Mathematics Policy

Committee Name:	Curriculum
Date of Approval:	November 2015
Validity Date:	2014-2017 (updated March 2016)
Person responsible:	Maths Leader

Purpose

"Mathematics is essential for everyday life and understanding our world. It is also essential to science, technology and engineering, and the advances in these fields on which our economic future depends. It is therefore fundamentally important to ensure that all pupils have the best possible mathematics education." (HMCI, 2012, p4.)

At St. Fidelis Catholic Primary School we want to encourage everyone to grow in confidence within mathematics to achieve their full potential. We wish to give our children fluency in skills to be able to apply these to any problem so that they are ready to tackle any situation which they may face.

Broad Aim

To ensure all children reach their full potential within mathematics by increasing the children's fluency within skills, their ability to reason and justify answers and developing the children's ability to solve challenging problems.

Reasoning

This policy has been redesigned in-line with the new National Curriculum; it encompasses the same fundamentals, whilst also applying lessons learnt from Maths Mastery.

Application

This policy is to ensure consistency throughout the school. While this is to be applied by all year groups, some year groups will also be following the Maths Mastery policy alongside this (see appendix 1).

Maths is to occur in each class for at least an hour a day. A daily maths meeting of 10 minutes is also to occur. In addition to this, mathematical skills will be applied to different subjects such as data-handling skills within Science and measuring skills within technology subjects.

Planning

Year groups who are following Maths Mastery are to use their planning and adapt this to suit their children. The other year groups are to follow the framework from Rising Stars which recomends when to teach each learning objective. *"Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas."* (DfE – National Curriculum, 2014, p3). Due to this, mathematics is to be taught in blocks which link different parts of the curriculum. These are called sequences. There are 14 sequences to be taught to each year group. Each sequence is based upon one of the four areas – number sense, additive reasoning, multiplicative reasoning and geometric reasoning.

Within each sequence a range of learning objectives are to be planned for. These use the same wording as the learning objectives within the new curriculum. The

combined learning from these learning objectives support the children in being able to meet the overview for that sequence. Due to the amount of learning objectives which need to be covered, teachers need to actively use their own assessment to calculate how much time should be allocated to each objective.

Lessons which are planned from the framework follow the 6 part lesson as designed by Maths Mastery. The lessons are to include differentiation of at least 3 ways from which the children can choose.

Assessment

Teacher assessment – teachers are to complete a class version of the assessment tracker where by the teacher colour codes each objective at the end of the sequence (or collection of lessons) against the classes' ability. If the majority of the class meet this objective, it is to be coloured green; those which only half of the class met or those which the class did not meet in enough depth are to be coloured yellow while the learning objectives which the class did not understand or meet are to be coloured red. This class assessment tracker is to then directly inform planning when that strand is revisited. This class tracker must be updated by the end of each half term.

Those learning objectives which were coloured red or yellow are to be allocated more time within the next sequence within that strand. In the same way those learning objectives which were coloured green will be allocated less time or may even only be covered within mental maths sessions.

Children's assessment – Children will have their own assessment tracker. This is to be filled in regularly so that it is complete by the end of each term. To help guide the children on what colour they should colour their tracker, they should be encouraged to refer to their book to see whether they met that L.O. or whether it was not met. This will help to inform them on what colour to use. The teacher is to identify any children who may struggle to complete their tracker by themselves and offer support to them on how to do this, filling it in alongside them.

The children's assessment tracker is to replace the old targets which were used. They are to be used as tool from which the children can work out which L.O.s they need to focus on, through using the colours. Due to this, the trackers need to be readily available to the children; all the trackers are now combined within one booklet and teachers may find it beneficial to keep these on the children's tables.

Self assessment – children are to complete self assessment using 'what went wells' and 'even better ifs' in-line with our assessment policy which is broken down differently for different year groups.

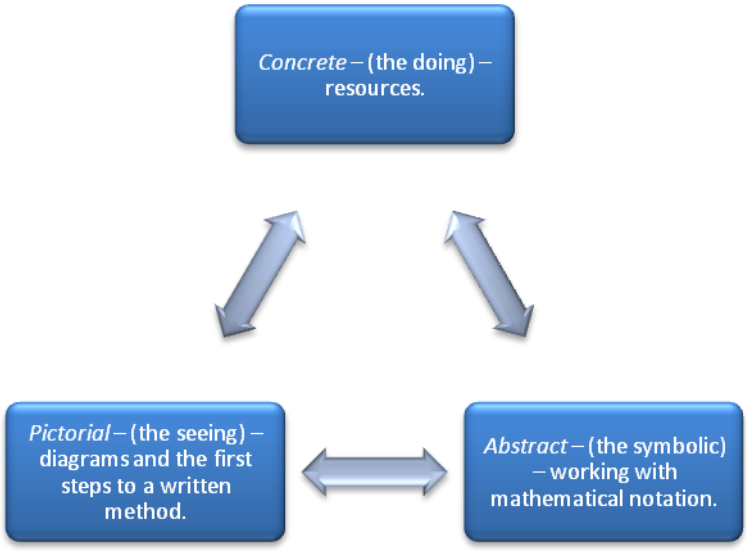
Assessment tasks – Each term teachers are to decide whether each child is now emerging, expecting or exceeding the standards for that year group. To help them decide this, teachers are to refer to the key performance indicators in the middle of the assessment sheets with the examples of children's work. To aid the teachers in deciding where the child should be assessed and to help fully access each aspect of the new curriculum the assessment tasks are to be used. (Maths mastery years are to use the end of topic assessments.) These can be used after each sequence of lessons and have been designed to assess the curriculum in-line with the new framework. Teachers are to also consider the scores from any practice papers they have used.

GL assessments - In addition to this, a test is to occur during March, assessing the children against their age-related expectations.

Concrete – Pictoral – Abstract (CPA)

When new concepts are to be introduced, all three approaches to learning should be used. Jerome Bruner reminds us that these three representations are needed for pupils to learn and he notes how these are not age-dependent.

All three concepts do not need to be evident in all lessons; however when new concepts are introduced, the children need an opportunity to explore this using concrete manipulatives first, then use pictorial representations before exploring this as the abstract, no matter what year group they are in. This then builds solid foundations for them to work from.



The Teaching of Calculations

The teaching of the four operations is to follow our school's calculations policy (appendix 2). Please refer to this for more detail. Here it explains that initially children are to be introduced to the four operations through the use of resources (concrete manipulatives). Once they are confident with exploring the operation with resources, they are to be introduced to the first stages of the written method - this shows the method in a pictorial form helping the children to understand this further. After this the children are to work with the abstract form. For addition, subtraction and multiplication, this is the column method and for division the children are to use short division and then long division. The calculation of decimals and fractions and the use of percentages follows different methods. Due to this the steps for calculating with decimals and fractions have been broken down further. Please see the end of the calculations policy (appendix 2).

Language

Children should be encouraged to discuss mathematical concepts, to help them turn their thoughts into concrete ideas. Discourse and working with others is a vital part of Vygotsky's *zone of proximal development*, helping to scaffold children's learning further. To support this, children should be encouraged to talk within lessons.

As language in maths can be very confusing due to multiple meanings, children are to be taught new vocabulary (star words) directly. This can occur through the vocabulary spider diagrams, which create links between meanings, representations, spellings and actions for the word, or activities based around actions for each term.

If a child uses a mathematical word incorrectly, the adult will model the correct word back to the child within the sentence. Children should always be encouraged to speak in full sentences when answering questions, showing their full understanding. In

addition to this, children should be encouraged to not only be involved actively in answering questions; but they should also be encouraged to ask questions.

Year groups which have taught Maths Mastery have seen good outcomes in terms of both mathematical understanding and language development. To provide equal opportunities for all children, including those not doing the programme, teachers are to plan talk tasks for lessons as well as expecting answers in full sentences. The talk task is to be on the planning and it should encourage children to explore the learning objective further with a partner. This should be clearly modelled to the children and it will often be supported by concrete manipulatives and pictorial images.

Rich Tasks

Rich tasks are open, investigative tasks. This is St Fidelis' definition of rich tasks –
Rich tasks encourage children of all abilities to use and apply skills to explore open-ended questions and investigative tasks through using a collaborative approach. Rich tasks use high-order thinking skills as they encourage children to challenge and question maths through creating a 'what if' culture.

Rich tasks are to occur as an integral part of the maths lessons by all children. They also provide a way to differentiate tasks further as they broaden the children's understanding by applying their skills to situations which require them to link their mathematical understanding. In addition to this, some lessons should be designed solely for rich tasks where everyone within the class is completing this at the same time. Ideas can be taken from the nrich website and the Collins resources which each year group has.

To develop the skills needed for rich tasks, the mathematical skills poster is to feature within maths lessons. This is to be used in a similar way to the excellent learner poster where children are praised for displaying a skill. These skills include: showing resilience, working systematically, showing your working out, spotting patterns, asking 'what if' and justifying your answers.

Recording

Each lesson, children should have evidence of their learning within their book to show the current attainment they are working at; this will also allow progression to be seen. When working with the pictorial and abstract, recording can occur through written work within their book. When completing tasks, children need to be encouraged to show their working-out thus helping the teacher to identify any misconceptions. When working with the concrete, where not much pictorial or abstract work has occurred to show their understanding, the evidence is to come from photographs.

Mental Maths / Maths Meetings

Mental maths is to occur every day within the 10/15 minute maths meeting (this occurs outside the maths lesson, to allow for a full-hour lesson, around one learning objective, to take place). Within each sequence, the mental maths which is to be covered can be found on the framework under the mental maths heading. This consists of 'I can' statements. These are to form the bases of the planning; however other things can also be covered. For example, this would be a great opportunity to recap learning from the week before, tackle any class weaknesses or cover learning objectives which the class are strong at, which you do not feel need a whole lesson devoted to them. Maths mastery year groups are to plan for their maths meetings in

this way, using it as a time to fill gaps and revisit learning that has not been looked at for a little while.

Mental maths activities should involve the whole class and open questions/tasks are a good way to do this. Ideas which you could use include 'which is the odd one out?', 'and another one' and 'give me a question where …'.

During each lesson, counting is to occur - this is no longer to remain as a separate activity within the lesson, but is to occur through a transition. At the start of the year it would be beneficial to teach the children how transitions will occur so that these can be requested at different points when the children are asked to move.

SMSC (Spiritual, Moral, Social and Cultural)
SMSC is an important part of maths and it helps our children to become confident mathematicians who are open to challenges both independently and collaboratively. While SMSC helps to develop our mathematicians, maths also develops SMSC for our children. It supports children when learning how to: work collaboratively (in both pairs and groups), solve problems, build resilience, develop confidence, develop language and discussion skills, support one another and learn how to be patient. When the children demonstrate these skills, they should also be identified and celebrated through the use of the maths super hero poster and the excellent learners poster.

These skills should be developed seamlessly within a lesson. This may be through: talk tasks, rich tasks, independent tasks, group work, mathematical games or the children becoming experts and helping others. SMSC will also feature more strongly within certain lessons such as: exploring number systems from different times/cultures (Egyptian hieroglyphs (Year 5) and Roman numerals (Year 3)), looking at currencies from different countries (IDR (Year 5)), looking at Maths within books from other cultures, big pictures (Reception – Year 3) and exploring finance (Enterprise project).

ICT
Children should use ICT where appropriate to support their learning; such as key stage two children creating graphs. RM Easimaths should be used to allow children to practise their mathematical skills both within school and at home. This software should be prioritised as the built-in diagnostics run continuously to calculate which questions the children get asked next. The use of this software will support the National Curriculum's aim of fluency in skills. Those children who use RM Easi maths the most in Key Stage 1 should receive a certificate and those children in Key Stage 2 who use it the most should be recognised in the proud assembly and be given a sticker.

Parental Involvement
The school recognises the importance of both parents and teachers working together to support a child's progress. Due to this, parents will be kept informed of how they can support their child in mathematics. This will occur through workshops, updates on policies, information in the newsletter and parents' meetings/evenings where progress will also be discussed.

To help support parents in knowing what their children are learning about, information about the curriculum is to be sent home on the termly curriculum letters. The curriculum plan can also be found on the school's website.

Consistent Approaches

- Place value – units are to be called ones with a letter O to be written as the column heading. For the tenths, hundredths etc. the headings are to written as a fraction.
- Zero – zero is to be referred to as zero or nought, not 'oh'.
- RUCSAC – this is to stand for: read, understand, choose (operation), solve, answer and check.
- Negative numbers – these are to be referred to as negative or minus numbers, but when a negative number is stated, it is to be called minus … e.g. minus 1.

Appendices

Appendix 1 – Maths Mastery Policy
Appendix 2 – Calculations Policy (This includes the breakdown for working with decimals, fractions and percentages.)

Maths Mastery Policy – Appendix 1

Committee Name:	Curriculum
Date of Approval:	
Validity Date:	2014-2017 (updated March 2016)
Person responsible:	Maths Leader

Purpose

"Mathematics is essential for everyday life and understanding our world. It is also essential to science, technology and engineering, and the advances in these fields on which our economic future depends. It is therefore fundamentally important to ensure that all pupils have the best possible mathematics education." (HMCI, 2012, p4.)

At St. Fidelis Catholic Primary School we want to encourage everyone to grow in confidence within mathematics to achieve their full potential. We wish to give our children the fluency in skills to be able to apply these to any problem so that they are ready to tackle any situation which they may face.

Broad Aim

To ensure that all children reach their full potential within mathematics through deepening their understanding by: using concrete manipulatives and visual representations before moving onto the abstract, developing language development and by having problem solving at the heart of the curriculum.

Reasoning

This policy has been designed in-line with the Maths Mastery programme which Reception and Year One started in 2014 – 2015. Due to the successes of this programme, within 2015 – 2016 Reception, Year 1, Year 2 and Year 3 will all be following Maths Mastery. After this time the programme will continue to grow through one year group being added each year as the Year 3 children progress through the school. This programme is designed in-line with the new National Curriculum and it encompasses the same fundamentals such as problem solving. It has been based on research gathered on Shanghai and Singapore maths and this features within its design.

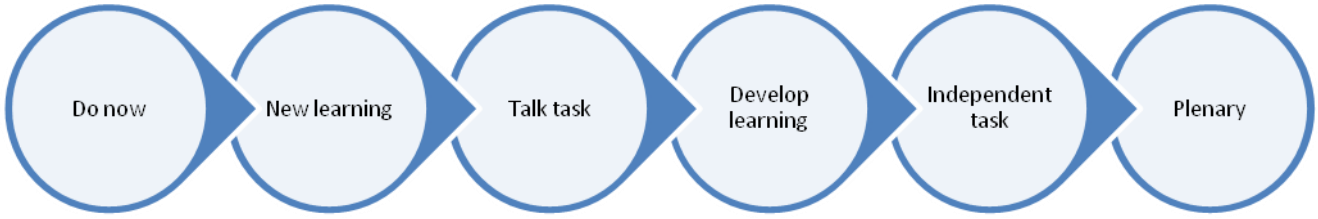
Maths mastery strongly believes that all children can do maths; they believe in a growth mindset where intellectual ability is effort based. This mirrors the schools aim where we want all children to reach their full potential.

Application

This policy is to ensure consistency with the classes which are following the programme and to ensure that this programme is adapted to suit our school and the needs of our children. While some year groups are following this policy, they are to still shadow our school's mathematics policy.

Reception are to adapt the programme through their timings. They are to still follow the six part lesson following all the transitions, but they are to spend less time on each section to allow time for the children to apply their learning to play.

Planning
Each lesson is to follow the six part lesson structure.



Before the talk task and the independent task the teacher is to use modelling to help the children know what to do. In addition to this, transitions are to occur where the children will also use this time for learning – this could include singing mathematical songs or counting. This lesson structure allows scaffolded learning where assessment from the segments can feed into the rest of the lesson. Due to the success of this format all year groups are to follow the 6 part lesson as stated within the maths policy.

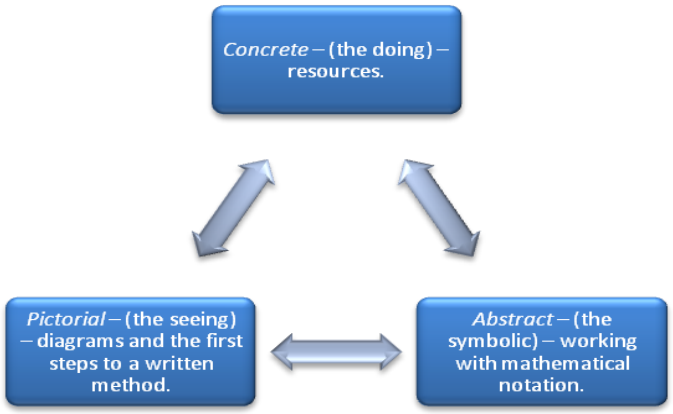
Lessons will be supplied on the Maths Mastery tool kit; however, these need to be adapted for the school and differentiation will need to be planned for. The planning is to use the format supplied on the toolkit.

Differentiation
The lessons supplied by Maths Mastery are not differentiated. Class teachers are to differentiate for their year group through considering the range of attainment within their year group. Differentiation is to encourage higher ability to deepen their understanding; rich tasks would be one helpful tool to do this. The next steps for depth cards are to be used as a tool to challenge children further and the amount of scaffold is to be considered. All children are to work at a suitable but challenging level for them, with all children working on the same learning objective. In line with the rest of the school, the children can select their own task.

Assessment
Assessment for learning is an essential feature of the Maths Mastery approach, with teacher assessment continually feeding into the next task and lesson. The teachers need to ensure that they allow their ongoing formative assessment to adapt different parts of the lesson where needed. They are to also input more lessons when needed to help children fully grasp an idea and similarly move on if the children are already showing a firm, deep understanding of the learning objective; this is particularly important for teachers with children who have already been on the programme, as their understanding is more secure. Unit assessments are to be used to identify which areas of mathematics have been understood and which need further consolidation, assessing the curriculum which has been taught and covered within that unit. Similarly, pre-assessments can identify gaps where additional lessons may be needed.

The classes participating with Maths Mastery are to also follow the school's method of summative assessment which is to occur in March through age-related tests (GL assessments).

Concrete – Pictoral – Abstract (CPA)
The CPA approach as discussed in the maths policy is to be applied when new concepts are to be introduced to children. Jerome Bruner reminds us that these three representations are needed for pupils to learn and he notes how these are not age dependent.



Language
Each topic starts with a big picture; this is to promote discussion. It sets the context of the learning for that unit and creates discussion through providing a stimulus.

Language is a key part of a Maths Mastery lesson and there is a section of the 6-part lesson structure devoted purely to talk. Here the teacher is to model how to use mathematical language appropriately. They are to model how to use full sentences, as well as expecting children to always respond using full sentences. New language is to be taught and the school's current practice of using the vocabulary spider diagram could help to do this.

Although talk is promoted within a separate section of the lesson, children are to be encouraged to talk at numerous points. This is to occur through either talk-partners or talking trios as this promotes a deeper level of conversation where the children can build upon each other's ideas.

Emphasis on problem solving
Problem solving is a fundamental part of the Maths Mastery programme. To help ensure consistency, investigative tasks are still to be called 'rich tasks'. Rich tasks should be an integral part of lessons and higher-ability children should often be encouraged to apply their skills within these. To develop the skills needed for rich tasks, the mathematical skills poster is to feature within each maths lesson. This is to be used in a similar way to the excellent learner poster where children are praised for displaying a skill. These skills include: showing resilience, working systematically, showing your working out, spotting patterns, asking 'what if' and justifying your answers.

Recording
Photography is to support recording within lessons. The children are to have something recorded from each lesson even if the task has been based upon concrete manipulatives. If recording has not occurred within the child's book through drawing a visual representation or writing the abstract, photos are to be used as evidence of the child's understanding.

Professional Development
Videos and support are available to teachers on the toolkit; time which teachers have saved from planning is to be used to watch these videos to help them develop their practice. It is also recommended that teachers complete the practical task at the start of the unit to help them identify any possible misconceptions and to aid them in identifying the steps needed within the thought process, so they know how best to support the children further.

Calculations Policy – Appendix 2

Committee Name:	Curriculum
Date of Approval:	
Validity Date:	2013-2017 (updated June 2015)
Person responsible:	Maths Leader

Purpose
At St. Fidelis Catholic Primary School we want to encourage everyone to grow in confidence to achieve their full potential. Calculating is a crucial aspect of Mathematics and with Mathematics being an integral part of various industries, children need to be mathematically literate and confident.

Broad Aim
To equip children with reliable methods, which they feel confident with, for the four operations, enabling them to flourish within calculating; thus supporting them within learning beyond St. Fidelis.

Reasoning
With lower-attaining pupils becoming confused with different approaches/methods and higher-attaining pupils needing to be able to move swiftly onto more efficient methods (Ofsted, Good Practice, 2011) a change to the number of methods taught was required. Fewer methods, taught to a higher quality, will result in increased time spent per method and the children becoming more confident. This will then support fluency within the new maths curriculum and it will allow children to deepen their understanding of maths, as they have a reliable method to apply to different challenges and contexts.

Application
These methods are to be followed across the school, providing consistency; however on occasions children may not be able to grasp a given method. Initially the teacher is to support the child in understanding the concept behind the method, with the use of resources. If this does not help the child to access the method within this policy, the teacher may wish to then equip the child with another method to help them access the curriculum.

Prior to written calculation methods, children are to have a pre-requisite knowledge of the number system. They are to understand place value, partitioning, number facts and number bonds through the use of resources and visual images. Children need to continue to develop mental methods supported by jottings and visual images throughout their time at St Fidelis.

Although the methods are to be the same throughout a child's time at St Fidelis, progress should still be seen through different approaches such as: looking at the need to 'carry', extending to larger numbers and using decimals. More information about calculating with decimals and fractions can be found towards the end of this policy. Throughout their time in school, children should have the experience to use these methods to solve a wide range of problems.

Resources to aid calculation

Numicon is a key resource to support calculation. Numicon is beneficial to children as it provides them with a firm concept of number, rather than number being an abstract digit without meaning. Children are to also be familiar with a range of resources such as cubes, Dienes, number lines, bead strings and counters. Teachers are to decide which resources are suitable for each occasion. Numicon is currently commonly used within Key Stage 1 and the Foundation Stage; however, where appropriate Numicon can be used anywhere across the school. Remember, children are to be confident with completing calculations with resources prior to using any written methods.

Maths Mastery

Maths Mastery has its own calculations policy for each year group, which can be found on the tool kit; however, this is to be tied to the school's calculations policy. Worksheets and flipcharts are to be adapted to ensure that presentation is the same across the school as set out in this policy. For example, currently for Maths Mastery in Year 1, children are encouraged to place carried numbers above the answer line. This needs to be adapted so that children are used to placing the carried number underneath the equals line.

Addition

First steps for a written calculation - Reception and Year 1 are likely to use number lines to support them in understanding addition; this will also help them in completing mental methods. This could be a number line resource, a drawn number line for children to draw on, or a blank number line to support children with larger numbers.

(*Example of a blank addition number line*)

8 + 7 = 15

Addition Column Method

```
  4 7
+ 7 6
 1 2 3
  1 1
```

Notes: Children are to become confident in using the column method for addition. As part of this, they are to record their carried numbers underneath the bottom line, below the answer. In teaching how to carry numbers initially, the use of practical equipment to understand the concept of exchange is to occur. If children are struggling to apply their understanding of place value to this method, the partitioned column method can be used to bridge this gap.

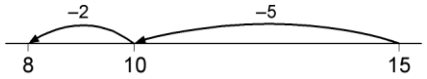
```
 47  =  40 +  7
+76     70 +  6
       110 + 13  = 123
```

Subtraction

First steps for a written calculation – A number line is to be used to support younger children in either counting on or back to complete subtraction questions. This could be a number line resource, a drawn number line for children to draw on, or a blank number line to support children with larger numbers.

(*Example of a blank subtraction number line*)

15 – 7 = 8



Subtraction Column Method

$$\begin{array}{r} {}^{2}\not{3}\,{}^{1}\not{5} \\ -\ 1\ 7 \\ \hline 1\ 8 \end{array}$$

Notes: Children are to become confident in using the column method for subtraction. Some children are less successful in this method when the second ones digit (for example) is larger than the first ones digit which sits above it. For this children need to be taught how to exchange (borrow) from the next column and shown how this is the same as partitioning that number; for example 35 – 17, goes to (20 + 15) – (10 + 7), rather than (30 + 5) – (10 + 7), which does not allow the 7 to be taken away from the 5. When exchanging (borrowing), the calculation must be set out as the example, with the old number crossed out and rewritten and the borrowed one written slightly smaller next to the digit it is being taken to.

Multiplication

First steps for a written calculation - Arrays are to be used to support children in learning the multiplication facts initially; however, children need to learn and memorise the multiplication facts up to 12 to support them in using the multiplication column method effectively.

(*Example of an array*)

7 x 3 = 21

Multiplication Column Method

```
   4 6
 x 2 4
 1 8 4
   2
 9 2 0
 1
1 1 0 4
 1
```

Notes: Children are to become confident in using the column method for multiplication. They are to multiply the top number by the ones first, then the tens etc., using each line underneath to record the answer. If an exchange is to occur when a multiplication creates an answer over 10, a small digit is to be carried by the line where that answer is being recorded. It is not to be placed at the top as this is then often multiplied again, by mistake.
When moving onto multiplying by the tens, a zero (place holder) must be written in the ones column for that line. If multiplying by hundreds, two zeros are to be written etc.

Alternative method if needed - As mentioned, various methods can be taught where children have a block with the suggested method. Where this is the case for multiplication, the grid method is to be the next method used.

(*Example of the grid method*)

×	20	9	
200	4000	1800	5800
80	1600	720	2320
6	120	54	174
			8294

Division

First steps for a written calculation - Children are to draw groups and share an amount into the circles/groups with dots or crosses.

(*Example of sharing groups*)

12 ÷ 3 = 4

Short Division Method

```
    0 2 4
16 )3 8 6 4
```

Notes: Children are to become confident in using the short division method. If the divisor does not go into the digit and the amount is carried over, or there is a remainder, it is to be set out like the example with the digit written smaller next to the column it is being taken to. Children are to be shown how to continue this into decimals.

If children struggle to work out a division as part of the whole calculation when larger numbers are used, encourage the children to use jottings alongside this method to jot down the first few numbers of the multiplication table of the divisor, e.g. 16, 32, 48, 64.

Long Division Method

```
   0 1 7 . 4
25 ) 4 3 5 . 0
   - 0
     4 3
   - 2 5
     1 8 5
   - 1 7 5
       1 0  0
     - 1 0  0
           0
```

Notes: Once children are confident in using the short division method, they are to be introduced to long division; this is now a requirement of the new curriculum and may feature on the new arithmetic test in KS2. Children must be taught when it is appropriate to use either short division or long division.

Please see the following website for a step by step break down on how to do long division - http://www.mathsisfun.com/long_division3.html

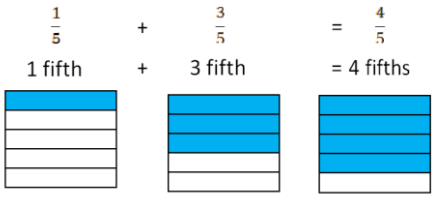
Please make sure that the children keep the numbers in the correct column when they bring down the next number. In a similar way to short division, children may want to make jottings at the side to support this method.

Working with Fractions, Decimals and Percentages – Appendix 2 continued

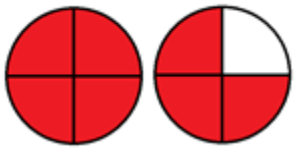
Adding Fractions

1) Use pictorial representations to add fractions with common denominators.

2) Demonstrate how the pictorial links with the abstract.

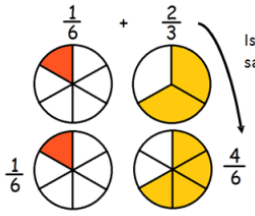


3) Add fractions with common denominators, where the answer is an improper fraction and then convert this to a mixed number.



$\frac{4}{4} + \frac{3}{4} = \frac{7}{4} = 1\frac{3}{4}$

4) Use the lowest common multiple to find the common denominator.

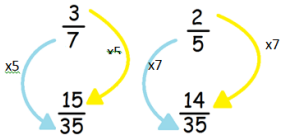


Then ... $\frac{1}{6} + \frac{4}{6} = \frac{5}{6}$

5) Find the common denominator by multiplying the two denominators together.

$\frac{3}{7} + \frac{2}{5}$

Equivalent fractions with a common denominator can be found in order to be able to add the fractions together.



This calculation becomes ... $\frac{14}{35} + \frac{15}{35} = \frac{29}{35}$

If the answer is an improper fraction then it should be simplified as a mixed number.

Adding Decimals

1) Add decimals in the context of money by using concrete resources such as coins.

£1.22 + 15p = £1.37

2) Add money using place value counters and the column method.

+ £3.45
£2.89
£6.34
1 1

The decimal point should be aligned in the same way as the other place value columns, and must remain in the same column in the answer row.

3) Add money using the column method.

+ £3.45
£2.89
£6.34
1 1

The decimal point should be aligned in the same way as the other place value columns, and must remain in the same column in the answer row.

4) Add decimals which use the same place value columns.

+ 3.455
7.422
10.877

+ 3.45
6.8

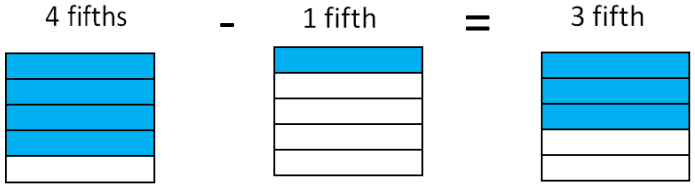
Don't ask questions where the numbers have a different amount of decimal places as this can lead to a common misconception as shown in the example.

5) Add decimals using the column method ensuring that the decimal point is always lined up.

+ 3.45
7.422
10.872

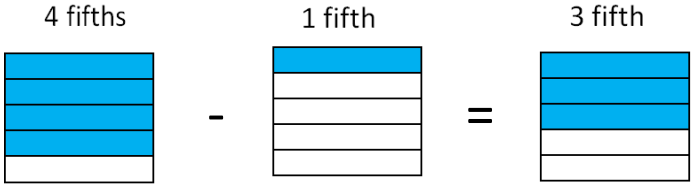
Subtracting Fractions

1) Use pictorial representations to subtract fractions with common denominators.

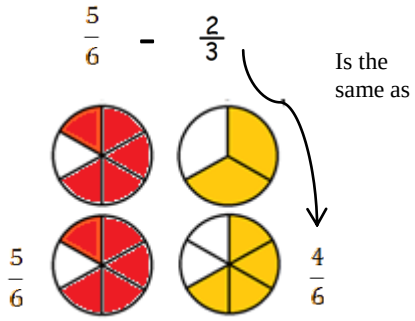


2) Demonstrate how the pictorial links with the abstract.

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



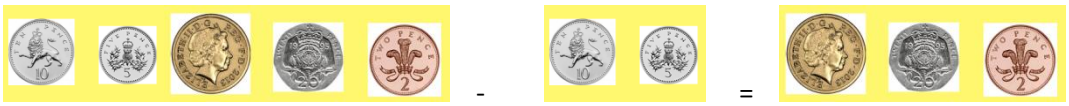
3) Use the lowest common multiple to find the common denominator.



$\frac{5}{6}$ - $\frac{4}{6}$ = $\frac{1}{6}$

Subtracting Decimals

1) Subtract decimals in the context of money by using concrete resources such as coins.



£1.37 - 15p = £1.22

2) Subtract money using place value counters and the column method.

```
  2 1
- £3.45
  £1.83
  £1.62
```

The decimal point should be aligned in the same way as the other place value columns, and must remain in the same column in the answer row.

3) Subtract money using the column method.

```
  4 1
- £5.26
  £1.83
  £3.43
```

The decimal point should be aligned in the same way as the other place value columns, and must remain in the same column in the answer row.

4) Subtract decimals which use the same place value columns.

```
- 9.455
  7.422
  2.033
```

```
- 3.405
    1.8
```

Don't ask questions where the numbers have a different amount of decimal places as this can lead to a common misconception, as shown in the example.

First ask the children where they do not need to borrow and then progress onto this.

5) Subtract decimals using the column method ensuring that the decimal point is always lined up. Teach the children to fill in gaps with a zero as a place holder.

```
- 3.45
  1.422
  _____
```

→

```
  4 1
- 3.450
  1.422
  2.028
```

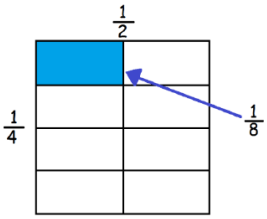
If the children do not put a zero, a common misconception arises where the children just put the second digit on the answer line. For example, in this question they would write 2 and then calculate the answer to be 2.032. This is why it is important for the children to add place value holders after the decimal point to use up the same amount of place value columns.

Multiplying Fractions

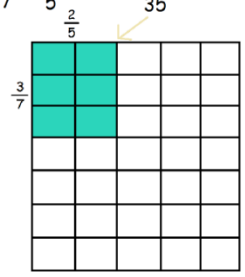
1) First multiply fractions by drawing a diagram. Start of by multiplying simple pairs of proper fractions. The denominators should be the amount of squares for the columns and rows, and the numerator should show how many to colour.

$\frac{1}{4} \times \frac{1}{2}$

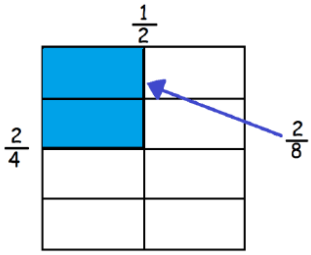
"a quarter of a half"



$\frac{3}{7} \times \frac{2}{5} = \frac{6}{35}$



2) Multiply simple pairs of proper fractions with the use of diagrams and then simplify the answer to its simplest form.



$$\frac{2}{8} = \frac{1}{4}$$

3) Multiply proper fractions by using a formal written method. First multiply the denominators and then the numerators. The answer should then be simplified.

$$\frac{2}{15} \times \frac{3}{8} = \frac{2 \times 3}{15 \times 8} = \frac{6}{120} = \frac{3}{60} = \frac{1}{20}$$

When children are multiplying a whole number by a fraction they are to turn the whole number into a fraction by putting it over 1, using the same method as above.

$$1\frac{1}{2} \times \frac{3}{4} = \frac{3}{2} \times \frac{3}{4} = \frac{3 \times 3}{2 \times 4} = \frac{9}{8} = 1\frac{1}{8}$$

4) Multiply mixed numbers by first converting them into improper fractions (making them top heavy). The same approach as point 3 can then be used.

Multiplying Decimals

1) Multiply decimals by 10, 100 or 1000 using place value columns.

44.6 x 10 = 446

TTh	Th	H	T	O	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
			4	4	.	6		
		4	4	6				

7.12 x 1000 = 7120

TTh	Th	H	T	O	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
				7	.	1	2	
	7	1	2	0				

2) Multiply decimals in the context of money using concrete resources and repeated addition.

£2.45 x 3 = £7. 35

£6 + £1.20 + 15p

3) Multiply decimals by whole numbers or other decimals.

5.63 x 4 = 22.52

```
  563
x   4
-----
 2252
  21
```

When teaching to multiply using the column method we teach the children to take the decimal point out and then replace it in the answer by the same number of place holders in the question.

2252 becomes 22.52 as there were two place holders in 5.63 so there need to be two place holders in the answer.

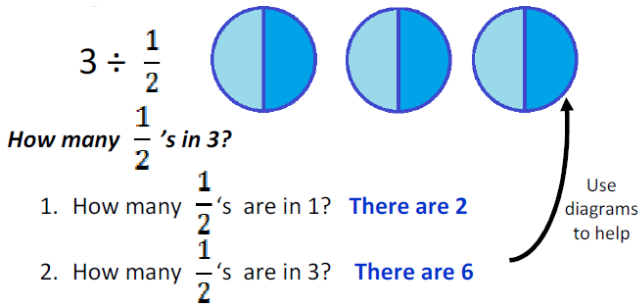
4.62 x 2.3 = 10.626

```
  462
x  23
 1386
  1
 9240
 1
-----
10626
  1
```

10626 becomes 10.626 as there were three place holders in the question (2 in 4.62 and 1 in 2.3) so there need to be three in the answer.

Dividing Fractions

1) First explore the concept with diagrams when dividing a whole number by a simple proper fraction. Represent the whole number by drawing that many shapes, then split each one by the fraction given.



2) Divide a whole number by a proper fraction where the numerator is 1. Explain that this is the same as multiplying by the denominator.

E.g.

$3 \div \frac{1}{3} =$ This is the same as 3 x 3 = 9

$3 \div \frac{1}{4} =$ This is the same as 4 x 3 = 12

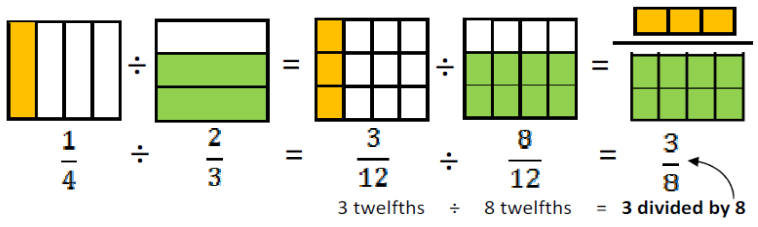
3) When dividing a whole number by a fraction where the numerator is not 1, turn the whole number into a fraction too.

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

The children then need to create common denominators. From this the common denominators cancel out so the numerators are then read as the fraction.

$\frac{3}{1} \div \frac{2}{3} = \frac{9}{3} \div \frac{2}{3} = \frac{9}{2} = 4\frac{1}{2}$

4) Divide two fractions by using common denominators. First find the common denominator; these then cancel out so that you are dividing the numerators.



When using mixed numbers, the children must first turn the fractions into improper fractions before using the same method. The answer should then be made back into a mixed number if appropriate.

Dividing Decimals

1) Divide decimals by 10, 100 or 1000 using place value columns.

34.7 ÷ 10 = 3.47

TTh	Th	H	T	O	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
			3	4	.	7		
				3	.	4	7	

16.1 ÷ 100 = 0.161

TTh	Th	H	T	O	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
			1	6	.	1		
				0	.	1	6	1

43.9 ÷ 1000 = 0.0439

TTh	Th	H	T	O	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	$\frac{1}{10000}$
			4	3	.	9			
				0	.	0	4	3	9

2) Divide a decimal number by a whole number.

9.1 ÷ 7 = 1.3

Long

$$
\begin{array}{r}
13 \\
7\,\overline{)\,91} \\
\underline{7} \\
21 \\
\underline{21} \\
0
\end{array}
$$

Short

$$
\begin{array}{r}
1.3 \\
7\,\overline{)\,9.^{2}1}
\end{array}
$$

When the children are dividing a decimal number by a whole number, they can solve it using either long division or short division.
If they choose to solve it using long division, they must remove the decimal point and place it in the correct place when the answer has been found.
If they choose to solve it using short division, they must keep the decimal point in place.

Fraction to Decimal

Children should divide the numerator by the denominator. They should be encouraged to use the short division method to help them work out the answer.

$\frac{1}{4}$ = 0.25

4)1.^{1}0^{2}0

Children can also make the denominator 100. Children must understand that whatever they do to the numerator, they need to do to the denominator. Children must understand that fractions transfer to the place value columns when the denominator is a multiple of 10, e.g. 10, 100, 1000 etc.

$\frac{1}{4}$ x25 $\frac{25}{100}$ = 0.25

Explain to the children that they must get the fraction to out of 100.

Fraction to Percentage

Children must be taught that per cent means out of 100. They can either make the denominator 100, or find the decimal equivalence first by dividing the numerator by the denominator before then multiplying by 100.

$\frac{1}{4}$ x25 $\frac{25}{100}$ = 25%

Explain to the children that they must get the fraction to out of 100.

$\frac{1}{4}$ = 0.25 = 25%

4)1.^{1}0^{2}0

Decimal to Percentage

Children must use their knowledge of place value and understanding that per cent is out of 100. They need to multiply the decimal by 100 to find the percentage.

O	.	$\frac{1}{10}$	$\frac{1}{100}$	
0	.	2	5	= 25%
0	.	4	0	= 40%

Decimal to Fraction

Children must use their knowledge of place value. Once the children have put the tenths and hundredths over 100 they then need to cancel the fraction down.

O	.	$\frac{1}{10}$	$\frac{1}{100}$
0	.	2	5
0	.	4	0

$= \frac{25}{100} = \frac{1}{4}$

$= \frac{40}{100} = \frac{4}{10}$

Percentage to Fraction

Children must be taught that per cent means out of 100. They should then always put the percentage over 100 and cancel the percentage down.

$25\% = \frac{25}{100} = \frac{1}{4}$

Percentage to Decimal

Children must understand that per cent means out of 100. To change a percentage into a decimal the children should be taught to divide the percentage by 100. They may also want to explore the percentage as a fraction to help them understand this further.

$25\% \div 100 = 0.25$ $25\% = \frac{25}{100} = 0.25$

$40\% \div 100 = 0.4$ $40\% = \frac{40}{100} = 0.40$ (Discuss whether the 0 is needed.)

Percentages of Amounts

1) Once children have a firm understanding of what a percentage is, they should be introduced to finding a percentage of an amount. First they are to explore the key percentages 50%, 25%, 20% and 10%. Children are to use their understanding of fractions to help them with this.

50% = $\frac{1}{2}$ So to find 50% I need to divide the amount by 2 to halve it.

25% = $\frac{1}{4}$ So to find 25% I need to divide the amount by 4 to find one quarter.

20% = $\frac{1}{5}$ So to find 20% I need to divide the amount by 5 to find one fifth.

10% = $\frac{1}{10}$ So to find 10% I need to divide the amount by 10 to find one tenth.

2) Children then need to apply this knowledge to find percentages which are multiples of 10. After finding 10%, multiply by the tens number to get to the desired percentage.

60% of 180 =

10% of 180 = 18

10% x 6 = 60% and 18 x 6 = 108

When the children are dividing by ten they should be encouraged to use their understanding of place value to shift the digits once to the right.
When multiplying by the tens number at the end, the children should be encouraged to use the column method to help them work out the answer.

3) For the next step there are two approaches that can be taken. The children should be introduced to both so they can select the one which they prefer.

3a) This approach is similar to step 1. Children are to use their understanding of fractions to build up to the percentage they are looking for. In addition to finding 50%, 25%, 20% and 10%, children should also be introduced to finding 5% and 1%. They will then need to multiply and add the different percentages together to get to the desired percentage.

5% = $\frac{1}{20}$ So to find 5% I need to divide the amount by 20 to find one twentieth. Or I can find 10% and divide this by 2.

1% = $\frac{1}{100}$ So to find 1% I need to divide the amount by 100 to find one hundredth.

37% of 260 =

10% = 26 (10% x 3 = 30% and 26 x 3 = 78)

5% = 13

1% = 2.6 (1% x 2 = 2% and 2.6 x 2 = 5.2)

30% + 5% + 2% = 37% and 78 + 13 + 5.2 = 96.2

37% of 260 = 96.2

3b) This approach includes less steps for the children. Always find 1% first by dividing by 100, then multiply by the percentage using the column method.

37% of 260 =

1% = 2.6

2.6 x 37 =

```
  26
X 37
 182
  4
 780
 1
 962
 1
```

To multiply a decimal number, this decimal point should be removed and then put back in depending on the amount of place holders after the decimal point in the question.
26 x 37 = 962
2.6 x 37 = 96.2

37% of 260 = 96.2