantity I can recognise, find and name a quarter as one of four equal parts of an object, shape or quantity.	COUNTING: Recognise, find and name a half as one of two equal parts of an object, shape or quantity (part, part, whole) CONCRETE/PICTORIAL COUNTING: Recognise, find and name a quarter as one of four equal parts of an object, shape or quantity CONCRETE/PICTORIAL	

RAINOW - MATHS ENDPOINTS - YEAR 1

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
Measurement	Distance Mass Capacity Time Money	I can compare, describe and solve practical problems for: • lengths and heights [for example, long/short, longer/shorter, tall/short, double/half] • mass/weight [for example, heavy/light, heavier than, lighter than] • capacity and volume [for example, full/empty, more than, less than, half, half full, quarter] • time [for example, quicker, slower, earlier, later] I can measure and begin to record the following: • lengths and heights • mass/weight • capacity and volume • time (hours, minutes, seconds) I can recognise and know the value of different denominations of coins and notes I can sequence events in chronological order using language [for example, before and after, next, first, today, yesterday, tomorrow, morning, afternoon and evening] I can recognise and use language relating to dates, including days of the week, weeks, months and years I can tell the time to the hour and half past the hour and draw the hands on a clock face to show these times.	<u>TIME</u> Know the days of the week Tell the time to the hour and half past the hour (link to fractions learning)	
Geometry	Properties of Shape	I can recognise and name common 2-D and 3-D shapes, including: • 2-D shapes [for example, rectangles (including squares), circles and triangles] • 3-D shapes [for example, cuboids (including cubes), pyramids and spheres].		
	Position & Direction	I can describe position, direction and movement, including whole, half, quarter and three-quarter turns.		

RAINOW - MATHS ENDPOINTS - YEAR 2

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
Number	Number & Place Value	I can count in steps of 2, 3, and 5 from 0, and in tens from any number, forward and backward I can recognise the place value of each digit in a two-digit number (tens, ones) I can identify, represent and estimate numbers using different representations, including the number line I can compare and order numbers from 0 up to 100; use <, > and = signs I can read and write numbers to at least 100 in numerals and in words I can use place value and number facts to solve problems.	Recognise the value of the digits in a 2-digit number Locate any 2-digit number on a landmarked line and use this to compare numbers; record comparisons using < > Read/identify any number on the 1-100 number grid; understand that each number is a multiple of ten and some ones, e.g. 54 is 50 and 4 more. Compare and order objects according to their lengths, weights and capacities using suitable units. COUNTING: Count in steps of 2s, 3s and 5s from 0 and 10s from any number (forwards and backwards)	
	Addition & Subtraction	I can solve problems with addition and subtraction: • using concrete objects and pictorial representations, including those involving numbers, quantities and measures • applying my increasing knowledge of mental and written methods I can recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 I can add and subtract numbers using concrete objects, pictorial representations, and mentally, including: • a two-digit number and ones • a two-digit number and tens • two two-digit numbers • adding three one-digit numbers I can show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot I can recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.	Recognise that addition and subtraction are inverse operations and understand that 10 – 4 = 6 as well as 6 + 4 = 10. (Part/Part/Whole & Bar Models) Know number pairs for all the numbers up to and including 20 Know different unit patterns when not crossing a ten, e.g. 4 + 3 = 7 14 + 3 = 17 24 + 3 = 27, etc. Begin to recognise unit patterns when crossing a ten, e.g. 5 + 6 = 11 15 + 6 = 21 25 + 6 = 31, etc. Add and subtract using concrete resources, pictorial representations (including dienes) and mental methods (number lines, partitioning): 2d+1d, 2d+2d, 1d+1d+1d. CPA	https://assets.whiteroseeducation.com/new-schemes/Addition%20and%20subtraction%20calculation%20policy%20July%202022%20v2.pdf
	Multiplication & Division	I can recall and use multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers I can calculate mathematical statements for multiplication and division within the multiplication tables and write them using the multiplication (×), division (÷) and equals (=) signs I can show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot I can solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods, and multiplication and division facts, including problems in contexts.	Recognise the x and ÷ signs, and use these to read and write multiplications and division calculations Multiply and divide (sharing and grouping) using materials, arrays, repeated addition, mental methods and x & ÷ facts. CONCRETE/PICTORIAL	https://assets.whiteroseeducation.com/new-schemes/Multiplication%20and%20Division%20calculation%20policy%20July%202022.pdf
	Fractions	I can recognise, find, name and write fractions 1/3 ¼ 2/4 ¾ of a length, shape, set of objects or quantity I can write simple fractions for example, 1/2 of 6 = 3 and recognise the equivalence of ½ and 2/4	Read & write and find 1/3, 1/4, 2/4, 3/4 of lengths, shapes, sets of objects NB.CONCRETE/PICTORIAL Using fractions as operators (½ of 6 is...?) NB. Abstract Count in halves	

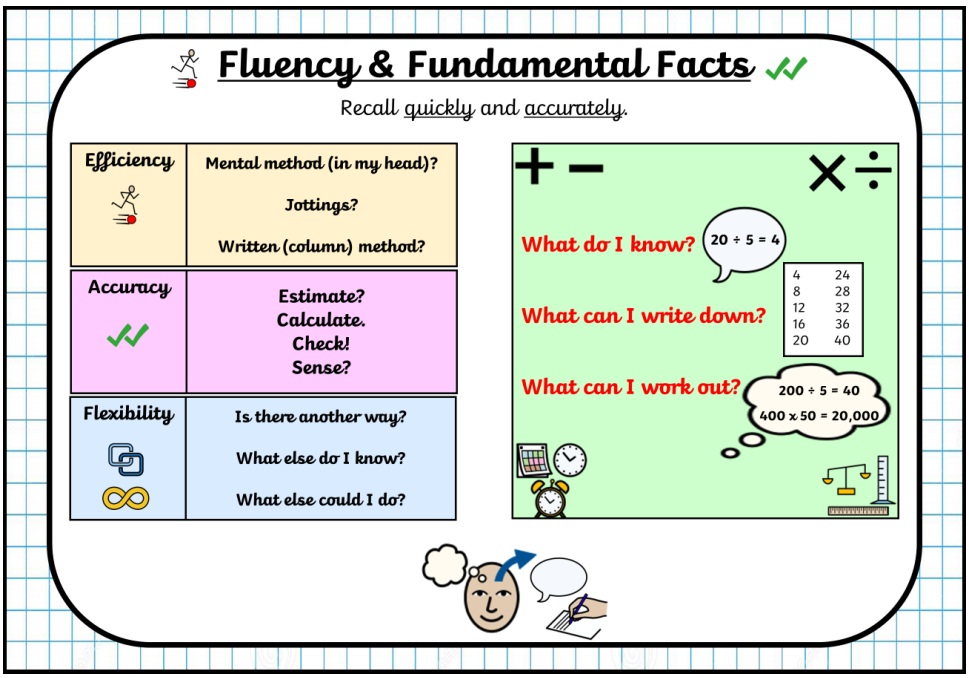
RAINOW - MATHS ENDPOINTS - YEAR 2

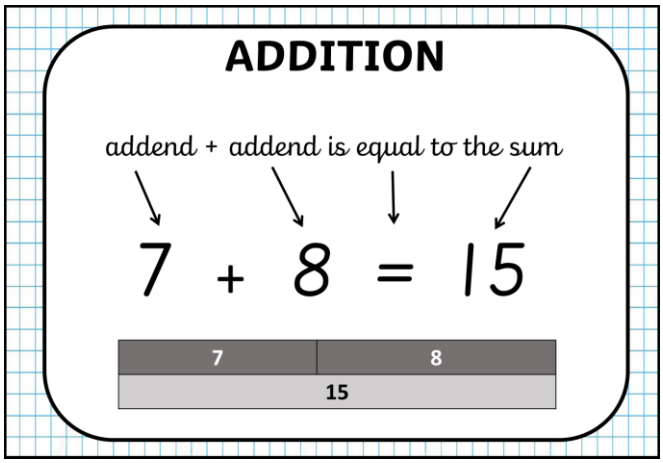
		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
Measurement	Distance Mass Capacity Time Money	I can choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm); mass (kg/g); temperature (°C); capacity (litres/ml) to the nearest appropriate unit, using rulers, scales, thermometers and measuring vessels I can compare and order lengths, mass, volume/capacity and record the results using >, < and = I can recognise and use symbols for pounds (£) and pence (p); combine amounts to make a particular value I can find different combinations of coins that equal the same amounts of money I can solve simple problems in a practical context involving addition and subtraction of money of the same unit, including giving change I can compare and sequence intervals of time I can tell and write the time to five minutes, including quarter past/to the hour and draw the hands on a clock face to show these times I know the number of minutes in an hour and the number of hours in a day.	<u>TIME</u> Tell the time to quarter past and quarter to the hour (link to fractions learning)	
Geometry	Properties of Shape	I can identify and describe the properties of 2-D shapes, including the number of sides and line symmetry in a vertical line I can identify and describe the properties of 3-D shapes, including the number of edges, vertices and faces I can identify 2-D shapes on the surface of 3-D shapes, [for example, a circle on a cylinder and a triangle on a pyramid] I can compare and sort common 2-D and 3-D shapes and everyday objects.		
	Position & Direction	I can order and arrange combinations of mathematical objects in patterns and sequences I can use mathematical vocabulary to describe position, direction and movement, including movement in a straight line and distinguishing between rotation as a turn and in terms of right angles for quarter, half and three-quarter turns (clockwise and anti-clockwise).		
	Statistics	I can interpret and construct simple pictograms, tally charts, block diagrams and simple tables I can ask and answer simple questions by counting the number of objects in each category and sorting the categories by quantity I can ask and answer questions about totalling and comparing categorical data.		

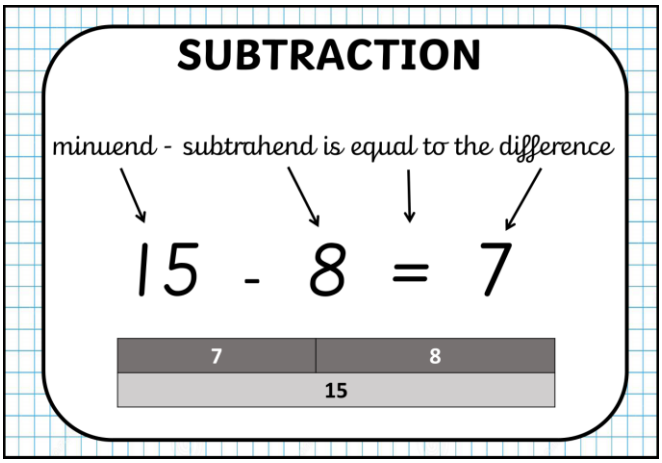
KS2 MATHS ENDPOINTS

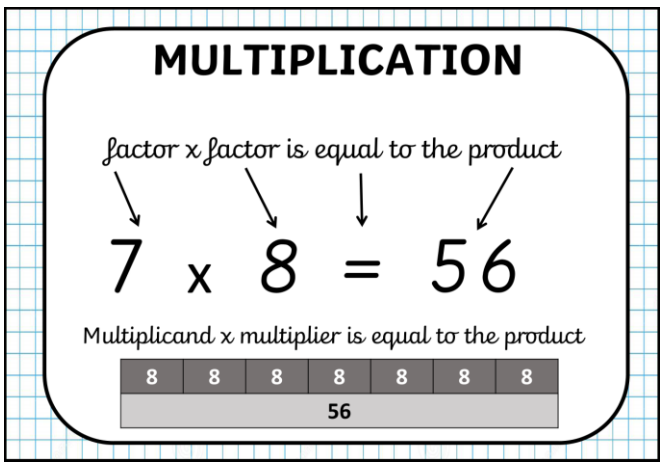
RAINOW ESSENTIALS

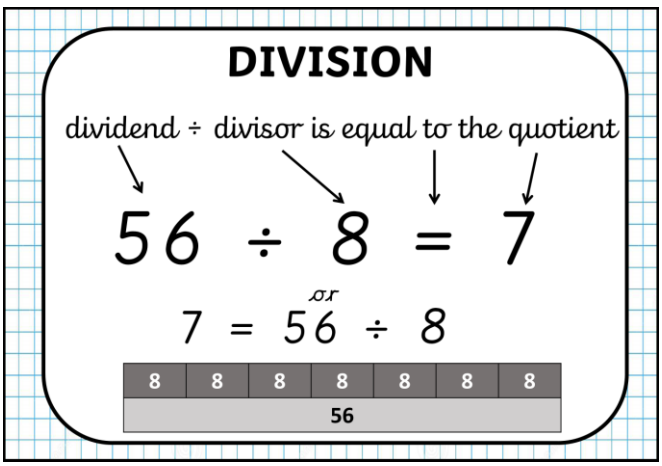
CALCULATION METHODS PROGRESSION











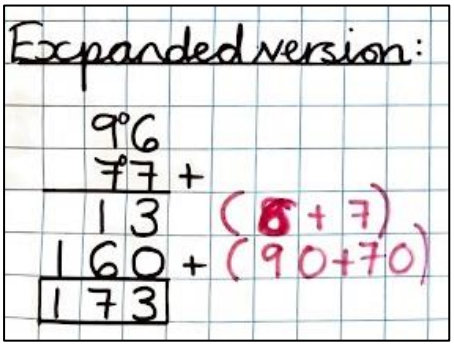
RAINOW - MATHS ENDPOINTS - YEAR 3

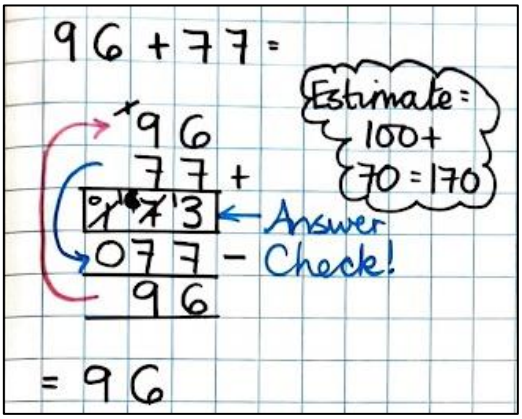
		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS	
Number	Number & Place Value	I can count from 0 in multiples of 4, 8, 50 and 100; find 10 or 100 more or less than a given number I can recognise the place value of each digit in a three-digit number (hundreds, tens, ones) I can compare and order numbers up to 1000 I can identify, represent and estimate numbers using different representations I can read and write numbers up to 1000 in numerals and in words I can solve number problems and practical problems involving these ideas.	**Recognise the value of the digits in a 3-digit number** **Locate any 3-digit number on a landmarked line from 0-1000 and use this to order and compare numbers (< >)** **COUNTING** **Begin to read scales (inc. numberlines) of different types (and count up in) halves, 5s, 50s, 500s** **Count from 0 in multiples of 4, 8, 50 and 100**		
	Addition & Subtraction	I can add and subtract numbers mentally, including: • a three-digit number and ones • a three-digit number and tens • a three-digit number and hundreds I can add and subtract numbers with up to three digits, using formal written methods of columnar addition and subtraction I can estimate the answer to a calculation and use inverse operations to check answers I can solve problems, including missing number problems, using number facts, place value, and more complex addition and subtraction.	**Partition to double and halve numbers (odd and even numbers) 58 => 25 + 4 = 29** **Mentally add or subtract: 3d+1d, 3d+2d, 3d+3d** **Add up to 3-digit numbers using column addition NB. Secure understanding of PV and concept of zero as a placeholder are pre-requisite to this** **Subtract up to 3-digit numbers using column subtraction (including exchanging across columns) NB. Secure understanding of PV and concept of zero as a placeholder are pre-requisite to this**	**INFORMAL METHODS** Empty numberline (counting on) Partitioning (expanded column)	**COLUMN METHODS (method first followed by 'carrying' & 'exchanging')** 2d + 2d 3d + 2d 2d - 2d 3d - 2d 3d - 3d
	Multiplication & Division	I can recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables I can write and calculate mathematical statements for multiplication and division using the multiplication tables that they know, including for two-digit numbers times one-digit numbers, using mental and progressing to formal written methods I can solve problems, including missing number problems, involving multiplication and division, including positive integer scaling problems and correspondence problems in which n objects are connected to m objects.	**Multiply any 2-digit number by 10 or a 1-digit number by 100; divide any multiple of 10 or 100 by 10 or 100.** **Understand the effect of multiplying and dividing whole numbers by 10 & 100. (LINK TO PLACE VALUE)** **Multiply a 1-digit number by a 2-digit number starting to use the grid e.g. 4 x 13 = (Use multiplication tables that they know)** **Mentally divide numbers using chunking on a numberline by counting up (Use multiplication tables that they know)**	**INFORMAL METHODS** Grouping on numberlines	**COLUMN METHODS (only use multipliers and divisors of x2,x3,x4,x5x10)** **GRID:** 2d x 1d **CHUNKING:** 2d ÷ 1d (no remainders)
	Fractions	I can count up and down in tenths; recognise that tenths arise from dividing an object into 10 equal parts and in dividing one-digit numbers or quantities by 10 I can recognise, find and write fractions of a discrete set of objects: unit fractions and non-unit fractions with small denominators I can recognise and use fractions as numbers: unit fractions and non-unit fractions with small denominators I can recognise and show, using diagrams, equivalent fractions with small denominators I can add and subtract fractions with the same denominator within one whole [for example, 5/6 + 1/7 = 6/7 I can compare and order unit fractions, and fractions with the same denominators I can solve problems that involve all of the above	**Understand the value of fractions to be able place them onto numberlines (different starting and ending numbers), comparing and ordering them. PICTORIAL** **Recognise and show equivalent fractions CONCRETE PICTORIAL** **Add and subtract fractions with the same denominator within one whole CPA (introduced in Y3, essential skill at end of Y4)**	**ADDITION OF FRACTIONS** Same denominator 1/3 + 1/3 2/5 + 2/5 NB Keep answers less than 1.	**SUBTRACTION OF FRACTIONS** Same denominator 2/3 - 1/3 3/5 - 1/5 NB Keep answers less than 1.

RAINOW - MATHS ENDPOINTS - YEAR 3

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
Measurement	Distance Mass Capacity Time Money	I can measure, compare, add and subtract: lengths (m/cm/mm); mass (kg/g); volume/capacity (l/ml) I can measure the perimeter of simple 2-D shapes I can add and subtract amounts of money to give change, using both £ and p in practical contexts I can tell and write the time from an analogue clock, including using Roman numerals from I to XII, and 12-hour and 24-hour clocks I can estimate and read time with increasing accuracy to the nearest minute; record and compare time in terms of seconds, minutes and hours; use vocabulary such as o'clock, a.m./p.m., morning, afternoon, noon and midnight I can know the number of seconds in a minute and the number of days in each month, year and leap year I can compare durations of events [for example to calculate the time taken by particular events or tasks].	**TIME** **Tell the time to the nearest minute on an analogue clock**	
Geometry	Properties of Shape	I can draw 2-D shapes and make 3-D shapes using modelling materials I can recognise 3-D shapes in different orientations and describe them I can recognise angles as a property of shape or a description of a turn I can identify right angles, recognise that two right angles make a half-turn, three make three quarters of a turn and four a complete turn I can identify whether angles are greater than or less than a right angle I can identify horizontal and vertical lines and pairs of perpendicular and parallel lines.		
	Position & Direction	n/a		
Statistics		I can interpret and present data using bar charts, pictograms and tables solve one-step and two-step questions [for example, 'How many more?' and 'How many fewer?'] using information presented in scaled bar charts and pictograms and tables.		

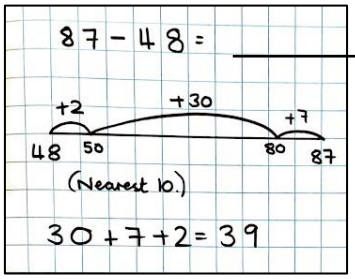
Y3 ADDITION

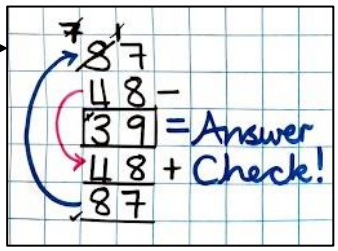


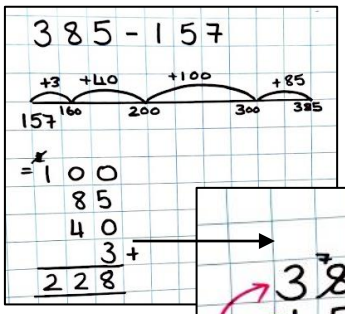


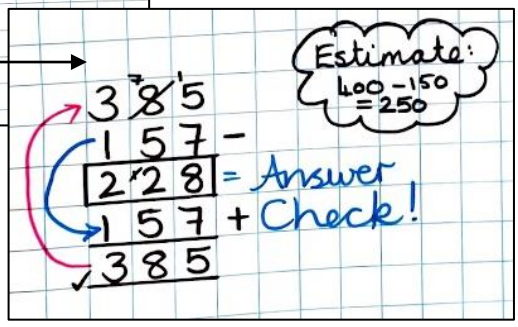
* This can be simplified by excluding the inverse checking step.

Y3 SUBTRACTION



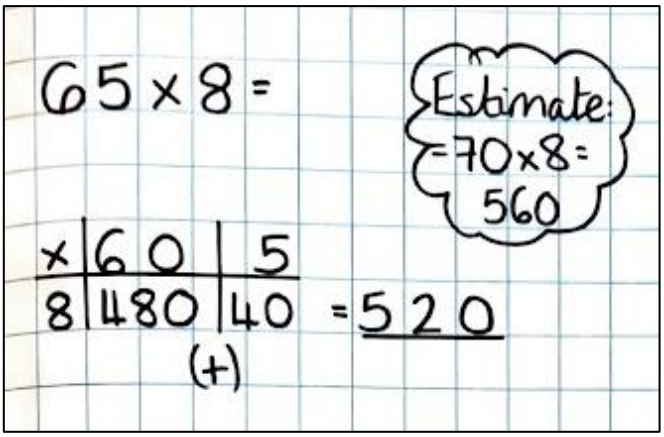






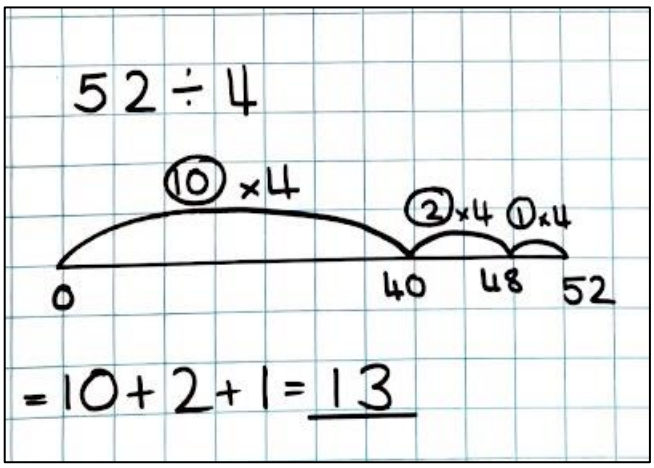
* This can be simplified by excluding the inverse checking step.

Y3 MULTIPLICATION



* Checking with inverse should be encouraged once fluency achieved in multiplication and division methods.

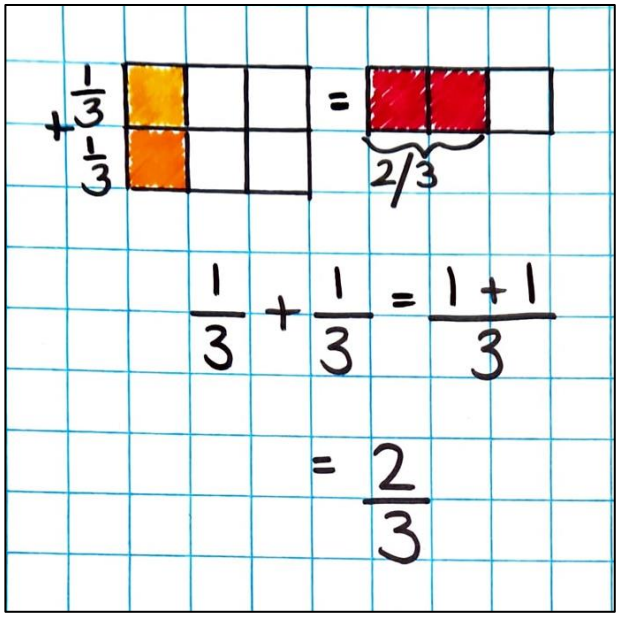
Y3 DIVISION



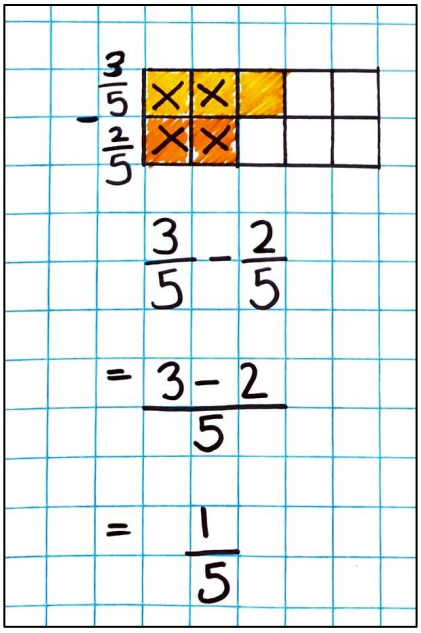
*Writing out multiples of the divisor should be encouraged. This will prepare for when It becomes vital in Y5 and Y6.

4	24
8	28
12	32
16	36
20	40

Y3 ADDING FRACTIONS



Y3 SUBTRACTING FRACTIONS



* NB. The ‘thing’ that is being added or subtracted has to be the same.

1 apple + 1 apple = 2 apples

3 cakes + 4 cakes = 7 cakes

2 quarters + 1 quarter = 3 quarters

RAINOW - MATHS ENDPOINTS - YEAR 4

Number

NUMBER & PLACE VALUE

I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
I can count in multiples of 6, 7, 9, 25 and 1000 I can find 1000 more or less than a given number I can count backwards through zero to include negative numbers I can recognise the place value of each digit in a four-digit number (thousands, hundreds, tens, and ones) I can order and compare numbers beyond 1000 I can identify, represent and estimate numbers using different representations I can round any number to the nearest 10, 100 or 1000 I can solve number and practical problems that involve all of the above and with increasingly large positive numbers I can read Roman numerals to 100 (I to C) and know that over time, the numeral system changed to include the concept of zero and place value.	**Recognise the value of the digits in a 4-digit number and the use of zero as a place holder.** **Recognise the value of tenths and hundredths** **Locate 4- and 5-digit numbers on a landmarked line and use this to compare and order numbers (< >)** **Round any number to the nearest 10, 100, 1000** **Multiply 1- and 2-digit numbers by 10, 100 and 1000; divide 1- and 2-digit numbers by 10 and 100 to understand place value in decimal numbers with one place.** **Convert between units of measurement, e.g. cm to m, g to Kg and ml to L NB. Teach alongside objective above** **COUNTING** **Recognise negative numbers in relation to number lines and temperature; count backwards through zero** **Count in multiples of 6, 7, 9, 25 and 1000** **Begin to read scales (inc. numberlines) of different types (and count up in) 0.1s, 10s, 100s, 1000s**	ROUNDING LINES: 340 350 360 370 380 390 400 410 Which multiples of ten would **363** be found between? Which is it closest to? 360 363 365 370

ADDITION & SUBTRACTION

I CAN STATEMENTS	RAINOW ESSENTIALS	INFORMAL METHODS	COLUMN METHODS (method first followed by 'carrying' & 'exchanging') USE INVERSE TO CHECK	
I can add and subtract numbers with up to 4 digits using the formal written methods of columnar addition and subtraction where appropriate I can estimate and use inverse operations to check answers to a calculation I can solve addition and subtraction two-step problems in contexts, deciding which operations and methods to use and why.	**Add multiples of 1, 10, 100, 1000 without difficulty, e.g. 15,347 + 3000, 434 + 300 and 648 – 220** **Know how to use column addition for up to 4-digit numbers** **Find the difference using counting up** **Know how to use column subtraction for up to 4-digit numbers - include exchanging**	Partitioning Number lines (counting on)	Revise 3d+2d 3d + 3d 4d + 2d 4d + 3d 4d + 4d	Revise 3d-3d 4d - 2d 4d - 3d 4d – 4d

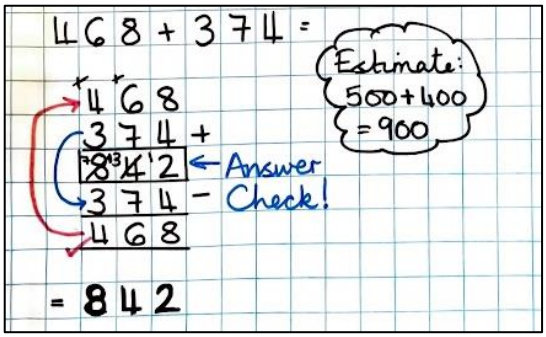
MULTIPLICATION & DIVISION

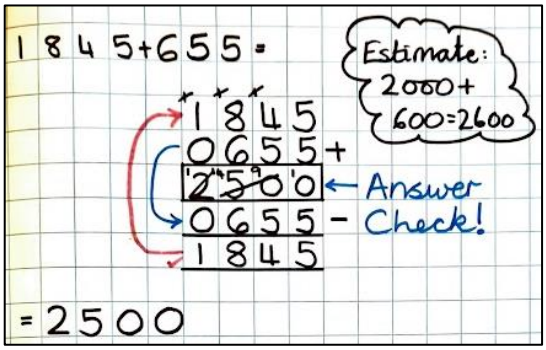
I CAN STATEMENTS	RAINOW ESSENTIALS	INFORMAL METHODS	COLUMN METHODS (method first followed by 'carrying' & 'exchanging') USE INVERSE TO CHECK	
I can recall multiplication and division facts for multiplication tables up to 12 × 12 I can use place value, known and derived facts to multiply and divide mentally, including: multiplying by 0 and 1; dividing by 1; multiplying together three numbers I can recognise and use factor pairs and commutativity in mental calculations I can multiply two-digit and three-digit numbers by a one-digit number using formal written layout I can solve problems involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and harder correspondence problems such as n objects are connected to m objects.	**Multiply 1- digit numbers by 2-digit or 3-digit numbers using grid method** **Use column multiplication (short multiplication) to multiply 2-digit x 1-digit and 3-digit x 1-digit numbers** **Know how to use 'efficient chunking' for division above the range of the tables' facts, e.g. 84 ÷ 6 = ?** **NB: LONG DIVISION COLUMN METHODS TO BE INTRODUCED IN Y5**	GRID METHOD: Revise 2d x 1d 3d x 1d 2d x 2d (precursor to Y5 using column method) FACTOR CARDS: 1 12 2 3 ~~5~~ 6 4 X Grouping on a numberline (precursor to chunking)	2d x 1d (any multiplier) 3d x 1d	2d ÷ 1d no remainders 2d ÷ 1d with remainders 3d ÷ 1d no remainders 3d ÷ 1d with remainders (Interpret remainders in context)

RAINOW - MATHS ENDPOINTS - YEAR 4

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS	
				ADDITION OF FRACTIONS	SUBTRACTION OF FRACTIONS
Numner	FRACTIONS	I can recognise and show, using diagrams, families of common equivalent fractions I can solve problems involving increasingly harder fractions to calculate quantities, and fractions to divide quantities, including non-unit fractions where the answer is a whole number I can add and subtract fractions with the same denominator I can count up and down in hundredths; recognise that hundredths arise when dividing an object by one hundred and dividing tenths by ten. I can recognise and write decimal equivalents of any number of tenths or hundredths I can recognise and write decimal equivalents to ¼ ½ 3/4 I can find the effect of dividing a one- or two-digit number by 10 and 100, identifying the value of the digits in the answer as ones, tenths and hundredths I can round decimals with one decimal place to the nearest whole number I can compare numbers with the same number of decimal places up to two decimal places I can solve simple measure and money problems involving fractions and decimals to two d.p	**Know that one-place decimal numbers represent ones and tenths e.g. 3.7 = 3 ones and 7 tenths.** **Calculate the equivalent fraction for fractions with given denominators or numerators, e.g. ½ = ?/8** **Reduce a fraction to its simplest form, e.g. 6/12 ≡ ½. (make links to multiplication and division)** **Add and subtract fractions with the same denominator CPA (introduced in Y3, essential skill at end of Y4)**	Add fractions within 1 (same and different denominators) Add fractions total over 1 (same and different denominators) 2/5 + 4/5 = 6/5 = 1 1/5 2/6 + ½ = 2/6 + 3/6 = 5/6	Subtract fractions within 1 (same and different denominators) 6/8 – ½ = 6/8 – 4/8 = 2/8
Measurement	DISTANCE MASS CAPACITY TIME MONEY	I can convert between different units of measure [for example, kilometre to metre; hour to minute] I can measure and calculate the perimeter of a rectilinear figure (including squares) in centimetres and metres I can find the area of rectilinear shapes by counting squares I can estimate, compare and calculate different measures, including money in pounds and pence	**TIME** **Read and convert 12-and 24-hour clock**		
Geometry	PROPERTIES OF SHAPE	I can compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes I can identify acute and obtuse angles and compare and order angles up to two right angles by size I can identify lines of symmetry in 2-D shapes presented in different orientations I can complete a simple symmetric figure with respect to a specific line of symmetry.			
	POSITION & DIRECTION	I can describe positions on a 2-D grid as coordinates in the first quadrant I can describe movements between positions as translations of a given unit to the left/right and up/down I can plot specified points and draw sides to complete a given polygon.			
	STATISTICS	I can interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs. I can solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.			

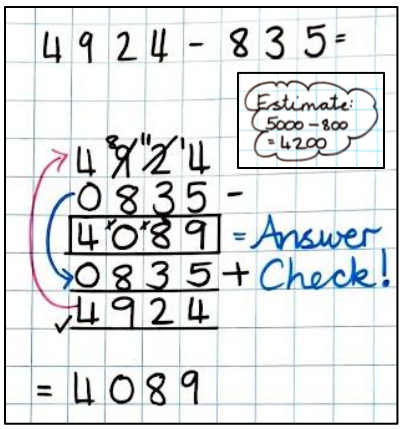
Y4 COLUMN ADDITION

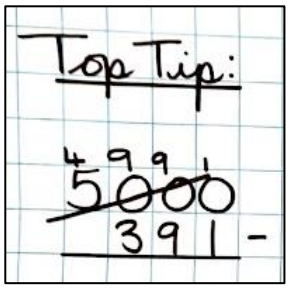


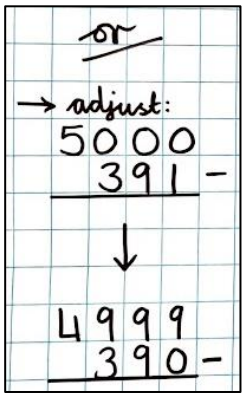


* This can be simplified by excluding the inverse checking step.

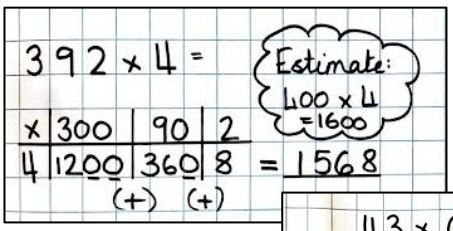
Y4 SUBTRACTION

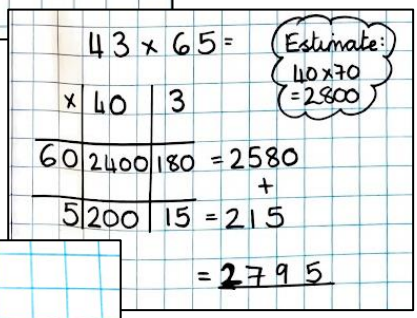


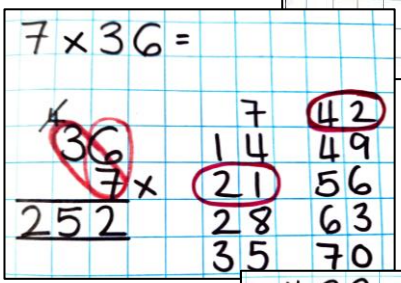


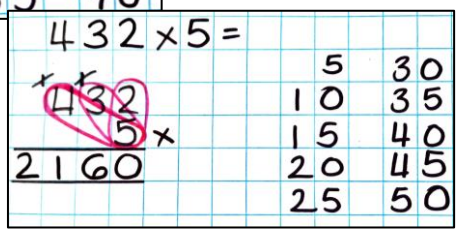


Y4 MULTIPLICATION





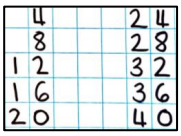


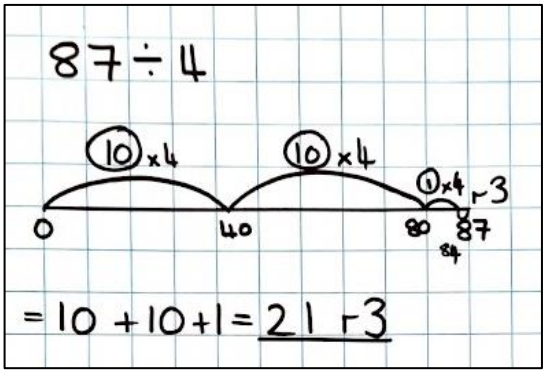


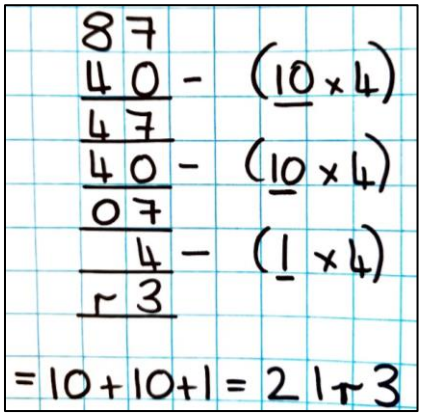
* Checking with inverse should be encouraged once fluency achieved in multiplication and division methods.

Y4 DIVISION

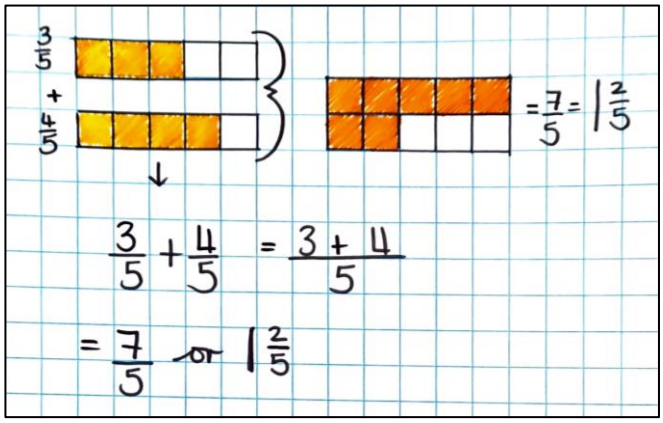
MULTIPLE CARD: *Writing out multiples of the divisor should be encouraged. This will prepare for when It becomes vital in Y5 and Y6.

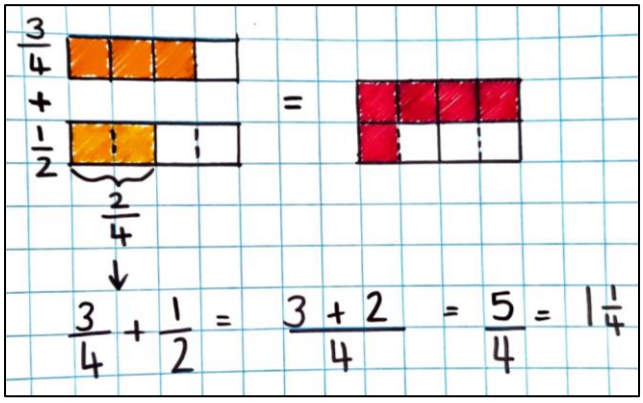




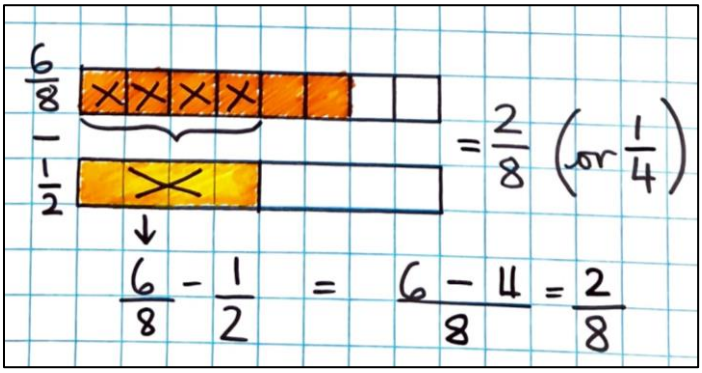


Y4 ADDING FRACTIONS





Y4 SUBTRACTING FRACTIONS



* NB. The ‘thing’ that is being added or subtracted has to be the same.

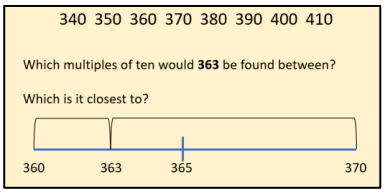
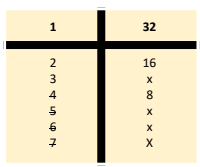
1 apple + 1 apple = 2 apples

3 cakes + 4 cakes = 7 cakes

2 quarters + 1 quarter = 3 quarters

In Y4, different denominators are introduced. The idea of equivalence and finding equivalent fractions is key.

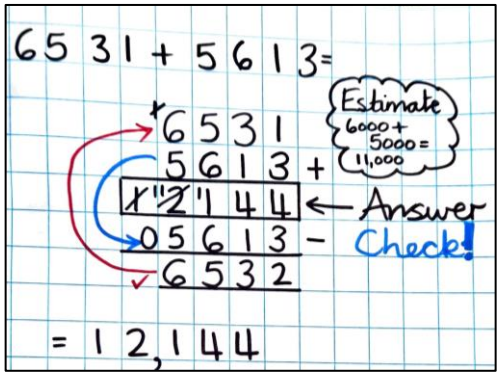
RAINOW - MATHS ENDPOINTS - YEAR 5

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS	
Number	NUMBER & PLACE VALUE	I can read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit I can count forwards or backwards in steps of powers of 10 for any given number up to 1 000 000 I can interpret negative numbers in context, count forwards and backwards with positive and negative whole numbers, including through zero I can round any number up to 1 000 000 to the nearest 10, 100, 1000, 10 000 and 100 000 I can solve number problems and practical problems that involve all of the above I can read Roman numerals to 1000 (M) and recognise years written in Roman numerals.	**Recognise the value of the digits in a 5- and 6-digit number (up to 1,000,000)** **Locate 5- and 6-digit numbers on a landmarked line; use this to compare/order numbers (< >)** **Round any number up to 1,000,000 to the nearest 10,100, 1,000, 10,000 and 100,000** **Recognise the value of tenths, hundredths and thousandths** **Understand the effect of multiplying and dividing by 10, 100 and 1,000 (including whole numbers and decimals)** **Extend multiplication/division fact knowledge to powers of 10 (inc. decimals) - If I know that 4 x 5 = 20 then I also know that 40 x 5 = 200** **COUNTING** **Read scales (inc. numberlines) of different types (and count up in) quarters, 2.5s, 25s, 250s etc.**	Rounding lines: 	
	ADDITION & SUBTRACTION	I can add and subtract whole numbers with more than 4 digits, including using formal written methods (columnar addition and subtraction) I can add and subtract numbers mentally with increasingly large numbers I can use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy I can solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why.	**Make decisions about the most efficient and therefore appropriate method to use based on the numbers involved** **Add and subtract whole numbers and decimals (inc. money) using column methods**	**INFORMAL METHODS** *Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving.* **Include: partitioning + / numberlines –** **Pupils' own choice informal methods (use number sense)**	**COLUMN METHODS (method first followed by 'carrying' & 'exchanging') USE INVERSE TO CHECK** Revise 4d + 4d 5d + 5d 2d.1dp + 2d.1dp 2d.2dp + 2dp.2dp (money) Revise 4d - 4d 5d - 5d 2d.1dp - 2d.1dp 2d.2dp - 2dp.2dp (money)
	MULTIPLICATION & DIVISION	I can identify multiples and factors, including finding all factor pairs of a number, and common factors of two numbers I can know and use the vocabulary of prime numbers, prime factors and composite (non-prime) numbers I can establish whether a number up to 100 is prime and recall prime numbers up to 19 I can multiply numbers up to 4 digits by a one- or two-digit number using a formal written method, including long multiplication for two-digit numbers I can multiply and divide numbers mentally drawing upon known facts I can divide numbers up to 4 digits by a one-digit number using the formal written method of short division and interpret remainders appropriately for the context I can multiply and divide whole numbers and those involving decimals by 10, 100 and 1000	**Multiply 2- and 3-digit numbers and decimals using grid method (use known facts)** **Multiply up to 4-digit by 1-digit and 2-digit numbers using column multiplication** **Divide 2-digit and 3-digit numbers by 1-digit numbers above the range of tables using efficient chunking** **Use long division (column method) to divide up to 4-digit numbers by 1-digit number.** **Interpret remainders in context.**	**INFORMAL METHODS** **GRID METHOD** Up to 3d x 2d (It becomes less efficient with anything bigger). Use known facts (number sense). Decimals: 1d.1dp x 1d.1dp **NUMBERLINE** (grouping) use efficient groups (link to CHUNKING) FACTOR CARDS: 	**COLUMN METHODS (method first followed by 'carrying' & 'exchanging') USE INVERSE TO CHECK** **LONG MULTIPLICATION** Revise 3 x 1 4d x 1d 2d x 2d (previously used grid) 3d x 2d **CHUNKING (efficient groups) No remainders first** Revise 3d ÷ 1d **LONG DIVISION** 2d ÷ 1d 3d ÷ 1d 4d ÷ 1d (list multiples -> MULTIPLE CARD) INTERPRET REMAINDERS IN CONTEXT.

RAINOW - MATHS ENDPOINTS - YEAR 5

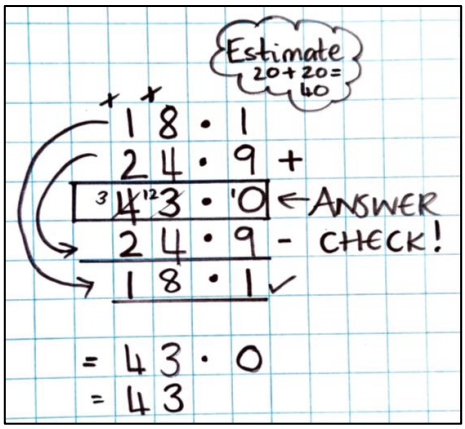
		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS	
Number	FRACTIONS	I can compare and order fractions whose denominators are all multiples of the same number I can identify, name and write equivalent fractions of a given fraction, represented visually, including tenths and hundredths I can recognise mixed numbers and improper fractions and convert from one form to the other and write mathematical statements > 1 as a mixed number [for example, 2/5 + 4/5 = 1 1/5] I can add and subtract fractions with the same denominator and denominators that are multiples of the same number I can multiply proper fractions and mixed numbers by whole numbers, supported by materials and diagrams I can read and write decimal numbers as fractions [for example, 0.71 = 71/100] I can recognise and use thousandths and relate them to tenths, hundredths and decimal equivalents I can round decimals with two d.p. to the nearest whole number and to one d.p. I can read, write, order and compare numbers with up to three d.p. I can solve problems involving number up to three d.p. I can recognise the per cent symbol (%) and understand that per cent relates to 'number of parts per hundred', and write percentages as a fraction with denominator 100, and as a decimal I can solve problems which require knowing percentage and decimal equivalents of ½ ¼ 1/5 2/5 4/5 and those fractions with a denominator of a multiple of 10 or 25.	**Compare and order fractions where the denominators are multiples of the same number** **Recognise mixed numbers and improper fractions and convert them** **Find equivalent fractions of any given fraction** CPA **Add and subtract fractions with different denominators** CONCRETE PICTORIAL **Multiply a fraction by a whole number** CONCRETE PICTORIAL **Recognise that percentages relate to the number of parts per hundred (% = out of a hundred)** **Recognise the value of tenths, hundredths and thousandths**	**ADDITION OF FRACTIONS** Add fractions within 1 (different denominators) Add fractions to total over 1 (different denominators) Add mixed number **MULTIPLICATION OF FRACTIONS** Multiply a unit fraction by an integer Multiply a non-unit fraction by an integer. Multiply a mixed number by an integer **(REPEATED ADDITION)**	**SUBTRACTION OF FRACTIONS** Subtract fractions (different denominators) Subtract mixed numbers **PERCENTAGES (link to powers of ten)** Find 1% (/100) Find 10% (/10) to calculate other percentages.
Measurement	DISTANCE MASS CAPACITY TIME MONEY	I can convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre; gram and kilogram; litre and millilitre) I can understand and use approximate equivalences between metric units and common imperial units such as inches, pounds and pints I can measure and calculate the perimeter of composite rectilinear shapes in centimetres and metres I can calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm^2) and square metres (m^2) and estimate the area of irregular shapes I can estimate volume [for example, using 1 cm^3 blocks to build cuboids (including cubes)] and capacity [for example, using water] I can solve problems involving converting between units of time I can use all four operations to solve problems involving measure [for example, length, mass, volume, money] using decimal notation, including scaling.	**TIME** **Read and interpret 12- and 24-hour clock presented in timetables**		
Geometry	PROPERTIES OF SHAPE	I can identify 3-D shapes, including cubes and other cuboids, from 2-D representations I know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles I can draw given angles, and measure them in degrees I can identify: • angles at a point and one whole turn (total 360°) • angles at a point on a straight line and 2 • 1 a turn (total 180°) • other multiples of 90° I can use the properties of rectangles to deduce related facts and find missing lengths and angles I can distinguish between regular and irregular polygons based on reasoning about equal sides and angles.			
	POSITION & DIRECTION	I can identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language, and know that the shape has not changed.			
	STATISTICS	I can solve comparison, sum and difference problems using information presented in a line graph I can complete, read and interpret information in tables, including timetables.			

Y5 ADDITION

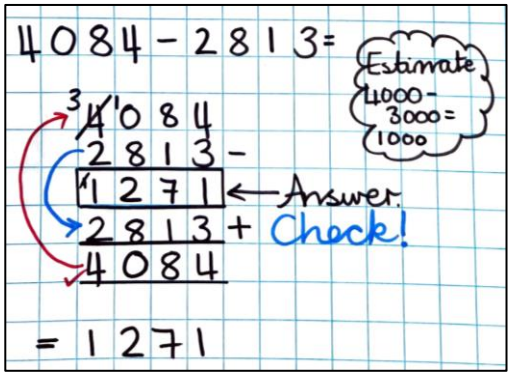


Introduce:

*decimal points need to line up.

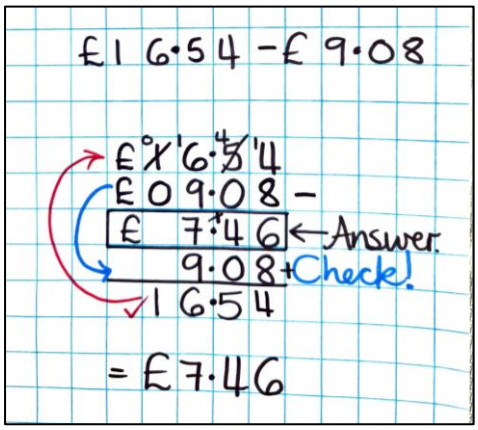


Y5 SUBTRACTION

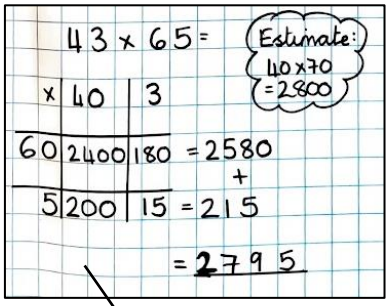


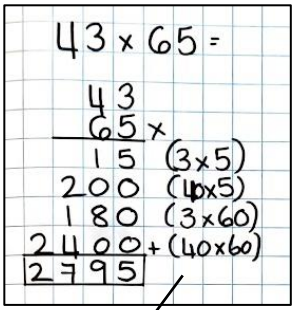
Introduce:

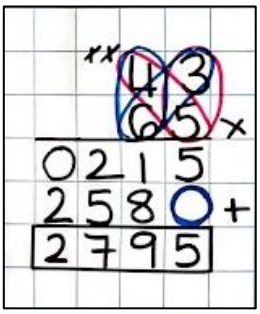
*decimal points need to line up.

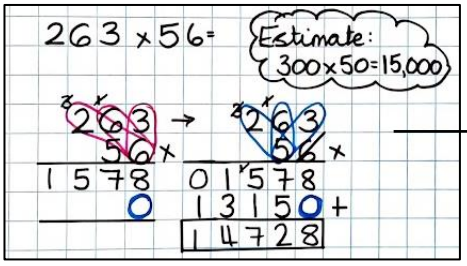


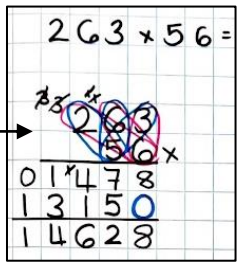
Y5 MULTIPLICATION







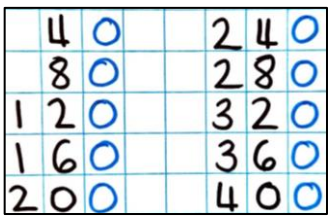


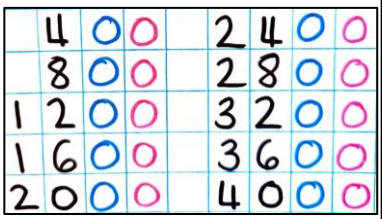


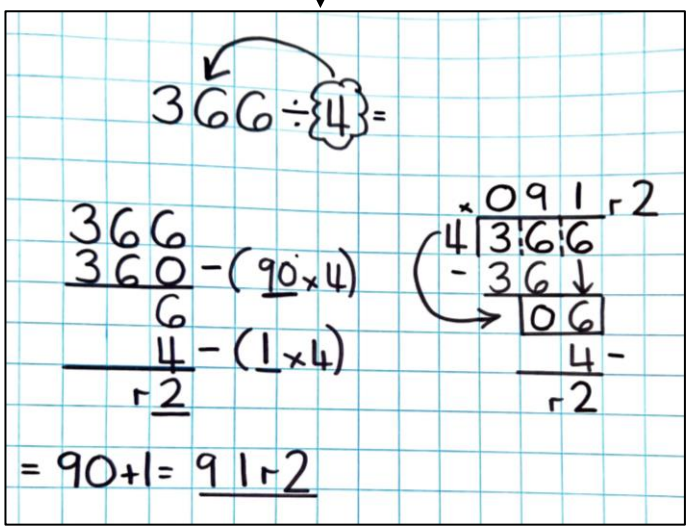
*** The more steps involved, the more chances there are to make computational errors. Therefore, it is vital to double-check workings and/or use the inverse operation.**

Y5 DIVISION

MULTIPLE CARDS:

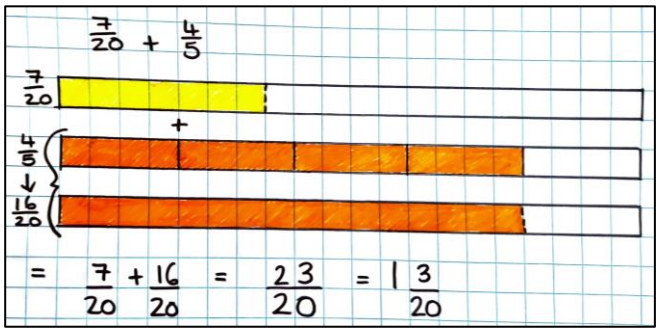


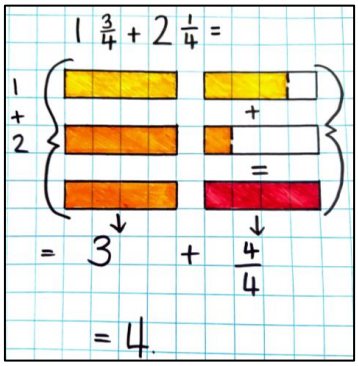




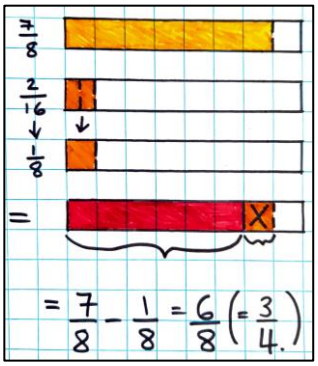
Chunking --> Long division

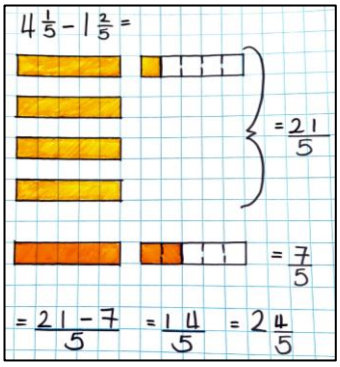
Y5 ADDING FRACTIONS

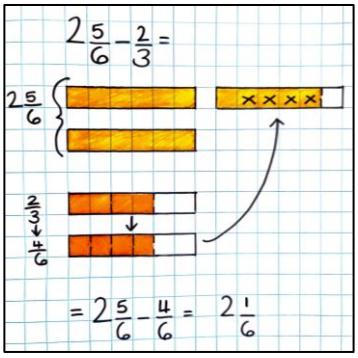




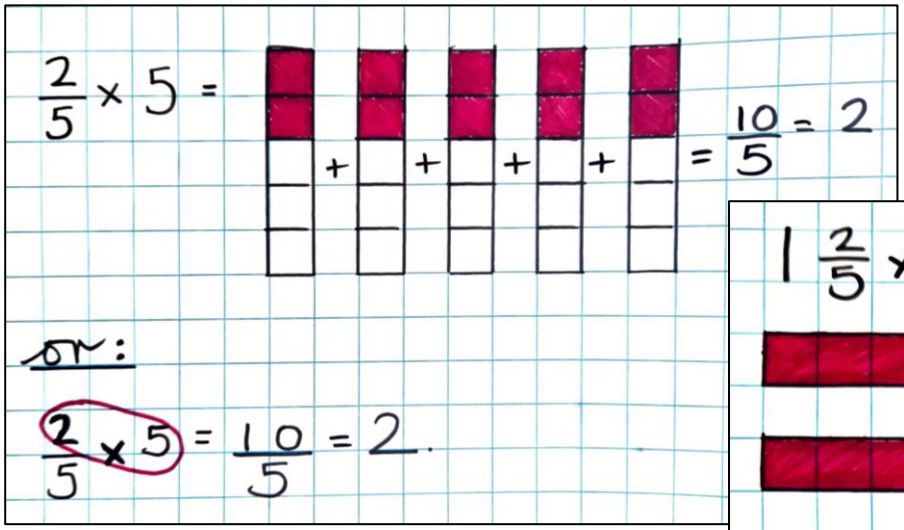
Y5 SUBTRACTING FRACTIONS

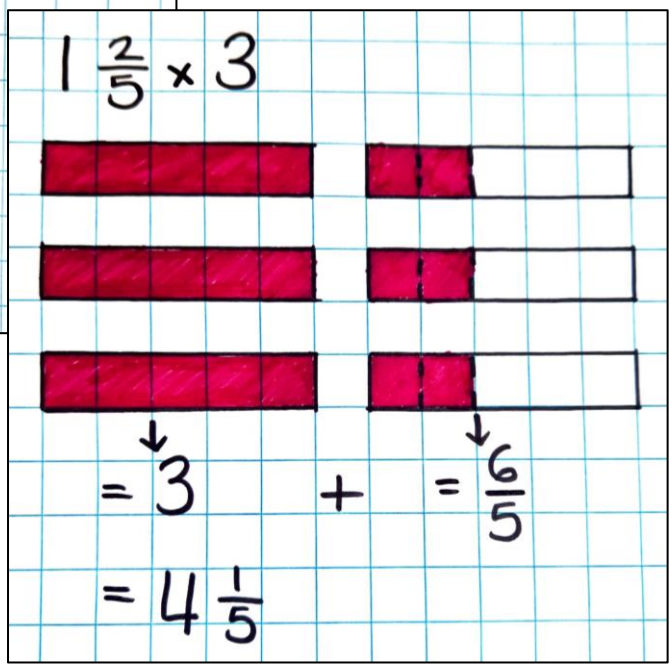




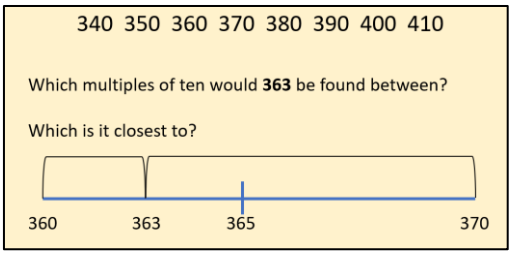


Y5 MULTIPLYING FRACTIONS





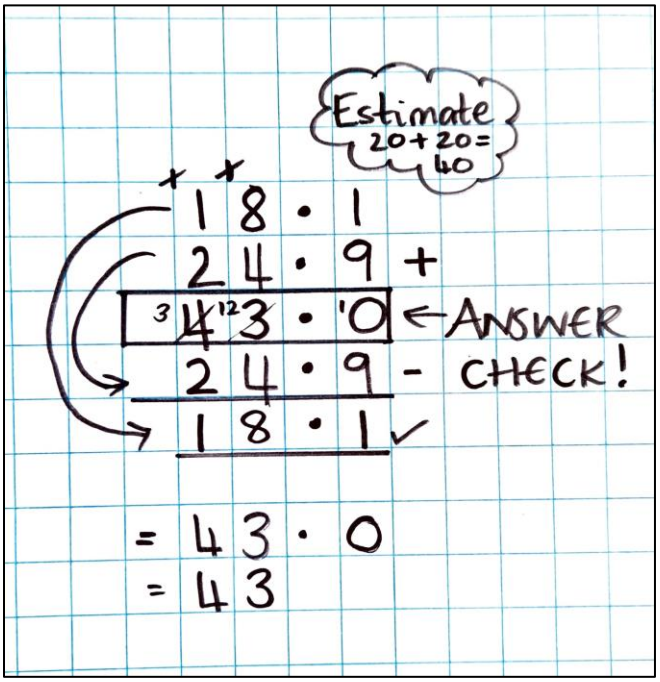
RAINOW - MATHS ENDPOINTS - YEAR 6

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS	
Number	NUMBER & PLACE VALUE	I can read, write, order and compare numbers up to 10 000 000 and determine the value of each digit I can round any whole number to a required degree of accuracy I can use negative numbers in context, and calculate intervals across zero I can solve number and practical problems that involve all of the above.	**Recognise the value of the digits in numbers greater than 1,000,000** **Locate numbers above 1,00,000 on a landmarked line; use this to compare/order numbers (< >)** **Recognise the effect of multiplying and dividing numbers by 10, 100, 1000, giving answers up to 3-decimal places** **Round decimals to the nearest whole number and to 1-decimal place** **Calculate intervals across zero (between positive and negative numbers)**	**ROUNDING LINES:** 	
	ADDITION & SUBTRACTION	I can perform mental calculations, including with mixed operations and large numbers I can use my knowledge of the order of operations to carry out calculations involving the four operations I can solve addition and subtraction multi-step problems in contexts, deciding which operations and methods to use and why I can solve problems involving addition, subtraction, multiplication and division I can use estimation to check answers to calculations and determine, in the context of a problem, an appropriate degree of accuracy.	**Choose and apply an appropriate method (mental, jottings or formal/column) for all four operations depending on the numbers involved in the calculation (whole numbers and decimals)** **Scale up or down by a factor of 2, 5 or 10** **Find and interpret the mean (average) of several quantities**	**INFORMAL METHODS** *Mental methods should continue to develop, supported by a range of models and images, including the number line. The bar model should continue to be used to help with problem solving. Written methods As year 5, progressing to larger numbers, aiming for both conceptual understanding and procedural fluency with columnar method to be secured.* **Include: partitioning + / numberlines –** **Pupils' own choice informal methods (use number sense)**	**COLUMN METHODS (method first followed by 'carrying' & 'exchanging') USE INVERSE TO CHECK** Any amount of whole number (including mixed amount of digits) 1dp + 1dp 2dp + 2dp (money) 3dp + 3dp Mixed dp Any amount of whole number (including mixed amount of digits) 1dp - 1dp 2dp - 2dp (money) 3dp - 3dp Mixed dp
	MULTIPLICATION & DIVISION	I can multiply multi-digit numbers up to 4 digits by a two-digit whole number using the formal written method of long multiplication I can divide numbers up to 4 digits by a two-digit whole number using the formal written method of long division, and interpret remainders as whole number remainders, fractions, or by rounding, as appropriate for the context I can divide numbers up to 4 digits by a two-digit number using the formal written method of short division where appropriate, interpreting remainders according to the context		**INFORMAL METHODS** **GRID METHOD** up to 3d x 2d Useful for decimals too **NUMBERLINE** (grouping) – use efficient groups (link to CHUNKING)	**COLUMN METHODS (method first followed by 'carrying' & 'exchanging') USE INVERSE TO CHECK** **LONG MULTIPLICATION** Revise 4d x 1d and 3d x 2d 4d x 2d 1dp x 1d 2dp x 1d **CHUNKING** Revise 3d ÷ 1d and 4d ÷ 1d **LONG DIVISION** Revise 3d ÷ 1d and 4d ÷ 1d (list multiples -> MULTIPLE CARD) 4d ÷ 2d CHALLENGE – find fraction & decimal remainders.

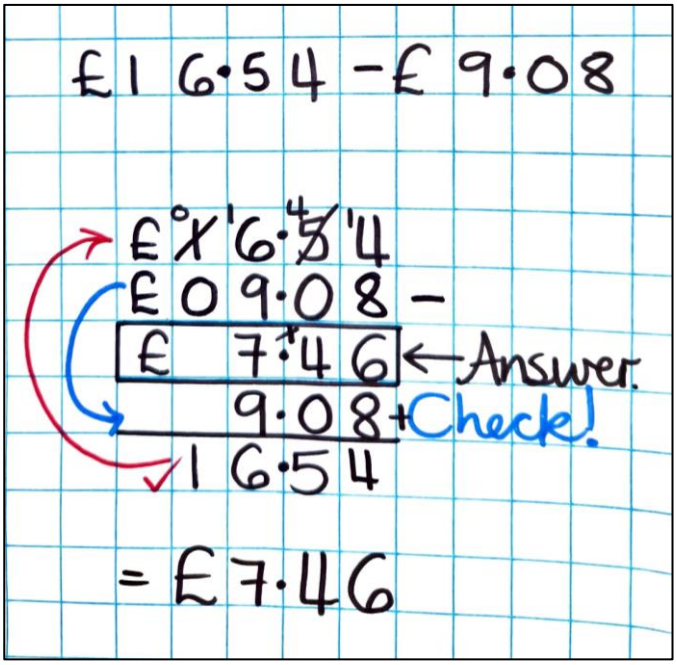
RAINOW - MATHS ENDPOINTS - YEAR 6

		I CAN STATEMENTS	RAINOW ESSENTIALS	CALCULATION METHODS, MODELS & REPRESENTATIONS
	FRACTIONS	I can use common factors to simplify fractions; use common multiples to express fractions in the same denomination I can compare and order fractions, including fractions > 1 I can add and subtract fractions with different denominators and mixed numbers, using the concept of equivalent fractions I can multiply simple pairs of proper fractions, writing the answer in its simplest form [for example, ¼ x ½ = 1/8] I can divide proper fractions by whole numbers [for example, 1/3 ÷ 2 = 1/6] I can associate a fraction with division and calculate decimal fraction equivalents [for example, 0.375] for a simple fraction [for example, 3/8] I can identify the value of each digit in numbers given to three d.p. and multiply and divide numbers by 10, 100 and 1000 giving answers up to three d.p. I can multiply one-digit numbers with up to two d.p. by whole numbers I can use written division methods in cases where the answer has up to two d.p. I can solve problems which require answers to be rounded to specified degrees of accuracy I can recall and use equivalences between simple f / d / p including in different contexts.	**Add and subtract fractions with different denominators** ABSTRACT **Multiply pairs of fractions** CONCRETE PICTORIAL **Divide a fraction by a whole number** CONCRETE PICTORIAL	**ADDITION OF FRACTIONS** Add any fractions Add any mixed numbers **SUBTRACTION OF FRACTIONS** Subtract any fractions Subtract any mixed numbers **MULTIPLICATION OF FRACTIONS** Multiply a fraction by an integer Multiply fractions by fractions **DIVISION OF FRACTIONS** Divide a unit fraction by an integer Divide any fraction by an integer It's often best to begin with dividing fractions where the divisor is a factor of the numerator; this is a good introduction to fraction divisions as pupils already know how to divide this way. Encourage your pupils to think about the denominator as a name for the fraction, rather than a value to be divided. For example, if calculating $\frac{3}{5} \div 3$, start by writing "3 bananas ÷ 3". Then swap out the word "bananas" for "fifths", to become "3 fifths ÷ 3". This should consolidate the idea that the denominator tells us about the size of the fraction, not the quantity we have. Once your pupils have understood this step, then move onto examples where the divisor isn't a factor of the numerator – for example, $\frac{2}{5} \div 3$. Using bar models (as demonstrated above), show the pupils how divisions like this can be calculated. If pupils don't properly understand the process, they often end up dividing the wrong part of the fraction. For example, with $\frac{1}{6} \div 2$, pupils may see that 6 can be divided by 2 and answer as $\frac{1}{3}$. Or with $\frac{4}{8} \div 2$, they may divide both the numerator and denominator and answer with $\frac{2}{4}$. Some teachers use 'KCF', or 'Keep, Change, Flip' to teach dividing fractions. This means you keep the first fraction the same, change the division sign to a multiplication sign, and then 'flip' the divisor (find the reciprocal). Whilst this does yield the correct answer, it is important that if you choose to use this 'method', it is only once pupils fully understand the process of dividing fractions – are they just working through an abstract checklist of instructions, or do they know why they're doing what they're doing?
	RATIO	I can solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts I can solve problems involving the calculation of percentages [for example, of measures, and such as 15% of 360] and the use of percentages for comparison I can solve problems involving similar shapes where the scale factor is known or can be found I can solve problems involving unequal sharing and grouping using knowledge of fractions and multiples.	**TIME** **Use 12- and 24-hour clock to solve problems**	
	ALGEBRA	I can use simple formulae I can generate and describe linear number sequences I can express missing number problems algebraically I can find pairs of numbers that satisfy an equation with two unknowns I can enumerate possibilities of combinations of two variables.		
Measurement	DISTANCE MASS CAPACITY TIME MONEY	I can solve problems involving the calculation and conversion of units of measure, using decimal notation up to three decimal places where appropriate I can use, read, write and convert between standard units, converting measurements of length, mass, volume and time from a smaller unit of measure to a larger unit, and vice versa, using decimal notation to up to three decimal places I can convert between miles and kilometres I can recognise that shapes with the same areas can have different perimeters and vice versa I can recognise when it is possible to use formulae for area and volume of shapes I can calculate the area of parallelograms and triangles I can calculate, estimate and compare volume of cubes and cuboids using standard units, including cubic centimetres (cm^3) and cubic metres (m^3), and extending to other units [for example, mm^3 and km^3].		
Geometry	PROPERTIES OF SHAPE	I can draw 2-D shapes using given dimensions and angles I can recognise, describe and build simple 3-D shapes, including making nets I can compare and classify geometric shapes based on their properties and sizes and find unknown angles in any triangles, quadrilaterals, and regular polygons I can illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius I can recognise angles where they meet at a point, are on a straight line, or are vertically opposite, and find missing angles.		
	POSITION & DIRECTION	I can describe positions on the full coordinate grid (all four quadrants) I can draw and translate simple shapes on the coordinate plane, and reflect them in the axes.		
	STATISTICS	I can interpret and construct pie charts and line graphs and use these to solve problems I can calculate and interpret the mean as an average.		

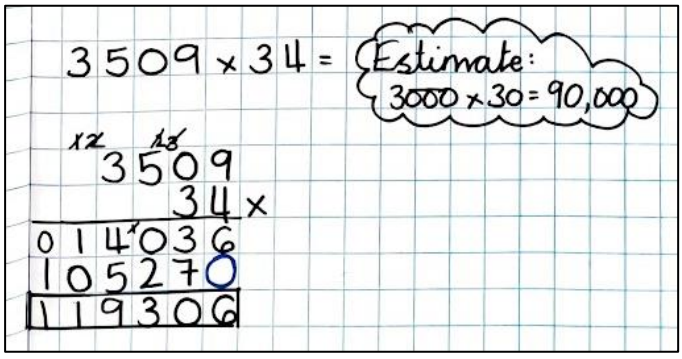
Y6 COLUMN ADDITION



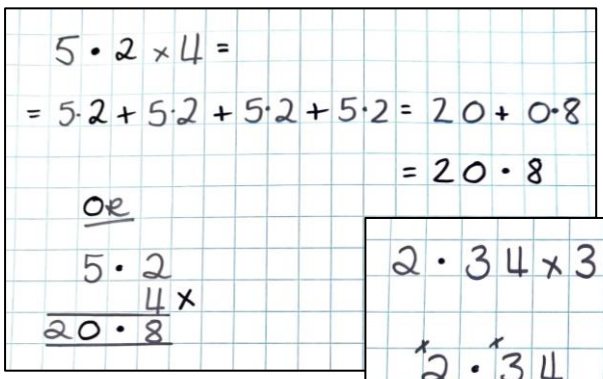
Y6 COLUMN SUBTRACTION

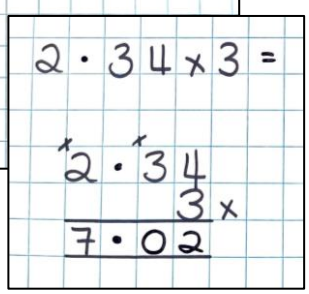


Y6 COLUMN MULTIPLICATION

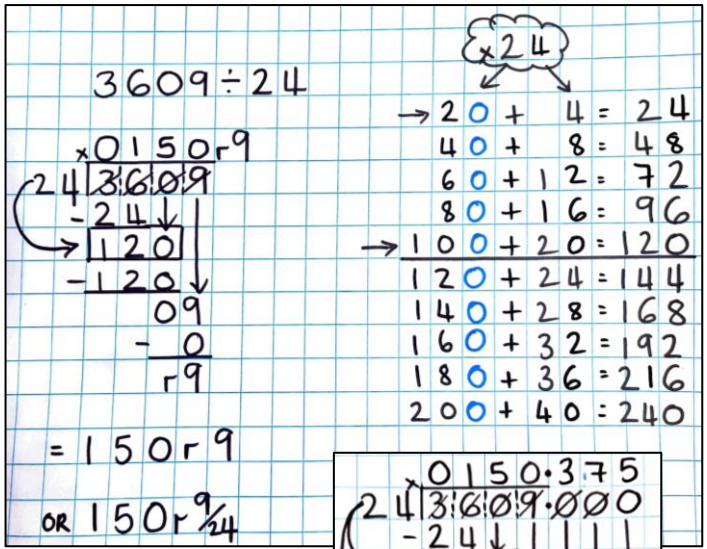


*** The more steps involved, the more chances there are to make computational errors. Therefore, it is vital to double-check workings and/or use the inverse operation.**



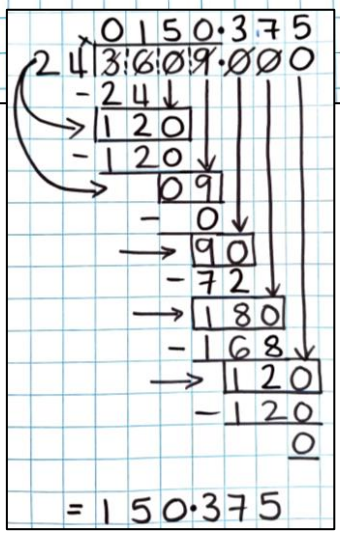


Y6 COLUMN DIVISION



Decimal remainder:

*Pupils should consider which is the most appropriate remainder to use.



Y6 ADDING FRACTIONS

$\frac{3}{4} + \frac{5}{8}$

×2 ($\frac{6+5}{8}$) ×1 $= \frac{13}{8} = 1\frac{5}{8}$

$= \frac{13}{8} = 1\frac{5}{8}$

$\frac{2}{5} + \frac{1}{10} + \frac{3}{20}$

×4 (↓×2) ×1

$\frac{8+2+3}{20} = \frac{13}{20}$

$\frac{1}{3} + \frac{1}{4}$

×4 ($\frac{4+3}{12}$) ×3

3, 6, 9, **12** ↔ 4, 8, **12** (LCD)

$= \frac{7}{12}$

Y6 SUBTRACTING FRACTIONS

$\frac{1}{3} - \frac{3}{15}$

×5 ($\frac{5-3}{15}$) ×1 $= \frac{2}{15}$

$6\frac{4}{5} - 2\frac{3}{5}$

$= 6 - 2 = 4$

$\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$

$= 4\frac{1}{5}$

$\frac{4}{9} - \frac{1}{6}$

×2 ($\frac{8-3}{18}$) ×3

9, **18** ↔ 6, 12, **18** (LCD)

$= \frac{5}{18}$

Y6 MULTIPLYING FRACTIONS

$2\frac{2}{5} \times 5$

= 5 lots of $2\frac{2}{5}$

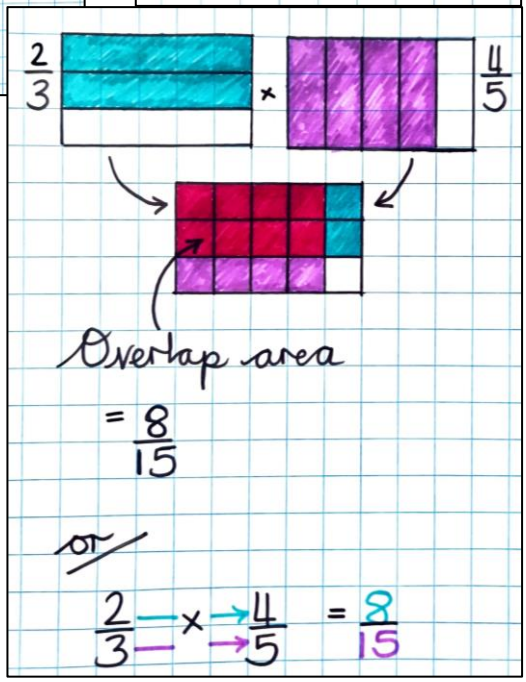
$= 5 \times 2 = 10$

$+ \quad 5 \times \frac{2}{5} = \frac{10}{5}$

$= 10\frac{10}{5}$

$= 12$

$\frac{2}{3} \times \frac{4}{5} = \frac{2}{3}$ of $\frac{4}{5}$



Y6 DIVIDING FRACTIONS

$\frac{2}{3} \div 2 =$

÷2 equal parts

$= \frac{1}{3}$

or:

$\frac{2}{3} \div 2 = \frac{2}{6} = \frac{1}{3}$

$\frac{2}{5} \div 5$

$(\frac{2}{5} = 2 \div 5 \rightarrow \div 5)$

1 equal group → ÷ into 5 equal parts.

$\frac{2}{5}$

$= \frac{}{25}$ (total parts)

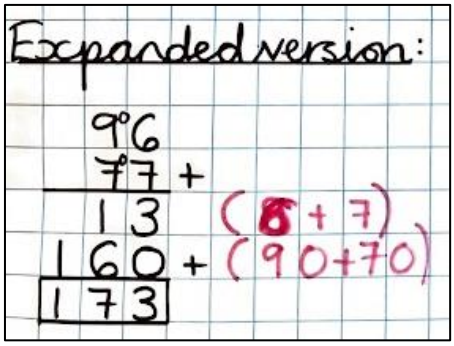
1 equal group = $\frac{2}{25}$

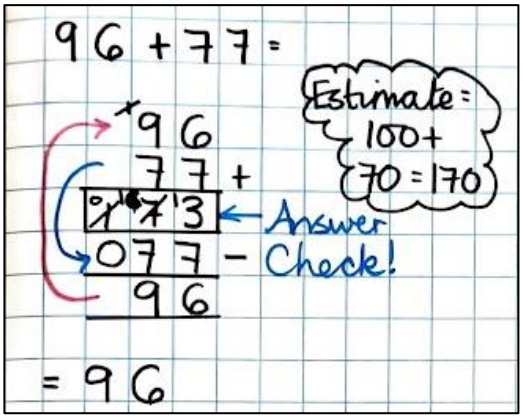
or:

$\frac{2}{5} \div 5 = \frac{2}{25}$

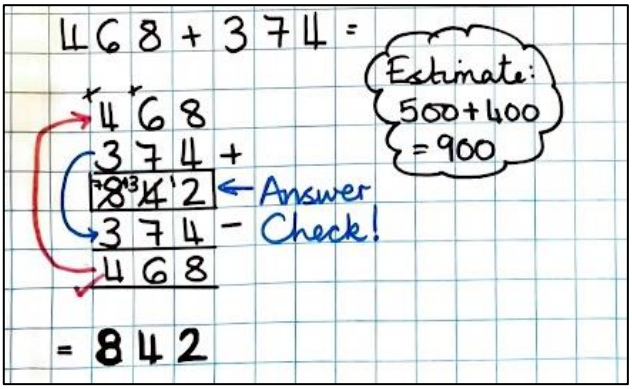
PROGRESSION IN ADDITION

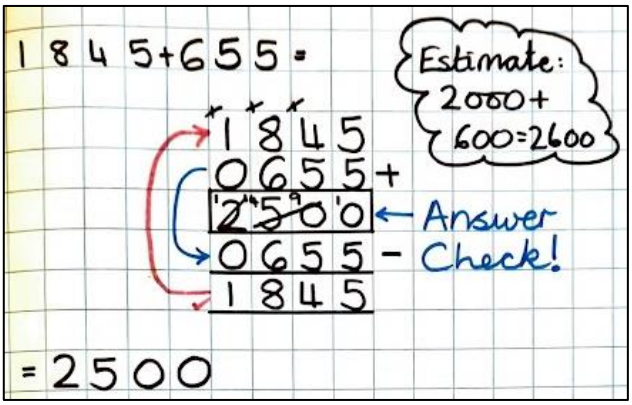
Y3



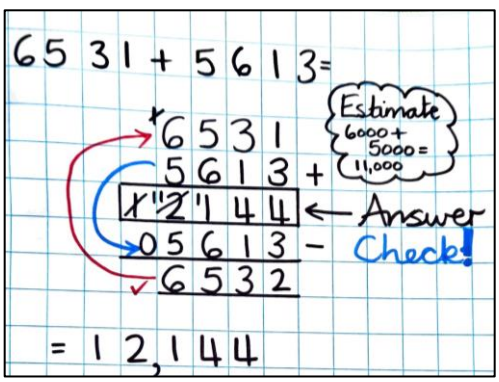


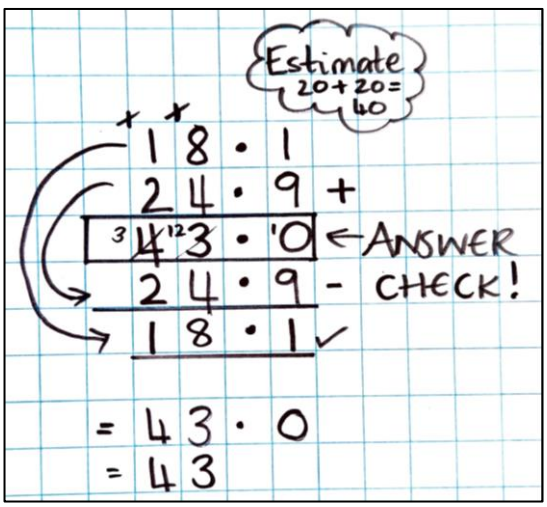
Y4



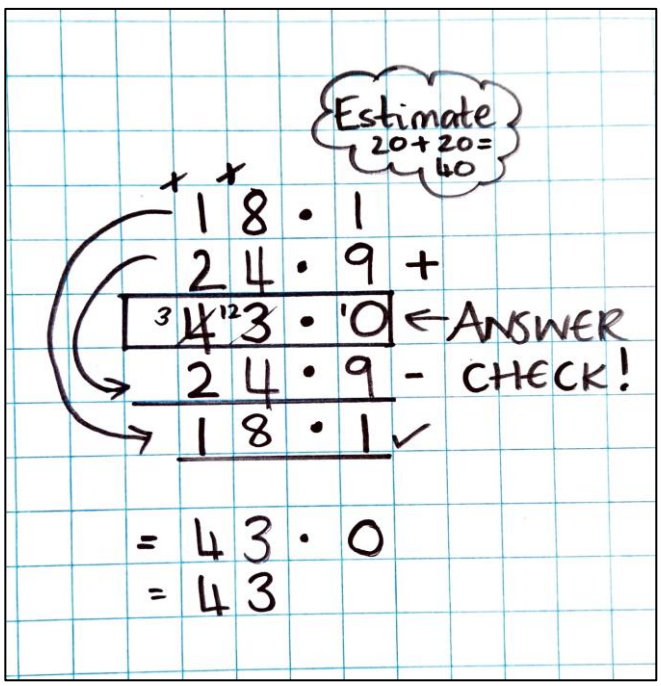


Y5



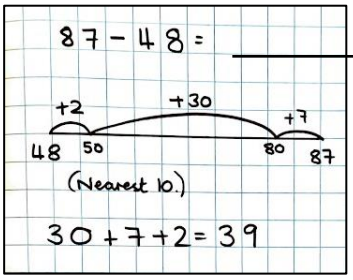


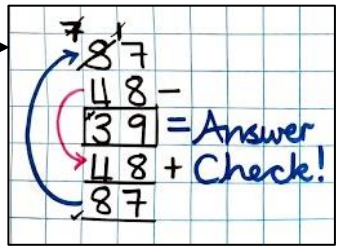
Y6

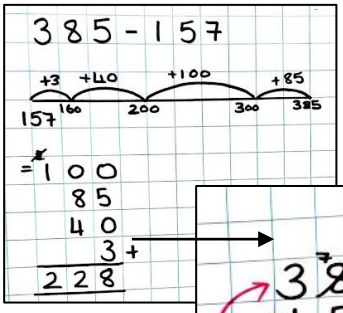


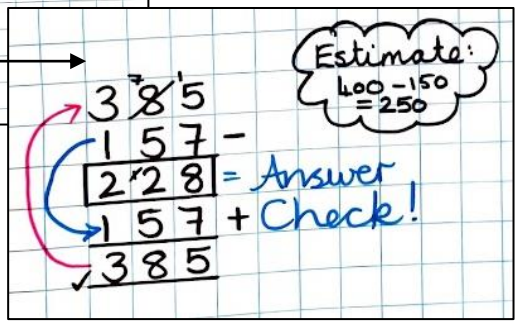
PROGRESSION IN SUBTRACTION

Y3

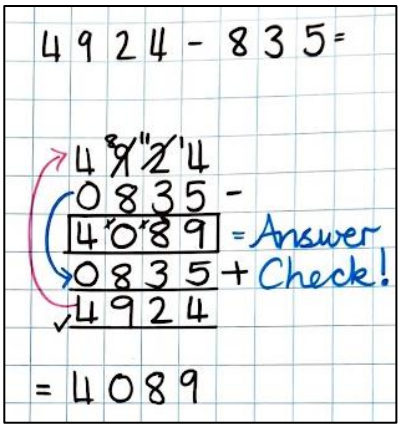


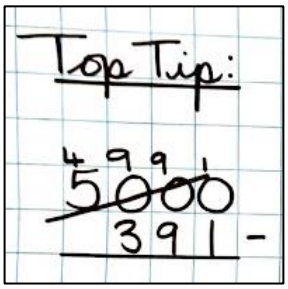


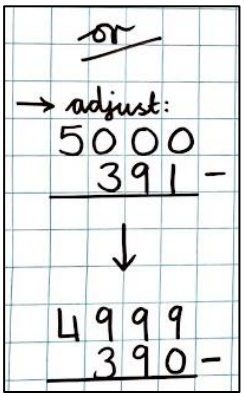




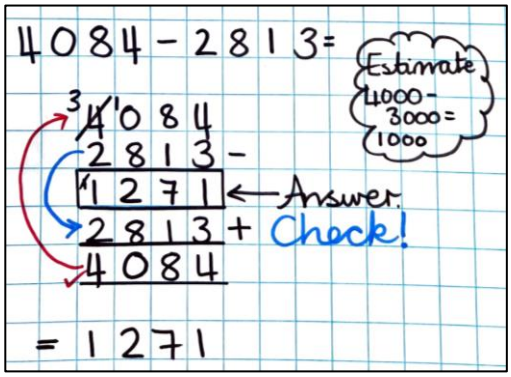
Y4

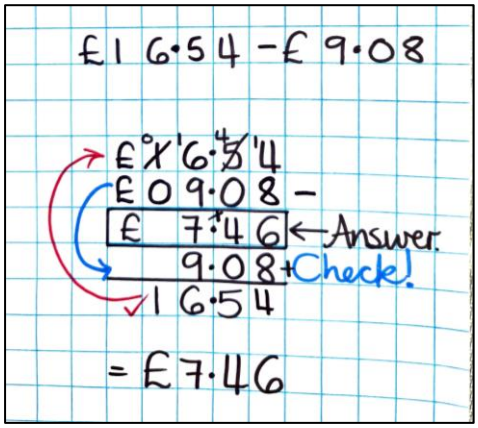




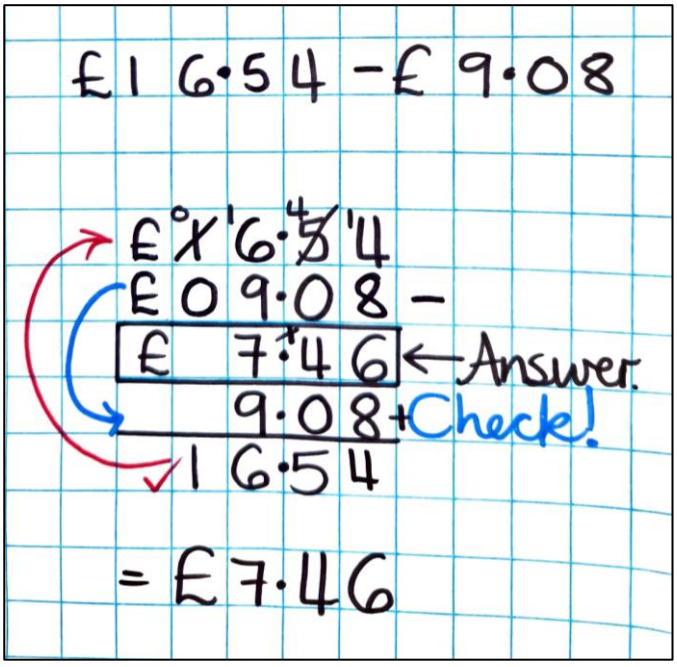


Y5



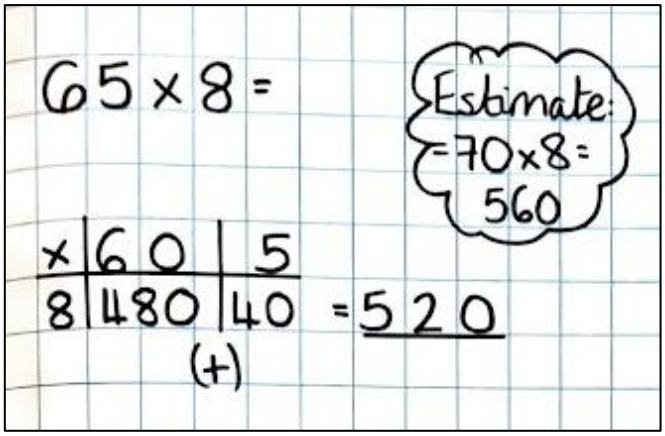


Y6

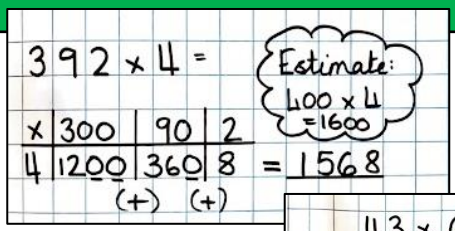


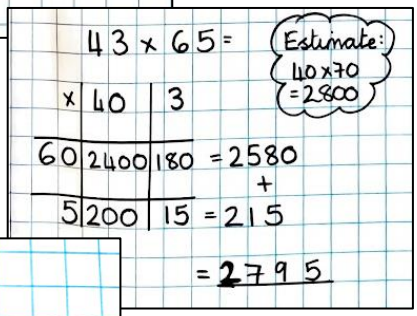
PROGRESSION IN MULTIPLICATION

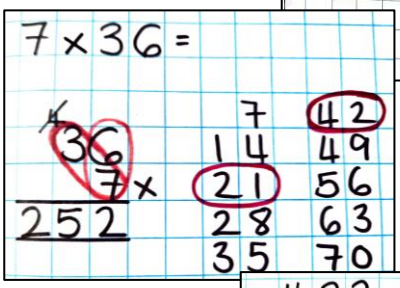
Y3

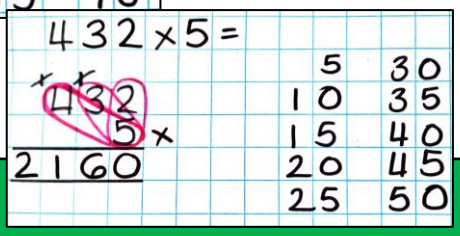


Y4

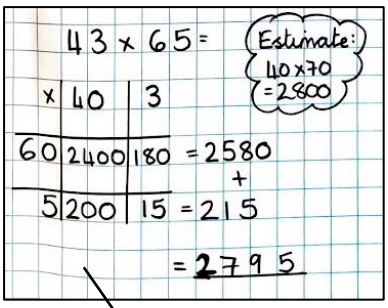


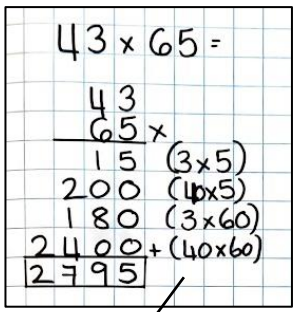


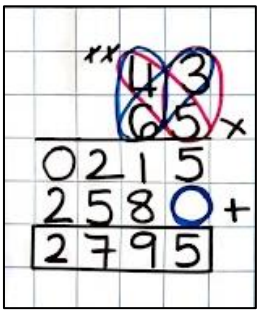


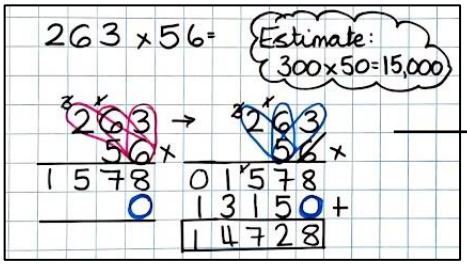


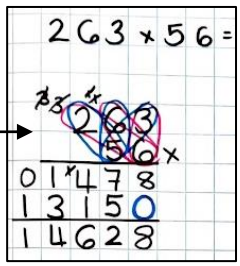
Y5





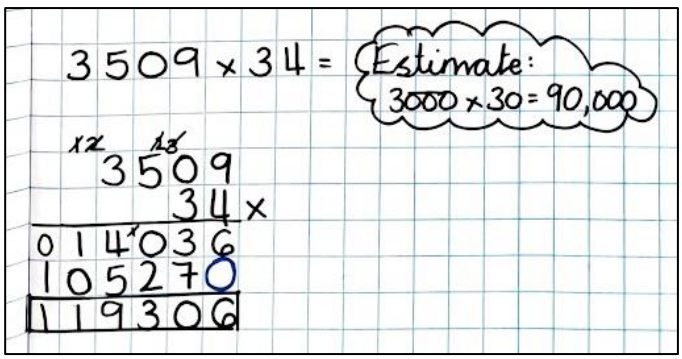


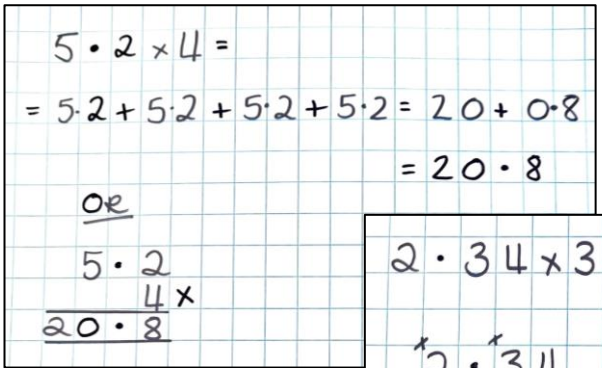


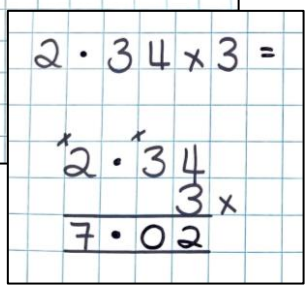


* The more steps involved, the more chances there are to make computational errors. Therefore, it is vital to double-check workings and/or use the inverse operation.

Y6



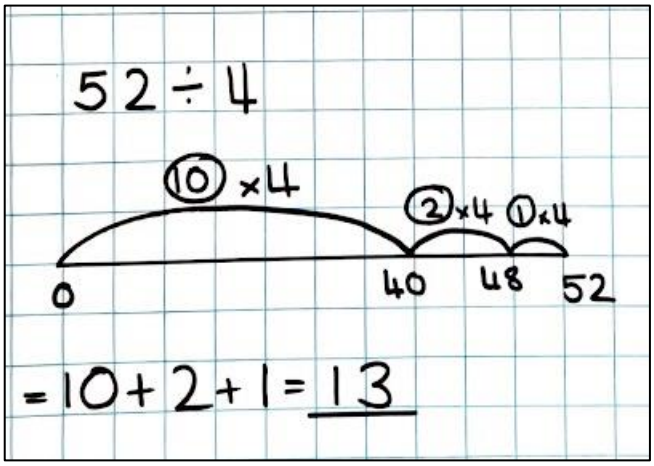




* Checking with inverse should be encouraged once fluency achieved in multiplication and division methods.

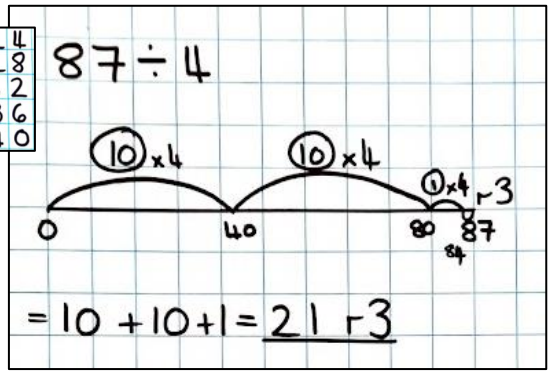
PROGRESSION IN DIVISION

Y3

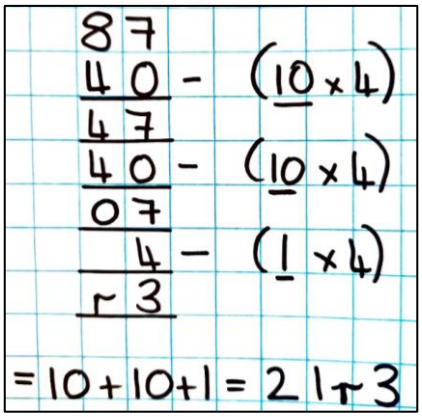


Y4

4	24
8	28
12	32
16	36
20	40



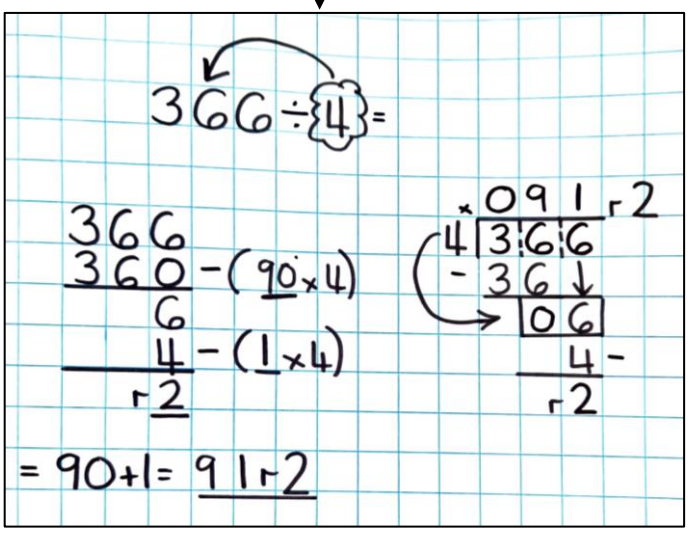
*Writing out multiples of the divisor should be encouraged. This will prepare for when It becomes vital in Y5 and Y6.



Y5

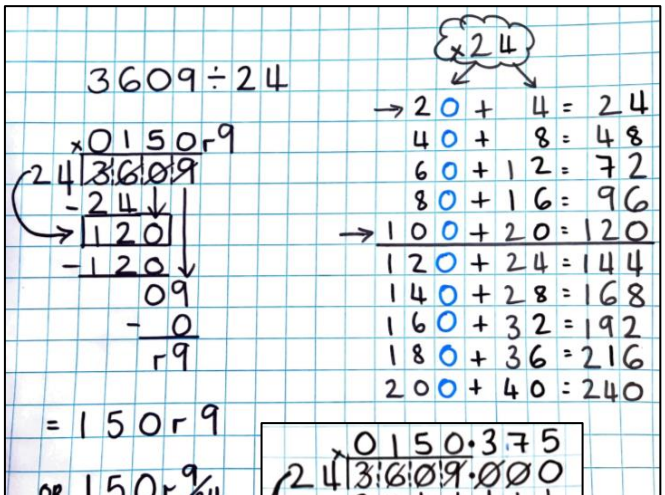
40	240
80	280
120	320
160	360
200	400

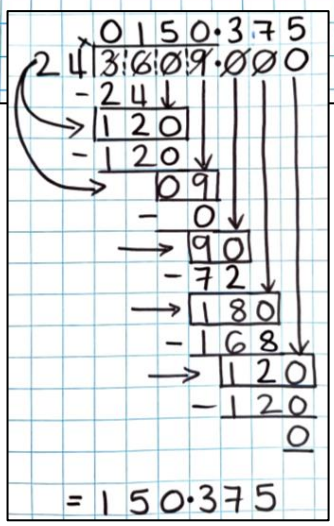
400	2400
800	2800
1200	3200
1600	3600
2000	4000



Chunking --> Long division

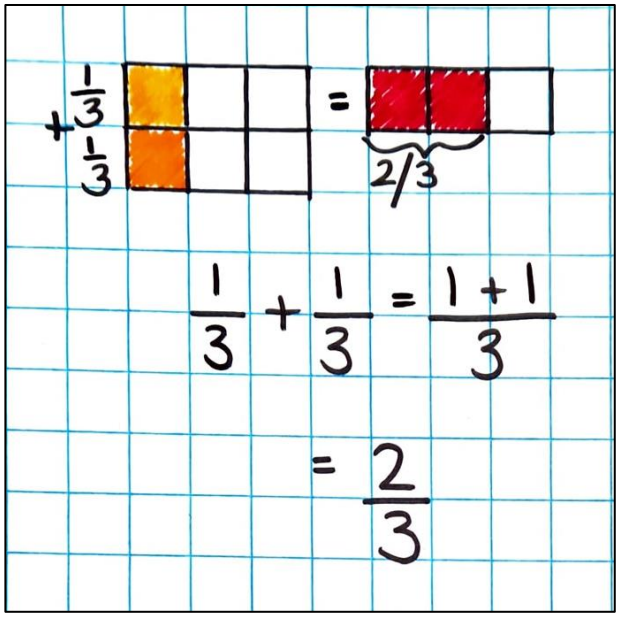
Y6



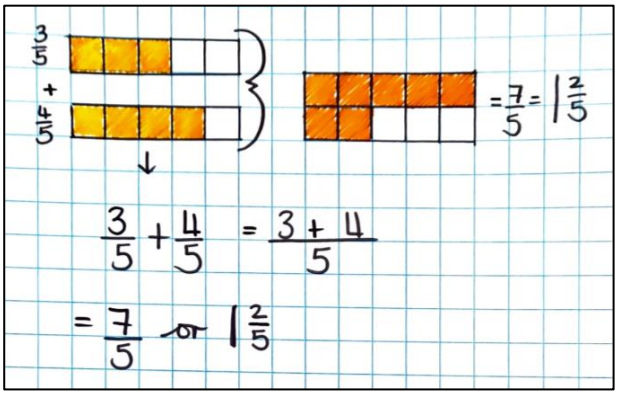


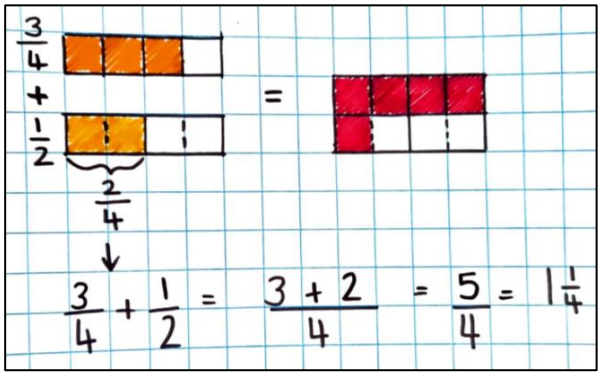
PROGRESSION IN ADDITION OF FRACTIONS

Y3

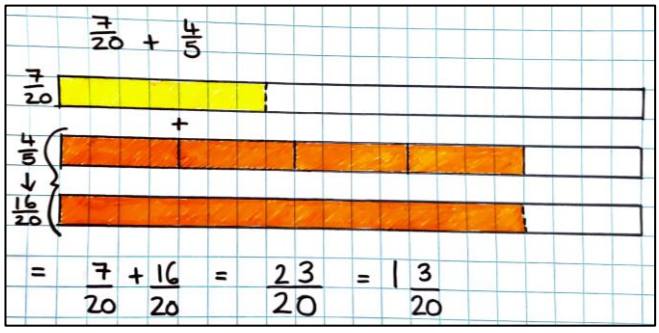


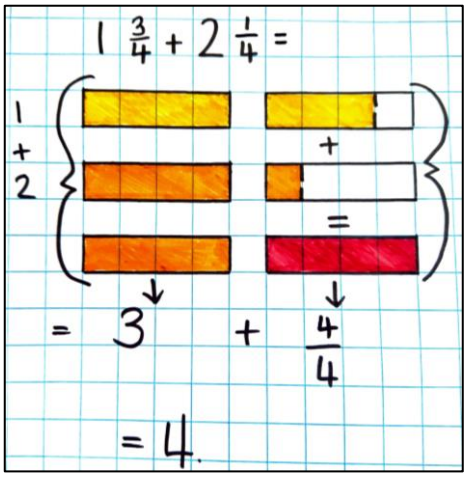
Y4



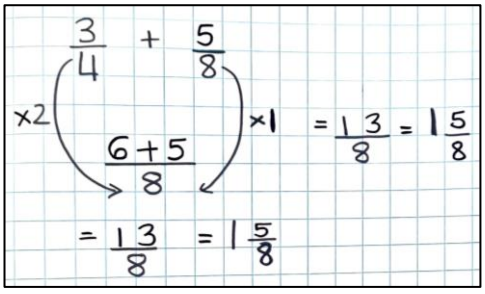


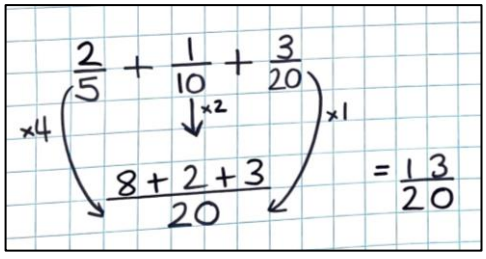
Y5

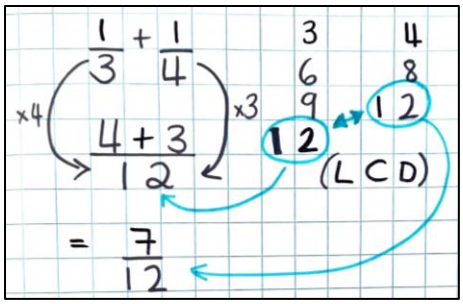




Y6

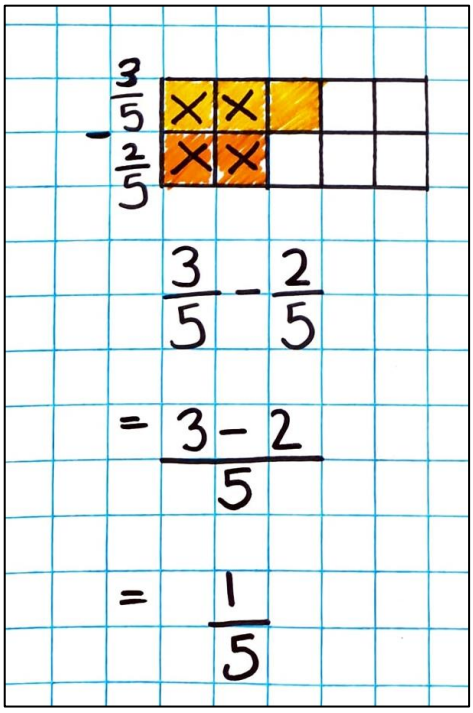




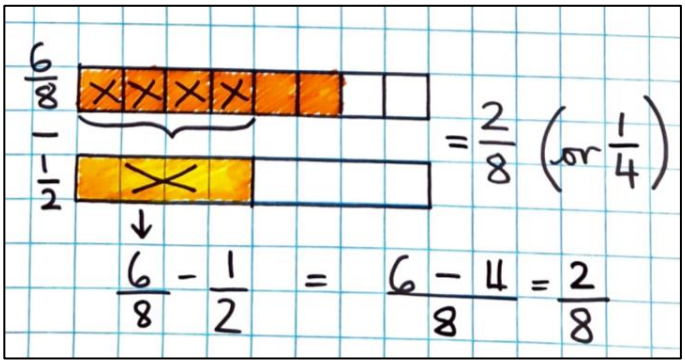


PROGRESSION IN SUBTRACTION OF FRACTIONS

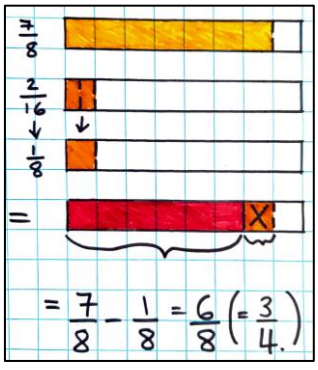
Y3

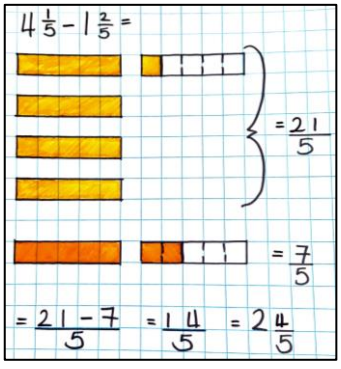


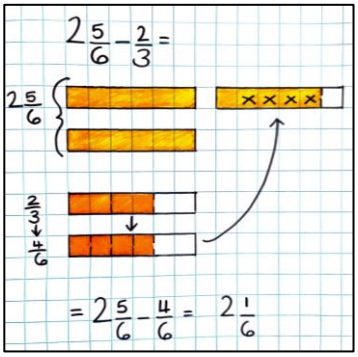
Y4



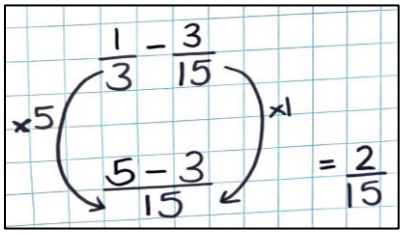
Y5

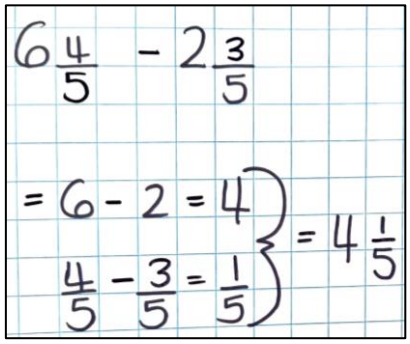


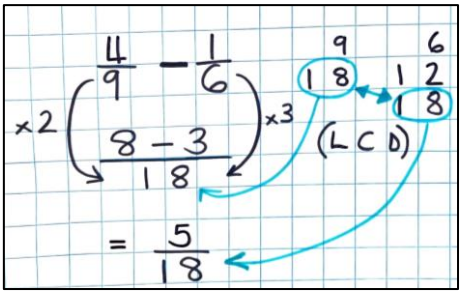




Y6

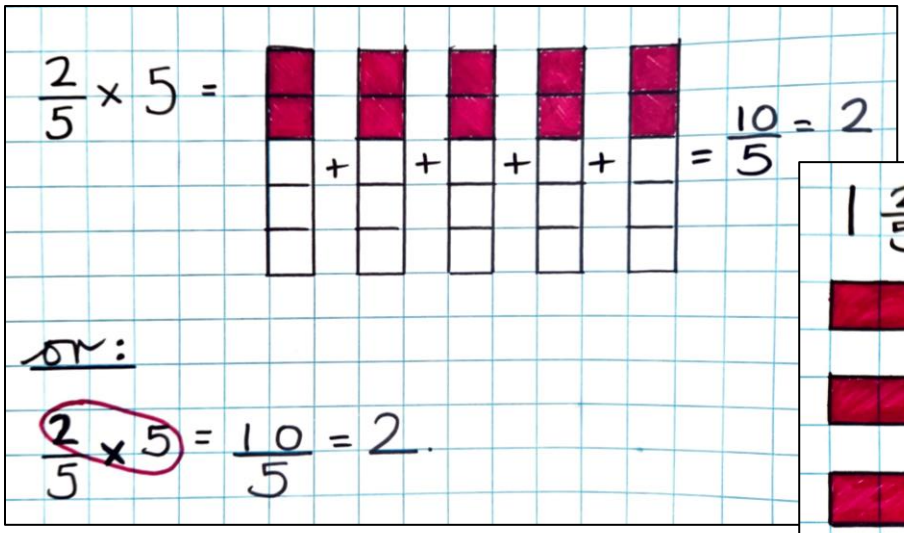


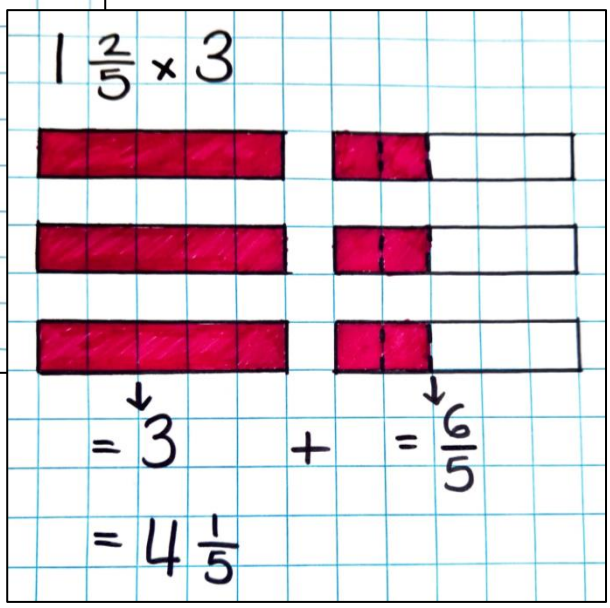




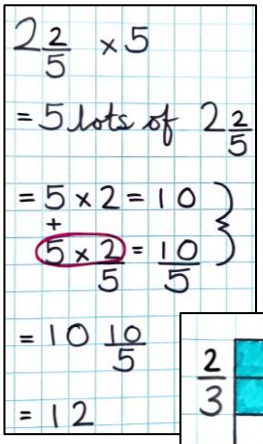
PROGRESSION IN MULTIPLICATION & DIVISION OF FRACTIONS

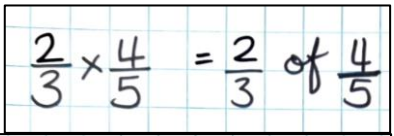
Y5 MULTIPLICATION

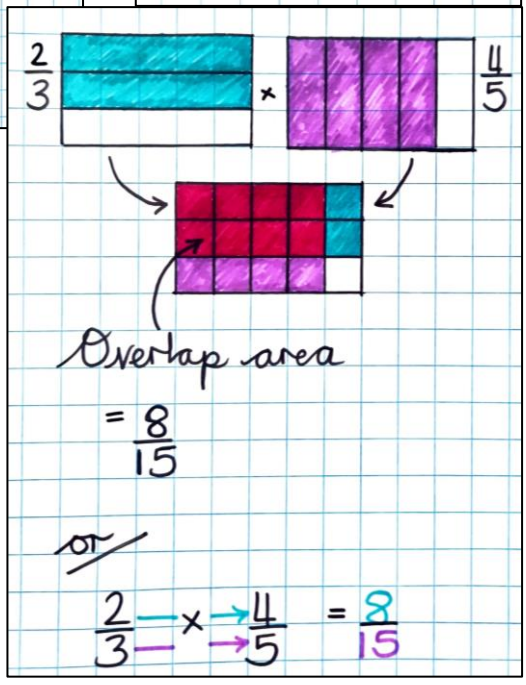




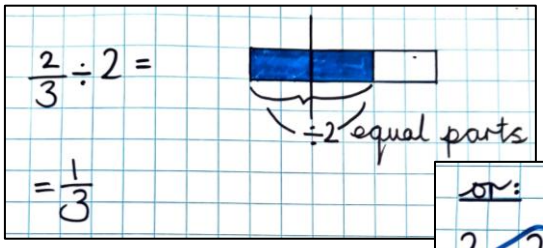
Y6 MULTIPLICATION

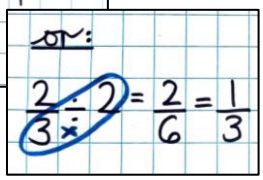


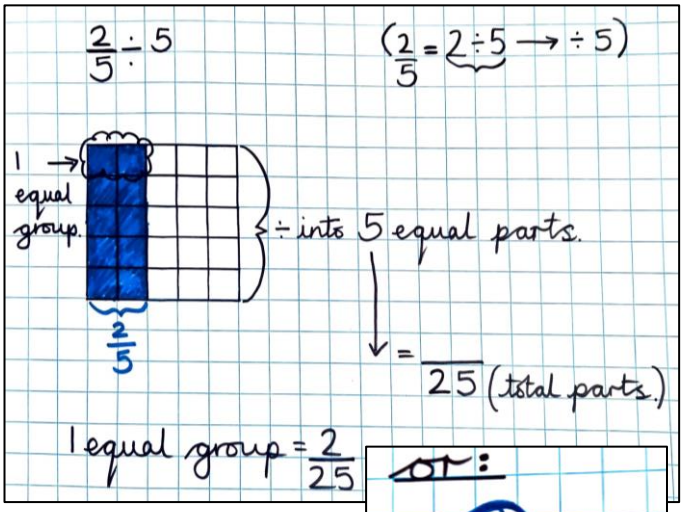


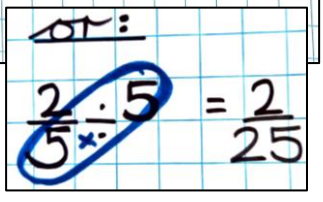


Y6 DIVISION









YEAR 1 – WHITE ROSE SMALL STEPS version 3.0		
PLACE VALUE	**CALCULATION**	**FRACTIONS**
Place Value (within 10)	**Addition and Subtraction (within 10)**	Recognise a half of an object or a shape
Sort objects	Introduce parts and wholes	Find a half of an object or a shape
Count objects	Part-whole model	Recognise half of a quantity
Count objects from a larger group	Write number sentences	Find a half of a quantity
Represent objects	Fact families - addition facts	Recognise a quarter of an object or a shape
Recognise numbers as words	Number bonds within 10	Find a quarter of an object or a shape
Count on from any number	Systematic number bonds within 10	Recognise a quarter of a quantity
1 more	Number bonds to 10	Find a quarter of a quantity
Count backwards within 10	Addition - add together	
1 less	Addition - add more	
Compare groups by matching	Addition problems	
Fewer, more, same	Find a part	
Less than, greater than, equal to	Subtraction - find a part	
Compare number	Fact families - the eight facts	
Order objects and numbers	Subtraction - take away/crossing out (How many left?)	
Place Value (within 20)	Subtraction - take away (How many left?)	
Count within 20	Subtraction on a number line	
Understand 10	Add or subtract 1 or 2	
Understand 11, 12 and 13	**Addition and Subtraction (within 20)**	
Understand 14, 15 and 16	Add by counting on within 20	
Understand 17, 18 and 19	Add ones using number bonds	
Understand 20	Find and make number bonds to 20	
1 more and 1 less	Doubles	
The number line to 20	Near doubles	
Use a number line to 20	Subtract ones using number bonds	
Estimate on a number line to 20	Subtraction – counting back	
Compare numbers to 20	Subtraction – finding the difference	
Place Value (within 50)	Related facts	
Count from 20 to 50	Missing number problems	
20, 30, 40 and 50	**Multiplication and Division**	
Count by making groups of tens	Count in 2s	
Groups of tens and ones	Count in 10s	
Partition into tens and ones	Count in 5s	
The number line to 50	Recognise equal groups	
Estimate on a number line to 50	Add equal groups	
1 more, 1 less	Make arrays	
Compare volume	Make doubles	
Measure capacity	Make equal groups - grouping	
Place Value (within 100)	Make equal groups - sharing	
Count from 50 to 100		
Tens to 100		
Partition into tens and ones		
The number line to 100		
1 more, 1 less		
Compare numbers with the same number of tens		
Compare any two numbers		

MEASURES	GEOMETRY
Money	**Shape**
Unitising	Recognise and name 3-D shapes
Recognise coins	Sort 3-D shapes
Recognise notes	Recognise and name 2-D shapes
Count in coins	Sort 2-D shapes
Time	Patterns with 2-D and 3-D shapes
Before and after	**Position and Direction**
Days of the week	Describe turns
Months of the year	Describe position - left and right
Hours, minutes and seconds	Describe position - forwards and backwards
Tell the time to the hour	Describe position - above and below
Tell the time to the half hour	Ordinal numbers
Length and Height	
Compare lengths and heights	
Measure length using objects	
Measure length in centimetres	
Mass and Volume	
Heavier and lighter	
Measure mass	
Compare mass	
Full and empty	
Compare volume	
Measure capacity	
Compare capacity	

YEAR 2 – WHITE ROSE SMALL STEPS version 3.0		
PLACE VALUE	**CALCULATION**	**FRACTIONS**
Numbers to 20	**Addition and Subtraction**	Introduction to parts and whole
Count objects to 100 by making 10s	Bonds to 10	Equal and unequal parts
Recognise tens and ones	Fact families - addition and subtraction bonds	Recognise a half
Use a place value chart	Related facts	Find a half
Partition numbers to 100	Bonds to 100 (tens)	Recognise a quarter
Write numbes to 100 in words	Add and subtract 1s	Find a quarter
Flexibly partition numbers to 100	Add by making 10	Recognise a third
Write numbers to 100 in expanded form	Add three 1-digit numbers	Find a third
10s on the number line to 100	Add to the next 10	Find the whole
10s and 1s on the number line to 100	Add across a 10	Unit fractions
Estimate numbers on a number line	Subtract across 10	Non-unit fractions
Compare objects	Subtract from a 10	Recognise the equivalence of a half and two-q
Compare numbers	Subtract a 1-digit number from a 2-digit numb	Recognise three-quarters
Order objects and numbers	10 more, 10 less	Find three-quarters
Count in 2s, 5s and 10s	Add and subtract 10s	Count in fractions up to a whole
Count in 3s	Add two 2-digit numbers (not across a 10)	
	Add two 2-digit number (across a 10)	
	Subtract two 2-digit numbers (not across a 10)	
	Subtract two 2-digit number (across a 10)	
	Mixed addition and subtraction	
	Compare number sentences	
	Missing number problems	
	Multiplication and Division	
	Recognise equal groups	
	Make equal groups	
	Add equal groups	
	Introduce the multiplication symbol	
	Multiplication sentences	
	Use arrays	
	Make equal groups - grouping	
	Make equal groups - sharing	
	The 2 times-table	
	Divide by 2	
	Doubling and halving	
	Odd and even numbers	
	The 10 times-table	
	Divide by 10	
	The 5 times-table	
	Divide by 5	
	The 5 and 10 times-tables	

MEASURES	GEOMETRY	STATISTICS
Money	**Shape**	Make tally charts
Count money - pence	Recognise 2-D and 3-D shapes	Tables
Count money - pounds (notes and coins)	Count sides on 2-D shapes	Block diagrams
Count money - pounds and pence	Count vertices on 2-D shapes	Draw pictograms (1–1)
Choose notes and coins	Draw 2-D shapes	Interpret pictograms (1–1)
Make the same amount	Lines of symmetry on shapes	Draw pictograms (2, 5 and 10)
Compare amounts of money	Use lines of symmetry to complete shapes	Interpret pictograms (2, 5 and 10)
Calculate with money	Sort 2-D shapes	
Make a pound	Count faces on 3-D shapes	
Find change	Count edges on 3-D shapes	
Two-step problems	Count vertices on 3-D shapes	
Length and Height	Sort 3-D shapes	
Measure in centimetres	Make patterns with 2-D and 3-D shapes	
Measure in metres	**Position and direction**	
Compare lengths and heights	Language of position	
Order lengths and heights	Describe movement	
Four operations with lengths and heights	Describe turns	
Mass, Capacity and Temperature	Describe movement and turns	
Compare mass	Shape patterns with turns	
Measure in grams		
Measure in kilograms		
Four operations with mass		
Compare volume and capacity		
Measure in millilitres		
Measure in litres		
Four operations with volume and capacity		
Temperature		
Time		
O'clock and half past		
Quarter past and quarter to		
Tell the time past the hour		
Tell the time to the hour		
Tell the time to 5 minutes		
Minutes in an hour		
Hours in a day		

YEAR 3 – WHITE ROSE SMALL STEPS version 3.0		
PLACE VALUE	**CALCULATION**	**FRACTIONS**
Represent numbers to 100	**Addition and Subtraction**	**Fractions A**
Partition numbers to 100	Apply number bonds within 10	Understand the denominators of unit fractions
Number line to 100	Add and subtract 1s	Compare and order unit fractions
Represent numbers to 1000	Add and subtract 10s	Understand the numerators of non-unit fractions
Partition numbers to 1000	Add and subtract 100s	Understand the whole
Flexible partitioning of numbers to 1000	Spot the pattern	Compare and order non-unit fractions
Hundreds, tens and ones	Add 1s across a 10	Fractions and scales
Find 1, 10 or 100 more or less	Add 10s across a 100	Fractions on a number line
Number line to 1000	Subtract 1s across a 10	Count in fractions on a number line
Estimating on a number line to 1000	Subtract 10s across a 100	Equivalent fractions on a number line
Compare numbers to 1000	Make connections	Equivalent fractions as bar models
Order numbers to 1000	Add two numbers (no exchange)	**Fractions B**
Count in 50s	Subtract two numbers (no exchange)	Add fractions
	Add two numbers (across a 10)	Subtract fractions
	Add two numbers (across a 100)	Partition the whole
	Subtract two numbers (across a 10)	Unit fractions of a set of objects
	Subtract two numbers (across a 100)	Non-unit fractions of a set of objects
	Add 2-digit and 3-digit numbers	Reasoning with fractions of an amount
	Subtract a 2-digit number from a 3-digit number	
	Complements to 100	
	Estimate answers	
	Inverse operations	
	Make decisions	
	Multiplication and Division A	
	Multiplication - equal groups	
	Use arrays	
	Multiples of 2	
	Multiples of 5 and 10	
	Sharing and grouping	
	Multiply by 3	
	Divide by 3	
	The 3 times-table	
	Multiply by 4	
	Divide by 4	
	The 4 times-table	
	Multiply by 8	
	Divide by 8	
	The 8 times-table	
	The 2, 4 and 8 times-tables	
	Multiplication and Division B	
	Multiples of 10	
	Related calculations	
	Reasoning about multiplication	
	Multiply a 2-digit number by a 1-digit number - no exchange	
	Multiply a 2-digit number by a 1-digit number - with exchange	
	Link multiplication and division	
	Divide a 2-digit number by a 1-digit number - no exchange	
	Divide a 2-digit number by a 1-digit number - flexible partitioning	
	Divide a 2-digit number by a 1-digit number - with remainders	
	Scaling	
	How many ways?	

MEASURES	GEOMETRY	STATISTICS
Length and Perimeter	**Geometry: Shape**	Interpret pictograms
Measure in metres and centimetres	Turns and angles	Draw pictograms
Measure in millimetres	Right angles	Interpret bar charts
Measure in centimetres and millimetres	Compare angles	Draw bar charts
Metres, centimetres and millimetres	Measure and draw accurately	Collect and represent data
Equivalent lengths (metres and centimetres)	Horizontal and vertical	Two-way tables
Equivalent lengths (centimetres and millimetres)	Parallel and perpendicular	
Compare lengths	Recognise and describe 2-D shapes	
Add lengths	Draw polygons	
Subtract lengths	Recognise and describe 3-D shapes	
What is perimeter?	Make 3-D shapes	
Measure perimeter		
Calculate perimeter		
Mass and Capacity		
Use scales		
Measure mass in grams		
Measure mass in kilograms and grams		
Equivalent masses (kilograms and grams)		
Compare mass		
Add and subtract mass		
Measure capacity and volume in millilitres		
Measure capacity and volume in litres and millilitres		
Equivalent capacities and volumes (litres and millilitres)		
Compare capacity and volume		
Add and subtract capacity and volume		
Money		
Pounds and pence		
Convert pounds and pence		
Add money		
Subtract money		
Find change		
Time		
Roman numerals to 12		
Tell the time to 5 minutes		
Tell the time to the minute		
Read time on a digital clock		
Use a.m. and p.m.		
Years, months and days		
Days and hours		
Hours and minutes - use start and end times		
Hours and minutes - use durations		
Minutes and seconds		
Units of time		
Solve problems with time		
		*REFER TO OUR CALCULATION POLICY

YEAR 4 – WHITE ROSE SMALL STEPS version 3.0		
PLACE VALUE	**CALCULATION**	**FRACTIONS**
Represent numbers to 1000	**Addition and Subtraction**	**Fractions**
Partition numbers to 1000	Add and subtract 1s, 10s, 100s and 1,000s	Understand the whole
Number line to 1000	Add up to two 4-digit numbers - no exchange	Count beyond 1
Thousands	Add two 4-digit numbers - one exchange	Partition a mixed number
Represent numbers to 10 000	Add two 4-digit numbers - more than one exchange	Number lines with mixed numbers
Partitiion numbers to 10 000	Subtract two 4-digit numbers - no exchange	Compare and order mixed numbers
Flexible partitioning of numbers to 10 000	Subtract two 4-digit numbers - one exchange	Understand improper fractions
Find 1, 10, 100, 1000 more or less	Subtract two 4-digit numbers - more than one exch	Convert mixed numbers to improper fractions
Number line to 10 000	Efficient subtraction	Convert improper fractions to mixed numbers
Estimate on a number line to 10 000	Estimate answers	Equivalent fractions on a number line
Compare numbers to 10 000	Checking strategies	Equivalent fraction families
Order numbers to 10 000	**Multiplication and Division A**	Add two or more fractions
Roman numerals	Multiples of 3	Add fractions and mixed numbers
Round to the nearest 10	Multiply and divide by 6	Subtract two fractions
Round to the nearest 100	6 times-table and division facts	Subtract from whole amounts
Round to the nearest 1000	Multiply and divide by 9	Subtract from mixed numbers
Round to the nearest 10 000	9 times-table and division facts	**Decimals A**
Decimals A	The 3, 6 and 9 times-tables	Tenths as fractions
Tenths as decimals	Multiply and divide by 7	Hundredths as fractions
Tenths on a place value chart	7 times-table and division facts	**Decimals B**
Tenths on a number line	11 times-table and division facts	Make a whole with tenths
Divide a 1-digit number by 10	12 times-table and division facts	Make a whole with hundredths
Divide a 2-digit number by 10	Multiply by 1 and 0	Halves and quarters as decimals
Hundredths as decimals	Divide by 1 and itself	
Hundredths on a place value chart	Multiply three numbers	
Divide a 1- or 2-digit number by 100	**Multiplication and Division B**	
Decimals B	Factor pairs	
Partition decimals	Use factor pairs	
Flexibly partition decimals	Mulitply by 10	
Compare decimals	Multiply by 100	
Order decimals	Divide by 10	
Round to the nearest whole number	Divide by 100	
	Related facts - multiplication and division	
	Informal written methods for multiplication	
	Multiply a 2-digit number by a 1-digit number	
	Mulitply a 3-digit number by a 1-digit number	
	Divide a 2-digit number by a 1-digit number (1)	
	Divide a 2-digit number by a 1-digit number (2)	
	Divide a 3-digit number by a 1-digit number	
	Correspondence problems	
	Efficient multiplication	

MEASURES	GEOMETRY	STATISTICS
Area	**Shape**	**Statistics**
What is area?	Understand angles as turns	Interpret charts
Counting squares	Identify angles	Comparison, sum and difference
Make shapes	Compare and order angles	Interpret line graphs
Compare area	Triangles	Draw line graphs
Length and Perimeter	Quadrilaterals	
Measure in kilometres and metres	Polygons	
Equivalent lengths (kilometres and metres)	Lines of symmetry	
Perimeter on a grid	Complete a symmetric figure	
Perimeter of a rectangle	**Position and direction**	
Perimeter of rectilinear shapes	Describe position using coordinates	
Find missing lengths in rectilinear shapes	Plot coordinates	
Calculate perimeter of rectilinear shapes	Draw 2-D shapes on a grid	
Perimeter of regular polygons	Translate on a grid	
Perimeter of polygons	Describe translation on a grid	
Money		
Write money using decimals		
Convert between pounds and pence		
Compare amounts of money		
Estimate with money		
Calculate with money		
Solve problems with money		
Time		
Years, months, weeks and days		
Hours, minutes and seconds		
Convert between analogue and digital times		
Convert to the 24-hour clock		
Convert from the 24-hour clock		
		A mixed unit which needs to be split between PV and fractions.
		*REFER TO OUR CALCULATION POLICY

YEAR 5 – WHITE ROSE SMALL STEPS version 3.0		
PLACE VALUE	**CALCULATION**	**FRACTIONS**
Roman numerals to 1000	**Addition and Subtraction**	**Fractions A**
Numbers to 10 000	Mental strategies	Find fractions equivalent to a unit fraction
Numbers to 100 000	Add whole numbers with more than four digits	Find fractions equivalent to a non-unit fraction
Numbers to 1 000 000	Subtract whole numbers with more than four digits	Recognise equivalent fractions
Read and write numbers to 1 000 000	~~Round to check answers~~	Convert improper fractions to mixed numbers
Powers of 10	Inverse operations (addition and subtraction)	Convert mixed numbers to improper fractions
10/100/1 000/10 000/100 000 more or less	Multi-step addition and subtraction problems	Compare fractions less than 1
Partition numbers to 1 000 000	Compare calculations	Order fractions less than 1
Number line to 1 000 000	Find missing numbers	Compare and order fractions greater than 1
Compare and order numbers to 100 000	**Multiplication and Division A**	Add and subtract fractions with the same denominator
Compare and order numbers to 1 000 000	Multiples	Add fractions within 1
Round to the nearest 10, 100 or 1000	Common multiples	Add fractions with total greater than 1
Round wtihin 100 000	Factors	Add to a mixed number
Round within 1 000 000	Common factors	Add two mixed numbers
Negative Numbers	Prime numbers	Subtract fractions
Understand negative numbers	Square numbers	Subtract from a mixed number
Count through zero in 1s	Cube numbers	Subtract from a mixed number - breaking the whole
Count through zero in multiples	Multiply by 10, 100 and 1000	Subtract two mixed numbers
Compare and order negative numbers	Divide by 10, 100 and 1000	**Fractions B**
Find the difference	Multiples of 10, 100 and 1000	Multiply a unit fraction by an integer
Decimals	**Multiplication and Division B**	Multiply a non-unit fraction by an integer
Decimal sequences	Multiply up to a 4-digit number by a 1-digit number	Multiply a mixed number by an integer
Multiply by 10, 100 and 1000	Multiply a 2-digit number by a 2-digit number (area model)	Calculate a fraction of a quantity
Divide by 10, 100 and 1000	Multiply a 2-digit number by a 2-digit number	Fraction of an amount
Multiply and divide decimals – missing values	Multiply a 3-digit number by a 2-digit number	Find the whole
Decimals and Percentages	Multiply a 4-digit number by a 2-digit number	Use fractions as operators
Decimals up to 2 decimal places	Solve problems with multiplication	**Decimals and Percentages**
Thousandths as decimals	~~Short division~~	Equivalent fractions and decimals (tenths)
Thousandths on a place value chart	Divide a 4-digit number by a 1-digit number	Equivalent fractions and decimals (hundredths)
Order and compare decimals (same number of dec places)	Divide with remainders	Equivalent fractions and decimals
Order and compare any decimals with up to 3 dec places	Efficient division	Thousandths as fractions
Round to the nearest whole number	Solve problems with multiplication and division	Understand percentages
Round to 1 decimal place	**Decimals**	Percentages as fractions
	Use known facts to add and subtract decimals within 1	Percentages as decimals
	Complements to 1	Equivalent fractions, decimals and percentages
	Add and subtract decimals across 1	
	Add decimals with the same number of decimal places	
	Subtract decimals with the same number of decimal places	
	Add decimals with different numbers of decimal places	
	Subtract decimals with different numbers of decimal places	
	Efficient strategies for adding and subtracting decimals	

MEASURES	GEOMETRY	STATISTICS
Perimeter and Area	**Shape**	**Statistics**
Perimeter of rectangles	Understand and use degrees	Draw line graphs
Perimeter of rectilinear shapes	Classify angles	Read and interpret line graphs
Perimeter of polygons	Estimate angles	Read and interpret tables
Area of rectangles	Measure angles up to 180°	Two-way tables
Area of compound shapes	Draw lines and angles accurately	Read and interpret timetables
Estimate area	Calculate angles around a point	
Converting units	Calculate angles on a straight line	
Kilograms and kilometres	Lengths and angles in shapes	
Millimetres and millilitres	Regular and irregular polygons	
Convert units of length	3-D shapes	
Convert between metric and imperial units	**Position and direction**	
Convert units of time	Read and plot coordinates	
Calculate with timetables	Problem solving with coordinates	
Volume	Translation	
Cubic centimetres	Translation with coordinates	
Compare volume	Lines of symmetry	
Estimate volume	Reflection in horizontal and vertical lines	
Estimate capacity		
		A mixed topic which needs to be split between PV and calculations and fractions.
		*REFER TO OUR CALCULATION POLICY

YEAR 6 – WHITE ROSE SMALL STEPS version 3.0		
PLACE VALUE	**CALCULATION**	**FRACTIONS**
Numbers to 1 000 000	Add and subtract integers	Fractions A
Numbers to 10 000 000	Common factors	Equivalent fractions and simplifying
Read and write numbers to 10 000 000	Common multiples	Equivalent fractions on a number line
Powers of 10	Rules of divisibility	Compare and order (denominator)
Number line to 10 000 000	Primes to 100	Compare and order (numerator)
Compare and order any integers	Square and cube numbers	Add and subtract simple fractions
Round any integers	Multiply up to a 4-digit number by a 2-digit number	Add and subtract any two fractions
Negative numbers	Solve problems with multiplication	Add mixed numbers
Decimals	~~Short division~~	Subtract mixed numbers
Place value within 1	Division using factors	Multi-step problems
Place value – integers and decimals	Introduction to long division	Fractions B
Round decimals	Long division with remainders	Multiply fractions by integers
Multiply by 10, 100 and 1000	Solve problems with division	Multiply fractions by fractions
Divide by 10, 100 and 1000	Solve multi-step problems	Divide a fraction by an integer
	Order of operations	Divide any fraction by an integer
	Mental calculations and estimation	Mixed questions with fractions
	Reason from known facts	Fraction of an amount
	Multi-step problems	Fraction of an amount - find the whole
	Algebra	Ratio
	1-step function machines	Add or multiply?
	2-step function machines	Use ratio language
	Form expressions	Introduction to the ratio symbol
	Substitution	Ratio and fractions
	Formulae	Scale drawing
	Form equations	Use scale factors
	Solve 1-step equations	Similar shapes
	Solve 2-step equations	Ratio problems
	Find pairs of values	Proportion problems
	Solve problems with two unknowns	Recipes
	Decimals	Fractions, Decimals and Percentages
	Add and subtract decimals	Decimal and fraction equivalents
	Multiply decimals by integers	Fractions as division
	Divide decimals by integers	Understand percentages
	Multiply and divide decimals in context	Fractions to percentages
		Equivalent fractions, decimals and percentages
		Order fractions, decimals and percentages
		Percentage of an amount – one step
		Percentage of an amount – multi-step
		Percentages – missing values

MEASURES	GEOMETRY	STATISTICS
Converting Units	**Shape**	Line graphs
Metric measures	Measure and classify angles	Dual bar charts
Convert metric measures	Calculate angles	Read and interpret pie charts
Calculate with metric measures	Vertically opposite angles	Pie charts with percentages
Miles and kilometres	Angles in a triangle	Draw pie charts
Imperial measures	Angles in a triangle – special cases	The mean
Area, Perimeter and Volume	Angles in a triangle – missing angles	
Shapes – same area	Angles in quadrilaterals	
Area and perimeter	Angles in polygons	
Area of a triangle – counting squares	Circles	
Area of a right-angled triangle	Draw shapes accurately	
Area of any triangle	Nets of 3-D shapes	
Area of a parallelogram	**Position and direction**	
Volume – counting cubes	The first quadrant	
Volume of a cuboid	Read and plot points in four quadrants	
	Solve problems with coordinates	
	Translations	
	Reflections	
		A mixed topic which needs to be split between PV and calculations and fractions.
		*REFER TO OUR CALCULATION POLICY

RAINOW MATHS - FUNDAMENTAL FACTS - YEAR 1

Two or three facts should be explicitly taught and practised over a period of at least three weeks and should then be regularly re-visited to ensure that they are fully embedded into the long term memory.

Related addition & subtraction facts (inverse) should be taught together as a whole 'fact family'.

Number Bonds to 10

1+9=10	9+1=10	10-1=9	10-9=1
2+8=10	8+2=10	10-8=2	10-2=8
3+7=10	7+3=10	10-3=10	10-7=10
4+6=10	6+4=10	10-4=6	10-6=4
5+5=10		10-5=10	

Doubles and their halves up to 10

1+1=2	1/2 of 2 = 1
2+2=4	1/2 of 4 = 2
3+3=6	1/2 of 6 = 3
4+4=8	1/2 of 8 = 4
6+6=12	1/2 of 12 = 6
7+7=14	1/2 of 14 = 7
8+8=16	1/2 of 16 = 8
9+9=18	1/2 of 18 = 9
10+10=20	1/2 of 20 = 10

Useful online resources for teaching and practising these facts

ITPs:

Number Grid	*Numberline*	*Counting*
Difference	*Number facts*	*Beadstring*

Websites:

https://www.topmarks.co.uk/maths-games/hit-the-button

Number Bonds - Make 10
Number Bonds - Addition within ten
Doubles - to ten

https://mathsframe.co.uk/en/resources/category/9/addition-and-subtraction

MyMaths:

https://app.mymaths.co.uk/5850-homework/number-bonds-to-20

RAINOW MATHS - FUNDAMENTAL FACTS - YEAR 2

Two or three facts should be explicitly taught and practised over a period of at least three weeks and should then be regularly re-visited to ensure that they are fully embedded into the long term memory.

Related addition & subtraction and multiplication & division facts (inverse) should be taught together as a whole 'fact family'.

x2 multiplication and division facts ***(Make links to doubling & halving)***

2 x 1 = 2	1 x 2 = 2	2 ÷ 2 = 1	2 ÷ 1 = 2
2 x 2 = 4		4 ÷ 2 = 2	
2 x 3 = 6	3 x 2 = 6	6 ÷ 2 = 3	6 ÷ 3 = 2
2 x 4 = 8	4 x 2 = 8	8 ÷ 2 = 4	8 ÷ 4 = 2
2 x 5 = 10	5 x 2 = 10	10 ÷ 2 = 5	10 ÷ 5 = 2
2 x 6 = 12	6 x 2 = 12	12 ÷ 2 = 6	12 ÷ 6 = 2
2 x 7 = 14	7 x 2 = 14	14 ÷ 2 = 7	14 ÷ 7 = 2
2 x 8 = 16	8 x 2 = 16	16 ÷ 2 = 8	16 ÷ 8 = 2
2 x 9 = 18	9 x 2 = 18	18 ÷ 2 = 9	18 ÷ 9 = 2
2 x 10 = 20	10 x 2 = 20	20 ÷ 2 = 10	20 ÷ 10 = 2
2 x 11 = 22	11 x 2 = 22	22 ÷ 2 = 11	22 ÷ 11 = 2
2 x 12 = 24	12 x 2 = 24	24 ÷ 2 = 12	24 ÷ 12 = 2

x10 multiplication and division facts

10 x 1 = 10	1 x 10 = 10	10 ÷ 10 = 1	10 ÷ 1 = 10
10 x 2 = 20	2 x 10 = 20	20 ÷ 10 = 2	20 ÷ 2 = 10
10 x 3 = 30	3 x 10 = 30	30 ÷ 10 = 3	30 ÷ 3 = 10
10 x 4 = 40	4 x 10 = 40	40 ÷ 10 = 4	40 ÷ 4 = 10
10 x 5 = 50	5 x 10 = 50	50 ÷ 10 = 5	50 ÷ 5 = 10
10 x 6 = 60	6 x 10 = 60	60 ÷ 10 = 6	60 ÷ 6 = 10
10 x 7 = 70	7 x 10 = 70	70 ÷ 10 = 7	70 ÷ 7 = 10
10 x 8 = 80	8 x 10 = 80	80 ÷ 10 = 8	80 ÷ 8 = 10
10 x 9 = 90	9 x 10 = 90	90 ÷ 10 = 9	90 ÷ 9 = 10
10 x 10 = 100		100 ÷ 10 = 10	
10 x 11 = 110	11 x 10 = 110	110 ÷ 10 = 11	110 ÷ 11 = 10
10 x 12 = 120	12 x 10 = 120	120 ÷ 10 = 12	120 ÷ 12 = 10

x5 multiplication and division facts ***(multiples of 5 are half of multiples of 10)***

5 x 1 = 5	1 x 5 = 5	5 ÷ 5 = 1	5 ÷ 1 = 5
5 x 2 = 10	2 x 5 = 10	10 ÷ 5 = 2	10 ÷ 2 = 5
5 x 3 = 15	3 x 5 = 15	15 ÷ 5 = 3	15 ÷ 3 = 5
5 x 4 = 20	4 x 5 = 20	20 ÷ 5 = 4	20 ÷ 4 = 5
5 x 5 = 25		25 ÷ 5 = 5	
5 x 6 = 30	6 x 5 = 30	30 ÷ 5 = 6	30 ÷ 6 = 5
5 x 7 = 35	7 x 5 = 35	35 ÷ 5 = 7	35 ÷ 7 = 5
5 x 8 = 40	8 x 5 = 40	40 ÷ 5 = 8	40 ÷ 8 = 5
5 x 9 = 45	9 x 5 = 45	45 ÷ 5 = 9	45 ÷ 9 = 5
5 x 10 = 50	10 x 5 = 50	50 ÷ 5 = 10	50 ÷ 10 = 5

5 x 11 = 55	11 x 5 = 55	55 ÷ 5 = 11	55 ÷ 11 = 5
5 x 12 = 60	12 x 5 = 60	60 ÷ 5 = 12	60 ÷ 12 = 5

Time

60 minutes	= 1 hour
quarter past the hour	= 15 minutes
quarter to the hour	= 45 minutes

Fractions

1/2	= 2/4

Useful online resources for teaching and practising these facts

ITPs:

Number Grid	*Numberline*	*Counting*	*Clock*
Difference	*Number facts*	*Beadstring*	*Number Scales*
Multiplication Table	*Number Dial*	*Multiplication Array*	*Multiplication Facts*

Websites:

Times table rockstars

https://www.topmarks.co.uk/maths-games/hit-the-button

Times Tables - *Hit the question*

Division Facts - *Hit the Answer*

https://mathsframe.co.uk/en/resources/category/9/addition-and-subtraction

https://mathsframe.co.uk/en/resources/category/7/multiplication-and-division

https://mathsframe.co.uk/en/resources/category/23/measuring-and-time

MyMaths:

https://app.mymaths.co.uk/5935-lesson/telling-the-time-quarter-to-past

https://app.mymaths.co.uk/113-lesson/2-times-tables

https://app.mymaths.co.uk/115-lesson/10-times-tables

https://app.mymaths.co.uk/114-lesson/5-times-tables

https://app.mymaths.co.uk/82-lesson/introducing-fractions

RAINOW MATHS - FUNDAMENTAL FACTS - YEAR 3

Two or three facts should be explicitly taught and practised over a period of at least three weeks and should then be regularly re-visited to ensure that they are fully embedded into the long term memory.

Related multiplication & division facts (inverse) should be taught together as a whole 'fact family'.

x4 multiplication and division facts ***[double (x2) and double (x2) again]***

4 x 1 = 4	1 x 4 = 4	4 ÷ 4 = 1	4 ÷ 1 = 4
4 x 2 = 8	2 x 4 = 8	8 ÷ 4 = 2	8 ÷ 2 = 4
4 x 3 = 12	3 x 4 = 12	12 ÷ 4 = 3	12 ÷ 3 = 4
4 x 4 = 16		16 ÷ 4 = 4	
4 x 5 = 20	5 x 4 = 20	20 ÷ 4 = 5	20 ÷ 5 = 4
4 x 6 = 24	6 x 4 = 24	24 ÷ 4 = 6	24 ÷ 6 = 4
4 x 7 = 28	7 x 4 = 28	28 ÷ 4 = 7	28 ÷ 7 = 4
4 x 8 = 32	8 x 4 = 32	32 ÷ 4 = 8	32 ÷ 8 = 4
4 x 9 = 36	9 x 4 = 36	36 ÷ 4 = 9	36 ÷ 9 = 4
4 x 10 = 40	10 x 4 = 40	40 ÷ 4 = 10	40 ÷ 10 = 4
4 x 11 = 44	11 x 4 = 44	44 ÷ 4 = 11	44 ÷ 11 = 4
4 x 12 = 48	12 x 4 = 48	48 ÷ 4 = 12	48 ÷ 12 = 4

x3 multiplication and division facts

3 x 1 = 3	1 x 3 = 3	3 ÷ 3 = 1	3 ÷ 1 = 3
3 x 2 = 6	2 x 3 = 6	6 ÷ 3 = 2	6 ÷ 2 = 3
3 x 3 = 9		9 ÷ 3 = 3	
3 x 4 = 12	4 x 3 = 12	12 ÷ 3 = 4	12 ÷ 4 = 3
3 x 5 = 15	5 x 3 = 15	15 ÷ 3 = 5	15 ÷ 5 = 3
3 x 6 = 18	6 x 3 = 18	18 ÷ 3 = 6	18 ÷ 6 = 3
3 x 7 = 21	7 x 3 = 21	21 ÷ 3 = 7	21 ÷ 7 = 3
3 x 8 = 24	8 x 3 = 24	24 ÷ 3 = 8	24 ÷ 8 = 3
3 x 9 = 27	9 x 3 = 27	27 ÷ 3 = 9	27 ÷ 9 = 3
3 x 10 = 30	10 x 3 = 30	30 ÷ 3 = 10	30 ÷ 10 = 3
3 x 11 = 33	11 x 3 = 33	33 ÷ 3 = 11	33 ÷ 11 = 3
3 x 12 = 36	12 x 3 = 36	36 ÷ 3 = 12	26 ÷ 12 = 3

x6 multiplication and division facts **[*double multiples of 3]***

6 x 1 = 6	1 x 6 = 6	6 ÷ 6 = 1	6 ÷ 1 = 6
6 x 2 = 12	2 x 6 = 12	12 ÷ 6 = 2	12 ÷ 2 = 6
6 x 3 = 18	3 x 6 = 18	18 ÷ 6 = 3	18 ÷ 3 = 6
6 x 4 = 24	4 x 6 = 24	24 ÷ 6 = 4	24 ÷ 4 = 6
6 x 5 = 30	5 x 6 = 30	30 ÷ 6 = 5	30 ÷ 5 = 6
6 x 6 = 36		36 ÷ 6 = 6	
6 x 7 = 42	7 x 6 = 42	42 ÷ 6 = 7	42 ÷ 7 = 6
6 x 8 = 48	8 x 6 = 48	48 ÷ 6 = 8	48 ÷ 8 = 6
6 x 9 = 54	9 x 6 = 54	54 ÷ 6 = 9	54 ÷ 9 = 6
6 x 10 = 60	10 x 6 = 60	60 ÷ 6 = 10	60 ÷ 10 = 6
6 x 11 = 66	11 x 6 = 66	66 ÷ 6 = 11	66 ÷ 11 = 6
6 x 12 = 72	12 x 6 = 72	72 ÷ 6 = 12	72 ÷ 12 = 6

x9 multiplication and division facts

9 x 1 = 9	1 x 9 = 9	9 ÷ 9 = 1	9 ÷ 1 = 9
9 x 2 = 18	2 x 9 = 18	18 ÷ 9 = 2	18 ÷ 2 = 9
9 x 3 = 27	3 x 9 = 27	27 ÷ 9 = 3	27 ÷ 3 = 9
9 x 4 = 36	4 x 9 = 36	36 ÷ 9 = 4	36 ÷ 4 = 9
9 x 5 = 45	5 x 9 = 45	45 ÷ 9 = 5	45 ÷ 5 = 9
9 x 6 = 54	6 x 9 = 54	54 ÷ 9 = 6	54 ÷ 6 = 9
9 x 7 = 63	7 x 9 = 63	63 ÷ 9 = 7	63 ÷ 7 = 9
9 x 8 = 72	8 x 9 = 72	72 ÷ 9 = 8	72 ÷ 8 = 9
9 x 9 = 81		81 ÷ 9 = 9	
9 x 10 = 90	10 x 9 = 90	90 ÷ 9 = 10	90 ÷ 10 = 9
9 x 11 = 99	11 x 9 = 99	99 ÷ 9 = 11	99 ÷ 11 = 9
9 x 12 = 108	12 x 9 = 108	108 ÷ 9 = 12	108 ÷ 12 = 9

Measures - length (link to x10/100)

10mm	= 1cm
100cm	=1m

Time

365 days	= 1 year
366 days	= 1 leap year

31 days =	Jan, March, May, July, Aug, Oct, Dec
30 days =	April, June, Sept, Nov
28 days =	Feb (29 in a leap year)

?Y2?

30 days has September, April, June and dark November. All the rest have 31 days clear, except for February which has 28 and 29 in each leap year.

Useful online resources for teaching and practising these facts

ITPs:

Number Grid	*Number Dial*	*Multiplication Array*	*Grouping*
Multiplication Table	*Number facts*	*Multiplication Facts*	*Number Scales*

Websites:

Times table rockstars

https://www.topmarks.co.uk/maths-games/hit-the-button

Times Tables - Hit the question
Division Facts - Hit the Answer

https://mathsframe.co.uk/en/resources/category/7/multiplication-and-division
https://mathsframe.co.uk/en/resources/category/23/measuring-and-time

MyMaths:

https://app.mymaths.co.uk/118-lesson/4-times-tables
https://app.mymaths.co.uk/117-lesson/3-times-tables
https://app.mymaths.co.uk/119-lesson/6-times-tables
https://app.mymaths.co.uk/123-lesson/9-times-tables
https://app.mymaths.co.uk/283-lesson/understanding-time

RAINOW MATHS - FUNDAMENTAL FACTS - YEAR 4

Two or three facts should be explicitly taught and practised over a period of at least three weeks and should then be regularly re-visited to ensure that they are fully embedded into the long term memory.

Related multiplication & division facts (inverse) should be taught together as a whole 'fact family'.

x8 multiplication and division facts ***[double (x2), double (x2) and double (x2) again]***

8 x 1 = 8	1 x 8 = 8	8 ÷ 8 = 1	8 ÷ 1 = 8
8 x 2 = 16	2 x 8 = 16	16 ÷ 8 = 2	16 ÷ 1 = 8
8 x 3 = 24	3 x 8 = 24	24 ÷ 8 = 3	24 ÷ 3 = 8
8 x 4 = 32	4 x 8 = 32	32 ÷ 8 = 4	32 ÷ 4 = 8
8 x 5 = 40	5 x 8 = 40	40 ÷ 8 = 5	40 ÷ 5 = 8
8 x 6 = 48	6 x 8 = 48	48 ÷ 8 = 6	48 ÷ 6 = 8
8 x 7 = 56	7 x 8 = 56	54 ÷ 8 = 7	54 ÷ 7 = 8
8 x 8 = 64		64 ÷ 8 = 8	
8 x 9 = 72	9 x 8 = 72	72 ÷ 8 = 9	72 ÷ 9 = 8
8 x 10 = 80	10 x 8 = 80	80 ÷ 8 = 10	80 ÷ 10 = 8
8 x 11 = 88	11 x 8 = 88	88 ÷ 8 = 11	88 ÷ 11 = 8
8 x 12 = 96	12 x 8 = 96	96 ÷ 8 = 12	96 ÷ 12 = 8

x7 multiplication and division facts ***(NB. If all other multiplication tables have been learnt, then there is only 7 x 7 = 49 to learn)***

7 x 1 = 7	1 x 7 = 7	7 ÷ 7 = 1	7 ÷ 1 = 7
7 x 2 = 14	2 x 7 = 14	14 ÷ 7 = 2	14 ÷ 2 = 7
7 x 3 = 21	3 x 7 = 21	21 ÷ 7 = 3	21 ÷ 3 = 7
7 x 4 = 28	4 x 7 = 28	28 ÷ 7 = 4	28 ÷ 4 = 7
7 x 5 = 35	5 x 7 = 35	35 ÷ 7 = 5	28 ÷ 5 = 7
7 x 6 = 42	6 x 7 = 42	42 ÷ 7 = 6	35 ÷ 6 = 7
7 x 7 = 49		49 ÷ 7 = 7	
7 x 8 = 56	8 x 7 = 56	56 ÷ 7 = 8	56 ÷ 8 = 7
7 x 9 = 63	9 x 7 = 63	63 ÷ 7 = 9	63 ÷ 9 = 7
7 x 10 = 70	10 x 7 = 70	70 ÷ 7 = 10	70 ÷ 10 = 7
7 x 11 = 77	11 x 7 = 77	77 ÷ 7 = 11	77 ÷ 11 = 7
7 x 12 = 84	12 x 7 = 84	84 ÷ 7 = 12	84 ÷ 12 = 7

x11 multiplication and division facts

11 x 1 = 11	1 x 11 = 11	11 ÷ 11 = 1	11 ÷ 1 = 11
11 x 2 = 22	2 x 11 = 22	22 ÷ 11 = 2	22 ÷ 2 = 11
11 x 3 = 33	3 x 11 = 33	33 ÷ 11 = 3	33 ÷ 3 = 11
11 x 4 = 44	4 x 11 = 44	44 ÷ 11 = 4	44 ÷ 4 = 11
11 x 5 = 55	5 x 11 = 55	55 ÷ 11 = 5	55 ÷ 5 = 11
11 x 6 = 66	6 x 11 = 66	66 ÷ 11 = 6	66 ÷ 6 = 11
11 x 7 = 77	7 x 11 = 77	77 ÷ 11 = 7	77 ÷ 7 = 11
11 x 8 = 88	8 x 11 = 88	88 ÷ 11 = 8	88 ÷ 8 = 11
11 x 9 = 99	9 x 11 = 99	99 ÷ 11 = 9	99 ÷ 9 = 11
11 x 10 = 110	10 x 11 = 110	110 ÷ 11 = 10	110 ÷ 10 = 11
11 x 11 = 121		121 ÷ 11 = 11	
11 x 12 = 132	12 x 11 = 132	121 ÷ 11 = 12	132 ÷ 12 = 11

x12 multiplication and division facts

12 x 1 = 12	1 x 12 = 12	12 ÷ 12 = 1	12 ÷ 1 = 12
12 x 2 = 24	2 x 12 = 24	24 ÷ 12 = 2	24 ÷ 2 = 12
12 x 3 = 36	3 x 12 = 36	36 ÷ 12 = 3	36 ÷ 3 = 12
12 x 4 = 48	4 x 12 = 48	48 ÷ 12 = 4	48 ÷ 4 = 12
12 x 5 = 60	5 x 12 = 60	60 ÷ 12 = 5	60 ÷ 5 = 12
12 x 6 = 72	6 x 12 = 72	72 ÷ 12 = 6	72 ÷ 6 = 12
12x 7 = 84	7 x 12 = 84	84 ÷ 12 = 7	84 ÷ 7 = 12
12 x 8 = 96	8 x 12 = 96	96 ÷ 12 = 8	96 ÷ 8 = 12
12 x 9 = 108	9 x 12 = 108	108 ÷ 12 = 9	108 ÷ 9 = 12
12 x 10 = 120	10 x 12 = 120	120 ÷ 12 = 10	120 ÷ 10 = 12
12 x 11 = 132	11 x 12 = 132	132 ÷ 12 = 11	132 ÷ 11 = 12
12 x 12 = 144		144 ÷ 12 = 12	

Time

12pm	=12:00hrs	6pm	= 18:00hrs
1pm	= 13:00hrs	7pm	= 19:00hrs
2pm	= 14:00hrs	8pm	= 20:00hrs
3pm	= 15:00hrs	9pm	= 21:00hrs
4pm	= 16:00hrs	10pm	= 22:00hrs
5pm	= 17:00hrs	11pm	= 23:00hrs

60 seconds	= 1 minute
60 minutes	= 1 hour
24 hours	= 1 day

Useful online resources for teaching and practising these facts

ITPs:

Number Grid	*Number Dial*	*Multiplication Array*	*Grouping*
Multiplication Table	*Number facts*	*Multiplication Facts*	*Number Scales*
Clock			

Websites:

Times table rockstars

https://www.topmarks.co.uk/maths-games/hit-the-button

Times Tables - Hit the question
Division Facts - Hit the Answer

https://mathsframe.co.uk/en/resources/category/7/multiplication-and-division
https://mathsframe.co.uk/en/resources/category/23/measuring-and-time

MyMaths:

https://app.mymaths.co.uk/917-game/times-it-out
https://app.mymaths.co.uk/5349-worksheet/mixed-times-tables-ow
https://app.mymaths.co.uk/1761-lesson/time-2
https://app.mymaths.co.uk/121-lesson/7-times-tables
https://app.mymaths.co.uk/5340-worksheet/8-times-table-ow
https://app.mymaths.co.uk/122-lesson/8-times-tables
https://app.mymaths.co.uk/125-lesson/11-times-tables
https://app.mymaths.co.uk/126-lesson/12-times-tables

RAINOW MATHS - FUNDAMENTAL FACTS - YEAR 5

Two or three facts should be explicitly taught and practised over a period of at least three weeks and should then be regularly re-visited to ensure that they are fully embedded into the long term memory.

Square Numbers

1 x 1 = 1	6 x 6 = 36
2 x 2 = 4	7 x 7 = 49
3 x 3 = 9	8 x 8 = 64
4 x 4 = 16	9 x 9 = 81
5 x 5 = 25	10 x 10 = 100

Prime Numbers >50

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47.

Equivalent Fractions, Decimals & Percentages

FRACTION	DECIMAL (/10)	PERCENTAGE (/100)
1 (1/1 = 1 whole)	1	100%
1/2 = 2/4 = 4/8	0.5	50%
1/4 = 2/8 = 4/12	0.25	25%
3/4	0.75	75%
1/10 = 2/20 = 10/100	0.1	10%
1/5 = 2/10 = 20/100	0.2	20%

Measures: Mass (k = thousand)

1000g	= 1kg	100g	= 0.1kg
500g	= 0.5kg	1.5kg	= 1500g

Measures: Length (k = thousand, c = hundred, m = thousandth)

1000mm	= 1m	1000m	= 1km
5mm	= 0.5cm	500m	0.5km
500mm	= 0.5m	50cm	= 0.5m

Measures: Capacity (m = thousandth)

1000ml	= 1 litre	500ml	= 0.5 litres

Measures: Turn (degrees)

360^{o} = full turn	180^{o} = half turn = straight line	90^{o} = quarter turn = right angle

Useful online resources for teaching and practising these facts
ITPs: *Calculating Angles* *Measuring Cylinder* *Measuring Scales* *Twenty Cards* *Fractions* **Websites:** https://www.topmarks.co.uk/maths-games/hit-the-button *Square numbers* https://mathsframe.co.uk/en/resources/category/18/fractions-decimals-and-percentages **MyMaths:** https://app.mymaths.co.uk/149-lesson/squares-and-triangles https://app.mymaths.co.uk/1699-lesson/converting-measures https://app.mymaths.co.uk/262-game/angler-game https://app.mymaths.co.uk/90-lesson/fractions-to-decimals https://app.mymaths.co.uk/141-lesson/frac-dec-perc-1 https://app.mymaths.co.uk/5819-worksheet/fractions-decimals-percentages-ow

RAINOW MATHS - FUNDAMENTAL FACTS - YEAR 6

Two or three facts should be explicitly taught and practised over a period of at least three weeks and should then be regularly re-visited to ensure that they are fully embedded into the long term memory.

Square Numbers

11 x 11 = 121	16 x 16 = 256
12 x 12 = 144	17 x 17 = 289
13 x 13 = 169	18 x 18 = 324
14 x 14 = 196	19 x 19 = 361
15 x 15 = 225	20 x 20 = 400

Cube Numbers

1 x 1 x 1 = 1	4 x 4 x 4 = 64
2 x 2 x 2 = 8	5 x 5 x 5 = 225
3 x 3 x 3 = 27	10 x 10 x 10 = 1000

Prime numbers >50 <100

53, 59,61,67,71, 73,79, 83,89,97

Properties of triangles

Internal angles add up to 180◦
Equilateral triangles have 3 equal sides and 3 equal angles of 60°
Isosceles triangles have 2 equal sides and 2 equal angles.

Properties of quadrilaterals

Quadrilaterals have 4 sides.
Their internal angles add up to 360◦
There are 6 main quadrilaterals: square, rectangle, rhombus, parallelogram, trapezium,xkite.

Useful online resources for teaching and practising these facts

ITPs:

Twenty Cards *Polygon* *Fixpoints* *Calculating Angles*

Websites:

https://www.topmarks.co.uk/maths-games/hit-the-button

Square Numbers

https://www.youtube.com/watch?v=9m2cdWorIq8

https://mathsframe.co.uk/en/resources/category/18/fractions-decimals-and-percentages

MyMaths:

https://app.mymaths.co.uk/149-lesson/squares-and-triangles

https://app.mymaths.co.uk/251-game/2d-what-am-I

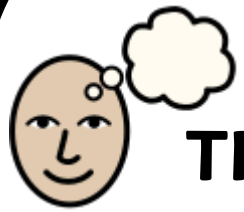
Make it

Draw it

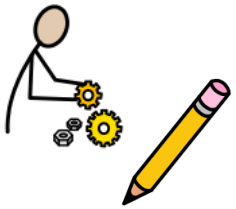
Write it

Prove it

What can I do if I am 'stuck'?



THINK! **HAVE A GO!** **TRY SOMETHING!**



What does the maths look like?

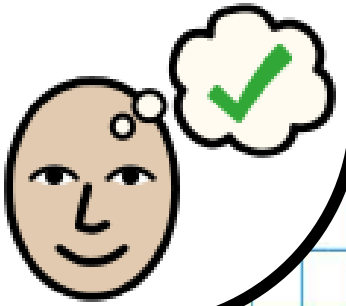
Can I make it?

Can I draw it?

What else do I already know?

What maths facts could I use?

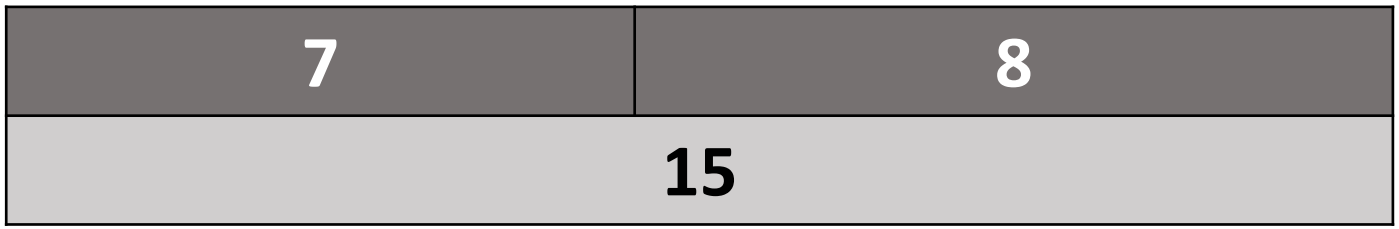
What other maths does it link to?



ADDITION

addend + addend is equal to the sum

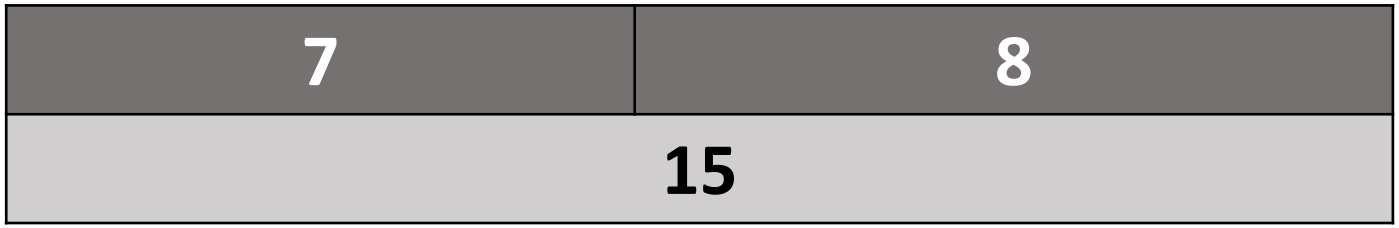
7 + 8 = 15



SUBTRACTION

minuend - subtrahend is equal to the difference

$$15 - 8 = 7$$



MULTIPLICATION

factor x factor is equal to the product

7 x 8 = 56

Multiplicand x multiplier is equal to the product

8	8	8	8	8	8	8
56						

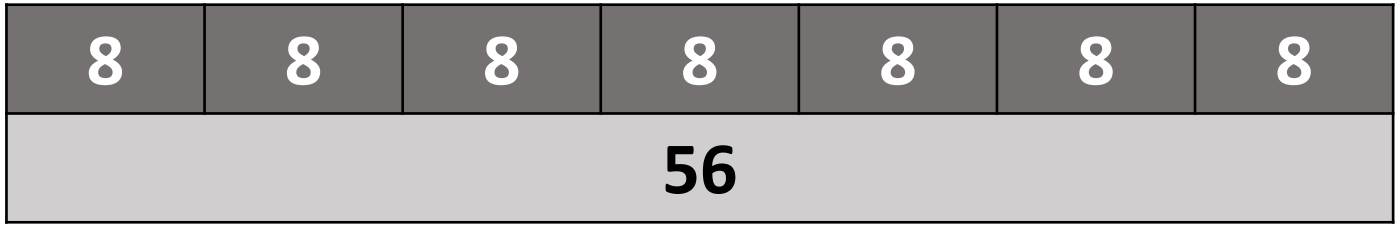
DIVISION

dividend ÷ divisor is equal to the quotient

$$56 \div 8 = 7$$

or

$$7 = 56 \div 8$$

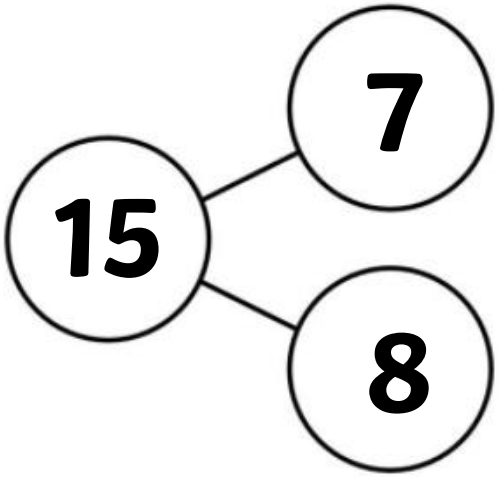


Fact Families – Inverse Relationships

ADDITION & SUBTRACTION

+ **-**

7	8
15	



part + part = whole

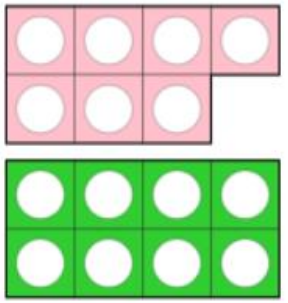
whole – part = part

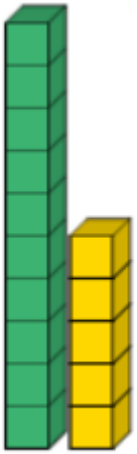
7 + 8 = 15

8 + 7 = 15

15 – 8 = 7

15 – 7 = 8

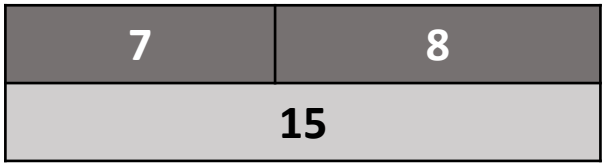




Fact Families – Inverse Relationships

ADDITION & SUBTRACTION

+ -



part + part = whole

whole – part = part

7 + 8 = 15

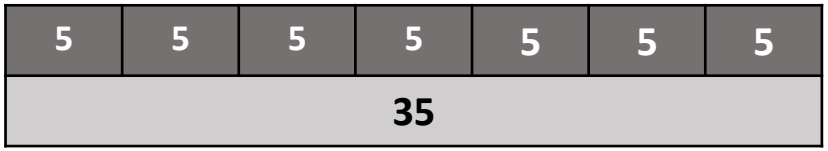
8 + 7 = 15

15 – 8 = 7

15 – 7 = 8

MULTIPLICATION & DIVISION

x ÷



part x part = whole

whole ÷ part = part

7 x 5 = 35

5 x 7 = 35

35 ÷ 5 = 7

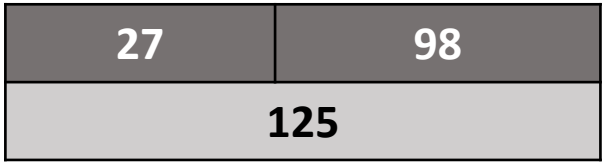
35 ÷ 7 = 5

KS1

Fact Families – Inverse Relationships

ADDITION & SUBTRACTION

+ -



part + part = whole
whole – part = part

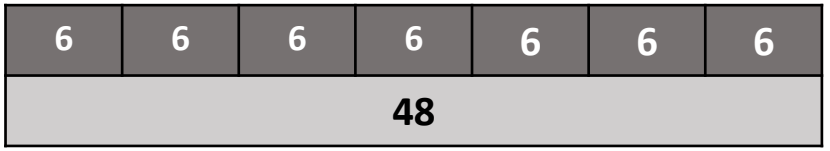
27 + 98 = 125
98 + 27 = 125
125 – 98 = 27
125 – 27 = 98

whole = part + part
part = whole – part

125 = 27 + 98
125 = 98 + 27
27 = 125 – 98
98 = 125 – 27

MULTIPLICATION & DIVISION

x ÷



part x part = whole
whole ÷ part = part

7 x 6 = 42
6 x 7 = 42
42 ÷ 6 = 7
42 ÷ 7 = 6

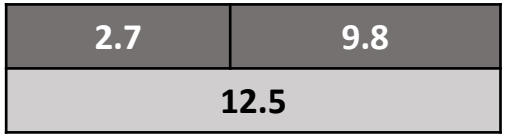
whole = part x part
part = whole ÷ part

42 = 7 x 6
42 = 6 x 7
7 = 42 ÷ 6
6 = 42 ÷ 7

Fact Families – Inverse Relationships

ADDITION & SUBTRACTION

+ -



part + part = whole
whole – part = part

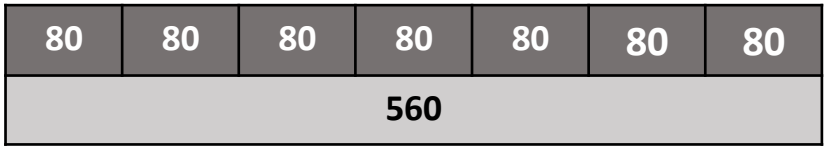
whole = part + part
part = whole – part

2.7 + 9.8 = 12.5
9.8 + 2.7 = 12.5
12.5 – 9.8 = 2.7
12.5 – 2.7 = 9.8

12.5 = 2.7 + 9.8
12.5 = 9.8 + 2.7
2.7 = 12.5 – 9.8
9.8 = 12.5 – 2.7

MULTIPLICATION & DIVISION

x ÷



part x part = whole
whole / part = part

whole = part x part
part = whole ÷ part

7 x 80 = 560
80 x 7 = 560
560 / 80 = 7
560 / 7 = 80

560 = 7 x 80
560 = 80 x 7
7 = 560 / 80
80 = 560 / 7

BALANCED EQUATIONS

part + part = part + part

part – part = part + part

part + part = part – part

part – part = part - part

BALANCED EQUATIONS

part x part = part x part

part x part = part / part

part / part = part x part

part / part = part / part

How can I check my answer?

- Make sure that you are using the correct numbers
- Have you used the correct operation?
- Does it make sense? Is it a sensible answer?
- Should the answer be odd or even?
- Is the answer close to the estimate?
- Is my answer larger or smaller than the starting numbers?
- What happens when you do the inverse?
- Does it fit into the whole fact family?
- Do it again using a different method; is the answer the same?

Maths Journal Sentence Starters

+ I noticed that...
+ I learned that...
+ I now know that...
+ I figured out that...
+ I proved it by...
+ I solved this by...
+ I wonder if...
+ To solve this, I ...
+ I compared...
+ I now understand...
+ The strategy that helped me was...
+ I can show this idea by...
+ I thought that...
+ I can prove my thinking by...
+ I can check by...
+ I know this because...

Deepening your answers in Maths

+ JUSTIFY
Why is your answer the best one?

+ EXPLAIN
How did you get your answer?

+ SHOW
Use resources, pictures and/or numbers to show how you got your answer.

+ DESCRIBE
Use mathematical vocabulary to justify, explain and demonstrate your answer.

How can I challenge myself?

+ Explain how you know – prove it!
+ Show/Draw what it looks like
+ Use a different method
+ Show all the methods that you know
+ Write a story to go with the question
+ Invent a new method
+ What else do you know because of this?
+ What links can you make to other learning?

Fluency & Fundamental Facts

Recall quickly and accurately.

Efficiency	Mental method (in my head)? Jottings? Written (column) method?
Accuracy	Estimate? Calculate. Check! Sense?
Flexibility	Is there another way? What else do I know? What else could I do?

+ −

× ÷

What do I know? 20 ÷ 5 = 4

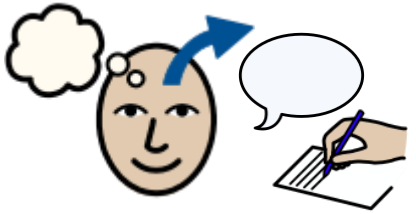
What can I write down?

4	24
8	28
12	32
16	36
20	40

What can I work out?

200 ÷ 5 = 40

400 x 50 = 20,000



Problem-solving Prompts

What do I know?

What don't I know?

What do I need to know?

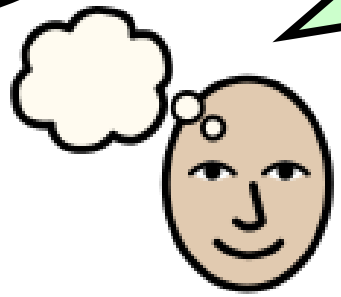
What don't I need to know?

What can you answer?

What can't you answer yet?

What could it be?

What couldn't it be?



Reasoning Reminders

Describe

I can see that...

What did you do?
What do you notice?

Explain

...because...

Give an example.

Justify

I know that...

Facts? Rules?
Convince me.

Show

It looks like:

Representations?
Proof?