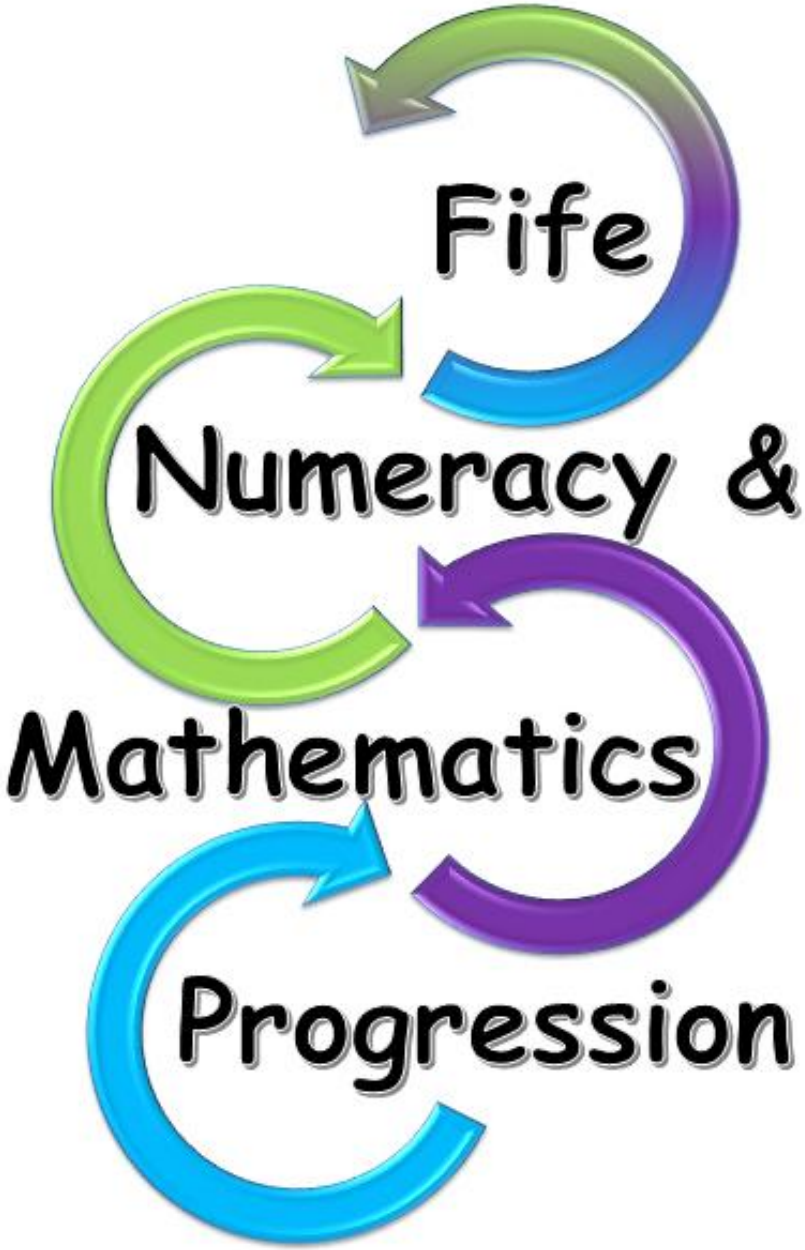

Number, Money & Measure

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Enquiries about the Council's professional learning programme and the use of this work should be directed to: Fife Council Pedagogy Team at Pedagogy.team@fife.gov.uk

Contents Page

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ACKNOWLEDGEMENT

This programme is extensively based on proven approaches and strategies defined within the First Steps in Mathematics resources, Maths Recovery and New Zealand programmes.

Unlike many resources that present mathematical concepts that have been logically ordered and prioritized by mathematicians or educators, First Steps in Mathematics follows a sequence derived from the mathematical development of real children. It is based on five years of research by a team of teachers from the Western Australia Department of Education and Training, and tertiary consultants led by Professor Sue Willis at Murdoch University. The First Steps in Mathematics project team conducted an extensive review of international research literature, which revealed gaps in the field of knowledge about students' learning in mathematics. Using tasks designed to replicate those in the research literature, team members interviewed hundreds of elementary school children in diverse locations. Analysis of the data obtained from these interviews identified characteristic phases in the development of students' thinking about mathematical concepts.

Maths Recovery, founded on years of research by Dr Robert Wright, Professor in Maths Education within Southern Cross University in Australia and colleagues, is now internationally renowned in responding to problems of children's failure in early numeracy and primary mathematics and has been used extensively by many nations, including New Zealand, to develop their own standards and teaching approaches in mathematics.

We are also very grateful to the work done by both Angus and Highland Council. Their input has been key in the development of this progression

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GUIDANCE

The Fife Numeracy and Mathematics Progression (Number, Money and Measure) sets out a clear set of learning experiences and outcomes from the following Curriculum for Excellence Numeracy and Mathematics strands:

Estimation and Rounding
Number and Number Processes
Multiples, Factors and Primes
Powers and Roots
Fractions, Decimals and Percentages
Money
Time
Measurement
Mathematics - its impact on the world, past, present and future
Patterns and Relationships
Expressions and Equations

The purpose of this document is to provide a continuum of learning both within a level and through the Early, First, Second and Third Levels. The developmental stages of learning in numeracy are clearly documented and this will support teachers when identifying starting points for learners. The progression is intended to assist teachers as they plan their numeracy and mathematics curriculum. Links are made throughout the document to the Benchmarks. However, it should be noted that, as the Benchmarks are the minimum requirement for a level, the language of "at least" has been used in order that ceilings are not placed on learners' experiences.

The 'Points to Consider' section provides detailed descriptions of key mathematical ideas or concepts and provides clear and concise guidance for teachers.

Each strand is shown as a pyramid to show how learning and teaching progress within this. The skills at the base of the pyramids are required to be understood for further learning to be built upon and are not aligned to any particular year group (at First Level, statements in blue do *not* equate to Primary 2, for example). Pupils will progress through the pyramids as and when they are ready and able to do so.

The Fife Numeracy and Mathematics Progression focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, logical reasoning, analytical thought and problem solving skills which can be applied in unfamiliar situations.

Early Level Experiences and Outcomes

** The numeracy learner statements that are the responsibility of all are shown in bold italics.*

I am developing a sense of size and amount by observing, exploring, using and communicating with others about things in the world around me.

MNU 0-01a Pg 10

I have explored numbers, understanding that they represent quantities, and I can use them to count, create sequences and describe order.

MNU 0-02a Pg's 11-13

I use practical materials and can 'count on and back' to help me to understand addition and subtraction, recording my ideas and solutions in different ways.

MNU 0-03a Pg 14

I can share out a group of items by making smaller groups and can split a whole object into smaller parts.

MNU 0-07a Pg 15

I am developing my awareness of how money is used and can recognise and use a range of coins.

MNU 0-09a Pg 16

I am aware of how routines and events in my world link with times and seasons, and have explored ways to record and display these using clocks, calendars and other methods.

MNU 0-10a Pg 17

I have experimented with everyday items as units of measure to investigate and compare sizes and amounts in my environment, sharing my findings with others.

MNU 0-11a Pg 18

I have spotted and explored patterns in my own and the wider environment and can copy and continue these and create my own patterns.

MTH 0-13a Pg 19

Points to Consider

- The key focus in **pre-counting** is an understanding of the concept **more, less** and **the same** and an appreciation of how these are related. Children at the early stages of Early level develop these concepts by comparison and no counting is involved.

- Children often have some concept of 'more'; this needs to be extended and refined. 'Less' is a more difficult concept and understanding can be developed by pairing the terms less and more to help develop an understanding of the relationship between the two.

- The **number ranges** e.g. 1 – 5 are guides only and should be adapted to suit the needs/ability levels of the pupils.

- **Representing numbers** in a variety of ways is essential for developing number sense e.g.

- **Counting** is an important component of number and the early learning of operations. There is a distinction between counting by rote (not necessarily having a **one-to-one correspondence**) and counting with understanding.

- Teaching the **Counting Principles** is essential for success.

- **Order-irrelevance principle**: When counting the number of objects in a set, the order they are counted in is irrelevant, as long as each object is counted and pupils know and understand that the last number is 'the count'. Sometimes an item is counted more than once by pupils or two items are counted for one number, e.g.... se-ven so lots of practice is required.

Can start at any animal – the **count stays the same**.

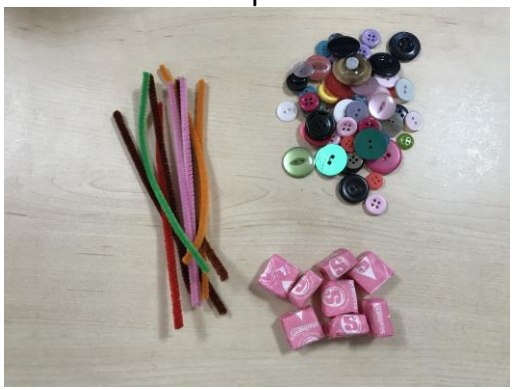
- Once children become very familiar with counting collections they realise that numbers can be used to count **anything**.

- The **teen numbers** are often the most difficult for pupils. The oral language pattern of teen numbers is the reverse of the usual pattern of 'tens first and **then** ones', e.g....13 is 'thir' 'teen' and 31 is 'thirty' 'one'. There is often difficulty distinguishing between 12 and 21. Confusion can also arise when saying ty and teen endings.

- Children can and should become skilful at associating number words with numerals in the **teens** long before they understand that the left hand digit ('1') stands for the number 'ten'.

- **Subitising** involves immediately recognising the number of objects in a small collection without having to count the objects e.g. the dots on a dice. The pattern should be flashed to avoid the temptation to count. Six is generally the most anyone can individually recognise in one pattern.

- **Collections** should be presented in a variety of ways.



- **Addition and Subtraction** needs to move from counting and combining concrete materials to using abstract methods e.g. hiding materials behind screens and in boxes to develop the pupils' ability to visualise and internalise before introducing written number sentences.

- Numeral tracks, numeral rolls and hundred squares are all excellent tools to support children's understanding of **number sequences, forwards and backwards**.

- Addition and subtraction problems should be related to **real-life experiences** and stories.

- Wherever possible, addition and subtraction should be taught simultaneously to reinforce the concept of the **inverse operation**.

- **Subtraction** typically covers three different situations:
  - '**Taking away**' from a group (need to be confident at this before being introduced to the next two).
  - '**Comparing**' two groups – find the difference to a numeric value not any other attributes - see example of towers below.
  - Finding '**how many more or less**' are in a group.

- Children may have difficulty linking their ideas about addition and subtraction to situations involving the comparison of collections e.g. how much bigger is the tallest tower?

- All activities should involve children **manipulating concrete materials** to begin with and then gradually removing these by **flashing** (a quick look) the materials/tool and then **screening** (hiding). The fact that the materials/tools are still there can support children's imagery, through **visualisation** and eventually help embed the basic facts or strategies.

- **Division** - there are two forms of division: **sharing** and **grouping**.

- When sharing a collection of objects fairly, children should understand that their share is the same as everyone else's share i.e. that all **fair shares are equal**.

- Children should also have an understanding that within real life situations some shares may have some items 'left over' and that they then need to think about how they are going to deal with this.

- After children have shared objects equally, the process can be INVERSED to begin to develop the **link between division and multiplication**. This can be done by pupils first sharing a group of objects and then putting back together all of the shares to form one collection.

- Children may be able to represent division-type situations by sharing out or **forming equal groups**, but become confused about what to count to solve the problem, often choosing to count all the items. Rich discussion and experiences, putting 'sharing problems' into context (listening to and making up their own stories), will support their development.

- Pupils may deal out an equal number of items or portions in order to share, but do not use up the whole quantity or attend to the equality of the size of the portions. This is perfectly acceptable and should be supported by discussion with the child if one share having more (or not using the whole up) is fair.

- **Multiplication** - pupils will begin to use forward and backward number word sequences using the multiples of 2 and 5. They begin counting these using a rhythmic count 1, **2**, 3, **4,** 5, **6**, 7, **8**… and progress to skip counting - **2, 4, 6, 8.**

- At this level children learn that building two collections by matching one to one leads to collections of equal size, and can 'fix' one collection to make it match another in size e.g. show a row of three horses and ask the child if they can make a second row of three horses to match.

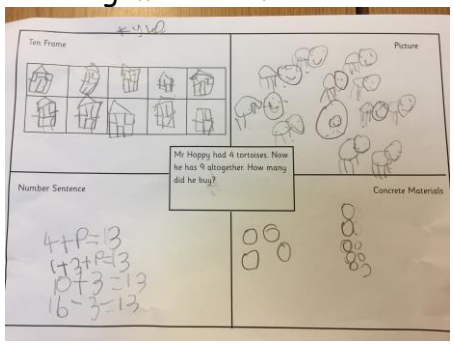
Children may '**skip count**' but do not realise it gives the same answer as counting by ones and, therefore do not trust it as a strategy to find out 'how many?' e.g. for above they may count in 2s – 2, 4, 6 but then not rely on this answer and so then count the cars individually.

- **Modelling** (using concrete materials to represent the numbers in the sum), drawing and writing mathematical problems should be encouraged at this level e.g. when told a story about black horses and white horses, they represent the horses with black and white counters or cubes.

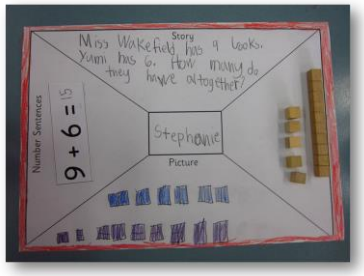
- They may 'act out' or draw a picture to **represent a small number** of things e.g. they pretend to be the horses and act out the story.

- Children should also be asked to represent a story with objects or on a **think board** e.g. substitute counters for cows to solve the problem 'Three cows were put in a field with four other cows. How many cows were there in the field?'

- <u>EXAMPLES OF THINK BOARDS</u> Specific key areas are designated to 'show strategies used', 'show with a picture', 'show using a number sentence', and 'show using materials'.



Mr Hoppy had 4 tortoises. Now he has 9 altogether. How many did he buy?



Miss Wakefield has 9 books. Yami has 6. How many do they have altogether?

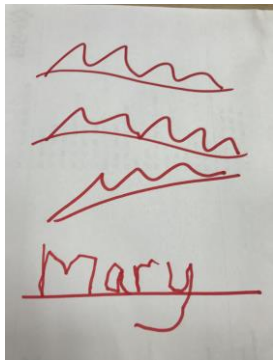
- When exploring measurement, although the term "weighing" is used it is important to be clear that it is the mass of an object that is being calculated not the weight. Weight is the force exerted by the gravity on objects, mass is the amount of material contained and is measured in kg, gm etc.

Suggested Written Recording

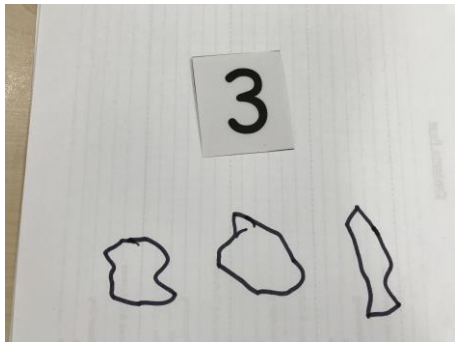
At Early Level children's written recording can be nurtured by the provision of a mathematically rich environment which helps them to explore the world of mathematics. A wide range of resources (pens, clipboards, post-its, notebooks) should be readily available to encourage children to record their own mathematical thinking. The following points are important when considering what, when and where they should be recording.

Children need to be free to choose how they will represent and communicate their own mathematical understanding. Emergent writing may also be visible at this point.

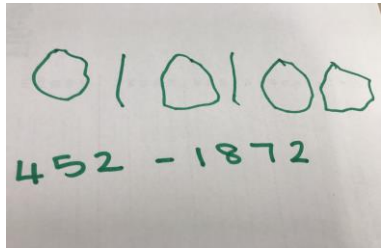
Between the ages of 3 and 4 years of age children will begin to attribute mathematical meanings to the marks they make on paper.



'Emergent' and 'individual' mathematical graphics and open ended discussions should be encouraged to help children make sense of the sometimes confusing symbols and abstract nature of mathematics.

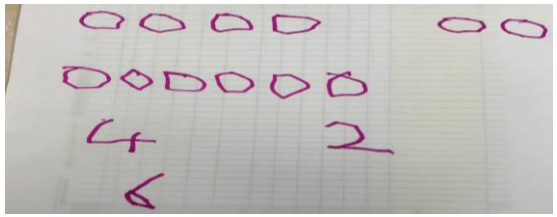


Recording can be temporary, for example on a white/chalk board, scrap paper and post-it notes or stored more permanently in a designated maths jotter/folder. Photos may be taken of this as and when appropriate.



'exploring telephone numbers'

Children are encouraged to give their own meanings to their graphics (drawings, writing, symbols, and marks).

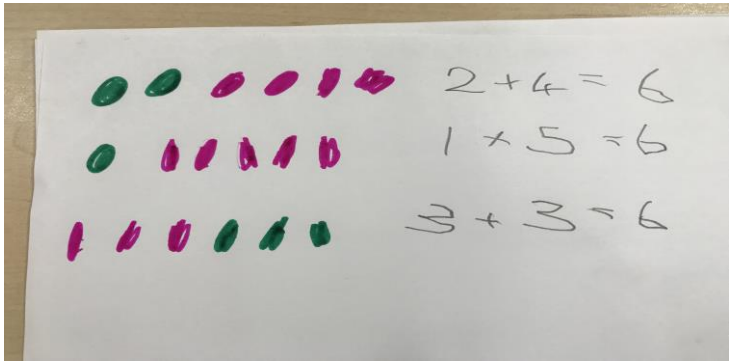


At Early Level children's written recording can be nurtured by the provision of a mathematically rich environment which helps them to explore the world of mathematics. A wide range of resources (pens, clipboards, post-its, notebooks) should be readily available to encourage children to record their own mathematical thinking. The following points are important when considering what, when and where they should be recording.

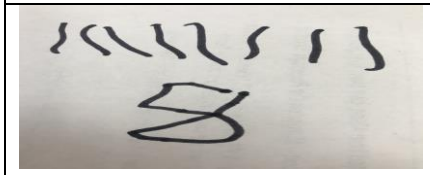
Once children represent quantities that are counted, they begin to explore calculations.

Supportive and encouraging adults can support children's own ways of exploring their mathematical thinking so that they make strong connections with their own understanding.

Children do not need to record their mathematics if they can work something out mentally, neither do they need to record something they have already worked out in a practical context with resources.

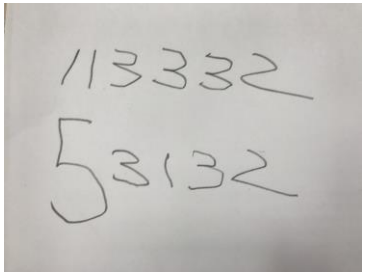


Young children are very good at making sense of their solutions through their own marks and symbols. Children need to make sense of maths in their own ways rather than being required to 'colour-in' or complete worksheets designed by teachers.

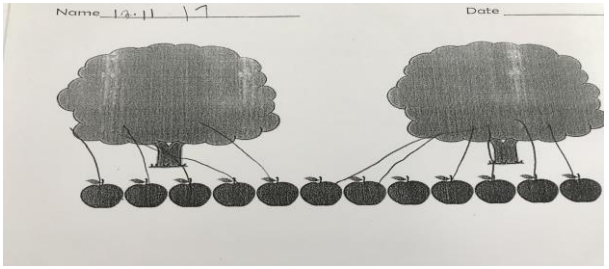


"8 more sleeps until mummy comes home." This pupil has recorded 8 tally marks to represent this and recognises the numeral 8. Children will integrate standard symbols and written methods as they develop their understanding.

Numerals will be written as labels for collections, both to represent quantities that have not been counted as well as those that have been counted.



Un-ruled jotters have a distinctive advantage over lined/squared books in that pupils are not restricted by lines and have the space to choose whether to use pictures, numbers, words or a combination of these to record their thinking.



Can 12 be shared equally between 2?

ESTIMATION AIM: Identify the quantity in a group and use that fact to reasonably estimate the quantity of objects in other groups. Use relevant vocabulary to demonstrate estimation skills.

MNU 0-01a

Demonstrates skills of estimation in a context using relevant vocabulary including less than, longer than, more than and the same

Estimate the number of objects in a group of up to 20 objects and count to check.

Recognises the number of objects in a group without counting (Subitising).

Orally find a number more or less than.

Use vocabulary such as 'bigger', 'smaller', 'longer' and 'the same' to compare groups of items.

Use 'more', 'less' and 'the same' to compare groups of items.

Model, represent or draw to show 'big', 'bigger', 'biggest', 'small', 'smaller', 'smallest' etc. in relation to size.

Model, represent or draw to show 'big', 'bigger', 'biggest', 'small', 'smaller', 'smallest' etc. in relation to amount.

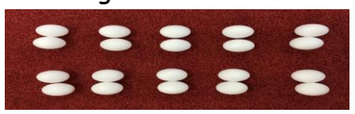
Use vocabulary such as 'bigger', 'smaller' and 'the same' to compare size.

NUMBER WORD SEQUENCES AIM: Pick up and continue the NWS forwards and backwards from any given point within 30. Identify numbers before and after within at least 20. Read and sequence numbers to at least 20.

MNU 0-02a

Find a number between two 2 digit numbers within 20. *e.g. Give me a number between 11 and 15? Can you think of another?*

Recite in multiples of two (in the range of 0-20), five and ten (in the range of 0 – 30) forwards and backwards, altering the start number.



Identify missing numbers, in a sequence up to 20. *e.g. 16, *, *, 19, 20 (on a numeral track).*

Identify one missing number in a sequence up to 10.
*e.g. 5, 6, *, or 8, 9, *, (on a numeral track)*

Read and use ordinal names in real contexts to at least ten.

Identifies & recognises number names and numerals from 0-20 in a variety of contexts.

Identify and represent all numbers to at least 10 (including 0), using numerals, words, symbols and objects.

Confidently manipulate and order numbers to 20 on a number line.

Identify and represent some numbers to at least 10 (including 0), using numerals, words, symbols and objects.

Identify the number before, after and inbetween a given number within 10.

Sequence numerals (forwards and backwards to at least 10 altering the start number).

Distinguish the numerals to 10 and beyond from other written symbols.

Recite number word sequences forwards, in order, in the range of 0-30, from any given number.

Use some ordinal names (first, second etc.)

Recite number word sequences backwards, in order, in the range of at least 0-20, from any given number.

Explore the order of the number sequence 1-5, and beyond.

e.g.

Children build patterns with concrete materials so they can see the numbers are increasing by one. They may comment that pattern is getting bigger/ taller.

Orally recall number names from 0-10.

Join in reciting number word sequences backwards through songs and free play opportunities; listen to staff modelling backward number words sequences.

Identify the missing number from a sequence of 1 – 5 (practical materials used where possible).
e.g. If one piece of the train puzzle was missing, would they know which number was missing?

Read the numerals 0-20.

Read the numerals 0-10.

Distinguish the numerals 0-10 from other written symbols.

Distinguish number names from other words. *e.g. recognise their age on a birthday card, or the bus number.*

Distinguish spoken numbers from other spoken words.

Recite some number word sequences but not always in order.

Join in with stories, rhymes and songs with predictable rhythms.

Begin to understand ordinal names, first and last. *e.g. describe who is first/last to go on the slide.*

Understand the concept of before and after e.g. name the person who is behind them in a line.

Identify and represent some numbers by making marks and drawings.

COUNTING AIM: In real life and everyday situations, demonstrate the principles of counting, subitise and use number words and numerals to represent quantities.

MNU 0-02a

COUNTING PRINCIPLE ~ Cardinality: Understand that the last count of a group represents how many are in the group.

Skip count in 2s, 5s and 10s to begin to see how many is in a larger group.

COUNTING PRINCIPLE ~ One-to-One Correspondence: Understand that each object is only counted once.

Understand that zero means there is none of a particular quantity and we write this as '0'.

COUNTING PRINCIPLE ~ Order Irrelevance: Understand that the counting of objects can begin with any object in a set and the total will remain the same.

COUNTING PRINCIPLE ~ Conservation: Understand that the count for a set of objects stays the same no matter whether they are spread out or close together.

COUNTING PRINCIPLE ~ Abstraction: Understand that the quantity of five large things is the same as five small things.

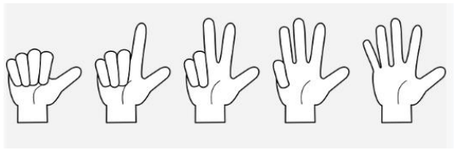
Can count items in a collection and know that if items are added to a collection or taken away, there will be a change in the size of the set.

Connect and order number names, groups of objects and numerals up to 10.

Connect and order number names, groups of objects and numerals up to 20.

Understand that by building two collections, matching one to one, leads to equal sized collections.

Use finger patterns to keep track of temporal sequences (like beats of a drum or jumps).
e.g. Use your fingers to count how many beats are made on this drum.



Connect and order number names, groups of objects and numerals up to 5.

Subitise small collections e.g. 0-6, including irregular patterns using concrete materials such as five frames, ten frames, dice and arrays.

Count out a requested number of items. *e.g. please put 4 red buttons on the plate.*

COUNTING PRINCIPLE ~ Stable Order: Understand that the counting sequence stays consistent.
e.g. 1,2,3 not 1,3,2

Be able to see at a glance how many there are in a small collection (0-3) and attach number names yet may not be able to say the number names in order. This is called **SUBITISING**.

Count and copy a sequence of individual sounds, up to 3 claps (temporal sequence).

Match objects in a collection to see which has the most or the fewest.

Use fingers and beats to represent numbers in stories and songs.

Use a wide variety of collections to make small sets up to five N.B. what is important here is that the pupil collects the correct amount in each set rather than necessarily the same type of article. *e.g. three apples, four bananas and two grapes.*

Show an awareness of counting a collection using some number names, but not always reliably. (Staff model touching and moving an object to count it.)

STRUCTURE OF NUMBER AIM: Understand that numbers to 10 and beyond can be constructed in multiple ways, for example by combining and partitioning.

MNU 0-02a

Represent all possible partitions of numbers to 10.
e.g. 4 = 4+0, 3+1, 2+2, 1+3 and 4+0.

Double numbers to a total of 10 mentally.
e.g. 4 + 4 = 8

Understand that 3 + 2 will result in the same amount as 2 + 3.

Represent numbers to 10 and beyond in a variety of ways such as modelling and writing.

Understand the link between addition and subtraction with numbers to 10.
e.g. 6+3 = 9, 9 - 6 = 3.

Group items understanding that the appearance of the group has no effect on the overall total.

Use the language of maths to compare quantities in real life situations, for example, more, less, first, second.

Separate and take part of a group of objects away within 10, to model the part-part-whole relationship.

Recognise doubles up to value of 10 - *double 1, 2, 3, 4, and 5.*

Explore odd and even numbers through pairing.

Compare two collections one to one and use this to decide which is bigger and by how much bigger.

Use finger patterns to show patterns of 0-10, doubles.

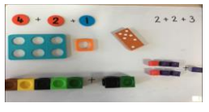
Make finger patterns up to 10 in different ways without looking at their fingers.

e.g. make different combinations of ten.

Use 5 as an anchor in forming numbers from 6 – 10 e.g. 'eight is three more than five', using ten frames and bead strings.

Understand that collections can be made up of smaller collections. *e.g. 7 can be made up of*

2 + 2 + 3 or 5 +2 and 4 + 2 +1= 7



Make finger patterns up to 5 and beyond in different ways by looking at their fingers.

e.g. Put 1 finger up on one hand and 4 on the other,2 fingers up on one hand and 3 on the other, 0 fingers up on one hand and 5 on the other.

Represent numbers up to 5 in a variety of ways such as modelling and writing.

Understand the link between addition and subtraction with numbers to 5.
e.g. 2+3 = 5, 5 - 2 = 3.

Recognise doubles up to value of 6 i.e. *1+1=2, 2+2=4 and 3+3 = 6* and begin to use the word 'doubles' or 'halves' and 'doubling' or 'halving' in everyday situations.

Make finger patterns up to 5 by looking at their fingers on one hand.

Understand the relative magnitude of whole numbers.

Recognise doubles in concrete materials but not necessarily work out their value e.g. notice ladybird has two dots on both wings.

Connect the differences they see between collections. *e.g. they see one, two and three things and connect this with the spoken number string one, two, three.*

CALCULATING AIM: Use a range of strategies to add some, take some away, or combine two amounts mentally to 10 in a variety of contexts.

MNU 0-03a

Solve missing number equations.
e.g. 3+?=10, ?+2=10.

Recall doubles and halves within 20. *e.g.1+1, 2+2, 3+3, 4+4, 5+5.*

Use doubles and halves to find other facts (relational understanding) within 20.

Use the relationship between addition and subtraction to solve problems. *e.g. Solve 'There are 7 children in a group, 2 leave, how many are still in class? By understanding that 2 + 5 = 7.*

Recall addition and subtraction facts to ten
e.g. 2+1, 3+1, 3-2, 4-1…etc.

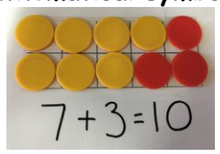
Demonstrate an understanding of all possible partitions of numbers to at least 10.

Solve problems by imagining or role playing the situation.

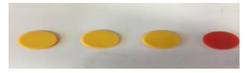
Can count items from two collections with one of the collections screened (hidden) – see 'Points to Consider'.

4 + 3 counters screened (how many altogether?)

Record, model and enact simple addition and subtraction of whole numbers to 10 and beyond using mathematical symbols.



Demonstrate the relationship between addition and subtraction to solve problems within 10
e.g. 3 + 1 is 4 so 4 – 1 is 3.



Can count items when both collections are screened (hidden) but will count all the items starting from one.

Record addition and subtraction informally using role play, concrete materials, subitising, singing, drawings, numerals and words.

<u>Any algorithms should be horizontal rather than vertical.</u>

Use concrete materials to explore counting on and counting back strategies.

Count on and back in ones to demonstrate understanding of addition and subtraction.

Can combine two or more groups of objects to model and solve addition and use appropriate vocabulary; makes, join, altogether.
(They may start to count by counting both groups separately and then start at one again when combining the count).
e.g. 3+2 = 1, 2, 3 1, 2 then 1,2,3,4,5, They will then progress to counting the first group and carry on the count to the last counter in other group, (for example…. 3+2= 1,2,3, 4,5.)

Recognise that by adding two collections together in everyday situations, the collection will increase.

Partition single digit numbers into 2 or more parts and recognise that this does not affect the total.

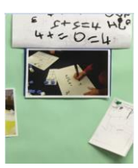
Recognise that by subtracting items from a collection in everyday situations, the collection will decrease.

Record, model and enact simple addition and subtraction of whole numbers up to 5.

Solve a variety of simple stories (change unknown, start unknown, result unknown) by subitising, acting out, using concrete materials or by drawing a picture. *e.g. 'Kate has two cows and Jordan has three cows. How many cows are there altogether?' can be acted out.*

Solve simple stories by subitising, acting out, using concrete materials or by drawing a picture. *e.g. children and objects represent characters and events in stories such as The Three Little Pigs, Five Little Ducks etc.*

Make marks, subitise, draw pictures and sing songs to record ideas about number problems and stories.



Begin to understand the concept of 'one more' and 'one less' by staff modelling the language.

e.g. one child goes to the toilet or goes home early. There is now one less child on the carpet, or there's space for 'one more' at the snack table.

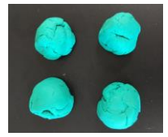
Informally record addition and subtraction using role play, singing songs, drawings, marks and possibly numerals and letters to represent answers.

FRACTIONS AIM: In real life situations, demonstrate an understanding that simple fractions (halves and quarters) of an amount or item will result in equal parts and that the entire whole must be used. Share groups of items equally.

MNU 0-07a

When finding a simple fraction, recognise that the whole may be made up of a single item or a group of items.

Demonstrate an understanding of simple fractions (halves and quarters) using a variety of models.



Use simple fraction names in real life situations.

Describe why parts are equal or unequal e.g. explain why this is a half.

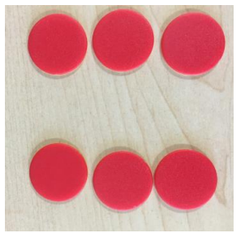
Share by dealing out an equal number to each recipient handing out 2 or 3 items or portions at a time.

Draw, build or fold to show a whole with equal parts.

Recognise that a whole object can be divided into equal or unequal parts and relate that to fractions.

Understand the concept that fair sharing means all shares are equal.

Introduce the notion of a fair share.



Recognise smaller parts made from a whole object.

Respond to grouping and sharing questions by drawing, acting, guessing and checking by using concrete materials.

Can the two bears receive equal shares of the biscuits?

Distribute items or portions in order to 'share', but may not be concerned with fair shares.

Share by dealing out an equal number of items or portions to each recipient, cycling around the group one at a time.

MNU 0-09a

MONEY AIM: Recognise that there are different ways to make exact amounts of money.

Be able to use a range of addition and subtraction strategies with money up to 20p.

Sort coins and notes according to value.

Choose the correct change (up to 20p) to give in role play and a range of activities.

Order coins according to their values.

Choose coins up to 20p to play in role play and a range of situations.

Skip count coins in 1p, 2p, 5p and 10p amounts.

Represent money values in multiple ways with coins to 20p

e.g. 10p+5p+5p or 10p+10p.

Be able to calculate the cost of items by adding them together using the most appropriate strategies.

Identify all coins up to at least £2.

Be able to confidently use estimation and money vocabulary. *e.g. more, less, about the same.*

Understand the notion of saving. *e.g. piggy bank.*

Use appropriate language when talking about money. *e.g. pounds, pence, how much, cost, change etc.*

Have experience of giving and receiving change.

Recognise that there are different ways of making exact amounts of money. *e.g. 5p, 2p+2p+1p, 2p+1p+1p+1p*

Know that money is used in real life to buy items and services.

Has knowledge of the existence of money.

Has an awareness of buying and selling.

Explore making exact combinations of simple amounts using mental strategies.

Sort coins and notes according to appearance.

<u>Associated Knowledge</u>

- Knowledge and understanding of whole numbers and their relative values.
- Know and understand whole number addition and subtraction.

TIME AIM: Use appropriate language when discussing time. Recognise, talk about and use simple visual calendars, timers and clocks to record and find information.

MNU 0-10a

Read and write o'clock times.

Use language of time to describe events.
e.g It's my Dad's birthday next month.
I am going to the cinema on Saturday.

Match events to months or a season.

Understand that the hands on an analogue clock have different names and give different information e.g. hour hand and minute hand

Recognise that there are a variety of devices to tell the time.

Use sequence vocabulary such as today, tomorrow and before and after.

Use vocabulary such as light, dark, night, day, moon, sun.

Identify 'half past' times on analogue and digital clocks.

Identify o'clock times on analogue and digital clocks.

Name the days of the week and understand the cyclical pattern.

Use comparative vocabulary such as longer, shorter summer, winter.

Understand that daily routines can be sequenced. *e.g. I get up in the morning, then I get dressed, then I have breakfast.*

Talk about daily routines.
e.g. I walk to nursery with Gran.

Respond to start/stop instructions.

Manipulate clocks to show 'half past' displays.

Manipulate clocks to show o'clock displays.

Name the seasons and understand the cyclical pattern.

Refer to recurring events.
e.g. I go swimming every Saturday.

Sequence events from own life or stories.

Describe events in real life situations.

Interpret a simple visual calendar such as a class timetable.

Estimate times *e.g. I think it is almost home time, I think it is almost the weekend.*

Name the word sequence of the months of the year and understand the cyclical pattern.

Order everyday events by duration.
e.g. the journey to Granny's is longer than the journey to nursery.

Compare duration of events using everyday language by asking 'Which takes longer?'

Use clapping to compare duration of two 'quick' events. *'Do we clap for longer watching Jo walk to the door or Mark go to the cloakroom?'*

Talk about important events in own lives.

e.g. birthdays, tooth fairy at night.

MEASUREMENT AIM: In real life contexts use non-standard units and appropriate language to compare the length, height, mass and capacity of objects and justify thinking. Describe common objects using the appropriate measurement language.

MNU 0-11a

Recognise that the order of objects may change when compared by different attributes.

Length width

Explain why standard units of measure are necessary.

Compare objects according to non-standard units. *e.g. number of hands, cubes.*

Recognise that when covering an object, no gaps should be left. *e.g. wrapping a present.*

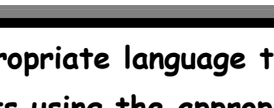
Recognise that when measuring, no gaps or overlaps should be left/made.

Compare the capacity of objects using non-standard units. *e.g. cups.*

Explain if something is long enough etc. through estimation skills. *e.g. the pencil is too long to fit into the box.*

Share relevant experiences where measurements of length, height, mass and capacity are used. *e.g. baking*

Estimate and measure objects by length, height etc. using non-standard units. *e.g. hands, cubes.*



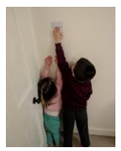
Select an appropriate tool to measure an object/amount. *e.g. a cup to investigate liquid, string to investigate length.*

Measure the mass & capacity of objects using non-standard units. *e.g. cups.*

Develop language to describe objects appropriately.

Develop appropriate language for approximating size of objects. *e.g. about, almost, nearly, a bit under.*

Explore through 'best guessing' an estimation of the size of an object. *e.g. Is it the same size as a pencil? Am I tall enough to reach the switch?*



Order objects according to size. *e.g. heaviest to lightest.*

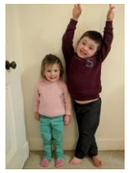
Find items that are longer, heavier etc. than a given object.

Sort objects according to size. *e.g. heavy/light, long/short.*

Explore that an object can have a capacity. *e.g. a jug can be filled with water.*

Explore the use of tools used to measure. *e.g. scales, measuring tape.*

Describe objects using language of size. *e.g. tall/short, heavy/light.*



Develop appropriate language to compare objects in terms of size. *e.g. longer, big enough.*

Develop language to compare the capacity of objects. *e.g. fuller than, less than.*

Develop language to describe the capacity of objects. *e.g. half full, nearly empty.*

Develop appropriate language to describe aspects of area. *e.g. edge, top, cover.*

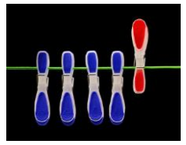
Using the wider environment, explore where the need for measurement arises. *e.g. shoe shop*

Explore situations where the need for measurement arises. *e.g. baking.*

PATTERNS AND RELATIONSHIPS AIM: Copy, extend and generate patterns with objects, words, numbers, materials, drawings, symbols and/or actions.

MTH 0-13a

Sort and classify familiar objects and explain the basis for these classifications.



Find missing numbers on a number line ranging from 0 to at least 20.

Explore, recognise and continue simple number patterns and describe them using appropriate vocabulary.

Compare and order groups of numbers by deciding the criteria for themselves and be able to articulate their criteria for sorting, *e.g. bigger than 5, less than 10 (within 20).*

Recognise, discuss, duplicate and create simple numeric sequences.

e.g. 1,2,1,2,1,2

Recognise, discuss, duplicate and create simple colour sequences.

e.g.

Recognise simple patterns in concrete objects. *e.g. girl/boy in a line.*

Children sit/stand in a circle and can continue the pattern.

Confidently predict repetitive features in a poem, story or song.

Begin to recognise simple AB colour patterns.

Recognise and discuss simple size sequences.

big, little, big, little

Find and describe items that are the same and different within a collection. *e.g. 'horses' and 'not horses'.*

Sort objects using familiar or given criteria. *e.g. colour, size, family, etc.*

Find groups of the same theme within a collection, *e.g. pigs in farmyard toys, or from box of plastic fruit find 5 bananas, 5 apples, 5 lemons.*

Recognise and discuss pattern in nature and the environment.

e.g. pavements.

Recognise a pattern in a song or story and use this to learn the lyrics or predict the repetitive features.

e.g. 'Going on a Bear Hunt'.

Explore a variety of concrete materials. Make simple patterns (which may be random) and talk about them.

e.g. a flowery pattern.

Use appropriate language to describe patterns in their environment. *e.g. I've got a stripey pattern on my jumper. Who else is wearing anything stripey?*

Notice groupings that occur in everyday contexts or notice groupings in stories e.g. Noah's Ark. Adult models the language of counting in 2s, 5s and 10s.

Find pairs of items and match them. *e.g. sort a bag of baby shoes and put them together. Adult models counting in 2s.*

Early Level Overview ** The numeracy learner statements that are the responsibility of all are shown in italics.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Estimating and Rounding Pg 10	*I am developing a sense of size and amount by observing, exploring, using and communicating with others about things in the world around me.* *MNU 0-01a*	• *Recognises the number of objects in a group, without counting (subitising) and uses this information to estimate the number of objects in other groups.* • *Checks estimates by counting.* • *Demonstrates skills of estimation in the contexts of number and measure using relevant vocabulary, including less than, longer than, more than and the same.*
Number Word Sequences Pg 11	*I have explored numbers, understanding that they represent quantities, and I can use them to count, create sequences and describe order.* *MNU 0-02a*	• *Recalls the number sequence forwards within the range 0 - 30, from any given number.* • *Recalls the number sequence backwards from 20.* • *Identifies and recognises numbers from 0 to 20.* • *Orders all numbers forwards and backwards within the range 0 - 20.* • *Identifies the number before, the number after and missing numbers in a sequence within 20.* • *Uses ordinal numbers in real life contexts, for example, 'I am third in the line'.* • *Uses the language of before, after and in-between.*
Counting Pg 12		• *Explains that zero means there is none of a particular quantity and is represented by the numeral 0.* • *Uses one-to-one correspondence to count a given number of objects to 20.* • *Identifies 'how many?' in regular dot patterns, for example, arrays, five frames, ten frames, dice and irregular dot patterns, without having to count (subitising).* • *When counting objects, understands that the number name of the last object counted is the name given to the total number of objects in the group.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Structure of Number Pg 13	*I have explored numbers, understanding that they represent quantities, and I can use them to count, create sequences and describe order.* *MNU 0-02a*	• *Doubles numbers to a total of 10 mentally.* • *Groups items recognising that the appearance of the group has no effect on the overall total (conservation of number).* • *Partitions quantities to 10 into two or more parts and recognises that this does not affect the total.*
Calculating: Addition and Subtraction Pg 14	*I use practical materials and can 'count on and back' to help me to understand addition and subtraction, recording my ideas and solutions in different ways.* *MNU 0-03a*	• *Counts on and back in ones to add and subtract.* • *Adds and subtracts mentally to 10.* • *Uses appropriately the mathematical symbols +, – and =.* • *Solves simple missing number problems.*
Fractions Pg 15	*I can share out a group of items by making smaller groups and can split a whole object into smaller parts.* *MNU 0-07a*	• *Splits a whole into smaller parts and explains that equal parts are the same size.* • *Uses appropriate vocabulary to describe halves.* • *Shares out a group of items equally into smaller groups.*
Money Pg 16	*I am developing my awareness of how money is used and can recognise and use a range of coins.* *MNU 0-09a*	• *Identifies all coins to £2.* • *Applies addition and subtraction skills and uses 1p, 2p, 5p and 10p coins to pay the exact value for items to 10p.*
Time Pg 17	*I am aware of how routines and events in my world link with times and seasons, and have explored ways to record and display these using clocks, calendars and other methods.* *MNU 0-10a*	• *Links daily routines and personal events to time sequences.* • *Names the days of the week in sequence, knows the months of the year and talks about features of the four seasons in relevant contexts.* • *Recognises, talks about and, where appropriate, engages with everyday devices used to measure or display time, including clocks, calendars, sand timers and visual timetables.* • *Reads analogue and digital o'clock times (12 hour only) and represents this on a digital display or clock face.*

Key Aspect	Experiences and Outcomes	National Benchmarks
		• ***Uses appropriate language when discussing time, including before, after, o'clock, hour hand and minute hand.***
Measurement Pg 18	***I have experimented with everyday items as units of measure to investigate and compare sizes and amounts in my environment, sharing my findings with others.*** ***MNU 0-11a***	• ***Shares relevant experiences in which measurements of lengths, heights, mass and capacities are used, for example, in baking.*** • ***Describes common objects using appropriate measurement language,*** • ***including tall, heavy and empty.*** • ***Compares and describes lengths, heights, mass and capacities using everyday language, including longer, shorter, taller, heavier, lighter, more and less.*** • ***Estimates, then measures, the length, height, mass and capacity of familiar objects using a range of appropriate non-standard units.***
Patterns and Relationships Pg 19	I have spotted and explored patterns in my own and the wider environment and can copy and continue these and create my own patterns. **MTH 0-13a**	• Copies, continues and creates simple patterns involving objects, shapes and numbers. • Explores, recognises and continues simple number patterns. • Finds missing numbers on a number line within the range 0 - 20.

First Level Experiences and Outcomes

** The numeracy learner statements that are the responsibility of all are shown in italics.*

I can share ideas with others to develop ways of estimating the answer to a calculation or problem, work out the actual answer, then check my solution by comparing it with the estimate. *MNU 1-01a Pg 31* *I have investigated how whole numbers are constructed, can understand the importance of zero within the system and can use my knowledge to explain the link between a digit, its place and its value.* *MNU 1-02a Pg's 32-36* *I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed.* *MNU 1-03a Pg's 37-39* *Having explored fractions by taking part in practical activities, I can show my understanding of:* *• how a single item can be shared equally* *• the notation and vocabulary associated with fractions* *• where simple fractions lie on the number line.* *MNU 1-07a Pg 40* *Through exploring how groups of items can be shared equally, I can find a fraction of an amount by applying my knowledge of division.* *MNU 1-07b Pg 40* Through taking part in practical activities including use of pictorial representations, I can demonstrate my understanding of simple fractions which are equivalent. **MTH 1-07c Pg 40**	*I can use money to pay for items and can work out how much change I should receive.* *MNU 1-09a Pg 41* *I have investigated how different combinations of coins and notes can be used to pay for goods or be given in change.* *MNU 1-09b Pg 41* *I can tell the time using 12 hour clocks, realising there is a link with 24 hour notation, explain how it impacts on my daily routine and ensure that I am organised and ready for events throughout my day.* *MNU 1-10a Pg 42* *I can use a calendar to plan and be organised for key events for myself and my class throughout the year.* *MNU 1-10b Pg 42* *I have begun to develop a sense of how long tasks take by measuring the time taken to complete a range of activities using a variety of timers.* *MNU 1-10c Pg 42* *I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units.* *MNU 1-11a Pg's 43 & 44* *I can estimate the area of a shape by counting squares or other methods.* *MNU 1-11b Pg's 43 & 44*

First Level Experiences and Outcomes

**** The numeracy learner statements that are the responsibility of all are shown in italics.***

I have discussed the important part that numbers play in the world and explored a variety of systems that have been used by civilisations throughout history to record numbers.

MTH 1-12a Pg 45

I can continue and devise more involved repeating patterns or designs, using a variety of media.

MTH 1-13a Pg 46

Through exploring number patterns, I can recognise and continue simple number sequences and can explain the rule I have applied.

MTH 1-13b Pg 46

I can compare, describe and show number relationships, using appropriate vocabulary and the symbols for equals, not equal to, less than and greater than.

MTH 1-15a Pg 47

When a picture or symbol is used to replace a number in a number statement, I can find its value using my knowledge of number facts and explain my thinking to others.

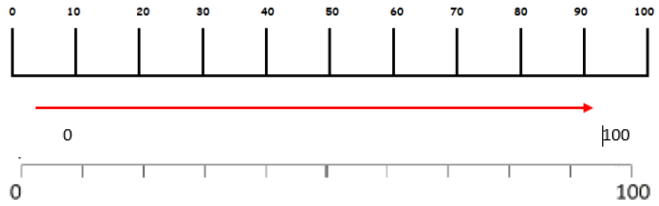
MTH 1-15b Pg 47

Points to Consider

- Saying one, two or three **number words forwards** forms an important basis for counting on strategies (**counting up from and counting up to**). Children may choose to use their fingers to keep track. They typically will have more difficulty when crossing a decade e.g. three numbers after 68.

- The use of tools such as numeral rolls, numeral tracks and hundred squares are very beneficial for promoting visualisation and help to support children when internalising the number sequences.

- Scaled number lines are an invaluable tool for children to show their understanding of number sequences and the relation numbers have with each other. They can have increments marked regularly or just at the beginning and end.



(Number lines with marked intervals will be easier to use. Only some children at First Level will be comfortable using the last two examples).

- Reversing 2 digit numbers can still be a problem for children who are using the sound of the number e.g. 16 and 61, both start with the six sound.

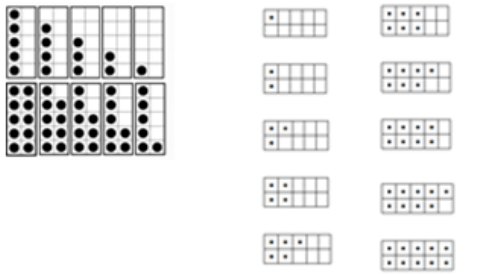
- Children need to be taught that **'ty' words mean 'tens'** (e.g. sixty means six tens) and decoding ones and tens notation (e.g. fifty eight means five tens and eight ones).

- Children can have difficulty with 3 digit numbers with a **zero in the tens** column especially whilst their knowledge of place value is not wholly secure.

- **Zero is used as a place holder**. It indicates that there is none of a particular quantity and holds the other digits in their place.

- It is important that children are able to see numbers being represented on a tens frame using both the five-wise and pair pattern. This supports their understanding of **5 and 10 as an anchor** to making larger numbers and supports their doubling capabilities.

- Other tools like the Rekenrek, bead strings, dot cards and counters all help to support children's number sense moving from concrete, to visualisation and then into understanding the abstract.



Five wise Tens Frames

Dots are built up one strip first.

Pair-wise tens frame

Dots are built up in pairs (doubles)

- Traditionally, the first column on the right has been called the 'units' column. The term 'ones' can be easier to understand as ten ones equate to one unit of ten.

- Developing children's early knowledge of tens and ones is a forerunner to the development of place value knowledge. It is very important that they have plenty of experience of counting large collections (within 100) and grouping these into 10s.

- Materials such as straws organised into bundles of ten and then hundreds support early knowledge of place value rather than the use of traditional Dienes apparatus. This is because children benefit significantly from creating the units of ten themselves.

- Children should be able to split (partition) 2 and 3 digit numbers into standard form (e.g. 369 = 300 + 60 + 9) without reference to actual quantities (concrete materials).

- It is also vital that children are able to split 2 and 3 digit numbers into non-standard form. They should understand that the number 237 has 23 tens and 7 ones and 237 ones. This will support their mental agility enormously in Second Level e.g. the sum 237 – 176 becomes 23 tens – 17 tens and 7-6, which leaves 6 tens and 1 one which equals 61. They will still need support materials at this stage.

- Children need to use the strategy of starting with the larger number when combining two or more collections and understand this is a more efficient use of time. They also need to keep track of the number of objects in the second, smaller collection.

- It isn't vital that children learn the word 'commutative' but it is important that they learn how to use the strategy i.e. 2+3 = 3+2.

- Part, Part, Whole (PPW) involves seeing numbers as being made up of two or more parts. This is a major conceptual achievement at the Early and First Level. A strong understanding of PPW has been shown to increase understanding of subsequent work with place value, number concepts and word problems.

- Children need to learn to use equal groupings or parts to help count collections. Simply learning how to skip count by reciting every second or every third number or by jumping along a number line may not help them to realise that they are in fact 'counting all.'

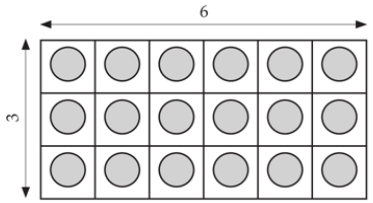
- The sequence for how children learn to say multiple counts starts with children counting rhythmically and identifies number patterns, e.g. 1, 2, 3 4, 5, 6 7, 8, 9… This in turn enables them to use skip counts and counting by ones e.g. 3, 6, 9, 12, 13, 14, 15 16, 17, 18. With practice they move onto skip counting in multiples, e.g. 3, 6, 9, 12, 15, 18, 21.

- Children need to be able to keep a double count in multiplicative situations by representing one group (e.g. by holding up four fingers).

- Children should keep track of their count using fingers or a temporal count (sequence of sounds) e.g. they hear themselves make three counts – eleven, twelve, thirteen.

- Children should be familiar with everyday vocabulary, such as 'groups of', 'lines of', 'bags of', 'boxes of' 'packets of', 'sets of' alongside the mathematical terminology. This vocabulary should support children when working out if the problem is a multiplication or division problem.

- In the operation 5 x 3, 5 is the multiplier (how many of) and 3 is the multiplicand (of what). Pupils will first see multiplication as repeated addition and so see 6 lots of 3 as 3 + 3 + 3 + 3+ 3+ 3 not as 6 x 3.
- Introducing arrays will support a pupil's ability to move from repeated addition to multiplicative strategies. Displaying a number problem in equal rows and equal columns allows the exploration of factors and multiples. Arrays help pupils visualise an increasing range of useful strategies that will support their ability to mentally solve multiplication and division problems.



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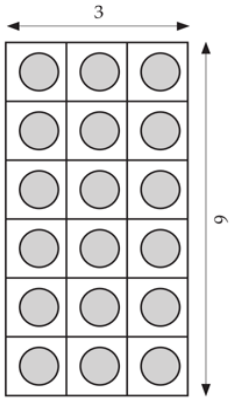


There are 6 rows of 3

A word of warning!

There is a routine to follow when introducing any new learning strategy.

- Concrete materials are always used to introduce the new strategy/knowledge.
- When children are confident using the materials, these are screened to encourage children to visualise the materials and to help build images in their mind.
- Pictorial representations such as dots, ten frames etc. acts as a bridge between using materials and being able to answer abstract questions.
- They will then need a period of time devoted to reinforcing and consolidating this new strategy/knowledge. It may be necessary for the children to go back to the materials either to manipulate them or to be used for checking answers and help build confidence.
- Once they have a secure understanding using pictorial representations, they can move on to number problems using abstract questions without the use of materials/pictures.
- The level of complexity of the tasks should be increased to show that the children have understood the strategy and can apply it to unfamiliar situations. Numbers that are too large to track in their heads forces them to connect to the number properties.
- It is very important for children to be encouraged to talk about how they found a solution to a given problem. It is also important for the teacher to keep a track of what the thinking behind the solution is. Listening to the strategy used by a child will give teachers a huge insight into the level of sophistication a child has used. For example, when asking a child to work out 25 + 6, there is a big difference between the child who counts up in ones from 25 to 31, the one who starts at 25, adds 5 and then 1 to make 31 and the one who knows 5 + 6 = 11, so 20 + 11 = 31.

- **Writing number stories** helps children visualise mathematical facts and integrate mathematics being learned into their own lives and experiences. When children write a number story, they are devising their own images for the numbers in an abstract number problem which can be presented in a variety of ways.

- Children should be actively encouraged to listen attentively to maths stories and then be asked to draw solutions or act out the solution e.g. 13 grey seals are on the beach and are soon joined by 12 more. How many seals are now on the beach?

- Children should also be given a picture of the solution and asked to draw, tell or act out the number story. The answer is five cows, what's the story? Children should share different responses from group/class.

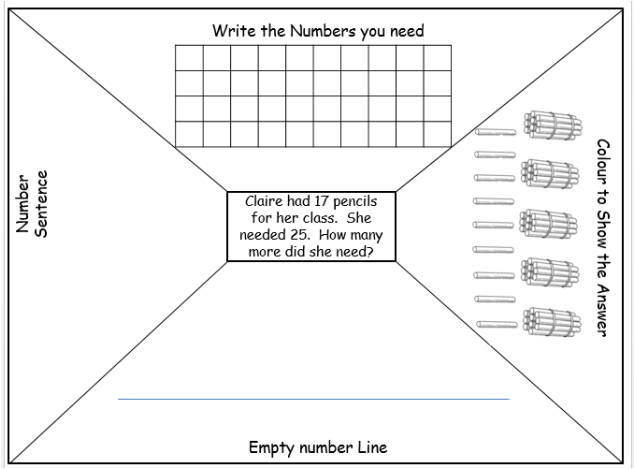
- **Written number sentences** which include symbols and numerals could be included once they are proficient with using models to represent their stories.

- Children also need to experience number problems (change unknown, start unknown, result unknown) where the answer is not always on the right hand side e.g. $\square = 3 + 8$

- Children do not need to know these terms, but need to experience number problems where they are finding the missing augend ($\square + 3 = 9$), addend ($6 + \square = 9$), minuend ($\square - 6 = 3$) and subtrahend ($9 - \square = 3$).

- The '**equal sign**' can initially be interpreted as 'find the answer'. For example, 2 dogs plus 3 dogs equals how many dogs ~ 2 + 3 =? However, during First Level children need a broader definition of 'equals'. To work out 8 + 7 using a 'jump to the next decade' strategy, children need to understand that 8 + 7 = 8 + 2 + 5 = 10 + 5 = 15 (**associative law**). Here, 'equals' means 'is the same as'. Both sides balance.
- Children should also be asked to represent a story with objects or on a **think board** e.g. use tally marks for cows to solve the problem 'Twenty three cows were put in a field with fourteen other cows. How many cows were there in the field?'

- EXAMPLES OF THINK BOARDS Specific key areas can be targeted to suit the learning e.g.

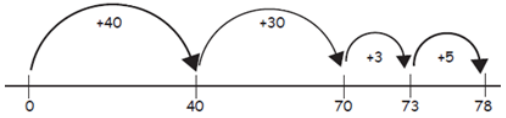


Suggested Written Recording

Whilst the main emphasis in this progression is on using mental strategies to solve numerical problems, it is important that written recording is recognised as an important part of mathematics.
The following points are important when considering what, when and where pupils should be recording.

Empty number lines are a good way for children to show their 'thinking'. Pupils can show their thinking/solution on the number line AFTER the problem has been mentally calculated.

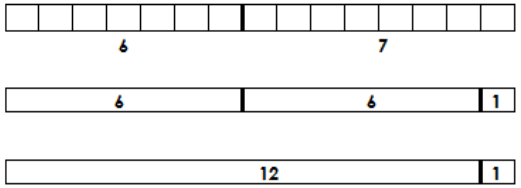
43 + 35 = 40 + 30 + 3 + 5



Mathematics is an activity of the mind.

Informal jottings can be used by pupils to reduce the mental load, to communicate their ideas to others and to provide a window into a child's thinking.

6 + 7 = 6 + 6 + 1= 12 + 1 = 13



Not all recording needs to be kept but should be acknowledged as being valuable as a record of the links that children make between oral, mental and written work. A simple copy of 'jottings' or main ideas could be transferred into a maths jotter if necessary.

Subtraction on an 'empty number line' starts at the right hand side of the line.

15 – 7 = 8

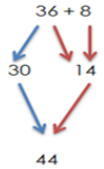
74 – 27 =

It is important that children are proficient at using a wide range of recording methods. These should be modelled by the teacher to support the child's mathematical thinking.

Be careful not to value 'neat' and 'ordered' recording over higher order mathematical ideas or informal jottings that make sense to the child.

The Split Strategy

Pupils have an understanding of the value of each digit and split them before adding the tens together and then the ones, and then recombine to get the answer.



e.g. 36 + 8

There is the danger when recording on squared paper that children focus too heavily on the digits and not the number as a whole, it is recommended that children do not use squared paper at this level.

As children develop mathematically it is important they record and use mathematical vocabulary, terminology and symbolism.

Informal written recording should take place regularly.

Suggested Written Recording

Whilst the main emphasis in this progression is on using mental strategies to solve numerical problems, it is important that written recording is recognised as an important part of mathematics.
The following points are important when considering what, when and where pupils should be recording.

Pupils use of standard symbols and conventions, for example numbers 0-9, equals sign and operation signs, will become more precise when recording their own explanations about a calculation.

Using paper and pencil for **informal jottings** can help keep a track of calculations if the numbers are large.

TO + TO possibly moving into HTO + TO or HTO + HTO
Example of horizontal expanded method, using splitting.

612 + 135 = 600 + 10 + 2 + 100 + 30 + 5
H T O
600 + 100 + 10 + 30 + 2 + 5
700 + 40 + 7
= 747

A jotting area can be created by dividing the page in the maths jotter rather than using a separate book. This helps the pupil and teacher understand how the calculation was undertaken.

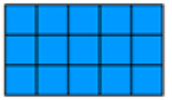
You have 50p in ten pence pieces,

how many friends can you each give 10p?

Recording their own ideas on paper with words, numbers, symbols, diagrams and pictures is part of pupils' exploration of number.

See Think Boards in 'Points to Consider'

It is important for children to establish connections between practical experiences, symbols, language and patterns.



× × × × ×
× × × × ×
× × × × ×

5 x 3 = 3 + 3 + 3 + 3 + 3
3 x 5 = 5 + 5 + 5

Introducing standard algorithms before pupils have fully established partitioning strategies can slow down the development of mental problem solving skills and number sense.

3 + 3 + 3 = 9 **3 x 3 = 9**

Children at this level begin to understand that diagrams and equations often provide a more efficient means of communicating ideas than textual explanations.

ESTIMATION AND ROUNDING AIM: Prior to calculating, use different strategies to make a reasonable estimate of the answer, for example by rounding or doubling.

MNU 1-01a

Round numbers to the nearest ten or hundred when estimating.
e.g. 345 to 350 or 300
875 to 880 or 900

Place whole numbers up to 1,000 on a number line, using varied intervals:

0 500

If this is where zero goes and this is where 500 goes, where would you put 300?

Uses strategies to estimate an answer to a calculation or problem

e.g. doubling & rounding.

Check the reasonableness of a calculation by comparing the final answer with the estimate.

Round numbers to the nearest ten or hundred when estimating.
e.g. 32 to 30 and 157 to 200 and explain their answer.

Estimate first then count a large collection by rounding and doubling.

Estimate first then count a large collection by systematically counting in 10s, 20s, 25s, and 100s.

Round numbers to the nearest ten when estimating. *e.g. decide whether a collection is nearer to 20 or 30 and explain their answer.*

Describe whether a number is closer to zero, ten or twenty by using a tool such as a tens frame or a number line.

8 is closer to ten than zero

7 is closer to ten than zero

Understand that an estimated value is not exact.

NUMBER WORD SEQUENCES AIM: Recall and recite the number words just before and after a given number in the range of at least 0-10 000 in 1s, 10s and 100s, (on and off the decade/hundred/thousand). Recognise, read and write all numbers to 10 000. Identify missing 3 and 4 digit numbers in a sequence within ten thousand (including in multiples of ten) *e.g. 5645, 5655, **, 5675, ****, ****, 5705.***

MNU 1-02a

Order a set of four-digit numbers in ascending or descending order starting from any number in the sequence. Present this information on an empty number line. *e.g. put these numbers in order from left to right – 8805. 8698. 410. 22. 6667*

Sequence off the decade numerals in the range of at least 0-10 000. *e.g.*

674	684	694	704	714

Find a number exactly half way between two 3 or 4-digit numbers within 10 000. e.g. *between 2567 and 2575?*

Sequence numerals in the range of at least 0-10 000 and be able to confidently cross the next hundred.

598	599	600	601	602

Find a number between 3 or 4-digit numbers within 10 000.

e.g. *Give me a number comes between 567 and 570? Can you think of another?*

Sequence and name multiples of hundred numeral cards in order (in the range of 100-10 000 and beyond).
e.g. 1800, 1900, 2000, 2100, 2200

Say the number words just before and after a given number in the range of 0-1000 in 1s and 10, (on and off the decade).
e.g. 699 - 700 699 - 709
801 - 800 801 - 791

Sequence multiples in 2s, 10s, 5s, 3s and 4s using numerals up to 10 000 *e.g.4, 8, 12, 16, 20….*

Sequence numerals in the range of at least 0-1000, without crossing into the next hundred, *e.g. if given cards within three hundred (not crossing into next hundred) child required to lay out sequence of cards in order. e.g. 217, 218……227*

Sequence on the decade numerals in the range of at least 0-1000 *e.g.*

580	590	600	610	620

Identify, say and represent all numbers to at least 1000 (including zero) using numerals and words.

Say forward number word sequences in multiples of 2s, 10s, 5s, 3s and 4s in the range of at least 0-100,
e.g. 2s - 14, 16, 18, 20, 22 5s = 25, 30, 35, 40, 45, 50,

Say backward number word sequences in multiples of 2s, 10s, 5s, 3s and 4s in the range of at least 0-100,
e.g. 43, 42, 30, 28….. 60, 57, 54, 51, 48…

Identify missing 3 digit numbers visually within 1000. Place numbers on a scaled number line in order. *e.g. 345, 346, ***, 348, ***, ***, 351*
*501, ***, ***, 498, 497, ***, 495*

Sequence and name multiples of hundred numeral cards in order (in the range of 100-1000). *e.g. 100, 200, 300……900*
600, 500, 400, 300

Recite number word sequences forwards, by ones, tens and hundreds in the range of at least 0-1000, from any given number.
e.g. 567, 568, 569, 570… 456,466, 476, 486… 378, 478, 578, 678…

Recite number word sequences backwards by ones, tens and hundreds in the range of at least 0-1000, and beyond, from any given number. *e.g. 765, 764, 763…*
828, 818, 808, 798…

Order a set of two-digit numbers in ascending or descending order. Present this information on a scaled number line or hundred square.
e.g. put these numbers in order from left to right – 34, 56, 18, 22, 98

Sequence decade numerals in the range of at least 0-100.
e.g. put the cards 20-70 in order

20	30	40	50	60	70

Begin to sequence multiples of 2 and 10 using numerals in the range of 10 and 50 respectively. *e.g.*
2s – 2, 4, 6, 8, 10 … 10s – 10, 20… 50

Identify missing 2 digit numbers within 100. Place numbers on a simple number line.
*e.g. 100, **, 98, 97, 96, **, **, 93, **,*

*45, 46, **, **, 49, **, **, 52, 53*

Find a number between two 2 digit numbers within 100.
e.g. give me a number which comes between 67 and 70? Can you think of another?

Identify, say and represent all numbers to at least 100 (including zero) using numerals and words.

Sequence numerals in the range of at least 0-100 including crossing decades.
e.g. If given the cards 45-55, child required to lay them out in order from smallest to largest number and largest to smallest 63, 62, 61, 60, 59, 58

Recall the number word just before and after a given number in the range of at least 0-100 (on and off the decade).
e.g. 28 -29 28 - 38
56 -55 56 - 46

Recall the number word just before and after a given number in the range of at least 0-100.

Read and write all the numbers to at least 100.

Recite number word sequences forwards, in order, in the range of at least 0-100, from any given number, *e.g. 20 21 22 23*

Recite number word sequences backwards, in order, in the range of at least 0-100, from any given number.

Say decade number word sequence forwards and backwards in the range of at least 0-100,

Read and use the ordinal names to at least 'twentieth'.

Say forward number word sequences in multiples of 2, 5, 10 & 100. *e.g. 2, 4, 6, 8… 5, 10, 15, 20… 10, 20, 30, 40… 100, 200, 300, 400……*

Say backward number word sequences in multiples of 2, 5, 10 & 100
e.g. 66, 64, 62, 60…
85, 80, 75, 70…
90, 80, 70, 60…

COUNTING AIM: Count forwards and backwards in at least 10s and 100s using numerals in multiplicative situations. Select counting as a strategy when appropriate.

MNU 1-02a

Can count the number of jumps forwards and backwards from a to b up to 1000 (on a numeral track showing multiples of 2, 10, 5, 3 or 4). *e.g. How many jumps from 36 to 60 in 4s?*

Can instantly add/ subtract 10 to any 2 digit number.
e.g. 23 + 20 say 33,43
43 – 20 say 33, 23

Count on and back in multiples of 100 from an unscreened numeral to find a given numeral on a screened numeral track.
e.g. Start at 656, count back 3 places in 200s. What number have you reached? (56)

Count the number of jumps forwards and backwards from a to b (on a numeral track showing multiples of 2, 10, 5 or 3). Examples should cross decades.
e.g. How many jumps from 28 to 36 in 2s?

26	28	30	32	34	36	38	40

Count on and back in multiples of 2, 5,10, 3 or 4 from an unscreened numeral to find a given numeral on a screened numeral track.
e.g. Start at 56, count back 5 places in 2s. What number have you reached? (46)

Estimate first then count a large collection by systematically counting in 10s, 20s, 25s, and 100s.

Count on and back from an unscreened numeral to find a given numeral on a screened numeral track.
e.g. Start at 51, count back 5 places. What number have you reached? (46)

						50	51	52

Estimate first then count a large collection by systematically counting in 10s, 20s, 25s, and 100s.

Use counting as a strategy to solve problems such as 'Are there enough…?'

Continue rhythmic counting, skip counting and grouping.

Choose counting on rather than dropping back and counting all.
e.g. 5 + 3 = 5, 6, 7, 8 not 1,2,3,4,5,6,7,8.

Realise that repeated addition or skip counting will give the same result as counting by ones.

Count the number of jumps forwards and backwards from a to b (on a numeral track or numeral roll). Should not cross the decades. *e.g. How many jumps from 22 to 25 or 95 to 92?*

91	92	93	94	95	96	97	98	99

Understand that when you add or subtract zero to any number it does not change the value of the set.

STRUCTURE OF NUMBER AIM: Understand the part-part-whole relationship of numbers up to 100. Quickly recall number facts within 20 and use this knowledge to support working with larger numbers.

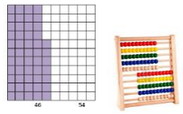
MNU 1-02a

Know by heart and recall quickly all subtraction facts within 10 and number bonds to 20.
e.g. 9 – 7, 8 – 4, 7 - 5
20 – 12 = 8, 20 – 6 = 14, 20 – 16 = 4

Regroup to solve problems efficiently i.e. can group numbers together and spot which numbers cancel each other out
e.g. 2 + 3 + 7 – 9 (They realise that 2 + 7 makes 9 and then remove the 9 to leave the 3)

Recall multiples of 10 facts that add to 100, (number bonds of 100). *e.g.10 +90, 50 + 50, 30 + 70.*

Recognise and record partitions to 100 using materials and written methods. *e.g.*



Standard Notation 100 = 46 + 54
Expanded Notation 100 = 40 + 6 + 50 + 4

Recall quickly 5 plus facts within 14 and subtraction facts using 5 plus facts.
e.g. 5 + 6, 5 + 7, 5 + 8, 5 + 9,
14 -5, 13 – 5, 12 – 5

Partition whole numbers with at least 2 digits into standard component parts to help with mental calculations.

Use the part-part-whole (see 'Points to Consider') notion of numbers, using concrete materials.
e.g. 'Use colour cubes to make the following

4 + 5 = 9 or 5 + 4 = 9

Know by heart and recall quickly all subtraction facts within 10.
e.g. 9 take away 6, 7 minus 5, plus bonds to 10.

Know 'ten plus' facts, *e.g.10 +4,* 7+10.

Recall all the addition facts within 20.
e.g. 17 + 2, 13 plus 6, 15 add 5, 16 and 4

Recall doubles (answer within 20) and all corresponding halves.
e.g. ½ of 16 =8, ½ of 18

Recall most doubles (answer within 20) and halves of ten and below. *e.g. 6 +6, 7+7, ½ of 6 is 3.*

Recall 5 plus facts within 10
e.g. 5 + 1, 5 + 2, 5 + 3, 5 + 4
Instantly recall subtraction facts using 5 plus facts, *e.g.*
9 – 5 = 4, because 9 is 5 plus 4
6 – 5 = 1 because 6 is 5 plus 1

Split small numbers and represent them in a variety of ways using concrete materials.

Use decades as an anchor in forming numbers within 100. *e.g. Fifty- seven is seven more than fifty and three away from 60.*

Identify a double plus one pattern. *e.g. on a Rekenrek or tens frame spot that 5 is made from double 2 add 1.*

Recall subtraction facts to 10 (bonds of 10 only)
e.g. 10 - 4 = 6, 10 – 7 = 3, 10 – 2 = 8

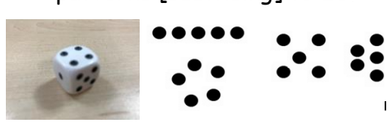
Recall all the addition facts within 10.
e.g. 7+2, 3 plus 6, 5 add 5, 6 and 4,

Use 10 as an anchor in forming numbers from 11 to 20. *e.g. thirteen is three more than ten,' using two tens frames, bead strings to 20 and Rekenreks.*

On the right you can see 12 beads, ten and two more.

Start to combine two visual patterns [subitising] to 10.

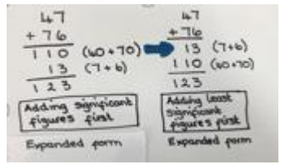
Start to combine more than two visual patterns [subitising] to 20.



Recognise and describe the five-wise and pair-wise ten frames and use these to fluently partition numbers in the range of 1 to 10, (see 'Points to Consider'.

PLACE VALUE AIM: Recognise zero as a placeholder in whole numbers and appreciate when it is necessary to include it in whole numbers to at least 1000. Understand that the position of a digit tells us the quantity it represents (up to at least three digits). Apply an understanding of place value to solve problems by mentally multiplying and dividing by 10 and 100 (where the answer is a whole number). MNU 1-02a **Note: This pyramid appears across two pages.**

Represent addition and subtraction situations using formal written strategies e.g. vertical expanded method.



Recognise and represent exact partitions of numbers up to 1000 and record in a standard and non-standard place value including expanded notations.

STANDARD PLACE VALUE

753 = 7 hundreds, 5 tens and 3 ones or 75 tens and 3 ones or 7 hundreds and 53 ones.

NON-STANDARD PLACE VALUE

753 = 6 hundreds, 14 tens and 13 ones for example

EXPANDED NOTATION

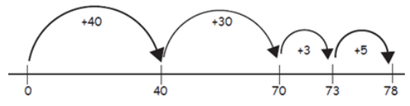
753 – 700 + 50 + 3

Use place value to compare and order numbers up to 1 000 and beyond.

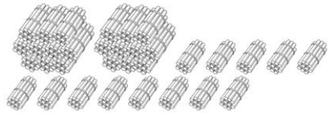
Apply an understanding of place value and the role of zero to identify, say and represent numbers up to 1 000 and beyond, using numerals, words and objects.

Arrow cards, numeral cards and digit cards are very useful materials.

Represent addition and subtraction situations using informal written strategies. *e.g. number line.*



Make and draw 3-digit numbers in non-standard form. Convert hundreds into tens and hundreds and tens into ones and vice versa.



Convert hundreds into groups of 10 and 100.

e.g. 258 is 2 hundreds, 5 tens and 8 ones or 25 tens and 8 ones.

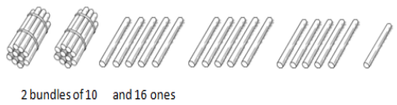
Efficiently increase and decrease by 10s and 100s off the century and off the decade, without seeing any materials.

e.g. 32, 142, 262….902

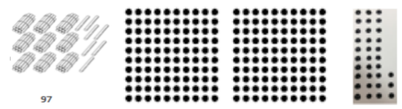
Systematically record all the possible digit combinations for 2 and 3 single digit numbers, starting with the smallest number.

e.g. 739= 379, 397, 739,793, 937, 973

Efficiently make and draw 2 digit numbers in non-standard form and convert tens into ones and vice versa.
e.g. 36 ones can look like this



Make and draw 2 and 3 digit numbers in standard hundred, tens and ones form and connect these into words and symbols. *e.g. using materials such as bundles of sticks or dot strips in ones and bundles/strips of ten, convert into words and symbols.*



9 bundles of ten and 7 ones = 97

2 hundreds, 3 tens and 3 ones = 233

Efficiently increase and decrease by tens and ones. *e.g.*

= 57

Children are told what number is under the screen but have to visualise it and then add one ten and three

Record all the possible digit combinations for 2 and 3 single digit numbers and order from smallest to largest and largest to smallest.
e.g. 678 =678, 687, 768, 786, 867, 876

Efficiently increase and decrease by tens on/off the decade.
e.g. Place 3 ten strips on the table. Add one ten strip, add a 3 dot strip and two more ten strips. How many dots altogether? (63)

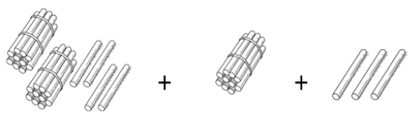
Increase and decrease by 100s on the century to 1 000. *e.g. 6 hundred, 7 hundred, etc.*

Identify the patterns within numbers and the cyclical nature of the numbers 0-9.

Apply an understanding of place value and the role of zero to identify, say and represent numbers up to 1000 and beyond, *e.g. know that the value of the digits in 20 are worth 2 tens or twenty and zero ones.*

Increase and decrease by hundred off the century. *e.g. 100 square and 2 ten dot strips. Add multiples of 100 squares and keep count, 120, 220, 320…*

Increase by tens and ones *e.g.*

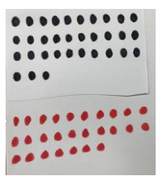


Increase and decrease by tens off the decade. *e.g.*

15 add ten = 25 add two tens = 45

Record and explain all the possible digit combinations for 2-digit numbers and order from smallest to largest and largest to smallest.
e.g. 2, 3 = 23 and 32
6 and 9 = 69 and 96

Show familiarity with grouping and counting in tens and explain why it is a more efficient way to count a larger collection. Connect these into words and symbols.

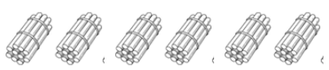


Count the tens first and add the ones 10, 20, 30, 40, 50, 51, 52, 53, 54, 54, 55, 56 instead of counting in ones, 10, 11, 12, 13, 14, 15, 16, 17, 18.

Begin to make and draw collections of a given size to 100s using tens and ones. Convert into words and symbols. *e.g. Using materials such as bundles of sticks – see 'Points to Consider'.*
6 bundles of ten and 7ones = 67

Increase and decrease by tens on decade (within 100)

Describe the number of tens in decades, *e.g. how many tens in 60?*
There are 6 tens in 60.



CALCULATING (ADDITION AND SUBTRACTION) AIM: Select an appropriate operation to solve different addition and subtraction situations by carefully interpreting a multi-step problem. Apply a range of strategies, justifying choice.

MNU 1-03a

Find the difference between quantities by adding or subtracting.
e.g. Ann has read 25 pages of a book which has 80 pages. How many pages will she need to read to finish the book?
Can be written as 25 + □ = 80 and 80 – 25 = □

Write sensible addition and subtraction story problems to match given number sentences. *e.g. for 'Sue invited 68 friends to her party but only 45 went. How many of her friends did not go?' Write 68 - ? = 45*

Use the inverse to routinely check answers.

Solve subtraction problems by subtracting ones and tens, using a split strategy. *e.g. 433 – 21= 433 – 20 - 1*

Use 'part-part-whole' diagrams to show the link between addition/subtraction word problems with a 'transformed' number sentence.
e.g. I had some strawberries and ate fourteen. There were thirty five left. How many strawberries were there to start with?' may be thought of as □ – 35 = 14 but can be worked out as 35 + 14 = □)

35	14

Solve addition problems by adding ones and tens using a split strategy. *e.g. 234 + 26 = 234 + 20 + 6*

Understand that subtraction is the inverse of addition in written and mental calculations. Change subtraction to addition. *e.g. 13 – 6. What do I add to 6 to make 13? 6 +? = 13 I had some toy cars and gave thirteen to my friend and had two left. How many cars did I have to start with?' may be thought of as □ – 13 = 2 but can be worked out using 13 + 2 = □*

13	2
?	

Solve subtraction problems by subtracting ones and tens, using a split strategy.

Identify the whole amount and the parts within addition and subtraction sums to 100 and write appropriate number sentences. (Should only cross one decade) *e.g. 48 pages from the class story were read in one week. There are 56 pages in the entire book so how many pages are left? 48 + □=56.*

Solve addition problems by adding ones and tens using a split strategy (answers within 99 - where the ones column does not add up to ten or more).
e.g. 34 + 55 = 30 + 50 + 4 + 5 = 89

Solve problems by using the commutative property to:
*** add three or more numbers, by making pairs of ten. *e.g. 2 + 6 + 8, 4 + 7 + 6***
- **Put largest number first. *e.g. 6 + 13 = 13 + 6***

Use known simple facts to discover an unknown fact beyond 100. *e.g. I know 160 + 42 is 202 because I know 160 + 40 is 200*

Use a known fact to work out a new one.
Use knowledge of doubles to 20 to discover near doubles.

Say or write addition and subtraction number sentences to match the meaning of the problem. *e.g. for 'I had some strawberries for lunch and ate three. There were five left. How many strawberries were there to start with?' Say or write □ – 3 = 5*

Can add or subtract multiples of ten to/from any multiple of ten, within 100. *e.g.*
20+30 30+40 30-10 60-30 60-50 80-50
20 + 30 = 2 tens and 3 tens = 5 tens =50

Can add or subtract multiples of ten to/from any two digit number, within 100, using a split strategy.
e.g. 12 + 30 = 30 + 10 + 2 = 40 + 2

Record written number sentences, including the symbols (+, –) to represent the operations of addition and subtraction using appropriate mathematical vocabulary. *e.g. add, subtract*

Connect addition and subtraction problems and the symbolic representations of them.
e.g. use a think board (see 'Points to Consider') to show the story, materials, picture, diagram and the number sentence for the calculation.

Use known simple facts to discover an unknown fact within 100.
e.g. I know 20 + 4 = 24 so 21 + 4 = 25.

Use a known fact to work out a new one.
Use knowledge of doubles to 10 to discover near doubles within ten.
e.g. 4 + 5 is same as double 4 + 1
3 + 5 is same as double 3 + 2

Model, draw and represent number problems; record addition and subtraction informally but begin to include symbols and numerals.

Understand that subtraction is not commutative.
e.g. We can take 4 away from 6 but when we take 6 away from 4 we get a different answer…negative numbers are for later!

Identify the whole amount and the parts within addition and subtraction sums and write number sentences. (One part needs to be 5 or less). *e.g.*
- *5 girls and 3 boys went ice- skating. There were 8 children altogether. 5 + 3 = 8*
- *8 children went ice-skating. 5 were girls. How many were boys? 8 - 5 = ?*

Solve simple addition/subtraction sums by adding on/counting back from the largest number in jumps of one.

e.g.... 9 + 4 by 9 10, 11, 12, 13
1 2 3 4 – track of count

e.g.... 59 - 4 =, start at 59 and track number of counts starting at 58, count back 4 to 55.
e.g.... 59 → 58 (1), 57(2), 56(3), 55(4)
(Largest number can be between 1 -100 and number being subtracted is 5 or less).

Represent a story with objects or on a think board.
e.g. Substitute counters for cows to solve the problem - Three cows were put in a field with fourteen other cows. How many cows were in the field altogether?

Understand that addition is commutative:
The order of the numbers can be rearranged to make counting on easier. *e.g. 2+6 is the same as 6+2*
Start at the largest number!

Understand that addition and subtraction can be described using everyday language. *e.g. take away, from, difference between, sum, combine and join.*

CALCULATING (MULTIPLICATION AND DIVISION) AIM: Select an appropriate operation to solve different multiplication and division situations within the number range 0-1000 by carefully interpreting a two-step problem. Apply a range of strategies to determine multiplication and division facts. Use the relationship between multiplication and division to complete mental and written calculations. **MNU 1-03a** **Note: This pyramid appears across two pages.**

Use repeated addition or subtraction to work out an unknown multiplication fact from a known fact.
e.g. Child knows that 5 x 4 = 20. To make 6 x 4 another strip of 4 must be added, so 20 + 4 = 24. To make 4 x 4 a strip of four must be removed, so 20 – 4 = 16.

Use division for situations involving sharing or partitioning a collection – sharing amongst 2, 3, 4, 5, and 10).

By using strategies, can determine division facts.

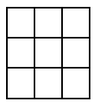
e.g. repeated subtraction, equal groups, sharing equally, using arrays and known multiplication facts.

Using whole numbers only, can multiply and divide by 10 and 100.

Use the inverse operation to routinely check answers.

Record an array as a multiplication sentence and work out how many there are in total.

e.g. there are two rows of cubes hidden. How many cubes are there altogether? Write the multiplication sentence. 3 x 3



3 + 3 + 3 = 9

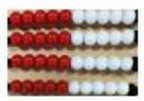
Use multiplication for situations involving repeating equal quantities.
e.g. 'Raspberries are £3 a box. How much do 6 boxes cost?' can be written as repeated addition or multiplication if the amounts are represented in an array. 3 counters are placed in a row to represent the cost for one punnet and 5 more rows are added to solve the problem below.

£.3 + £.3 + £.3 + £.3 + £.3 + £.3 = 6 x £.3 = £.18

Use repeated addition and known facts to work out multiplication problems

Understand that collections of objects can be shared evenly and some collections have objects left over.
e.g. Twenty eight pencils were shared between 3 groups of children. Each group received 9 pencils and one was left over.

Use known facts to solve an unknown fact
Begin to solve multiplication facts about the five times table from their knowledge of place value. *e.g. Understand that four tens is the same as eight fives.*



4 x 10 =40 so 8 x 5 = 40

Use known facts to solve an unknown fact.
Solve multiplication facts about the ten times table using their knowledge of the 'ty' words.
e.g. Four tens are forty because 'ty' means ten so 4 x 10 is 40.

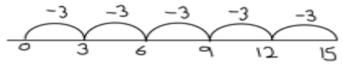
Sound recall of multiplication facts for the
2 times tables up to 10
5 times tables up to 25.

Sound recall of multiplication facts for the 2, 5 and 10 times table (up to x10) and the corresponding division facts.

Use known facts to solve an unknown fact.

e.g. solve multiplication facts about the two times table from their knowledge of doubling.

Begin to understand the connection between repeated subtraction and division by grouping. *e.g. Fiona has 15 large sunflower seeds that she puts into packets with three seeds in each. How many packets does she fill?*



15 – 3 – 3 -3 – 3 – 3 = 0

15 ÷ 3 = 5

Begin to use an addition strategy to solve a division by grouping by imaging.

e.g. The bakers have made a fresh batch of 18 rolls and place them in bags of 3. How many bags will they need? 3 + 3 + 3 + 3 + 3 + 3 = 18

Use materials, concrete or symbolic to form small equal-sized groups.

e.g. 'Use blocks to make 5 towers with 3 blocks in each. How many blocks there are altogether?' Can the 15 blocks be rearranged in towers of equal size to again equal 15?

(*Consider having vertical and flat groups)*

Use the rows and columns in arrays to represent the number of groups and the number of objects in each group. *e.g.*

Six groups of two represents two rows of six

Use arrays to show equal-sized groups that make the same quantity and note the commutative property.

e.g. 'Group 12 blocks into equal sized rows. How many ways can you do it? Record the number combinations:

Use multiplication for situations involving repeating equal quantities.

e.g. Jenny gets £5 pocket money each week. How much does she have after 6 weeks? can be written as repeated addition.

Use the symbols (x, ÷) to represent the operations of multiplication and division and appropriate mathematical vocabulary. *e.g. multiply, divide, product, shared equally.*

Recognise and represent multiplication as repeated addition, groups and arrays (rows and columns).

3 + 3 + 3 + 3 = 12

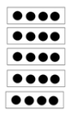
Begin to use symbols (x, ÷) to represent the operations of multiplication and division.

Comment on the patterns that skip-counting sequences make on a hundreds board and predict other numbers in a sequence in a forwards or backwards direction, whilst looking at a partially filled in pattern.

e.g. in this sequence of 3s, will 96 be covered?

Begin to understand the connection between repeated addition and multiplication.

e.g. 4 + 4 + 4 + 4 + 4 is the same as 5 x 4

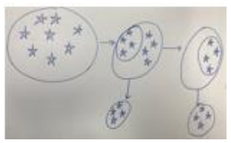


5 rows of 4 = 5 x 4

3 scuba divers catch 2 fish eac. How many fish do they catch altogether? 2 + 2 + 2 = 6. They also can record this as '3 groups of 2 is 6'.

Solve simple division problems by grouping collections into sets of particular size.

Divide 8 star biscuits onto plates with 4 on each plate. How many plates (groups) will we have?



Solve simple division problems by sharing into equal groups, *e.g.*

Share 8 star biscuits shared amongst 4 children.

Record multiplication problems using the terms 'groups of', 'lots of', 'sets of', 'shared equally' and 'remainders'.

Begin to solve a multiplication problem by using skip counting and understand that each successive count relates to putting sets of the same number together. *e.g. 5, 10, 15 is 3 groups of 5 and another group of 5 will make 20.*

Recognise equal-sized groups found in everyday situations.

e.g. Look for equal-sized groups such as stacks of class chairs. Count how many in each group and how many altogether.

4 stacks of chairs
10 chairs in each stack
4 stacks of 10 chairs
10, 20, 30, 40 – skip count

Use multiplication for situations involving repeating equal quantities.

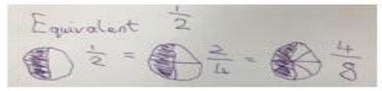
e.g. draw four oranges and then another four oranges. This is the same as two lots of four oranges.

FRACTIONS AIM: Understand the link between fractions and division. Use known multiplication and division facts and other strategies to find unitary fractions of whole numbers. Explain what a fraction is using concrete materials, pictorial representations and mathematical vocabulary and that the same quantity can be represented by different fractions e.g $\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$.

MNU 1-07a, MNU 1-07b, MNU 1-07c

Compare the size of simple fractions and order using a number line.

Describe and record simple fractional equivalences orally and using pictures.



Read, write and say fractional notation up to at least tenths, involving non-unitary fractions. *e.g. 2/5 = two fifths, 7/10 = seven tenths.*

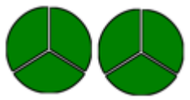
Use the relationship between multiplication & division and fractions to find unitary fractions of numbers. *e.g. a fifth of 15.*

Understand and explain what the numerator and denominator represents in a fraction symbol.

Count orally in fractional amounts including fifths, tenths etc. without pictures.

Explore the concept of equivalence. *e.g. two quarters of the sandwich is the same as a half.*

Count orally in fractional amounts such as thirds and quarters with pictures to support tracking.



Explore the way that equal sized fractional parts can look different.

Separate objects and collections into equal parts to compare unit fractions. *e.g. they can show that half of the crayons is more than a third of them.*

Order concrete representations of simple fractions from smallest to largest and vice versa.

Link the action of sharing into a number of equal portions with the language of unit fraction. *e.g. 'If I make five equal portions, then each portion is one fifth of the whole'.*

Read, write and say fractional notation involving unitary fractions. *e.g. 1/3 = one third; 1/4 = one quarter.*

Recognise that the more portions to be made from a quantity, the smaller the size of each portion.

Count orally in fractional amounts with pictures to support tracking. *e.g. one half, 1, one and a half, 2…*

Use fractional words *(one half, third, quarter etc.)* appropriately in describing and comparing things. *e.g. 'I ate about a quarter of my apple but you ate about half.'*

Understand that constructing fair shares from a whole requires splitting *all* of the whole.

Attempt to produce equal shares of continuous quantities by weighing, cutting or pouring.

Use halving based on symmetry as the basis for partitioning continuous quantities into four (eight) parts.

MONEY AIM: Identify and use all coins and notes up to at least £20 and explore different ways of making the same total. Use a variety of coin and note combinations, up to at least £20 to pay for items and given change.

MNU 1-09a & MNU 1-09b

Has experience of working with coins and note combinations up to at least £20 through relevant contexts *e.g. class enterprise, tuck shop, dinner money.*

Use mental strategies to estimate and calculate change up to at least £20.

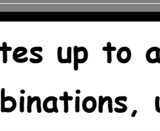
Use mental strategies to estimate and calculate total spend up to at least £20.

Record amounts accurately in different ways using the correct notation. *e.g. 149p = £1.49, 7p = £0.07.*

Use money including coins, notes, cards and vouchers increasingly appropriately in role play situations.

e.g. shop, post office, vet

Count coins in multiples of 5p, 10p, 20p 50p, £1 & £2 and record total amounts.



Realise that when paying with a card you will not receive change and payment with vouchers will usually result in change vouchers.

Read amounts of money and make up the amount with coins in different ways.

Decide whether or not they have more or less money than the price and whether to expect change. *e.g. "I have £5 the book costs £4.70 so I have more money than I need and should get some change".*

Be able to estimate and calculate costs. *e.g. £3.30 + £2.50 is approximately £6.*

Understand the various methods of paying for goods and services. *e.g. money, cards, vouchers*

Understand the difference between pounds and pence. *e.g. difference between 2p and £2.*

Estimate amounts using rounding strategies. *e.g. £4.70 is approximately £5.*

Read amounts of money and make up the amount with coins.

Count and order small collections of coins and notes according to their value.

Associated Knowledge

- Use a range of strategies to be able to add, subtract, multiply and divide using whole numbers.
- Demonstrate that I can use a range of methods to calculate total amounts and change.

TIME AIM: Use and interpret a variety of calendars and 12 hour timetables to plan key events and calculate durations. Use measures of time to assist problem solving in real life including situations involving more than one unit of time. Estimate and calculate durations.

MNU 1-10a, MNU 1-10b & MNU 1-10c

Convert units of time in worded problems. *e.g. The film lasts 110 minutes. How many hours and minutes is this?*

When planning events, understand why time is important.

Accurately read and interpret calendars. *e.g. David's birthday is June 7th. Which day of the week is it this year?*

Identify key times on a 24 hour clock, relating it to analogue displays.

Tell the time on an analogue clock and a 12 hour digital clock using half past, quarter past and quarter to.

Tell the time on an analogue clock using 5 past, 10 past, 5 to etc.

Identify 24hr notation in real life examples.

Record the date in a variety of ways using words and numbers.

Use am and pm notation.

Use key vocabulary such as minutes, seconds, decades.

Use calendars and diaries to record information. *e.g. record weekly information on a class calendar; keep a diary of class visitors.*

Relate understanding of half and quarter to a clock face, starting at different numbers.

Select and use the appropriate timers (alarms, stopwatch etc.) to measure time in classroom activities.

Connect months to ordinal numbers. *e.g. The fifth month is May.*

Explore the movements of clock hands. e.g. *why does the hour hand not point to 6 at 6.55am?*

Compare different layouts of calendars.

Know time facts such as: 24 hours in a day, 7 days in a week, 60 minutes in an hour, 12 months in a year, 60 seconds in a minute etc.

Recognise key times on an analogue clock.

Identify quarter past and quarter to times on analogue and digital clocks.

Order the months of the year and relate these to the appropriate season, understanding the cyclical pattern.

Relate daily events to time. *e.g. School starts at 9am, lunch time is 12.30pm*

Decide upon accuracy required to measure an activity. *e.g. should I measure in hours or days?*

Understand turns in terms of half, quarter and three quarter.

Use timers (sand, water etc.) to measure time in classroom activities.

Relate events to morning, afternoon, evening.

Understand the value of time. *e.g. hours are longer than minutes but shorter than days.*

Recognise numerals to 60 and count in 5s forwards and backwards from 0-60.

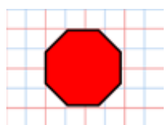
MEASUREMENT AIM: Solve problems by estimating and then measuring accurately, comparing and recording this, justifying choices and conclusions.

MNU 1-11a & MNU 1-11b **Note: This pyramid appears over two pages.**

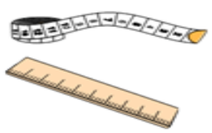
Create shapes with a given area to at least the nearest half square, using square tiles or grids.

Show representations of objects with the same area, volume, length etc. that look different.

Measure objects by area using standard units.



Solve problems involving estimation and measure by selecting appropriate tools and units of measure.



Read a given calibrated scale to the nearest labelled graduation using knowledge of fractions. *e.g. 250ml, which is one quarter of a litre.*

Relate knowledge of estimation to measurement.

e.g. Recognise that a bag of apples described as roughly 1kg is an estimation whilst a bag of apples described as 1kg is a measurement.

Measure using a given calibrated scale to the nearest labelled graduation. *e.g. 250ml.*

Use knowledge of relationships between units of measure to make simple conversions. *e.g. 1m 58cm = 158cm*

Make a model to represent a measurement. *e.g. a snake 6 cubes long, a playdoh ball weighing 10g.*

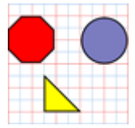
Measure objects by mass & capacity using the nearest standard units.

e.g. g, kg ml, l

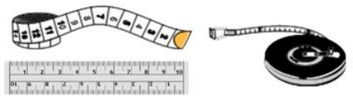
Measure objects by length, width & height using the nearest standard units. e.g. mm, cm

Explain the differences between length, height, width and mass.

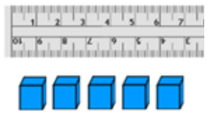
Explore how to find the area of a simple 2D shape to the nearest half square and compare this with an estimate. *e.g. count the number of squares on a grid that covers the surface.*



Explore how different types of objects are measured in different ways. *e.g. a ruler, metre stick, trundle wheel can all be used to measure length.*



Use language of estimation in relation to measurement. *e.g. the snake is 4 and a bit centimetres long, it weighs between 5 and 6 cubes.*



Explore how a calibrated scale is used for measuring. *e.g. scales, ruler.*

Compare objects given a known measurement. *e.g. this cup weighs 10 cubes, is your cup heavier or lighter?*

Measure objects by volume using standard units.

Order objects according to size by focusing on a particular attribute. *e.g. 4cm, 6cm, 8cm.*

Compare objects according to size by focusing on a particular attribute. *e.g. 5kg, 10kg.*

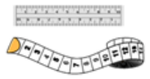
Investigate how standard units are used for measuring. *e.g. cm, kg, ml.*

Explore how objects that may look different can still have equal length, area, volume etc.

Show that using one representation of a non-standard unit repeatedly is the same as using multiple representations of it. *e.g. Using one worm repeatedly to measure the length of something, is the same as using three worms laid end to end.*

Explore how different units of measurement are used to measure different objects. *e.g. a ruler measures a small length, bathroom scales measure larger weights, a teaspoon measures small capacity.*

Model how standard units are all uniform. *e.g. all centimetres are the same size.*



Explore why non-standard units can be difficult to interpret. *e.g. Cut a piece of paper that is 3 hand spans. Why are there so many variations?*

Explore comparing objects knowing that there needs to be a common reference point. *e.g. shoes need to be taken off to compare two people's heights.*

Use appropriate language (regardless of understanding) to describe units of measure in a context. *e.g. 2l bottle of cola, 25g bar of chocolate.*

Explore the difference between length, height, width and mass.

Measure objects by mass using non-standard units. *e.g. cubes, two-pan balance.*

Measure objects by length, height & width using non-standard units. *e.g. number of hands, cubes.*

Measure the area of a surface using non-standard units. *e.g. cubes.*

Measure objects by volume using non-standard units. *e.g. number of cups.*

Explore the difference between area and volume using non-standard units.

MATHEMATICS - IT'S IMPACT ON THE WORLD, PAST, PRESENT, FUTURE AIM: Compare different number systems, decide which is most useful and justify thinking. Explain opportunities to use mathematics in everyday life.

MTH 1-12a

Discuss the impact that numbers have on everyday life.
e.g. Participate in a philosophical debate imagining a world without number.

Explore historical number systems.

e.g. Ancient Egyptian hieroglyphics, Roman numerals, Hindu-Arabic numerals.

Interpret and use tally marks.

Bird count		
Monday	III	II
Tuesday	I	IIII
Wednesday	I	
Thursday	II	I
Friday	IIII	III
		

Identify evidence of historical number systems in everyday life.

Identify number and mathematics in everyday life.



e.g. gaming, transport and shopping

Identify and explore opportunities to use numeracy and mathematics in everyday life.



e.g. time, navigation and shopping

Identify and explore numeracy and mathematics in the world of work.


e.g. nurses and lorry drivers

This Experience and Outcome should be explored throughout all other experiences and outcomes and at appropriate points in other curricular areas.

There is a great deal of opportunity for learner choice and the suggestions above should not be seen as definitive.

PATTERNS AND RELATIONSHIPS AIM: Describe, extend and generate simple number patterns. Describe, create and explain the rules for patterns and MTH 1-13a & MTH 1-13b sequences involving shapes, pictures, symbols and movements and be able to anticipate further terms.

Anticipate further items within any given pattern, ensuring consistency and that the pattern has been accurately repeated. Can identify shape in given ordinal position.
e.g. What shape will be in the 14th position?

Classify odd and even numbers up to 100 and beyond and is able to describe the rule (move to linking the equal sharing to being the same as the two times table).

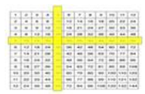
Understand repeating patterns in the hundreds, tens and ones columns and use this to explain patterns in the hundreds and thousands.

Describe, predict and record rule for spatial patterns.

Understand that the next number in a sequence of multiples is adding that multiple and the number before is removing one multiple.

Recognise that multiplying by an even number gives an answer which is always even.

Recognise that the 5 times table products end alternately in 5 and 0.

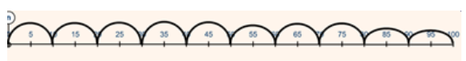


Confidently describe a 'rule' for continuing a pattern involving doubling and halving.

Understand repeating patterns in the tens and ones columns and use this to explain patterns in the decades. (0-9 numbers are repeated).
e.g. 21, 22, 23, 24…. and 31, 32, 33, 34….
20, 30, 40, 50, 60 …

Recognise that all the products of the two times table are even.

Recognise that within the 10 times table, the ones digit is always a zero.



Confidently describe a 'rule' for continuing a more complex number sequence. *e.g.* 3, 7, 15… 'The rule is going up by 4 or adding on 4'.

Anticipate further items within any given pattern, involving shapes, pictures and symbols, ensuring consistency and that the pattern has been accurately repeated.

Explore odd and even numbers up to 20 and beyond and be able to explain the rule – evens can be shared equally whereas odds can't.

Describe and explain number sequences and patterns, understanding the pattern for the 'teen' numbers and then extending this to other multiples of 10.
e.g. 11, 12, 13, 14, 15 etc. 1-9 is being repeated.
Look on a number line/hundred square and predict which number will come next.

Use materials to compare and order. *e.g. make 3 different sized towers of cubes and then place towers in ascending order.*

Understand that the next number in a sequence of ones is adding one and the one before is removing one.

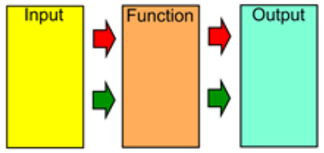
Explore sequential patterns from previous term and are able to reproduce given pattern.
e.g. carry on this pattern.

Invent their own pattern with numbers and communicate the 'rule' so that someone else can continue it.
e.g. 1, 3, 5, 7
'Add on 2 each time'

EXPRESSIONS AND EQUATIONS AIM: **Explain number relationships and comparisons using appropriate vocabulary and symbols. Find the value of a missing number when it is replaced by a picture or a symbol by using understanding of the equals sign as a balance.**

MTH 1-15a & MTH 1-15b

Use a function machine to create a table to identify the rule.



Create numerical expression using appropriate symbols when comparing quantities

(=, ≠, < and >).

Write a numerical expression to match the semantic structure of the word problem.

Investigate a variety of numerical expressions using pictures or symbols as multiplicands and multipliers.

e.g. **□ x 4 = 24 and**

4 x □ = 24

Investigate a variety of numerical expressions using pictures or symbols dividends and divisors.

e.g. □ -7 = 15 and 8 - □ = 15

Use equivalent numerical expressions involving addition *and* subtraction to find unknown quantities

e.g. 25 + 7 = 44 - ?

Orally explain the numerical expression required to solve a word problem (see P*oints to Consider*).

Select and justify the appropriate symbol to complete a numerical expressions.

Use a function machine and identify the rule.

Investigate a variety of numerical expressions using pictures or symbols as minuends and subtrahends.

e.g . □ - 7 = 8 and 15 - □ = 7

?	
8	**7**

Investigate a variety of numerical expressions using pictures or symbols as augends and addends.

e.g. □ + 7 = 15 and 8 + □ = 15.

?	**7**
15	

Identify the correct symbol (= , ≠, < and >) to make numerical expressions true.

Use the inverse relationship between addition and subtraction to solve calculations.

Use the vocabulary 'equal', 'not equal', 'greater than', 'less than' when discussing number relationships.

Use the correct symbol (= , ≠, < and >) to make number relationships.

Understand that < and > means 'greater than' and 'less than'.

Use equivalent numerical expressions involving addition *or* subtraction to find unknown quantities *.e.g. 15 + 7 = 14 + ? or 12 – 6 = 15 - ?*

Can explain why the order of the numbers is irrelevant to the answer when adding two numbers. *e.g. 4 + 3 = 3 + 4.*

When adding three or more numbers, can explain why the order of calculation results in the same answer. *e.g. 3 + 1 + 5 = 4 + 5 = 9 and 5 + 1 + 3 = 6 + 3 = 9.*

Understand that ≠ means 'not equal to' or 'not the same as'.

Understand that '=' means 'equal' or 'the same as'.

Create a function machine to explore numerical relationships.

First Level Overview

** The numeracy learner statements that are the responsibility of all are shown in italics.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Estimation and Rounding Pg 31	*I can share ideas with others to develop ways of estimating the answer to a calculation or problem, work out the actual answer, and then check my solution by comparing it with the estimate.* *MNU 1-01a*	• *Uses strategies to estimate an answer to a calculation or problem, for example, doubling and rounding.* • *Rounds whole numbers to the nearest 10 and 100 and uses this routinely to estimate and check the reasonableness of a solution.*
Number Word Sequences Pg 32	*I have investigated how whole numbers are constructed, can understand the importance of zero within the system and can use my knowledge to explain the link between a digit its place and its value.* *MNU 1-02a*	• *Reads, writes, orders and recites whole numbers to 1000, starting from any number in the sequence.*
Counting Pg 33		• *Counts forwards and backwards in 2s, 5s, 10s and 100s.*
Structure of Number Pg 34		• *Identifies the value of each digit in a whole number with three digits, for example, 867 = 800 + 60 + 7.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Place Value Pg's 35 & 36		• *Demonstrates understanding of zero as a placeholder in whole numbers to 1000.* • *Identifies the value of each digit in a whole number with three digits, for example, 867 = 800 + 60 + 7.* • *Adds and subtracts multiples of 10 or 100 to or from any whole number to 1000.* • *Multiplies and divides whole numbers by 10 and 100 (whole number answers only).*
Calculating (Addition and Subtraction) Pg 37	*I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed.* *MNU 1-03a*	• *Demonstrates understanding of the commutative law, for example,* • *6 + 3 = 3 + 6 or 2 × 4 = 4 × 2.* • *Solves addition and subtraction problems with three digit whole numbers.* • *Applies knowledge of inverse operations (addition and subtraction; multiplication and division).* • *Uses correct mathematical vocabulary when discussing the four operations including, subtract, add, sum of, total, multiply, product, divide and shared equally.* • *Solves two step problems.*
Calculating (Multiplication and Division) Pg's 38 & 39	*I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed.* *MNU 1-03a*	• *Applies strategies to determine multiplication facts, for example, repeated addition, grouping, arrays and multiplication facts.* • *Applies knowledge of inverse operations (addition and subtraction; multiplication and division).* • *Demonstrates understanding of the commutative law, for example,* • *6 + 3 = 3 + 6 or 2 × 4 = 4 × 2.* • *Applies strategies to determine division facts, for example, repeated subtraction, equal groups, sharing equally, arrays and multiplication facts.* • *Uses multiplication and division facts to solve problems within the number range 0 to 1000.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Calculating (Multiplication and Division – cont'd) Pg's 38 & 39		• ***Multiplies and divides whole numbers by 10 and 100 (whole number answers only).*** • ***Solves two step problems.*** • ***Uses correct mathematical vocabulary when discussing the four operations including, subtract, add, sum of, total, multiply, product, divide and shared equally.***
Fractions Pg 40	***Having explored fractions by taking part in practical activities, I can show my understanding of:*** ***•how a single item can be shared equally*** ***•the notation and vocabulary associated with fractions*** ***•where simple fractions lie on the number line.*** ***MNU 1-07a*** ***Through exploring how groups of items can be shared equally, I can find a fraction of an amount by applying my knowledge of division.*** ***MNU 1-07b*** Through taking part in practical activities including use of pictorial representations, I can demonstrate my understanding of simple fractions which are equivalent. **MTH 1-07c**	• ***Explains what a fraction is using concrete materials, pictorial representations and appropriate mathematical vocabulary.*** • ***Demonstrates understanding that the greater the number of equal parts, the smaller the size of each share.*** • ***Uses the correct notation for common fractions to tenths, for example, $\frac{1}{2}$, $\frac{2}{3}$ and $\frac{5}{8}$.*** • ***Compares the size of fractions and places simple fractions in order on a number line.*** • Uses pictorial representations and other models to demonstrate understanding of simple equivalent fractions, for example, $\frac{1}{2} = \frac{2}{4} = \frac{3}{6}$. • ***Explains the role of the numerator and denominator.*** • ***Uses known multiplication and division facts and other strategies to find unit fractions of whole numbers, for example, $\frac{1}{2}$ or $\frac{1}{4}$.***

Key Aspect	Experiences and Outcomes	National Benchmarks
Money Pg 41	*I can use money to pay for items and can work out how much change I should receive.* *MNU 1-09a* *I have investigated how different combinations of coins and notes can be used to pay for goods or be given in change.* *MNU 1-09b*	• *Identifies and uses all coins and notes to £20 and explores different ways of making the same total.* • *Records amounts accurately in different ways using the correct notation, for example, 149p = £1·49 and 7p = £0·07.* • *Uses a variety of coin and note combinations, to pay for items and give change within £10.* • *Applies mental agility number skills to calculate the total spent in a shopping situation and is able to calculate change.* • *Demonstrates awareness of how goods can be paid for using cards and digital technology.*
Time Pg 42	*I can tell the time using 12 hour clocks, realising there is a link with 24 hour notation, explain how it impacts on my daily routine and ensure that I am organised and ready for events throughout my day.* *MNU 1-10a*	• *Tells the time using half past, quarter past and quarter to using analogue and digital 12 hour clocks.* • *Records 12 hour times using am and pm and is able to identify 24 hour notation, for example, on a mobile phone or computer.* • *Records the date in a variety of ways, using words and numbers.* • *Uses and interprets a variety of calendars and 12 hour timetables to plan key events.* • *Knows the number of seconds in a minute, minutes in an hour, hours in a day, days in each month, weeks and days in a year.* • *Orders the months of the year and relates these to the appropriate seasons.* • *Selects and uses appropriate timers for specific purposes.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Time (continued) Pg 42	*I can use a calendar to plan and be organised for key events for myself and my class throughout the year.* *MNU 1-10b* *I have begun to develop a sense of how long tasks take by measuring the time taken to complete a range of activities using a variety of timers.* *MNU 1-10c*	
Measurement Pg 43 & 44	*I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units.* *MNU 1-11a* *I can estimate the area of a shape by counting squares or other methods.* *MNU 1-11b*	• *Uses knowledge of everyday objects to provide reasonable estimates of length, height, mass and capacity.* • *Makes accurate use of a range of instruments including rulers, metre sticks, digital scales and measuring jugs when measuring lengths, heights, mass and capacities using the most appropriate instrument for the task.* • *Records measurements of length, height, mass and capacity to the nearest standard unit, for example, millimetres (mm), centimetres (cm), grams (g), kilograms (kg), millilitres (ml), litres (l).* • *Compares measures with estimates.* • *Uses knowledge of relationships between units of measure to make simple conversions, for example, 1 m 58 cm = 158 cm.* • *Reads a variety of scales on measuring devices including those with simple fractions, for example, litre.* • *Uses square grids to estimate then measure the areas of a variety of*

Key Aspect	Experiences and Outcomes	National Benchmarks
		simple 2D shapes to the nearest half square. • ***Creates shapes with a given area to the nearest half square using square tiles or grids.*** • ***Recognises that different shapes can have the same area (conservation of area).***
Mathematics – its impact on the world, past, present and future Pg 45	I have discussed the important part that numbers play in the world and explored a variety of systems that have been used by civilisations throughout history to record numbers. **MTH 1-12a**	• Investigates and shares understanding of the importance of numbers in learning, life and work. • Investigates and shares understanding of a variety of number systems used throughout history.
Patterns and Relationships Pg 46	I can continue and devise more involved repeating patterns or designs, using a variety of media. **MTH 1-13a** Through exploring number patterns, I can recognise and continue simple number sequences and can explain the rule I have applied. **MTH 1-13b**	• Counts forwards and backwards in 2s, 5s and 10s from any whole number up to 1000. • Describes patterns in number, for example, in the multiplication tables and hundred square. • Continues and creates repeating patterns involving shapes, pictures and symbols. • Describes, continues and creates number patterns using addition, subtraction, doubling, halving, counting in jumps (skip counting) and known multiples.

Key Aspect	Experiences and Outcomes	National Benchmarks
Expressions and Equations Pg 47	I can compare, describe and show number relationships, using appropriate vocabulary and the symbols for equals, not equal to, less than and greater than. **MTH 1-15a** When a picture or symbol is used to replace a number in a number statement, I can find its value using my knowledge of number facts and explain my thinking to others. **MTH 1-15b**	• Understands and accurately uses the terms 'equal to', 'not equal to', 'less than', • 'greater than', and the related symbols (=, ≠ , <, >) when comparing quantities. • Applies understanding of the equals sign as a balance, and knowledge of number facts, • to solve simple algebraic problems where a picture or symbol is used to represent a number, for example, □ + 17 = 30 and □ × 6 = 30.

Second Level Experiences and Outcomes

** The numeracy learner statements that are the responsibility of all are shown in bold italics.*

I can use my knowledge of rounding to routinely estimate the answer to a problem then, after calculating, decide if my answer is reasonable, sharing my solution with others.
MNU 2-01a Pg 63

I have extended the range of whole numbers I can work with and having explored how decimal fractions are constructed, can explain the link between a digit, its place and its value.
MNU 2-02a Pg's 64 & 65

Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.
MNU 2-03a Pg's 67-74

I have explored the contexts in which problems involving decimal fractions occur and can solve related problems using a variety of methods.
MNU 2-3b Pg 67-78

Having explored the need for rules for the order of operations in number calculations, I can apply them correctly when solving simple problems.
MTH 2-03c Pg's 64, 67-74

I can show my understanding of how the number line extends to include numbers less than zero and have investigated how these numbers occur and are used.
MNU 2-04a Pg 64

Having explored the patterns and relationships in multiplication and division, I can investigate and identify the multiples and factors of numbers.
MTH 2-05a Pg 75

I have investigated the everyday contexts in which simple fractions, percentages or decimal fractions are used and can carry out the necessary calculations to solve related problems.
MNU 2-07a Pg's 76-78

I can show the equivalent forms of simple fractions, decimal fractions and percentages and can choose my preferred form when solving a problem, explaining my choice of method.
MNU 2-07b Pg's 76-78

I have investigated how a set of equivalent fractions can be created, understanding the meaning of simplest form, and can apply my knowledge to compare and order the most commonly used fractions.
MTH 2-07c Pg's 76-78

I can manage money, compare costs from different retailers, and determine what I can afford to buy.
MNU 2-09a Pg 79

I understand the costs, benefits and risks of using bank cards to purchase goods or obtain cash and realise that budgeting is important.
MNU 2-09b Pg 79

Second Level Experiences and Outcomes

** The numeracy learner statements that are the responsibility of all are shown in bold italics.*

I can use the terms profit and loss in buying and selling activities and can make simple calculations for this.
MNU 2-09c Pg 79

I can use and interpret electronic and paper-based timetables and schedules to plan events and activities, and make time calculations as part of my planning.
MNU 2-10a Pg 80

I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use.
MNU 2-10b Pg 80

Using simple time periods, I can give a good estimate of how long a journey should take, based on my knowledge of the link between time, speed and distance.
MNU 2-10c Pg 80

I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure.
MNU 2-11a Pg's 81 & 82

I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems.
MNU 2-11b Pg's 81 & 82

I can explain how different methods can be used to find the perimeter and area of a simple 2D shape or volume of a simple 3D object.
MNU 2-11c Pg's 81 & 82

I have worked with others to explore and present our findings on how mathematics impacts on the world and the important part it has played on advances and inventions.
MTH 2-12a Pg 83

Having explored more complex number sequences, including well-known named number patterns, I can explain the rule used to generate the sequence, and apply it to extend the pattern.
MTH 2-13a Pg 84

I can apply my knowledge of number facts to solve problems where an unknown value is represented by a symbol or letter.
MTH 2-15a Pg 85

Points to Consider

- Within this level, most children will understand and use the **cyclical pattern** in whole numbers and so can read the number below.

Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones	Hundreds	Tens	Ones
Thousands			Thousands			Thousands			Thousands		

4 0 2 7 3 4 6 4 2 7

4 027 346 427

- To find the quantity that a digit represents, the value of the digit is multiplied by the value of the place e.g. in 3264 the 3 represents 3 x 1000, 2 represents 200 because it is 2 x 100, the 6 represents 6 x 10 and the 4 represents 4 x 1. This is an important feature of place value at Second Level because children need to recognise the **relative magnitude of numbers** i.e. that 5730 is ten times as much as 537.

- There is a constant multiplicative relationship between the places, with the values of the positions increasing in powers of ten, from right to left hence the **decimal** system.

- It is important that pupils understand that the maximum number in any place is 9 and that this also applies to decimal places.

- Children need to have experience of a variety of activities that help develop the idea that there are numbers between consecutive whole numbers e.g. between 3 and 4 there are nine numbers in the tenths range – 3.1, 3.2, 3.3……3.9

- Children need to thoroughly understand fractions **and** place value before they can make links to decimal fractions. Pupils need to understand that fractions arise from division of whole numbers and that decimal fractions are special cases of fractions as their denominators are always a power of ten.

- As an introduction to **notation of decimals** the following definition should be used. 'The digit to the immediate right of the decimal point is in the tenths column' and 'The digit that is two places to the right of the decimal point is in the hundredths column' etc.

- It is **strongly recommended** that decimals are <u>initially</u> introduced by saying how many tenths there are e.g. 2.8 should be read as 'two and eight tenths', not 2 point 8.

- However, having established an understanding of place value within decimals, pupils should be able to demonstrate knowledge that decimal numbers are said differently to whole numbers. Pupils should say and read any decimal number e.g. for 347.37 say '347 point three seven' but should know, through discussion, that 347.37 is equivalent to $347\frac{37}{100}$ and written as a mixed number, it is 347 and 37 hundredths.

- Children sometimes confuse a decimal point and think of it as separating two whole numbers. This is a very common misconception; possibly because of the early introduction of money notation and that the point separates pounds and pence.

- Children should understand that **decimal fractions arise out of division** and that when any unit needs to be broken up it needs to be divided into ten equal parts. (It is useful to use visuals where the unit that can be broken into ten equal pieces is wrapped as a whole).

- The digits to the right of the ones column have decreasing values in powers of ten with the first place representing tenths, the second hundredths, and so on, and can represent infinitely small numbers.

- During this level children will need to be given ample opportunity to **solve problems and develop a wide range of strategies** to support the necessary mental calculations needed to solve them. Children must be able to discuss the strategies they have used to solve problems.

- When setting problems, set them out in a **horizontal form**. This will encourage a more flexible response. One drawback to textbook questions is that they are often set out in vertical form and this encourages children to follow a more procedural approach rather than an intuitive one.

- **Writing number stories** and representing what a story will look like using diagrams and number sentences is very important for children to be able to contextualise the numbers. This is just as relevant at Second Level as it is in Early and First Levels.

- When asking children to **write their own stories**, it is useful to reduce the level of difficulty in a question so pupils can concentrate on the language that needs to be included in the story to match the number sentence that is written. For example, 13 x 6 =? and '208 people went to a football match and sat in the first 6 rows, how many people were in each row?' do not match. The number sentence should be 208 ÷ 6 =

- It is very important that children **estimate answers** before attempting to solve a problem by calculating. They should then use their estimate to assess if their final result was reasonable.

- Some children will find it difficult to use the **inverse relationship** between addition and subtraction to choose the more efficient strategy between counting on or counting back for solving particular problems. They need to be able to re-interpret 47 – 26 as, 'what do you have to add to 26 to get to 47' and so count by tens and ones.

- Another useful strategy is to change them by adding or subtracting an amount to make the numbers more manageable. This '**transformation' strategy** (or 'Same Difference' strategy for subtraction) works as long as you:
    - add/subtract the same amount to both sides for a subtraction
    - add to one side and take exactly the same amount off the other side for an addition.

- We know that children have to go through many counting experiences before they **trust** that the order in which they **count** does not affect the final amount and so learn that starting at the largest number is the most efficient. The same idea underpins why facts for subtraction, multiplication and division can be relied upon. If offered a variety of rich experiences to construct number problems using concrete materials they will begin to trust the associations between the four operations.

- This trust enables children to recall a **'related facts'** from just one calculation. For example, if they have worked out that 18 x 6 is (10 x 6) + (8 x 6) = 60 + 48 = 108, then they will also know that 6 x 18 = 108 108 ÷ 18 =6 and 108 ÷ 6= 18.

- A **prime number** can only be divided by one and itself i.e, has two factors. One is not a prime number because it has only one factor i.e. itself. **Prime numbers are formally introduced at Third Level.**

- For children to understand negative numbers they need to understand that there are a set of whole numbers called integers. The set of integers consists of the 'Natural Numbers' {0, 1, 2, 3 …} and their non-zero negatives (-1, -2, -3 …). Zero is an integer, 2.6 and $8\frac{1}{2}$ are not.

- Children will need to record their calculations using a range of symbols and numbers. They will also use a wide range of jottings including empty number lines and arrow notation to show jump strategies and drop down notation for split strategies. Definitions of the seven most common strategies are given below:

1. ***Jump to the next decade***
   Begin from one number, jump to the nearest decade, jump tens, and then jump the remaining ones.

2. ***Jump***
   Begin from one number, jump tens then jump ones (or ones and tens).

3. ***Split***
   Split tens and ones, add/subtract them separately, and then recombine.

4. ***Split Jump***
   Split tens and ones, add/subtract tens first, then add first lot of ones and then second ones. E.g. 48 + 94 = 90 + 40 → 130 →138 → 142

5. ***Over jump***
   Begin from one number, overshoot the jump, and then compensate

6. ***Compensation***
   Change one or both numbers, add/subtract, and then compensate.

7. ***Transformation***
   Change both numbers while preserving the result, and then add/subtract.

- **The aim at this level is for children to have a flexible approach to the use of different strategies and be able to consider the efficiency. Written strategies should be used when the numbers get too big to calculate mentally but at all times, children should be able to explain their thinking.**

- As children become fluent with empty number line notation and split notation, more formal arrow notation can be used. It is more compact and moves closer to more conventional notations, such as the semi-formal column sum and the standard written algorithm. These need to be used with more precision especially when considering the meaning of the equals sign.
  Eg. We can write 37 + 25 → 37 + 20 → 57 + 5 → 62
  But not 37 + 25 = 37 + 20 = 57 + 5 = 62

- Working with equations such as 4 x 5 = 10 + 6 + 4 helps develop the understanding that the same quantity is shown on both sides of the equals sign, rather than one side showing an instruction for an operation and the other the answer.

- It would be useful if teachers were to show pupils that 'balance' is preserved provided we carry out the same operation to both sides of the equation. This then paves the way for a more formal treatment of equation solving when pupils move into Third Level.

<u>Informal Jottings</u>

- Children should be encouraged to record jottings. This is where a mental strategy has been used but some initial calculations are jotted down to avoid having to remember them. Keeping track of all the necessary parts allows space in the brain to apply to solving the problem.

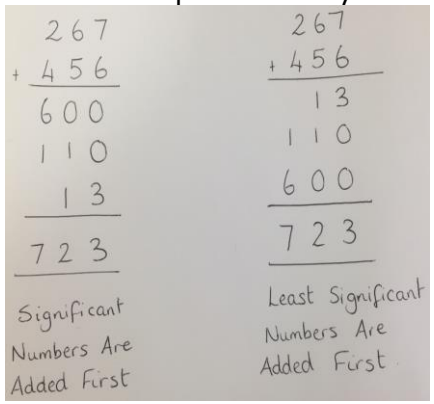
- Problems should be chosen which help children to apply combinations of mental strategies and which link with other areas of mathematics e.g. *John has dug up his old lawn and wants to reseed it. His lawn is rectangular and measures 11.7 metres by 4.8 metres. He needs 70 grams of grass seed for every square metre of lawn. Grass seed is sold in 1 kg boxes. How many boxes should John buy?*

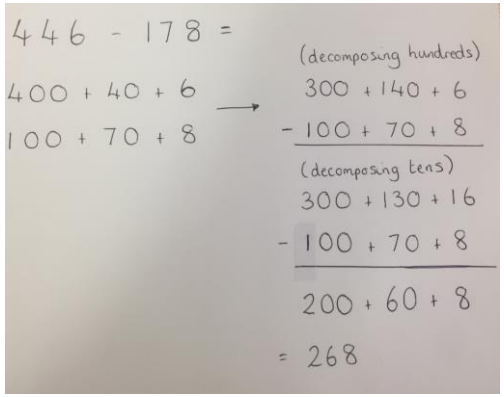
Suggested Written Recording

Written strategies should be used when the numbers get too big to calculate mentally i.e. when numbers have more than 3-digits.

Semi-formal Strategies for Addition and Subtraction

- These are well-organised, standardised, written strategies. This strategy requires reasoning with whole numbers. For example, the pupil calculates 500 + 200 = 700, not 5 + 2 = 7. They are generally set out in columns and still involve children doing multi-digit calculations mentally, but the writing systematically records intermediate results, and keeps them organised. It is essentially a split method where the hundreds, tens and ones part of each number are added separately, and then these sub-totals are added. The writing helps to keep track of the calculations, while actually adding the numbers together remains a mental task. It is not crucial where the subtotals are placed as they are added together as whole numbers.





This practice with decomposition supports the 'contracted form' to the right.

Formal Algorithms for Calculations

- **Formal algorithms should ideally be introduced once children have a clear understanding of place values within calculations through using a 'nested view' of numbers i.e. understand that 'nested' within thousands are hundreds, tens and ones.**

For example, how many tens are there in 347? If a child recognises that there are 34 tens or 2 hundreds and 14 tens then they can tackle the problem through use of a formal algorithm. If they do not understand this core concept, they should not be using a column layout.

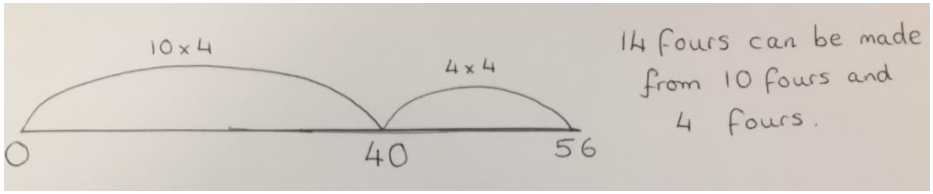
Formal algorithms are probably the most familiar written computational methods. They are sometimes referred to as standard or traditional algorithms. Algorithm means a step-by-step procedure for computing a standard task. In the formal algorithms, mental calculations mainly involve 1-digit numbers. Using this method requires pupils to follow a precise procedure, working from right to left, and so on. It also involves a precise layout of the writing, aligning the digits in columns.

Suggested Written Recording

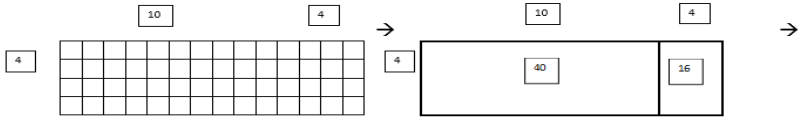
Semi-formal Strategies for Multiplication

These are well- organised, standardised written strategies.

Children can begin to use the '**empty number lines**' efficiently by making bigger jumps.



Or use the **grid method** (provide children with opportunities to create arrays for two-digit x one-digit multiplication as this leads them into recording the 'grid method' effectively). E.g. 14 x 4 =



=

X	10	4
4	40	16

= 56

e.g. 134 x 4

	100	30	4	
4	400	120	16	= 400 + 120 + 16 = 536

Semi-formal Strategies for Division

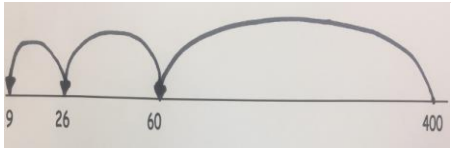
Chunking - pupil repeatedly takes away 'chunks' of the large number, where each 'chunk' is a known multiple of the divisor, until the large number has been reduced to zero or the remainder is less than the divisor. At the same time the pupil keeps track of the total amount of 'chunks' subtracted, which eventually becomes the final result of the sum.

132 ÷ 6 =

	132
We know 6 x 10 = 60	72
We know 6 x 10 = 60	12
We know 6 x 2 = 12	0

132 ÷ 6 = 22

Ensure pupils have a clear layout and that they understand the process for chunking by first dividing a single-digit number before moving into dividing by a two-digit number.



17 400	
340	17 x 20 = 340
60	
51	17 x 3 = 51
9	

Suggested Written Recording

Order of Operations

1. Where a calculation contains only addition and subtraction, the operations should be carried out in the order they appear.
2. Where a calculation contains only multiplication and division, the operations should be carried out in the order they appear.
3. Where a calculation contains a combination of the 4 operations, multiplication and division take priority over addition and subtraction.

Pupils should also set out their working correctly. When a calculation requires more than one operation, there are rules for ensuring that the operations are done in the correct order.

Example 1 $8+5-2-4+1$

This calculation contains only addition and subtraction. In this case, the operations are carried out in the order they appear:

$= 8+5-2-4+1$

$= 13-2-4+1$

$= 11-4+1$

$= 7+1$

$= 8$

Example 2 $4\times9\div3\times5$

This calculation contains only multiplication and division. In this case, the operations are carried out in the order they appear:

$= 4\times9\div3\times5$

$= 36\div3\times5$

$= 12\times5 = 60$

Example 3 $25-3\times4$

In a calculation containing a mixture of the 4 operations the rule is that multiplication and division should be carried out before addition and subtraction.

$= 25-3\times4$ (× is done before – even though the subtraction appears first)

$= 25-12$

$= 13$

Example 4 (Problem solving)

Which operations should go in the boxes to make the equation true?

24 ☐ 3 ☐ 4 ☐ 2 = 0

Example 5 (Problem solving)

How many ways can you find to make the number 42? Each calculation should contain at least one multiplication/division and one addition/subtraction.

ESTIMATION AND ROUNDING AIM: Use rounding to estimate sum, difference, product and quotient in real life situations including decimal fractions and fractions. Check reasonableness and share solutions with others.

MNU 2-01a

Round numbers to allow for an approximate answer, appropriate to a context, including decimals. ***e.g. If the length of park is 56.36m and the width is 37.79m, approximately what is the perimeter?***

Round numbers having up to two decimal places to the nearest hundredth, tenth or whole number.
e.g. 5.471 rounded to nearest hundredth - 5.47
nearest whole - 5
e.g. 6.786 rounded to nearest hundredth - 6.79
nearest tenth – 6.8

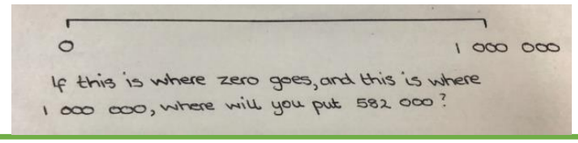
Given two numbers in the range 0-1 000 000 identify the number which is halfway between them.
e.g. an interval of 400 000 (what's halfway between 225 000 and 625 000?)
e.g. an interval of 30 000 (what's halfway between 130 600 and 160 600?
e.g. an interval of 1 500 (what's halfway between 7 500 and 9 000
e.g. an interval of 120 (what's halfway between 84 560 and 84 680
e.g. an interval of 1.6 (what's halfway between 2 and 3.6?)

Round numbers to allow for an approximate answer, appropriate to a context, including fractions.

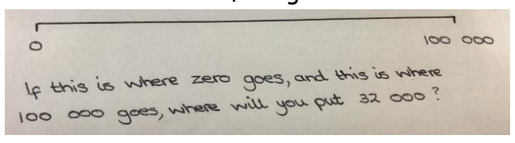
e.g. If I have 7/8 and 9/10, roughly how much do I have?

a) 1 b) 2 c)16 d)18

Place whole numbers up to 1 000 000 on a scaled number line, using varied intervals:



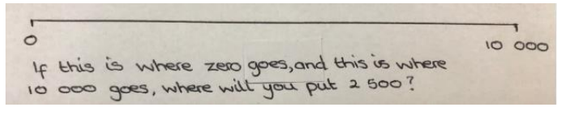
Place whole numbers up to 100 000 on a scaled number line, using varied intervals:



Round numbers having two decimal places to the nearest whole number.
e.g. round 3.48 to 3,
16.83 to 17

Round numbers having one decimal place to the nearest whole number.
e.g. round 3.6 to 4
17.2 to 17

Place whole numbers up to 10 000 on a scaled number line, using varied intervals:



Given two numbers in the range 0-100 000 identify the number which is halfway between them.
e.g. an interval of 60 000 (what's halfway between 20 000 & 80 000?)
e.g. an interval of 8 000 (what's halfway between 7 246 and 15 246
e.g. an interval of 1 500 (what's halfway between 7 500 and 9 000
e.g. an interval of 120 (what's halfway between

84 560 and 84 680?)

Explore the connection between rounding and accuracy.
e.g. rounding to tenths gives a more accurate answer than rounding to the nearest ten.

Round whole numbers to the nearest 10, 100, 1 000, 10 000 or 100 000.
e.g. 4 790 to 5 000
28 399 to 28 000

Explore situations which require rounding up.

e.g. If 12 friends order a taxi to take them to the cinema and a taxi can seat 5, how many do they need?

Round numbers to allow for an approximate answer.

e.g. If I earn £37 per day, roughly how much money will I have after 4 days' work?

Given two numbers in the range 0-10 000 identify the number which is halfway between them.
e.g. an interval of 4 000 (what's halfway between 3 000 & 7 000?)
e.g. an interval of 50 (what's halfway between 250 & 300?)
e.g. an interval of 20 (what's halfway between 4 520 & 4 540?)

NUMBER WORD SEQUENCES AIM: Understand the cyclical pattern of the number system to count, read, write, compare and order integers and decimal fractions.

MNU 2-02a, MNU 2-04a, MTH 2-03a

Confidently identify and represent whole numbers to a million and beyond using numerals, words and number lines.

Count forwards and backwards in steps of 1s, 10s, 100s, 1000s, 10 000s and decimal fraction parts simultaneously from different starting points. *e.g. 1 500, 2 500, 3 500, 3 600, 3 700, 3 800, 3 900, 4 000, 4 001, 4 002*

Count in decimal amounts to three decimal places forwards and backwards from any given number, understanding the value of each digit.
e.g. 2.345, 2.346, 2.347, 2.348…
87.234, 87.233, 87.232, 87.231…

Count number word sequences forwards and backwards in steps in ten thousand and one hundred thousand to a million.
e.g.
- *340 000, 350 000, 360 000 and 750 000, 740 000…*
- *800 000, 900 000, 1 000 000 and 2 600 000, 2 500 000, 2 400 000*

Count in decimal amounts to two decimal places forwards and backwards from any given number, understanding the value of each digit.
e.g. 2.34, 2.33, 2.32, 2.31… 19.21, 19.20, 19.19, 19.18…

Confidently read, write, order and say whole numbers in the range of a million and beyond (leaving a space between each cycle of three digits from right to left)

e.g. 2 109 850

Say the number word that is 0.001 before and after a number in the decimal (3 places) pattern, understanding the value of each digit.

Locate and order numbers less than zero, integers, fractions and decimal fractions.

Identify and represent whole numbers up to hundred thousand using numerals, words and number lines.

Understand decimals as numbers rather than as ways of representing money and measures.

Say the number word that is 0.01 before and after a number in the decimal (2 places) pattern, understanding the value of each digit.
e.g. What's after 3.56?
Answer = 3.57

Say the number word that is 0.1 before and after a number in the decimal (tenths) pattern, understanding the value of each digit.
e.g. What's after 2.6?
Answer = 2.7

Count number word sequences forward and backwards in steps of 100 000, 50 000, 10 000, 5 000, 1 000, 500, 100, 50, 20 and 10 *e.g.*
- *1s – 3 456, 3 457, 3 458 and 6 002, 6 001, 6 000…*
- *10s – 3 380, 3 390, 3 400 3 410 and 6 220 6 210, 6 200…*
- *100s – 4 800, 4 900, 5 000 and 3 060, 2 960, 2 860, 2 760…*
- *1000s – 8 000, 9 000, 10 000 and 32 000, 31 000, 30 000*

Confidently say the number word just before and after a 4, 5 and 6 digit number in the range of 0-1 000 000.

Count in decimal amounts to one decimal place, forwards and backwards from any given number understanding the value of each digit.
e.g. 2.3, 2.4, 2.5… 8.7, 8.6, 8.5, 8.4…

Say the number word just before and after a 4, 5 and 6 digit number in the range of 0-100 000.

Read, write and say whole numbers in the range of hundred thousand and beyond (leaving a space between each cycle of three digits from right to left) *e.g. 21 850*

Identify and represent whole numbers up to ten thousand and beyond using numerals, words and number lines.

Read, write and say whole numbers beyond ten thousand (leaving a space between each cycle of three digits from right to left). *e.g. 9 885*

Confidently sequence numerals up to and beyond 100 000 *e.g.*
- *456 000, 556 000, 656 000, 756 000*
- *832 000, 732 000, 632 000, 532 000*

Count number word sequences forward and backwards in steps of 1000, 500, 100, 50, 20, 10 and 1 from different starting points within 10 000 *e.g.*
- *6 000, 5 000, 4 000, 3 000, 2 000…*
- *2 300, 3 300, 4 300, 5 300, 6 300…*
- *1 500, 2 000, 2 500, 3 000, 3 500…*
- *3 020, 3 040, 3 060, 3 080…..*
- *3 456, 3 476, 3 496…*

and backwards.

Say the number word just before and after a 2, 3 and 4 digit number in the range of 0-10,000 and be confident when crossing into the next century/thousand. *e.g. 2 400, 2 399, 2 398, or next four numbers after 7 998, 7 999, 8 000, 8 001 4 001, 4 000, 3 999, 3 998*

Fluently use the convention for reading, writing and saying ordinal numbers beyond 1000, *e.g. 'In 2013 it was the 1 170th anniversary of Kenneth MacAlpine uniting the Scots and Picts as one nation'.*

Use the convention for reading, writing and saying ordinal numbers beyond 100. *e.g. 'It was the 250th anniversary of Robert Burns' birthday in the year 2009.'*

Sequence numerals up to and beyond 10,000 *e.g.*
- *20 000, 30 000, 40 000, 50 000*
- *87 000, 77 000, 67 000, 57 000*

Link number word sequences for skip counting to times table facts.

PLACE VALUE AIM: Demonstrate an understanding of the multiplicative relationship in the base 10 number system by explaining the link between a digit, its place and value including decimal fractions and whole numbers to 1 000 000. Order ragged decimals up to three decimal places.

MNU 2-02a

Sequence decimal numbers up to three decimal places. *e.g. understand that a book coded 360.341 under the Dewey system will come before a book coded 360.56*

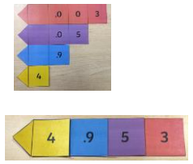
Use place value to order larger whole numbers in ascending or descending order up to and beyond 1 000 000

e.g. 25 296 is bigger than 24 987 because there is a 5 in the thousands place rather than a 4. **765 296 is bigger than 754 998 because there is a 6 in the ten thousands place rather than a 5.**

Identify and represent decimal numbers up to three decimal places using numerals and words, understanding the value of each digit.

Recognise the three places to the right of the decimal point are tenths, hundredths and thousandths and can be partitioned

e.g.4 .953 as $4+\frac{9}{10}+\frac{5}{100}+\frac{3}{1000}$



Recognise and represent exact partitions of numbers up to 1 000 000 and beyond, including decimals and record in a standard and non-standard place value including expanded notations.

STANDARD PLACE VALUE

4 753 = 4 thousands, 7 hundreds, 5 tens and 3 ones or 47 hundreds and 53 ones or 475 tens and 3 ones.

NON-STANDARD PLACE VALUE

4 753 = 46 hundreds, 14 tens and 13 ones for example

EXPANDED NOTATION

4753 = 4000 + 700 + 50 + 3

Convert a number up to one million into groups of 10, 100 and 1 000.

e.g. There are 367 889 tens in 3 678 890,
There are 8 459 hundreds in 845 956
There are 567 thousands in 567 923

Identify and represent decimal numbers up to two decimal place using numerals, words and pictures, understanding the value of each digit e.g.

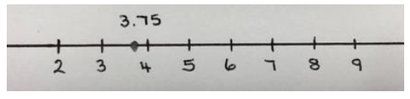
2.55 or two ones and 55 hundredths or 2 ones 5 tenths and 5 hundredths. Say two point five five.

Recognise the two places to the right of the decimal point as tenths and hundredths and understand they can be partitioned.

e.g. 1.46 as $1+\frac{4}{10}+\frac{6}{100}$

Confidently read, write and say decimal numbers to three decimal places. *e.g. 4.953 is '4 ones, 9 tenths 5 hundredths and 6 thousandths' or 4 ones and 956 thousandths' etc. and is read as 'four point nine, five, three'.*

Locate decimal numbers to 2 places on a scaled number line, using hundredths.



Sequence decimal numbers up to two decimal places. *e.g.*

11.97	11.9
9.9	9.79

Confidently read, write and say decimal numbers to two decimal places. *e.g. 1.46 is 'one and 4 tenths and 6 hundredths' or 'one and 46 hundredths' and is read as ' one point four, six'*

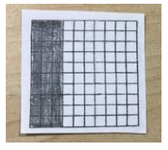
Convert a number in the thousands and ten thousands into groups of 10, 100 and 1,000 and know that there may be a remainder.

Convert hundreds and thousands into groups of 10, 100 and 1 000.

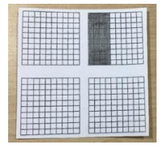
e.g. 2 000 is 20 hundred and/or 200 tens
1 600 is 16 hundred and/or 160 tens

How many tens are there in 258? 25 tens and 8 ones.

Identify and represent decimal numbers up to one decimal place using numerals, words and pictures, understanding the value of each digit. *e.g.*



0.3



3.4 is three point four

Or

3 tenths

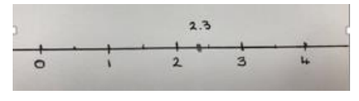
3 ones and four tenths

Understand the significance of zero as a place holder in decimal fractions.

Recognise the place to the right of the decimal point as tenths and understand they can be partitioned. *e.g. 3.8 as* $3+\frac{8}{10}$

Sequence decimal numbers to one decimal place.

Locate decimal numbers to 1 place on a scaled number line, using tenths.



Confidently read, write and say decimal numbers to one decimal place, *e.g. 3.8 is 'three ones and 8 tenths' and is read as 'three point eight'.*

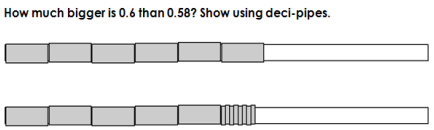
Use a graphic organiser to read and write any whole number up to a million.

Use place value to compare and order numbers beyond 10 000.

Model numbers to tens of thousands or beyond using the base 10 place value system.

THE NEXT DOMAIN NEEDS TO BE ORGANISED IN A DIFFERENT WAY BECAUSE THE INTRODUCTION, DEVELOPMENT AND PERFECTION OF THE STRATEGIES INCLUDED WILL NEED AT LEAST TWO/THREE YEARS FOR MOST SECOND LEVEL PUPILS TO FULLY MASTER. It is advised that the strategies in the Calculating: Addition and Subtraction and Calculating: Multiplication and Division domains are built up in more of a **linear progression**. Once the learner has proved competent in using a particular strategy, they may then move on to learning a new strategy. To be completely proficient with a strategy means that they have moved from understanding how the strategy works whilst using concrete materials to then being just as competent when visualising the materials or using pictorial clues. They then must make the important conceptual leap to being able to successfully answer problems given in the abstract form. This will involve using the strategies learned but applying these to numbers larger than they could possibly image in their heads.

The grey boxes along the bottom of the pyramids should be continued all the way through each pyramid and are a reminder how strategies can be introduced/developed.

New strategies introduced by using • **concrete** materials • **visualising** screening materials or using pictorial clues • **abstract** problems – *e.g. 862 + 25* The strategies will then be practiced and refined gradually, becoming confident with one strategy before moving on, until children slowly build up a wide range of useful approaches to solving problems. **PLEASE LOOK CAREFULLY AT THIS DOMAIN IN FIRST LEVEL!** A child will be unable to proceed successfully if First Level learning intentions are not fully understood and deeply embedded.	Pupils will need to show they **can successfully apply their knowledge/strategies** to solve problems in **familiar and unfamiliar** situations. **FORMAL ALGORITHMS ARE INTRODUCED AT THIS STAGE – see 'Points to Consider – Part 1 and examples in 'Suggested Written Recording'** A **daily mix of calculations** in the form of equations and word problems should be given to the children and ample time should be ring-fenced to allow **rich discussion** about the most **efficient strategies** to use. It is also very important that the type of calculations selected by the teacher provide **plenty of opportunity** to **practice the range of strategies** that have been taught. **As children progress, they should chose the strategy that best fits the problem**; teachers should not give a set of problems and tell the children which strategy would be the most efficient!	**Constant revision and practice** will ensure that the knowledge and strategies are deeply embedded and fully understood. This rich number sense will help to ensure that children can make informed decisions and solve problems efficiently. Calculations involving decimals and fractions are introduced at this stage. Decipipes and dienes are excellent tools to support pupils with understanding what tenths and hundredths look like.  Children are beginning to use explore how to use multiplication to aid their addition and subtraction calculations ('distributive law') *e.g. 21 + 42 + 14 are all multiples of 7 and so this can be changed to (3 x 7) + (6 x 7) + (2 x 7) = 11 x 7 = 77.*

CALCULATING AIM (JUMP STRATEGY): Use a range of mental and written strategies to solve multi-step problems, that involve a combination of addition, subtraction, multiplication and division with whole numbers ensuring the correct order of operations.

MNU 2-03a, MNU 2-03b, MTH 2-03c

EFFICIENTLY SOLVE PROBLEMS

Choosing effective strategies is a skill that children will develop gradually.

Regular practice (daily) with a wide range of mental calculations will help support their ability to employ **efficient strategies** and make informed decisions that they can **confidently discuss** with others.

Children need to be provided with a **wide mix of problems** that should be presented as both **equations and word problems**.

USE FORMAL ALGORITHMS

Pupils should be taught how to use the **standard written form** to solve addition and subtraction calculations.

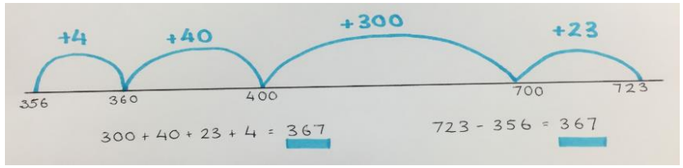
They should always mentally **estimate** the answer before using the written method.

(See 'Points to Consider')

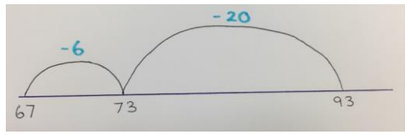
Add and subtract multiples of 10, 100 & 1 000 to and from whole numbers and decimal fractions with at least 3 decimal places.

Investigate negative numbers in real life contexts and explore the associated vocabulary. ***e.g. Temperature – below freezing***
Bank balances, debt – overdraft, bank loan
Height – above/below sea level
Sport – in golf, explore the idea of 'above' or 'below' par

Solve by understanding the 'Inverse Rule' i.e. use addition to solve a subtraction problem by 'turning the sum around'.
e.g. 356 + ? = 723 becomes 723 – 356 = 367

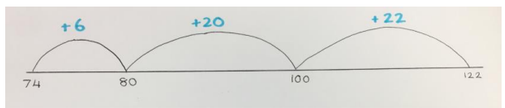


Solve addition and subtraction problems by using a jump strategy across the decade.



Solve addition and subtraction problems by using a jump strategy which bridges to ten/hundred.

e.g. 74 people on a train and 48 people get on at the next stop. How many people are now on the train?



Write number equations to match a given number sentence.

e.g. 24 – 13 = □

76 – □ = 35

97 = □ - 125

Write their own stories to accompany a given number sentence or one of their own, including multi-step problems.

Make connections between maths in school and everyday experiences.

e.g.

John has hired me to count his money. I counted £1 500 before stopping for coffee. After coffee I counted £5 more. John offered me £100 for the job or 10% of the money I had counted. Which choice will give me more money for my work?

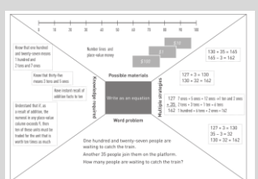
Solve problems that involve calculating ensuring start unknown, change unknown, result unknown:

Jamie has 150 fewer football cards than his cousin, Darren. If Darren has 378 how many does Jamie have?

Morag received some money for her birthday. When she added it to the £143 in her bank account she had £178. How much did she receive?

A double bed is 135 cm wide. Kiera's room is 3.5m wide. If she puts a bedside cabinet that is 45 cm wide beside the bed, how much space will be left?

Express understanding of a particular calculation using stories, symbols pictures and real life situations.



Use non-standard place value splits to mentally calculate.

e.g. 39 – 17 as 19 – 17 + 20

98 – 27 as 28– 27 + 70 = 71

Use a known fact to work out an unknown fact *e.g. Number bonds to 10: 40 + 70 → 40 + 60 = 100 so 40 + 70 is ten more = 110.*

Near doubles: e.g. 31 + 31 is double 3 tens add 2
69 + 69 is double 7 tens take 2 away

Use a known fact to work out an unknown fact *e.g. 142 + 144 is double 14 tens add 6 [280 + 6]*

CALCULATING AIM (SPLIT STRATEGY): Use a range of mental and written strategies to solve multi-step problems, that involve a combination of addition, subtraction, multiplication and division with whole numbers with whole numbers ensuring the correct order of operations.

MNU 2-03a, MNU 2-03b, MTH 2-03c

Investigate negative numbers in real life contexts and explore the associated vocabulary. e.g.

Temperature – below freezing

Bank balances, debt – overdraft, bank loan

Height – above/below sea level

EFFICIENTLY SOLVE PROBLEMS

Choosing effective strategies is a skill that children will develop gradually.

Regular practice (daily) with a wide range of mental calculations will help support their ability to employ **efficient strategies** and make informed decisions that they can **confidently discuss** with others.

Children need to be provided with a **wide mix of problems** that should be presented as both **equations and word problems**.

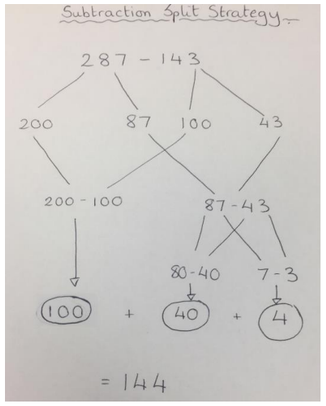
USE FORMAL ALGORITHMS

Pupils should be taught how to use the **standard written form** to solve addition and subtraction calculations.

They should always mentally **estimate** the answer before using the written method.

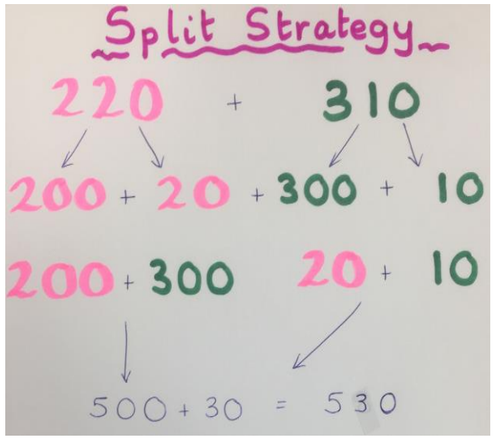
(See 'Points to Consider')

Solve subtraction problems by using a place value strategy (split strategy)



Solve addition problems by using a place value strategy (split strategy).

Partition the numbers in ones, tens and hundreds columns and then add/subtract them together and then recombine the columns to get the answer. *e.g. 220 + 310*



Write number equations to match a given number sentence.

e.g. 24 – 13 = □

76 – □ = 35

97 = □ - 125

Write their own stories to accompany a given number sentence or one of their own, including multi-step problems.

Make connections between maths in school and everyday experiences.

e.g.

John has hired me to count his money. I counted £1 500 before stopping for coffee. After coffee I counted £5 more. John offered me £100 for the job or 10% of the money I had counted. Which choice will give me more money for my work?

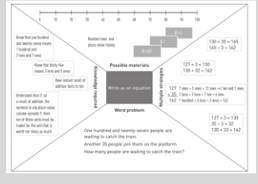
Solve problems that involve calculating ensuring start unknown, change unknown, result unknown:

Jamie has 150 fewer football cards than his cousin, Darren. If Darren has 378 how many does Jamie have?

Morag received some money for her birthday. When she added it to the £143 in her bank account she had £178. How much did she receive?

A double bed is 135 cm wide. Kiera's room is 3.5m wide. If she puts a bedside cabinet that is 45 cm wide beside the bed, how much space will be left?

Express understanding of a particular calculation using stories, symbols pictures and real life situations.



Use non-standard place value splits to mentally calculate. *e.g. 39 – 17 as 19 – 17 + 20*

98 – 27 as 28– 27 + 70 = 71

Use a known fact to work out an unknown fact *e.g. Number bonds to 10: 40 + 70 → 40 + 60 = 100 so 40 + 70 is ten more = 110.*

Near doubles: e.g. 31 + 31 is double 3 tens add 2
69 + 69 is double 7 tens take 2 away

Use a known fact to work out an unknown fact e.g. 142 + 144 is double 14 tens add 6 [280 + 6]

CALCULATING AIM (NUMBER STRATEGIES): Use a range of mental and written strategies to solve multi-step problems, that involve a combination of addition, subtraction, multiplication and division with whole numbers ensuring the correct order of operations.

MNU 2-03a, MNU 2-03b, MTH 2-03c

USE FORMAL ALGORITHMS

Pupils should be taught how to use the **standard written form** to solve addition and subtraction calculations.

They should always mentally **estimate** the answer before using the written method.

(See 'Points to Consider ')

EFFICIENTLY SOLVE PROBLEMS

Choosing effective strategies is a skill that children will develop gradually.

Regular practice (daily) with a wide range of mental calculations will help support their ability to employ **efficient strategies** and make informed decisions that they can **confidently discuss** with others.

Children need to be provided with a **wide mix of problems** that should be presented as both **equations and word problems**.

Investigate negative numbers in real life contexts and explore the associated vocabulary. *e.g.*

Temperature – below freezing

Bank balances, debt – overdraft, bank loan

Height – above/below sea level

Sport – in golf, explore the idea of 'above' or 'below' par

Use the commutative property to add numbers by making decade numbers up to 100 *e.g.*

16 + 8 + 4 = 20 + 8
16 + 9 + 4 + 8 + 1 = 20 + 10 + 8 = 38
24 + 7 + 6 = 24 + 6 + 7 = 30 + 7
14 + 16 + 45 = 30 + 45
60 + 20 + 40 = 60 + 40 + 20 = 100 + 20

Use multiplication to solve addition and subtraction problems where common factors can be found.

e.g. 36 + 45 = (4 x 9) + (5 x9) = 9 x 9 = 81 63 – 27 = (7 x 9) – (3 x 9) = 4 x 9 = 36

29 + 30 + 28 + 33 + 32 + 27 +31 + 30 = 8 x 30 = (8 x 3) x 10 = 24 x10 = 240

Solve addition and subtraction problems by using the 'Same Difference' Strategy (Transformation) Add - Take some from one number to give to the other *e.g.*

18 + 17 becomes 20 + 15 [by adding 2 to 18 and then subtracting 2 from 17]. 68 + 37 becomes 70 + 35 698 + 37 becomes 700 + 35 367 + 78 becomes 370 + 75 = 445

Subtract – change the numbers by adding or subtracting the same amount e.g.22 – 17 becomes 20 – 15 = 5 72 – 27 becomes 75 – 30 = 35

507 – 296 becomes 511 - 300 = 211

Start to use arrow notation to record thinking. 'Instead of 53 take 19, I did 54 take 20 ' $53 \xrightarrow{-19,\ +1} 54 \xrightarrow{-20} 34$

53 – 19 = 54 – 20 = 34

Pupils should explore the effect of carrying out operations on an existing equation, e.g. if they know (and write down) 20+15=35 then what is the effect of (say) doubling both sides? What happens if we add 5 to one side but not the other? What happens if we carry out different operations to both sides of the equation?

Solve addition and subtraction problems using a Rounding and Compensation strategy:

When one number is close to a multiple of ten. What is 39 + 66? Round 39 up to 40 and then add 66 = 106. Then subtract 1 to make 105

What is 51 – 35? Round 51 down to 50 and then subtract 35 = 15. Then add one more to make 16.

When one number is close to a multiple of ten or a hundred, What is £99 + £56? Round £99 up to £100 and then + £56 = £156. Then subtract £1 to make £155.

What is £568 - £99? Round £99 up to £100. Then subtract £100 from £568 to make £468. Then add £1 to make £469.

When one number is close to any multiple of ten. What is £39 + £516? Round £39 to £40 and then add £516 to give £556 Then subtract £1 to make £555, The answer is £555

What is £768 - £59? Round £59 to £60. Then subtract £60 from £768 to make £708. Then add £1 to make £709. The answer is £709

Write their own stories to accompany a given number sentence or one of their own, including multi-step problems.

Make connections between maths in school and everyday experiences.

e.g.

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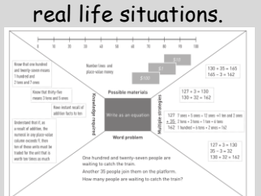
Use non-standard place value splits *to mentally calculate. e.g. 39 - 17 as 19 - 17 + 20*

98 – 27 as 28– 27 + 70 = 71

Express understanding of a particular calculation using stories, symbols pictures and real life situations.



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CALCULATING AIM (DECIMALS): Use a range of mental and written strategies to solve problems, that involve a combination of addition and subtraction of decimal fractions.

MNU 2-03a, MNU 2-03b, MTH 2-03c

Use the 'inverse rule' to add and subtract decimals to one decimal place.

e.g. 0.6 + ? = 1.7 so reverse it 1.7 – 0.6 =

What do I need to add to 0.6 to make 1.7?

USE FORMAL ALGORITHMS

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(See 'Points to Consider ')

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DECIMALS

Decimal addition and subtraction should be introduced when learners have a grasp of place value in relation to decimals and when strategies have been understood in the first place with whole numbers.

Use a split strategy to add and subtract decimals to one decimal place using non-standard place value partitions.

e.g. 4.3 – 1.7 → 4.3 converts to 3 + 13 tenths, so 3 + 13 tenths – 1 – 7 tenths 2 + 13 tenths – 7 tenths 2 + 6 tenths = 2.6

4.3 – 1 = 3.3 → 2 + 13 tenths → 13 tenths – 7 tenths = 6 tenths so 2 ones + 6 tenths → 2.6

N.B. In subtraction examples, the digit in the tenths column being subtracted needs to be greater than the digit in the tenths column from which it is being subtracted.

e.g. 1.9 + 2.5 → 1.9 + 2 → 3.9 → 3 and 9 tenths→ 9 tenths add 5 tenths → 14 tenths → 1 one and 4 tenths → 1.4 so 3 + 1.4 = 4.4

Can add and subtract decimal numbers by using a rounding and compensating method

e.g. 5.37 – 3.8 → 3.8 + 0.2 = 4 → 5.37 – 4 →

1.37 + 0.2 → 1.57

6.5 + 2.9 → 6.5 + 3 → 9.5 – 0.1 → 9.4

Use a split strategy to add and subtract decimals to one decimal place, using standard place value partitions.
Add 2 decimal numbers to one place by splitting the whole numbers and tenths,

e.g. 3.5 + 4.8 = 3 + 4 = 7

5 tenths + 8 tenths = 13 tenths → 1 one and 3 tenths, so 7 + 1 + 0.3 = 8.3

9.7 – 5.3 = 9 – 5 = 4

7 tenths – 3 tenths = 4 tenths

4 + 0.4 = 4.4

Add or subtract two decimal numbers to one place and explain what has happened to the decimal point (i.*e. when the combined answer is a whole number and there are no parts of a whole in the answer!).*

e.g. 1.5 + 3.5 = 5 2.7 + 3.3 = 6

7.4 + 2.6 = 10

7.5 – 3.5 = 4 9.4 – 6.4 = 3

Write their own stories to accompany a given number sentence or one of their own, including multi-step problems.

Make connections between maths in school and everyday experiences.

e.g.

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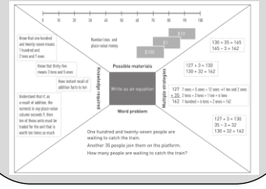

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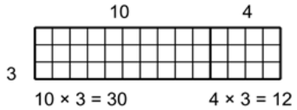
CALCULATING AIM (MULTIPLICATION AND TIMES TABLES): Use a range of mental and written strategies to solve multi-step problems, that involve a combination of addition, subtraction, multiplication and division with whole numbers with whole numbers ensuring the correct order of operations.

MNU 2-03a, MNU 2-03b, MTH 2-03c

Note: This pyramid appears across two pages.

Use place value to multiply the tens column and the ones column separately.



e.g. 14 x 3 =

e.g. 19 x 3 = (10 x 3) + (9x 3)

= 30 + 27

= 57

	10	*8*
3	*30*	*24*

e.g. 3 x 18 = 30 + 24 = 54

Solve multiplication problems involving whole numbers and two digit numbers. *e.g. 35 x 26*

×	40	8
20	800	160
5	200	40

48 x 25 =

800 + 200 + 160 + 40

= 1200

Begin to solve multiplication or division problems involving a 3 - digit number by a 1-digit number by a short written algorithm – *see 'Suggested Written Recording' Advice.*

Efficiently recall the divisibility rules for 2, 3, 5, 9 and 10. *e.g. 474 is divisible by 3 because 4 + 7 + 4 = 15 and 15 is divisible by 3.*

171 is divisible by 9 because 1 + 7 + 1 = 9 which is divisible by 9.

Have sound recall all multiplication and division facts up to the ten times tables (10 x 10).

Recall some common multiples beyond the ten times table.
e.g x11, x12, x15, x20…

x25, x50, x75, x125, x200

x75, x150, x300

Solve division problems by using standard place value.

e.g. 92 ÷ 4 = (80 ÷4) + (12 ÷ 4)

= 20 + 3 = 23

186 ÷ 3 = (180 ÷ 3) + (6 ÷ 3)

Recall all the doubles and corresponding halves.

Multiples of 10 *e.g. 90 -> 180, ½ of 160 is 80*

Multiples of 100 *e.g. 600 -> 1200*

Multiples of 1000 *e.g. ½ of 8000 is 4000*

Have sound recall all multiplication facts up to 10 x 10 and some corresponding division facts.

Recall multiplication with tens, hundreds and thousands.
e.g. 10 x 10 = 100

100 x 10 = 1000

100 x 100 = 10 000

Recall the divisibility rule for 2, 5 and 10.

e.g. all numbers in the two times tables are always even.

The pattern in the ones repeats for the five and ten times tables – 0 and 5.

USE FORMAL ALGORITHMS

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EFFICIENTLY SOLVE PROBLEMS

Choosing effective strategies is a skill that children will develop gradually.

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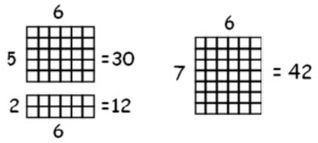
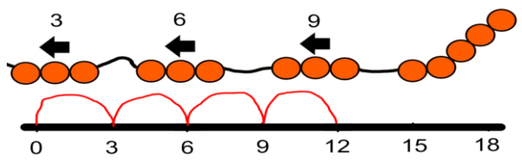
Work out the six, seven and eight times tables from their knowledge of the five times tables, using the distributive property of multiplication, *e.g. 7 x 6 = 5 x 6 + 2 x6*



Multiplying by 6 is same as x 5 add one more set, 8 x 6 = (8 x 5) + (8 x 1)
Multiplying by 7 is same as x 5 add 2 more sets, 9 x 7 = (9 x 5)

Solve division problems using known addition, subtraction and multiplication facts within the 2, 3, 4, 5 and 10 times table. *e.g.*

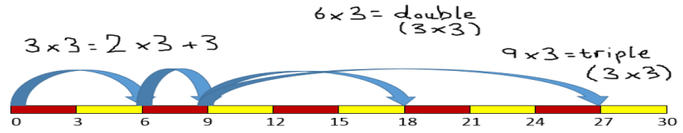


How many threes are there in 15?
15 ÷ 3 = 5
5 threes makes 15
How many equal sets of 3 makes 15
15 – 3 – 3 – 3 – 3 – 3 = 0

Use a known fact to derive a new fact

e.g. make the links between the 2 times table and the 3 times table; then the 6 and 9 times tables. Make the links between the 2, 4 and 8 times tables.

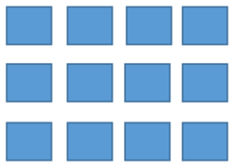
Make the links between the 2 times tables and the 3 times table and then the 6 and 9 times tables.



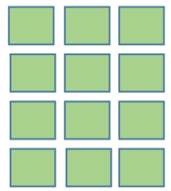
Use their ten times facts to work out the 9 times table.

8 x 9 is the same as 9 x 8.
This is just 10 x 8 – 1 x 8 = 80 – 8 = 72

Understand that multiplication is commutative and use this to solve a problem by changing the order of the factors.



3 X 4



4 X 3

Find solutions to multi-step problems involving mixed operations and make up their own multi-step word problems. e.g.
5 x 40 + 7 = 207
12 x 3 + 128 =

Write word problems to match a given number sentence. e.g.

□ – 97 = 125

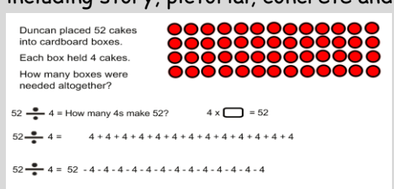
Solve problems that involve repeated equal quantities, rates etc. see *Points to Consider*

Jamie has 150 fewer football cards than his cousin, Darren. If Darren has 378 how many does Jamie have?

Morag received some money for her birthday. When she added it to the £143 in her bank account she had £178. How much did she receive?

A double bed is 135 cm wide. Kiera's room is 3.5m wide. If she puts a bedside cabinet that is 45 cm wide beside the bed, how much space will be left?

Represent multiplication/division stories using a variety of ways, including story, pictorial, concrete and abstract.



e.g. Tommy arranged his 15 football trophies evenly on three shelves. How many trophies were on each shelf?
Fiona distributed 650 flyers for her new restaurant evenly amongst 13 streets. To how many houses did she deliver the pamphlets in each street?

Continue to demonstrate an understanding of both the commutative law and the inverse rule in relation to multiplication and division.

Use a known fact to work out an unknown fact e.g. to find out 27 x 4, I know that 25 x 4 is 100, so 27 x 4 must be 2 x 4 more which is 108.

CALCULATING AIM (MULTIPLICATION STRATEGIES): Use a range of mental and written strategies to solve multi-step problems, that involve a combination of addition, subtraction, multiplication and division with whole numbers with whole numbers ensuring the correct order of operations.

MNU 2-03a, MNU 2-03b, MTH 2-03c

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Choosing effective strategies is a skill that children will develop gradually.

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Solve a multiplication or division problem that involves decimal fractions and is beginning to express the remainder as a whole number, fraction or decimal depending on the context. *e.g.*

426 ÷ 8 = 426 ÷ 2 ÷ 2 ÷ 2 →

213 ÷ 2 ÷ 2 → 106 ½ ÷ 2 → 53 ¼, 53.25 or 53 r2

426 ÷ 4 = 100 + 6

26 100 + 6

2 100 + 6

100 + 6

426 ÷ 4 = 106 r2

using the 'chunking down' method

$8\overline{)426}$ → ***53. 25***

Begin to reason which answer would be most appropriate for the set word problem.

Begin to split a number to reveal its factors to help solve a multiplication and division problem

e.g.

4 x 32 = 2 x 2 x 32 = 2 x 64 = 128

8 x 57 = 2 x 2 x 2 x 57 = 2 x 2 x 114 = 2 x 228 = 456

76 ÷ 4 = 76 ÷ 2 ÷ 2 =38 ÷ 2 =19

168 ÷ 8 = 168 ÷ 2 ÷ 2 ÷ 2 = 84 ÷ 2 ÷ 2 = 42 ÷ 2 = 21

Multiply and divide whole numbers and decimal fractions with at least 3 decimal places by multiples of 10.

Begin to solve division problems by using a rounding and compensation method.

e.g. 238 ÷ 7

How many 7s are there in 280?

7 x 40 = 280

280 – 238 = 42

42 ÷7 = 6 so 40 sevens subtract 6 sevens equals 34 sevens.

Solve multi step problems by ensuring correct order of operations.

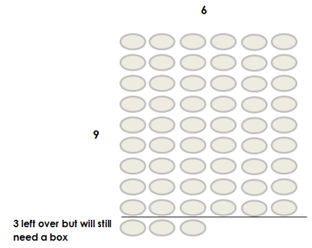
Multiply and divide whole numbers and decimal fractions with at least 2 decimal places mentally by 10, 100 and 1 000.

Use division for sharing or grouping a collection.

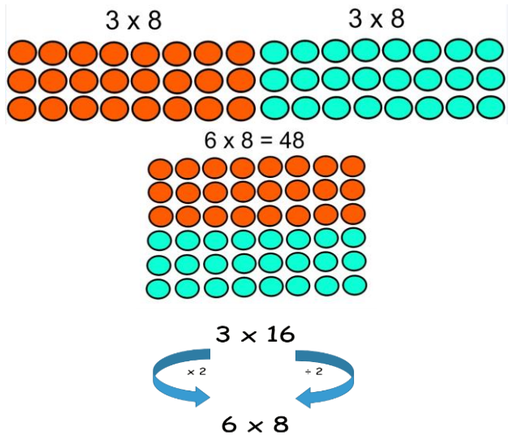
Remainders can be left or shared out depending on the context of the story e.g.

There were 33 people at the family reunion dinner. The restaurant only had tables that would sit four people. How many tables did the family need to book?

Anya has bought 57 eggs from the farmer but they are all in one basket. She wants to pack them safely into egg boxes of 6 to stop them from breaking on her journey home. How many boxes will she need?



Begin to solve multiplication problems by halving and doubling. *e.g. 3 x 16 =*



Solve multiplication problems by using a rounding and compensation method.

e.g. 5 x 19 → 5 x 20 and then subtract 5 → 100 - 5 = 95

5 x 21 → 5 x 20 and then add 5 → 100 + 5 = 105

6 x 37 → 6 x 40 – 6 x 3 →240 – 18 = 222

37 +3	37 +3	37 +3	37 +3	37 +3	37 +3

Find solutions to multi-step problems involving mixed operations and make up their own multi-step word problems.

Describe the rule for multiplication and division by a multiple of 10,

3x 30 arranged in groups of 10 → 3 x 3 x 10

10	10	10	10	10	10	10	10	10

Describe the rule for multiplication by 10 as 'the digits move one place to the left'.

6 x 10 = 60 *4 x 10 = 40*

24 x 10 = 240 *352 x 10 = 3,520*

Describe the rule for division by 10 as 'the digits move one place to the right'.

50 ÷ 10 = 5 *490 ÷ 10 = 49*

600 ÷ 10 = 60

Describe the rule for multiplication by 100 as 'the digits move two places to the left'.

8 x 100 = 800 *2 x 10 0= 200*

300 x 100 = 30 000

Describe the rule for division by 100 as 'the digits move two places to the right'.

500 ÷ 100 = 5 *4 900 ÷ 100 = 49*

6 000 ÷ 100 = 60

Solve division problems by using a multiplication strategy and by using the inverse rule.

e.g. using 5 x 8 = 40 to work out 40 ÷ ☐ = 5

72 ÷ 8 = how many 8s are there in 72?

Confidently describe and show using materials how the rules for multiplying and dividing by X10, x100 and x1000 work and be able to solve problems involving 2 and 3-digit numbers.

Find solutions to multi-step problems involving mixed operations and make up their own multi-step word problems. e.g.

5 x 40 + 7 = 207

12 x 3 + 128 =

Write word problems to match a given number sentence. e.g.

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Solve problems that involve repeated equal quantities, rates etc see *Points to Consider* Change examples

Jamie has 150 fewer football cards than his cousin, Darren. If Darren has 378 how many does Jamie have?

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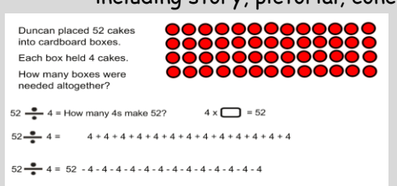

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Use a known fact to work out an unknown fact e.g. to find out 27 x 4, I know that 25 x 4 is 100, so 27 x 4 must be 2 x 4 more which is 108.

MULTIPLES, FACTORS AND PRIMES AIM: Identify the multiples and factors of numbers.

MTH 2-05a

Use the 'divisibility' rule to determine if a number is a multiple of a particular times table *e.g.*

Know that 273 is a multiple of 3 because the digits add up to 12, which is divisible by 3.
273 → 2 + 7 + 3 = 12 and 12 is divisible by 3

Know that 162 is in the nine times table because the digits add up to 9, which is divisible by 9.

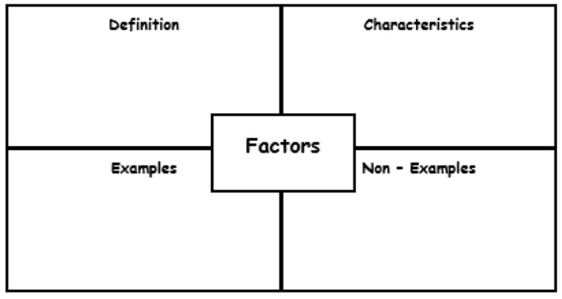
Uses and justifies the appropriate multiple or factor to solve problems.

Select factors or multiples to support efficient calculations depending upon numbers.

64 x 5 = 8 x 8 x 5 = 40 x 8 = 320

Patrick has £72 which he shares equally between his brothers. How many brothers might Patrick have?

Using the correct vocabulary, investigate the relationship between multiples and factors .



Begin to identify 'multiples', 'products' and 'factors'. *e.g.*

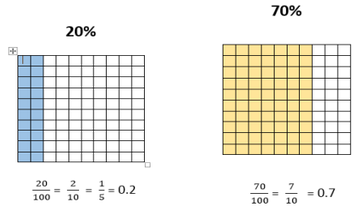
The multiples of 3 are 3, 6, 9, 12…

12 is a multiple of 4; 12 is the product of 3 x 4; 3 and 4 are factors of 12.

FRACTIONS, DECIMAL FRACTIONS AND PERCENTAGES AIM: Solve problems by selecting most appropriate fraction (decimal fraction, fraction or percentage) for the calculation. NOTE: This pyramid is displayed across three pages.

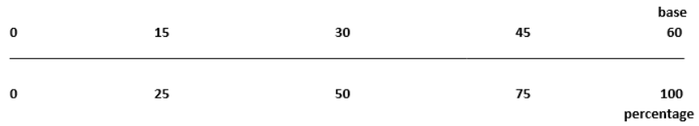
MNU 2-07a, MNU 2-07b, MNU 2-07c

Explain and justify, using models and diagrams, the relationship between simple fractions, decimal fractions and percentages. *e.g.*
20% = 0.2 = 1/5



Select the most effective strategy to calculate a simple percentage of a given amount *e.g.*
Find 23% by finding 10% and 1% first and calculate using the answers from these.
Find 15% by finding 10% and half of that.
Find 20% by relating to a fifth and dividing the whole by 5.

Find a simple percentage of a quantity or an amount, to solve problems in every day contexts.



Base	60	45	30	15
Percentage (%)	100	75	50	25

Explain numerical patterns in relationships between %, decimals and fractions.
1/5 = 20% = 0.2

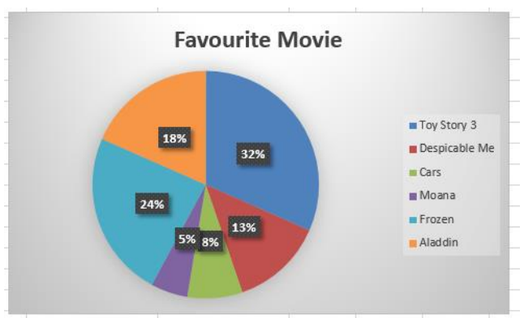
2/5= 40% = 0.4

3/5 = 60% = 0.6

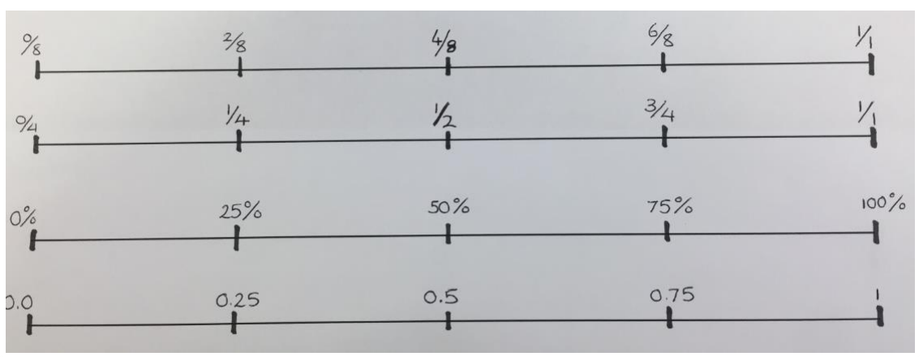
4/5 = 80% = 0.8

5/5 = 100% = 1

Model percentages.

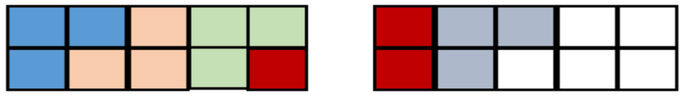


Use double number lines to show equivalence between %, fractions and decimals.

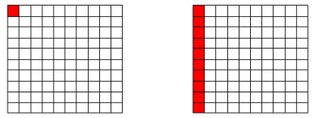


Model multiplication and division of a decimal fraction by a whole number and record the answer.

0.3 x 5 = 1.5



Understand that a percentage is a fraction with a denominator of 100 and 1% = 1 in every 100.



Record and convert amounts in money and measurement using decimal fractional notation
e.g. 501p= £5.01

Calculate simple fraction of an amount to solve everyday problems *e.g. find 3/5 of £60*

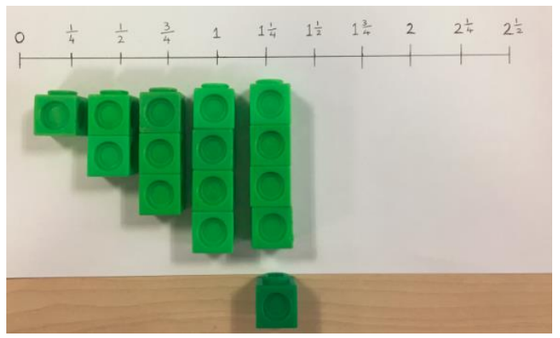
Represent common and decimal fractions both smaller and greater than 1 on a number line.

Name fractions as decimals and vice versa.

Show a fraction in its simplest form
e.g. 36/48 → 18/24 → 9/12 → 3/4

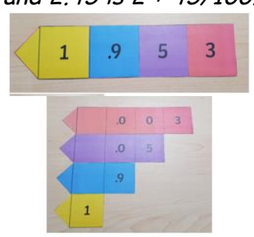
Estimate the position of a sequence of fractions on a number line; *e.g. mark 1/3, 2/3, 1, 1 1/3 on a paper strip marked 0, 1, 2, 3, 4*

Represent common fractions both smaller and greater than 1 on a number line. *e.g*
Ask learners to show with cubes and locate below the number strip, 1/4, 2/4, 3/4 and 1 1/4.



Represent simple fractions as a decimal fraction on a calculator.

Use the idea of splitting a whole into parts to understand, *for example, that 2.4 is 2 + 4/10 and 2.45 is 2 + 45/100.*



Be able to read a decimal in three ways. *e.g. 0.75 as zero point seven five, seven tenths and five hundredths and seventy five hundredths.*

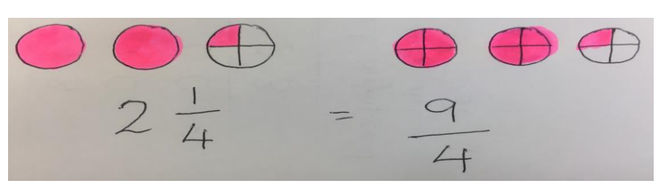
Creates, compares and order commonly used fractions using equivalence and simplest form.

Add and subtract decimal fractions in real life situations including money and measurement. (**See Calculations ~ Addition and Subtraction: Decimals)**
NOTE: Learners should be aware of the relationship to the whole and not see the whole number and decimal fraction as 2 separate things *e.g. 4.63m is 4 metres and 63 hundredths of a metre* rather than 4 metres and 63 centimetres.

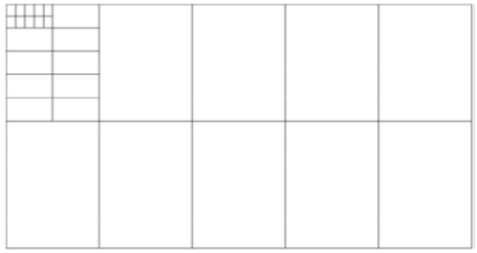
Continue to count orally in fractional and decimal fractional amounts.

Use language of fractions including improper fraction and mixed number.

Use diagrams to show understanding of equivalence between mixed numbers and improper fractions.

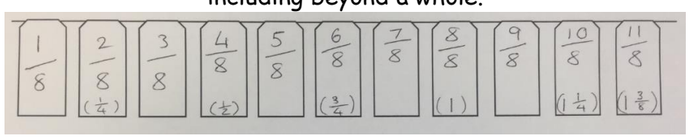


Model addition and subtraction of decimal fractions using decimats or decipipes.



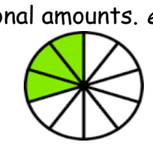
Understand that fractions are relative to particular wholes; *e.g. they can explain one quarter of the family-size pie is more than half of the small pie.*

Estimate position of a sequence of fractions on a number line including beyond a whole.



Link multiplication to non-unitary fractions. *e.g. understand that 5/6 of 30 is 25 because 1/6 = 5 and 5x5 = 25*

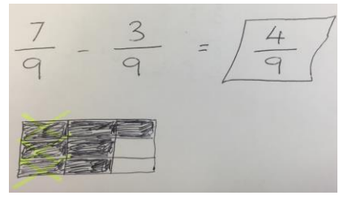
Use materials and diagrams to represent non unitary fractional amounts. *e.g. 3/10*



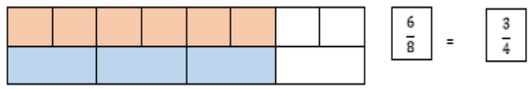
Find fractions of wholes where the fraction is greater than 1. *e.g. sharing 6 cookies with 4 people.*

By using understanding of fractional parts and how they relate to the whole, add and subtract fractions with the same denominator.

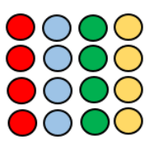
Model addition and subtraction of fractions with related denominators.



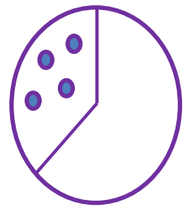
Visualise or draw their own diagrams to compare fractions with the same denominator *(eg 3/8 and 5/8)* or simple equivalence *(e.g. 6/8 and 3/4).*



Can use arrays to see that a fraction is both the whole split into equal parts and one in every n^{th}, for example, that four blue counters is one quarter of a bag of 16 counters, both because 16 can be split into four parts each of four **and** one in every four counters will be blue.



Use multiplication to find a set from a fraction. *e.g 1/3 of ? = 4*



Share an object or collection in different ways to generate equivalent statements; *e.g. three identical pizzas could be shared among four people in several 'fair' ways leading to 3 ÷ 4 = 3/4*

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

Use the language of fractions for example numerator, denominator.

Understand that not all numbers are whole numbers.

Select an appropriate number of partitions to enable a quantity. *e.g. 15* to be shared into two different numbers of portions *e.g. either 5 or 3.*

Use materials to show that 3 divided by 4 = $\frac{3}{4}$ and 2 divided by 6 = 2/6 and generalise for other fractions.

Decimals – Please refer to Place Value section.

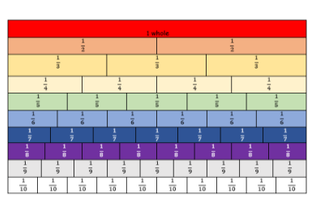
Explore the concept of simplified fractions through understanding of equivalent fractions and their relationship to multiplication and division.

$$\frac{4}{8} \begin{matrix}\div 4\\ \div 4\end{matrix} = \frac{1}{2}$$

Generate and justify equivalent fractions.

Using understanding of modelling and drawing experiences, write equivalent fractions using fractional notation.

Model equivalent fractions noting the patterns in sequences of equivalent fractions.



MONEY AIM: Give sound reasons for my decisions when solving problems involving money.

MNU 2-09a, MNU 2-09b, MNU 2-09c

Compares costs and determines affordability within a given budget.

Calculate profit and loss when working with a budget.

Explain the risks and benefits of using bank cards.

Create simple financial plans.

Cost of a Recipe

Ingredients	No. In Pack	Price per Pack	Price Per Item	Number Needed In Recipe	Total Cost
Apples	6	£1.50	25p	12	£3

Investigate and calculate 'best buys' with and without digital technologies.

e.g. buy one get one free v's 2 for £x

Investigate 10%, 25% & 50% discounts for sale items.

Explain the possible implications of debt.

Enter and read amounts correctly on a calculator to the nearest pence.

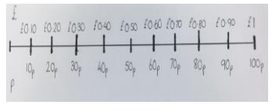
Use a range of strategies for the four operations, with numbers to 2 decimal places, to solve problems.

e.g. using jump & split strategies to solve £7.50 - £3.23

3 x £1.87

Understand why money uses decimal notation.

e.g.



Be able to explain the terms credit, debit & debt.

Be able to work out what needs to be saved over a period of time when planning a simple purchase.

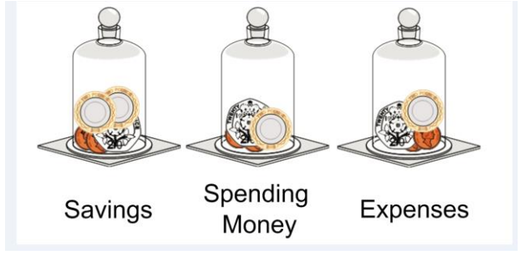
+

Understand how to access product prices from a variety of sources.

e.g.

internet, brochure, advert, price list etc.

Explain why budgeting is important.



Be able to contribute to a group or class project related to banking, budgeting etc.

Planning Page

Food Item(s)	Amount Needed	Cost Per Unit	Total For This Item	Running Total of Items so Far

Final Total _____ Amount Leftover _____

TIME AIM: Use appropriate units of time to assist problem solving in real life.

MNU 2-10a, MNU 2-10b, MNU 2-10c

Estimate the duration of a journey based upon the link between speed, distance and time.

Discuss the impact that changing time, distance or speed will have on a journey.

Create, use and interpret timetables for different purposes.

Choose the most appropriate timing device in practical situations and record using relevant units, including hundredths of a second.

Be able to convert times into a common unit *e.g. 2 hours and 90 mins = 2 hours plus 1.5 hours.*

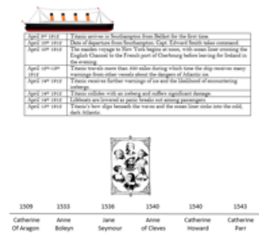
Read, write and convert 12 hour and 24 hour time.

12 hour	24 hour
9 am	09.00 hours
11.25 am	11.25 hours
3.15 pm	15.15 hours
7.42 pm	19.42 hours

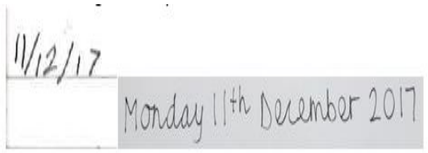
Determine times worldwide.

Interpret timelines.

Explore timelines.



Record using a variety of date formats. *e.g. 12/3/16 and March 12th 2016.*



Understand the factors to be considered when selecting an appropriate unit of time.

There are...	Time Units	In this Time Unit
60	seconds	minute
60	minutes	hour
24	hours	day
7	days	week
About 30	days	month
365	days	normal year
366	days	leap year

Recognise that timetables can take different forms.

Investigate journey times and discuss the impact of such things as using different routes or traffic jams.

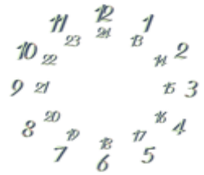
Distinguish starting and finishing times from elapsed time. e.g. *The person getting up last has not necessarily slept the longest.*

Read times using a variety of conventions. *e.g. 5 to 9, 8.55pm, 20:55.*

Understand the factors that influence the measurement of time.

Understand why there is a leap year.

Compare 12 hour and 24 hour notation.



Compare starting and finishing times on clocks, calendars and timetables to find out how long something has taken including bridging across several hours.

MEASUREMENT AIM: Select efficient and appropriate tools and units to solve problems including km, m, cm, mm, kg, g, l, ml

MNU 2-11a, MNU 2-11b, MNU 2-11c

Note: This pyramid appears over two pages.

Explain conservation of measurement.

Explore imperial units used in everyday life.

e.g. weight in stones, distance in miles

Convert between related units of measure using decimal notation

e.g. cm to m, g to kg.

Use multiple criteria to solve measurement problems. *e.g. make a bridge that needs to span a 40cm gap and must carry 4 cars weighing 20g each travelling in both directions at the same time.*

Solve problems involving estimation and measure by selecting the most efficient tools and units of measure.

Select which unit conversion to efficiently use when solving problems.

e.g. Jim had 1.5 kg of flour, he needed 750g for his recipe. How much will he have left over?

Measure accurately using un-numbered graduations on a scale.

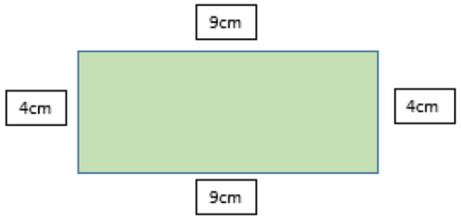
Using knowledge of standard units, estimate length, volume, perimeter, mass and areas without any units being present.

e.g. the car is about 3m long, the bag weighs about 5kg.

Measure accurately using standard units and a variety of scales.

Calculate the volume of a 3D object explaining the method used.

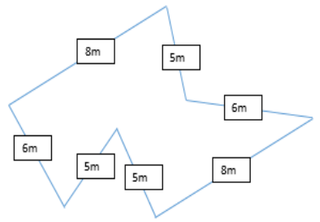
Calculate the area of a 2D shape explaining the method used.



Draw squares and rectangles with a given area.

Read and interpret scales on a range of appropriate measuring devices.


Calculate the perimeter of a simple straight sided 2D shape explaining the method used.



Draw squares and rectangles with a given perimeter.

Represent measurements using decimal and fraction notation.

e.g 3.5kg, 11.7m.

Convert between related units of measure.

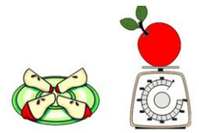
e.g. cm to m, g to kg.

Explore that there can be un-numbered graduations on a calibrated scale to measure more accurately.

Interpret un-numbered graduations on a whole-numbered scale.

e.g. scale is only labelled with 1 & 2 but there are marked sections for 1.2, 1.4, 1.6 etc.

Recognise that to measure objects, part objects can be amalgamated to make a unit.



Explore common prefixes in measurement.

e.g. kilo-, cent-, mille-.

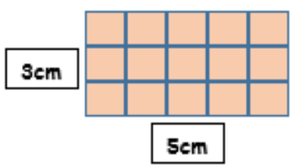
Compare objects using different standard units.

e.g. explain why 1.6kg is heavier than 1250g.

Order objects using different standard units.

e.g. 125cm, 1.2m

Explain the relationship between cm and cm^2.



Explore the relationship between fractional parts and decimal notation when recording measurements.

e.g. 4 $\frac{1}{2}$ m can be written as 4.5m.

Refer to Fractions, Decimals and Percentages pyramid.

Explore the connection between decimal notation and recording measurements.

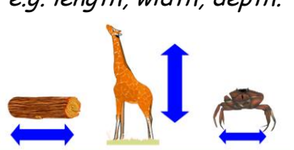
e.g. 4 m 25cm can be written as 4.25m.

Understand the effect of the size of the unit and the number required to measure.

e.g. Measuring a box of books will result in more grams than kilograms.

Describe dimensions of objects using appropriate vocabulary.

e.g. length, width, depth.



Select an appropriate measurement to give increasing accuracy.

e.g. use cm to measure a bookcase rather than m

Through practical experiences, explore the relationships between standard units.

e.g. 1kg = 1000g.

Explore how using the known size of an object can be used to help estimate the size of unfamiliar objects.

e.g. I know that I am 1.5m tall, so the tree must be about 3m.

Estimate lengths, volume and mass without units being present.

e.g. The school minibus is roughly 5m long.

MATHEMATICS – IT'S IMPACT ON THE WORLD, PAST, PRESENT, FUTURE AIM: Create and deliver a presentation with others detailing the impact that mathematics has had or is having on the world. Explain the impact mathematics has had on discoveries and inventions.

MTH 2-12a

Question others to further own knowledge about the role mathematics plays in the world.

Respond to questioning from others, sharing knowledge of research into impact that mathematics has had on the world.

Explore the role of mathematics in discoveries, past and present.

e.g. space. medicine

Share findings with others.

e.g poster, presentation

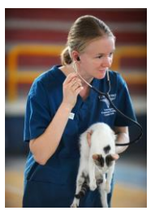
Explore mathematics used to interpret everyday life.

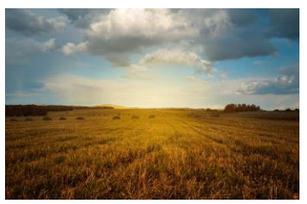
e.g. maps, surveys, exchange rates

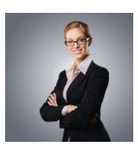
Explore mathematics used to support decision making.

e.g. shopping, timetables

Continue to explore numeracy and mathematics in the world of work.







e.g. salesperson, farmer, vet

This Experience and Outcome should be explored throughout all other experiences and outcomes and at appropriate points in other curricular areas.

There is a great deal of opportunity for learner choice and the suggestions above should not be seen as definitive.

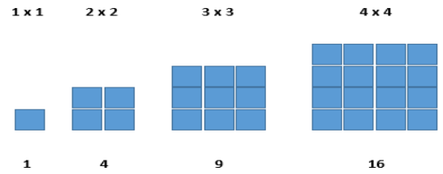
PATTERNS AND RELATIONSHIPS AIM: Generate patterns and describe rules used to generate sequences using multiples, factors, square numbers and triangular numbers.

MTH 2-13a

Observe a geometric pattern or a number pattern and create the following ways to record this pattern:

- builds a simple geometric pattern using materials;
- completes a table of values ;
- calculates the value of a missing number in a table of values and explains how it was determined;
- records a description of a number pattern using words; and,
- determines a rule, in words, to describe the pattern presented in a table and uses this to calculate the corresponding value for a larger number..

Find well known number patterns such as square numbers, triangular numbers and Fibonacci sequence using concrete materials and diagrams. *e.g.*



Solve simple combination problems. *e.g. record all the possible digit combinations for 4-digit numbers and order from smallest to largest:* 1, 2, 3, 4 = 1 234, 1 243, 1 324, 1 342, 1 423, 1 432, 2 134, 2 143, 2 314, 2 341, 2 413, 2 431, 3 124, 3 142, 3 214, 3 241, 3 412, 3 421, 4 123, 4 132, 4 213, 4 231, 4 312, 4 321.

Identify a number pattern involving one operation (increasing/ decreasing) using fractions or decimals.
The pattern 0.1, 0.15, 0.2, 0.25, 0.3 is increasing by 0.05

Identify a number pattern involving more than one step. *e.g.*

20, 15, 25, 20, 35

Determine the rule (known as 'generalisation') that describes the pattern from a table of results; use this rule to calculate the corresponding value for a larger number. *e.g.*

The top row shows the number of squares

and the bottom row shows how many sides.

1	2	3	4	5	6	7
4	8	12	16	20	24	

Applying the same rule, the 7th and 8th boxes [or numbers]

would have the answers 28 and 32.

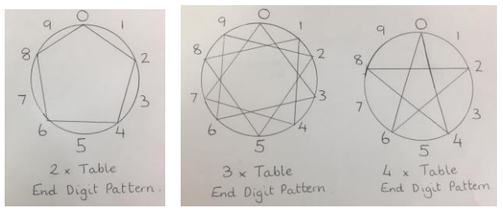
You multiply the top number by 4 to get the bottom number.

The 10th number will be 40.

Observe and describe the patterns in the multiplication tables up to 10 x 10.

e.g. repeating final digit patterns:

***8**, 1**6**, 2**4**, 3**2**, 4**0**, 4**8** or 9, 18, 27, 36, 45 – the ones column decreases by one each time because you add ten and take 1.*



Describe the pattern of combinations formed when using 2, 3, 4 numbers and make a generalisation.
e.g. in using 3 colours there will be 6 combinations RBG, RGB, BGR, BRG, GBR, GRB (1x2x3)
e.g. we have 4 objects: A, B, C and D. How many possible combinations are there when arranging them on a shelf? e.g. ABCD, ABDC, DACB…

Identify a simple number pattern involving one operation (increasing/ decreasing) and complete a table of values and describe the pattern in words. Ensure all four operations are experienced.

The pattern 3, 6, 9, 12 ,15, 18 ,21,and 24 is increasing by 3

Number of Triangles	1	2	3	4	5	6
Number of Vertices	3	6	9	12	15	18

Explain the relationship between multiplication facts by placing this information in a table and defining the rule (generalisation). *e.g. the 6 times table is double the 3 times table*

3	6	9	12	15	18	21
6	12	18	24	30	36	42

The 4 times table is half of the 8 times table

8	16	24	32	40	48	56
4	8	12	16	20	24	28

EXPRESSIONS AND EQUATIONS AIM: Solve problems that require finding the value of one unknown quantity represented by a symbol or letter. Solve problems using the properties and relationships of the four operations.

MTH 2-15a

Select and justify strategies to find unknown values in appropriate algebraic expressions.

Write stories to accompany an equation involving two variables.
d + h = 13 and d = 3 + h
d = dog and s = hamster I have 13 pets altogether. I have 3 more dogs than hamsters. How many dogs are there?

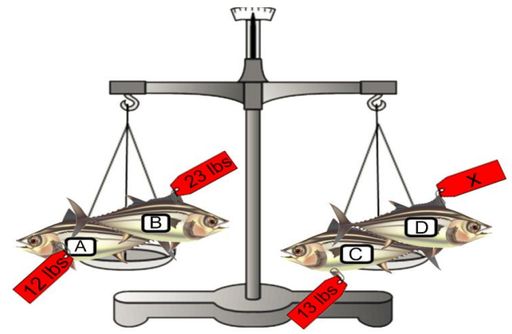
Recognise why 3+ 3 + 3 = 9 cannot be represented as

a + b + c = 9.

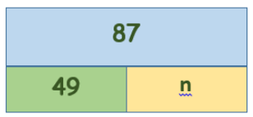
Find the value of an unknown variable in a simple algebraic equation.
e.g.
a – 30 = 30 and
4b = 20

Recognise 3c as 3 lots of c.

Find the value of an unknown quantity where there is one unknown.

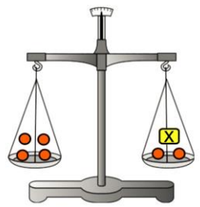


Explore strategies to find unknown values in appropriate algebraic expressions. *e.g. recording as a bar model.*



49 + n = 87

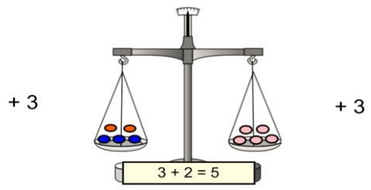
Write equations using a letter to represent an unknown quantity without recording an answer.



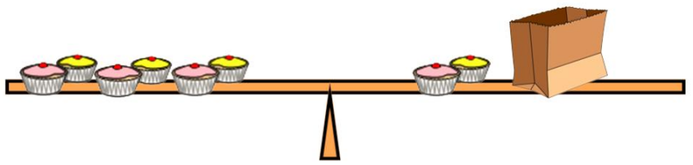
Check the truth of mathematical statements.

273 x 5 = 1065 cannot be right because 273 x 5 > 260 x 5 = 130 x 10 = 1300.

Explore why equal changes on both sides of the equality do not change the equality or the solution to the equation.



Understand that an unknown quantity can be determined by equating it to a known quantity (pictorial).



Complete mathematical statements (without finding the 'answer' to the actual calculations).

e.g. 392 x 15 = ☐ x 392

14 ÷ 0.7 ☐ 14 (Put in < or = or >.)

Second Level Overview

** The numeracy learner statements that are the responsibility of all are shown in italics.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Estimation and Rounding Pg 63	***I can use my knowledge of rounding to routinely estimate the answer to a problem then, after calculating, decide if my answer is reasonable, sharing my solution with others.*** ***MNU 2-01a***	• ***Rounds whole numbers to the nearest 1000, 10 000 and 100 000.*** • ***Rounds decimal fractions to the nearest whole number, to one decimal place and two decimal places.*** • ***Applies knowledge of rounding to give an estimate to a calculation appropriate to the context.***
Number Word Sequences Pg's 64, 67-74	***I have extended the range of whole numbers I can work with and having explored how decimal fractions are constructed, can explain the link between a digit, its place and its value.*** ***MNU 2-02a*** ***Having explored the need for rules for the order of operations in number calculations, I can apply them correctly when solving simple problems.*** ***MTH 2-03c*** I can show my understanding of how the number line extends to include numbers less than zero and have investigated how these numbers occur and are used. **MNU 2-04a**	• ***Reads, writes and orders whole numbers to 1 000 000, starting from any number in the sequence.*** • ***Adds and subtracts multiples of 10, 100 and 1000 to and from whole numbers and decimal fractions to two decimal places.*** • ***Adds and subtracts whole numbers and decimal fractions to two decimal places, within the number range 0 to 1 000 000.*** • ***Orders numbers less than zero and locates them on a number line.***

Key Aspect	Experiences and Outcomes	National Benchmarks
Place Value Pg 65	***I have extended the range of whole numbers I can work with and having explored how decimal fractions are constructed, can explain the link between a digit, its place and its value.*** ***MNU 2-02a***	• ***Partitions a wide range of whole numbers and decimal fractions to three decimal places, for example, 3·6 = 3 ones and 6 tenths = 36 tenths.*** • ***Explains the link between a digit, its place and its value for whole numbers to 1 000 000.*** • ***Explains the link between a digit, its place and its value for numbers with at least 3 decimal places.*** • ***Reads, writes and orders sets of decimal fractions to three decimal places.***
Calculating: Addition and Subtraction: Pg's 67-70	***Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.*** ***MNU 2-03a*** ***I have explored the contexts in which problems involving decimal fractions occur and can solve related problems using a variety of methods.*** ***MNU 2-03b***	• ***Adds and subtracts multiples of 10, 100 and 1000 to and from whole numbers and decimal fractions to two decimal places.*** • ***Adds and subtracts whole numbers and decimal fractions to two decimal places, within the number range 0 to 1 000 000.*** • ***Applies the correct order of operations in number calculations when solving multi-step problems.*** • ***Identifies familiar contexts in which negative numbers are used.***

Key Aspect	Experiences and Outcomes	National Benchmarks
Calculating: Multiplication and Division Pg's 71-74	***Having determined which calculations are needed, I can solve problems involving whole numbers using a range of methods, sharing my approaches and solutions with others.*** ***MNU 2-03a*** ***I have explored the contexts in which problems involving decimal fractions occur and can solve related problems using a variety of methods.*** ***MNU 2-03b***	• ***Uses multiplication and division facts to the 10th multiplication table.*** • ***Multiplies and divides whole numbers by multiples of 10, 100 and 1000.*** • ***Multiplies and divides decimal fractions to two decimal places by 10, 100 and 1000.*** • ***Multiplies whole numbers by two digit numbers.*** • ***Multiplies decimal fractions to two decimal places by a single digit.*** • ***Divides whole numbers and decimal fractions to two decimal places, by a single digit, including answers expressed as decimal fractions, for example, 43 ÷ 5 = 8·6.*** • Applies the correct order of operations in number calculations when solving multi-step problems.
Multiples, Factors and Primes Pg 75	Having explored the patterns and relationships in multiplication and division, I can investigate and identify the multiples and factors of numbers. **MTH 2-05a**	• Identifies multiples and factors of whole numbers and applies knowledge and understanding of these when solving relevant problems in number, money and measurement.

Key Aspect	Experiences and Outcomes	National Benchmarks
Fractions, Decimals and Percentages Pg's 76-78	***I have investigated the everyday contexts in which simple fractions, percentages or decimal fractions are used and can carry out the necessary calculations to solve related problems.*** ***MNU 2-07a*** ***I can show the equivalent forms of simple fractions, decimal fractions and percentages and can choose my preferred form when solving a problem, explaining my choice of method.*** ***MNU 2-07b*** I have investigated how a set of equivalent fractions can be created, understanding the meaning of simplest form, and can apply my knowledge to compare and order the most commonly used fractions. **MTH 2-07c**	• ***Uses knowledge of equivalent forms of common fractions, decimal fractions and percentages, for example, $\frac{3}{4}$ = 0.75 = 75%, to solve problems.*** • ***Calculates simple percentages of a quantity, and uses this knowledge to solve problems in everyday contexts, for example, calculates the sale price of an item with a discount of 15%.*** • ***Calculates simple fractions of a quantity and uses this knowledge to solve problems, for example, find $\frac{3}{5}$ of 60.*** • Creates equivalent fractions and uses this knowledge to put a set of most commonly used fractions in order. • Expresses fractions in their simplest form.

Key Aspect	Experiences and Outcomes	National Benchmarks
Money Pg 79	*I can manage money, compare costs from different retailers, and determine what I can afford to buy.* *MNU 2-09a* *I understand the costs, benefits and risks of using bank cards to purchase goods or obtain cash and realise that budgeting is important.* *MNU 2-09b* *I can use the terms profit and loss in buying and selling activities and can make simple calculations for this.* *MNU 2-09c*	• *Carries out money calculations involving the four operations.* • *Compares costs and determines affordability within a given budget.* • *Demonstrates understanding of the benefits and risks of using bank cards and digital technologies.* • *Calculates profit and loss accurately, for example, when working with a budget or an enterprise activity.*
Time Pg 80	*I can use and interpret electronic and paper-based timetables and schedules to plan events and activities, and make time calculations as part of my planning.* *MNU 2-10a* *I can carry out practical tasks and investigations involving timed events and can explain which unit of time would be most appropriate to use.* *MNU 2-10b*	• *Reads and records time in both 12 hour and 24 hour notation and converts between the two.* • *Knows the relationships between commonly used units of time and carries out simple conversion calculations, for example, changes 1 ¾ hours into minutes.* • *Uses and interprets a range of electronic and paper-based timetables and calendars to plan events or activities and solve real life problems.* • *Calculates durations of activities and events including situations bridging across several hours and parts of hours using both 12 hour clock and 24 hour notation.* • *Estimates the duration of a journey based on knowledge of the link*

Key Aspect	Experiences and Outcomes	National Benchmarks
	Using simple time periods, I can give a good estimate of how long a journey should take, based on my knowledge of the link between time, speed and distance. *MNU 2-10c*	*between speed, distance and time.* • *Chooses the most appropriate timing device in practical situations and records using relevant units, including hundredths of a second.* • *Selects the most appropriate unit of time for a given task and justifies choice.*
Measurement Pg's 81 & 82	*I can use my knowledge of the sizes of familiar objects or places to assist me when making an estimate of measure.* *MNU 2-11a* *I can use the common units of measure, convert between related units of the metric system and carry out calculations when solving problems.* *MNU 2-11b*	• *Uses the comparative size of familiar objects to make reasonable estimations of length, mass, area and capacity.* • *Estimates to the nearest appropriate unit, then measures accurately: length, height and distance in millimetres (mm), centimetres (cm), metres (m) and kilometres (km); mass in grams (g) and kilograms (kg); and capacity in millilitres (ml) and litres (l).* • *Calculates the perimeter of simple straight sided 2D shapes in millimetres (mm), centimetres (cm) and metres (m).* • *Calculates the area of squares, rectangles and right-angled triangles in square millimetres (mm2), square centimetres (cm2) and square metres (m2).* • *Calculates the volume of cubes and cuboids in cubic centimetres (cm3) and cubic metres (m3).* • *Converts between common units of measurement using decimal notation, for example, 550 cm = 5·5 m; 3·009 kg = 3009 g.*

Key Aspect	Experiences and Outcomes	National Benchmarks
	I can explain how different methods can be used to find the perimeter and area of a simple 2D shape or volume of a simple 3D object. ***MNU 2-11c***	• ***Chooses the most appropriate measuring device for a given task and carries out the required calculation, recording results in the correct unit.*** • ***Reads a variety of scales accurately.*** • ***Draws squares and rectangles accurately with a given perimeter or area.*** • ***Demonstrates understanding of the conservation of measurement, for example, draw three different rectangles each with an area of 24 cm2.*** • ***Shows awareness of imperial units used in everyday life, for example,*** • ***miles or stones.***
Patterns and Relationships Pg 84	Having explored more complex number sequences, including well-known named number patterns, I can explain the rule used to generate the sequence, and apply it to extend the pattern. **MTH 2-13a**	• Explains and uses a rule to extend well known number sequences including square numbers, triangular numbers and Fibonacci sequence. • Applies knowledge of multiples, square numbers and triangular numbers to generate number patterns.

Key Aspect	Experiences and Outcomes	National Benchmarks
Mathematics - its impact on the world, past, present and future Pg 83	I have worked with others to explore, and present our findings on, how mathematics impacts on the world and the important part it has played in advances and inventions. **MTH 2-12a**	• Researches and presents examples of the impact mathematics has in the world of life and work. • Contributes to discussions and activities on the role of mathematics in the creation of important inventions, now and in the past.
Expressions and Equations Pg 85	I can apply my knowledge of number facts to solve problems where an unknown value is represented by a symbol or letter. **MTH 2-15a**	• Solves simple algebraic equations with one variable, for example, a - 30 = 40 and 4b = 20.

Third Level Experiences and Outcomes

** The numeracy learner statements that are the responsibility of all are shown in bold italics.*

I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.
MNU 3-01a Pg 98

I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.
MNU 3-03a Pg 99

I can continue to recall number facts quickly and use them accurately when making calculations.
MNU 3-03b Pg's 99 & 100

I can use my understanding of numbers less than zero to solve simple problems in context.
MNU 3-04a Pg 100

I have investigated strategies for identifying common multiples and common factors, explaining my ideas to others, and can apply my understanding to solve related problems.
MTH 3-05a Pg 101

I can apply my understanding of factors to investigate and identify when a number is prime.
MTH 3-05b Pg 101

Having explored the notation and vocabulary associated with whole number powers and the advantages of writing numbers in this form, I can evaluate powers of whole numbers mentally or using technology.
MTH 3-06a Pg 102

I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.
MNU 3-07a Pg's 103-106

By applying my knowledge of equivalent fractions and common multiples, I can add and subtract commonly used fractions.
MTH 3-07b Pg 103

Having used practical, pictorial and written methods to develop my understanding, I can convert between whole or mixed numbers and fractions.
MTH 3-07c Pg 103

I can show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday contexts.
MNU 3-08a Pg 107

When considering how to spend my money, I can source, compare and contrast different contracts and services, discuss their advantages and disadvantages, and explain which offer best value to me.
MNU 3-09a Pg 108

I can budget effectively, making use of technology and other methods, to manage money and plan for future expenses.
MNU 3-09b Pg 108

Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.

MNU 3-10a Pg 109

I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required.

MNU 3-11a Pg's 110 & 111

Having investigated different routes to a solution, I can find the area of compound 2D shapes and the volume of compound 3D objects, applying my knowledge to solve practical problems.

MTH 3-11b Pg's 110 & 111

I have worked with others to research a famous mathematician and the work they are known for, or investigated a mathematical topic, and have prepared and delivered a short presentation.

MTH 3-12a Pg 112

Having explored number sequences, I can establish the set of numbers generated by a given rule and determine a rule for a given sequence, expressing it using appropriate notation.

MTH 3-13a Pg 113

I can collect like algebraic terms, simplify expressions and evaluate using substitution.

MTH 3-14a Pg 114

Having discussed ways to express problems or statements using mathematical language, I can construct, and use appropriate methods to solve, a range of simple equations.

MTH 3-15a Pg 114

I can create and evaluate a simple formula representing information contained in a diagram, problem or statement.

MTH 3-15b Pg 114

Points to Consider

When working at Third Level teachers are advised to refer to 'Points to Consider' and 'Suggested Written Recording' at Second Level to ensure consistency.

- Pupils should continue to build upon the language used in earlier levels to describe numeracy concepts to **ensure consistency** e.g. use partitioning instead of splitting, negative instead of minus, simplify instead of reduce, evaluate instead of solve, improper fractions instead of vulgar fractions.

- **Estimation** should permeate through all subject areas before calculations are attempted. Opportunities should be provided for all learners to develop estimation skills as often as possible. Encouragement should be given to ensure that this is an automatic process for learners.

- Pupils should **experience challenge** through applying their mathematical knowledge in a variety of contexts across the curriculum.

- Pupils are continuing to develop their understanding of the relationships between fractions, decimal fractions and percentages knowledge. Every opportunity should be maximised to **reinforce these links.**

- To support understanding of the relationship between fractions and decimal fractions it can be useful to display place value charts that show tenths, hundredths e.g. include $\frac{1}{10}, \frac{1}{100}$

- Like terms should be gathered together in equations and expressions.

- The use of brackets within operations is critical and time must be taken to ensure pupils have had many opportunities to explore their use.

Suggested Written Recording

Standard written recording that prepares pupils for the expectations of national examinations should be encouraged. **When working at Third Level teachers are advised to refer to 'Points to Consider' and 'Suggested Written Recording' at Second Level to ensure consistency.**	
• When working with fractions answers should always be simplified e.g. 2/8 x 2 = 4/8 = ½ • Answers should be presented in the same format as the question e.g. if there are mixed numbers in the questions, then the answer should be recorded as mixed numbers.	• Answer should be given to the same number of decimal places as the other numbers in the calculations, unless prompted differently in the question. • Pairs of factors should always be listed with the lowest factor first e.g. (1, 32) (2, 16) (4, 8).

ESTIMATION AIM: Anticipate whether an indicated change to a collection or quantity will make it bigger, smaller or leave it the same.

MNU 3-01a

Develop use of language used from maximum & minimum to upper and lower bounds/limits.

e.g. 3 ≤ x ≤ 8. So the upper bound is 8 and the lower bound is 3.

Show awareness of the danger of rounding through the stages of a calculation. *e.g. know why when using 33 1/3 % of a number on a calculator, we ensure that a third is calculated rather than 0.3.*

Know the expected reasonableness of an answer.

e.g. that a missing side on a rectangle must be less than 13.3 when completing a calculation including an area of 49.2m²

13.3m

X | 49.2m²

When completing a calculation, know what the maximum and minimum answers to expect might be.

e.g. Calculating the missing angle in a triangle, knows answer cannot be greater than 180 and using the other two given angle sizes know what the minimum size might be.

Round appropriately in context, justifying decision.

e.g. 99.5% in an exam gives a false impression if rounded up.

Finding the mean shoe size where the mean is calculated at 7.2 the average shoe size would actually be 7.

Show awareness of rounding too early leading to inaccuracies.

Rounding 100m sprint times to nearest 10 seconds would have multiple identical times.

Round numbers to at least 3 decimal places.

Show awareness of accuracy with an answer (3.58 and 3.63 both round to 3.6)

e.g. when measuring a length, rounding 3.63 to 3.6 has consequences for what would fit into a space.

Explore calculator interpretations of numbers in rounding situations. *e.g. when to use brackets on a scientific calculator for* $\frac{194 + 866}{122 + 90}$

Demonstrate understanding of rounding rules (include multiple decimal places).

What is 1 485.531to the nearest 100? 1 485.531 is between 1 400 and 1 500 but is closer to 1500 so round up.

What is 1 485.531 to the nearest tenth? 1 485.531 is between 1 485.5 and 1 485.6 but is closer to 1485.5 so round down.

Use rounding strategies to calculate approximate prices.

e.g. 28 packets of pens at £7 each is 30 x 7 ≈ £210

Explore multiplication and division: whole numbers by decimals and fractions <1.

e.g. 5 x 0.3 and 5 x 1.3

Link and reinforce relationship between fractions, decimals and percentages.

e.g. 50% = $\frac{1}{2}$ = 0.5

PLACE VALUE AIM: Demonstrate an understanding of numbers less than zero to solve simple problems in context. Use understanding of place value to solve mental problems involving the four operations.

MNU 3-07a & MNU 3-04a

Show flexibility when partitioning decimal numbers.

e.g. 26.45 could be 1 ten, 15 ones, 14 tenths and 5 hundredths.

Use knowledge of place value to mentally multiply and divide by a simple decimal.

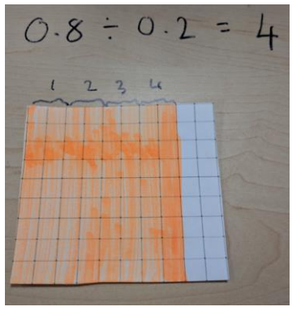
e.g.
0.8 ÷ 0.4 = 2.

Read decimal numbers correctly.

0.106 zero point one zero six

0.10 zero point one zero

Explore why, for divisors less than one, the result will be greater than the original.

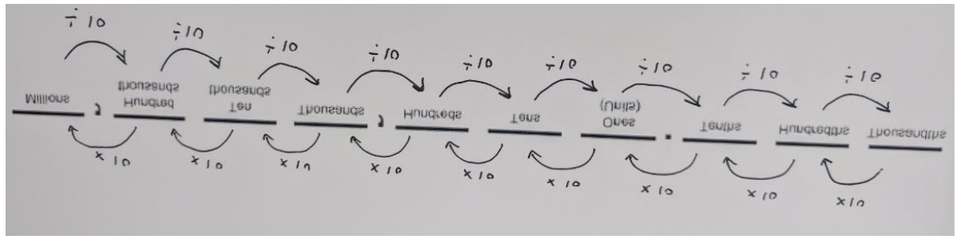


Understand the link between decimals, fractions and percentages for selecting which model to use for a purpose.

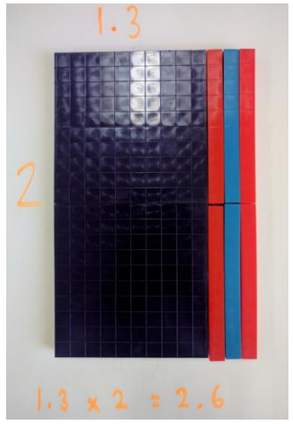
Relate multiplication of decimals to fractions.

e.g. 0.2 x 0.6 as 2/10 x 6/10.

Understand the multiplicative relationship within the base 10 system.



Use pictorial representations to explore multiplication and division: whole numbers by decimals.



Use knowledge of multiplicative relationships to mentally multiply and divide by multiples of 10, 100 and 1000.

Understand that with different rules and different starting points, there can be many possible different linear patterns of numbers.

e.g. 64, 32, 16, 8…….

4, ?, ?, 10.

CALCULATING AIM: Solve problems by identifying and applying efficient strategies and communicates both processes and solutions.

MNU 3-03a, MNU 3-03b & MNU 3-04a

Routinely use relationships to select operations as appropriate (understand & use BODMAS routinely).

e.g.

$\frac{7}{8} of (\frac{2}{3} + \frac{4}{5})$

Develop informal/formal methods of recording for strategies/working out used in "prove that" or "show that" type questions.

Ensure that a calculator is in maths mode to ensure the correct answer is given.

e.g. 3π

Know and use the inverse relationships between operations in calculations.

When problem solving use conjectures, testing and justification.

Mentally calculate solutions to problems involving integers using addition, subtraction, multiplication and division.

When using calculators, interpret the numbers displayed accurately.

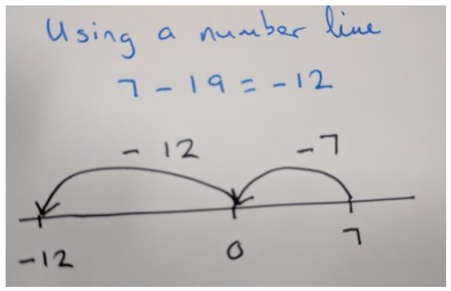
e.g. -3^2 versus $(-3)^2$

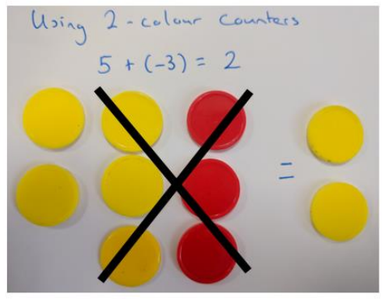
Select the most appropriate partitioning to solve a problem.

Carry out written algorithms for addition and subtraction problems with whole numbers and decimal fractions up to 3 decimal places.

Carry out written algorithms for multiplication and division problems with whole numbers and decimal fractions up to 3 decimal places.

Explore addition and subtraction of integers using models, number lines and metaphors.



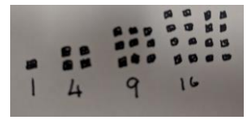


Solve multi step problems by ensuring correct order of operations.

Understand when using BODMAS, how to use brackets, squaring, unitary fractions, common % correctly.

e.g. $2 + 3^2 \times 4$

Quickly recall square numbers up to 12 x 12.

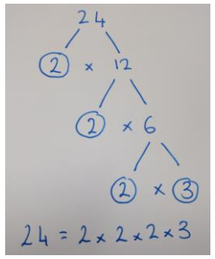


Quickly recall number facts up to 12 x 12.

MULTIPLES, FACTORS & PRIMES AIM: Demonstrate understanding of multiples, factors and primes to solve related problems.

MTH 3-05a & MTH 3-05b

Through exploration & discussion write a given number as a product of its prime factors. *e.g.*



Show factors of a number correctly in pairs.

e.g. factors of 32 are:

1, 32

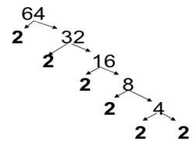
2, 16

4, 8

Use prime decomposition (factorisation) to find square roots.

e.g. √64 is

Factor Tree

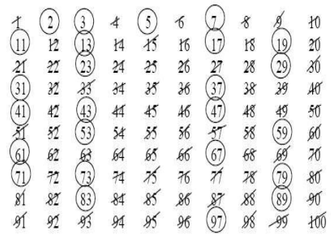


So the prime factorisation of 64 is: 2x2x2x2x2x2 or 2^6 because 64 has been broken down into all of its prime numbers.

Through exploration & discussion solve problems using factors and multiples.

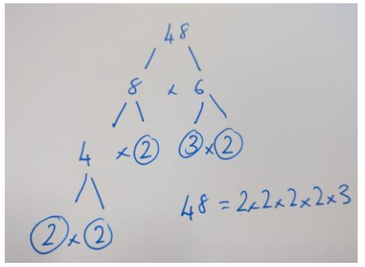
e.g. an electricity bill arrives every 2 months, the gas bill every 3 months. After how many months do you get both bills arriving?

Understand the use of the sieve of Eratosthenes to find primes between 1 and 100.



Show which prime numbers multiply together to make the original number (prime decomposition/factorisation)

e.g.



Investigate and then explain common factors.

e.g. list the common factors of 8 and 12. Which are common? What is the HCF?

For example, $8 = \mathbf{1} \times 8 = \mathbf{2} \times \mathbf{4}$

$12 = \mathbf{1} \times 12 = \mathbf{2} \times 6 = 3 \times \mathbf{4}$

∴ Factors of 8 are 1, 2, 4 and 8.

∴ Factors of 12 are 1, 2, 3, 4, 6 and 12.

So, the common factors of 8 and 12 are 1, 2 and 4.

Clearly, 4 is the largest common factor of 4 and 8.

∴ HCF = 4

Investigate and then explain common multiples.

e.g. list the first 9 multiples of 3 and 4. What are the common factors? What is the LCM?

Multiples of 3:

0, 3, 6, 9, 12, 15, 18, 21, 24...

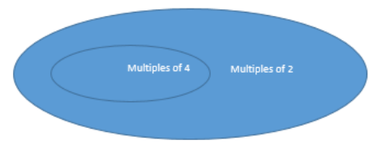
Multiples of 4:

0, 4, 8, 12, 16, 20, 24, 28 ...

The LCM of 3 and 4 is 12.

Investigate multiples and factors to discover prime numbers and explain how they have been identified.

e.g. sorting the numbers 11, 12, 13, 14, 15, 16, 17, 18 into multiples of 2, 3, 4 etc.



POWERS & ROOTS AIM: Understand and evaluate powers of whole numbers mentally or using technology.

MTH 3-06a

Evaluate powers of whole numbers mentally or using technology.

e.g. $4^3 = 64$

Write using index notation correctly.

e.g. $36 = 6^2$ ***and*** $6^2 = 36$

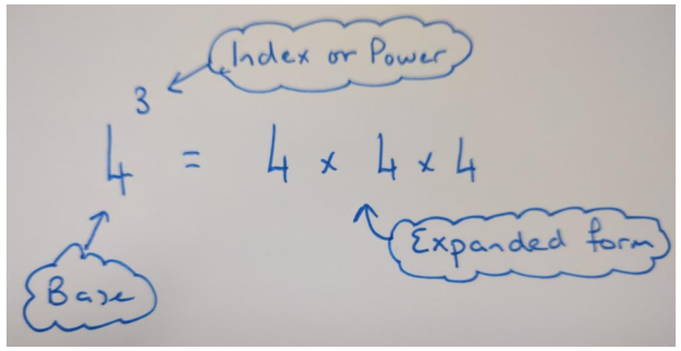
$2^3 = 8$ ***(not 6)***

Understand that there are patterns using powers.

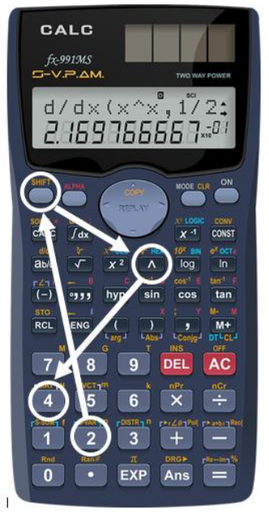
e.g. $10 \times 10 = 10^2$

$2 \times 2 \times 2 = 2^3$

Explain index notation and associated vocabulary.



Use index calculations correctly on a calculator.

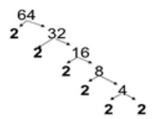


2^4

Understand that prime decomposition/factorisation can be used to derive square roots and cube roots of a number.

e.g.

Factor Tree



So the prime factorisation of 64 is: 2x2x2x2x2x2 or 2^6 *because 64 has been broken down into all of its prime numbers.*

Understand that there are advantages of using index notation as this is a shorthand way of writing down very large numbers.

e.g. recording the size of planets

Standard Form – Writing Large Numbers

The mass of planet Earth is about 5 970 000 000 000 000 000 000 000 kg.

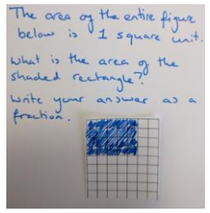
We can write this in standard form as a number between 1 and 10 multiplied by a power of 10.

5.97×10^{24} kg

FRACTIONS AIM: Solve problems by flexibly using knowledge of fractions.

MNU 3-07a, MTH 3-07b & MTH 3-07c

Solve problems where calculations involve fractional parts and whole numbers.



Model multiplication involving a unitary fraction and whole number.

e.g. 1/3 x 6

Draw diagrams to represent improper fractions clearly demonstrating the relationship to whole numbers.

Find Lowest Common Multiple (LCM) by identifying commonality in tables.

See link with Multiples, Factors & Primes

Simplify fractions potentially requiring more than one step.

e.g. 32/64 = 4/8 = $\frac{1}{2}$

Investigate the need for a common denominator.

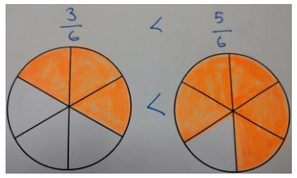
e.g. Mark scored 15/20 in one test and 19/25 in the next. How can we check which test he did best in?

Understand when to use mixed numbers and when to use improper fractions.

e.g. when solving equations.

Locate and represent improper fractions on a number line.

Produce own diagrams to compare two fractions.



Demonstrate confident recall of multiplication facts to allow for mental simplification.

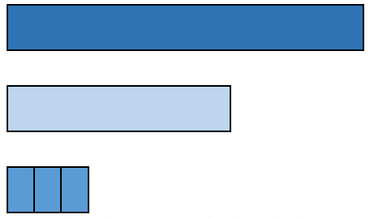
e.g. simplifying 3/9 to 1/3 by recognising 3 and 9 are both divisible by 3.

Create fractions with the same common denominator.

e.g. changing 1/5, 3/10 and 7/20 to 20/100, 30/100 and 35/100 for ease of converting to percentages.

Construct successive partitions.

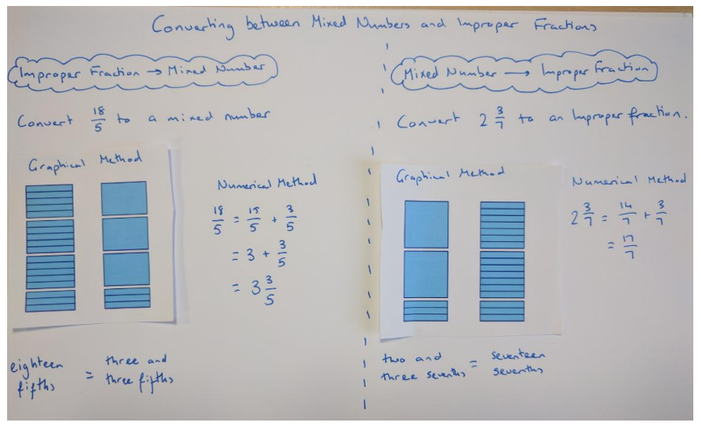
e.g. using paper strips to determine what fraction of the whole a fraction of a fraction is.



What fraction of the whole is 3/7 of a half?

Add and subtract whole numbers and fractions with different denominations.

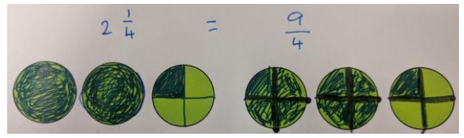
Model improper fractions and mixed numbers using less familiar fractional parts.



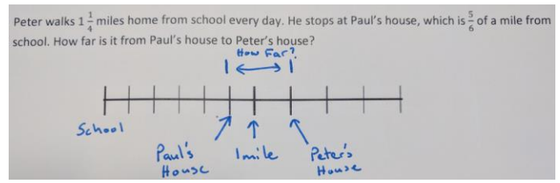
Multiply non unitary fractions using previous understanding

e.g. using 8 x ¼ to complete 8 x 3/4

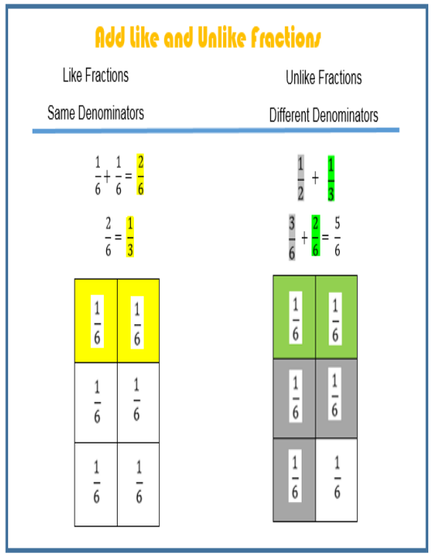
Fluently convert improper fractions and mixed numbers to allow correct recording.



Produce own diagrams to split and recombine two fractions.



Use diagrams to explain 1/2 + 1/3.



DECIMAL FRACTIONS AIM: Solve problems involving a wide range of decimal fractions calculations in real life situations.

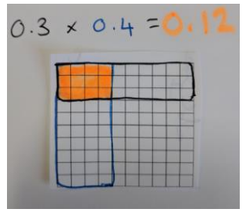
MNU 3-07a

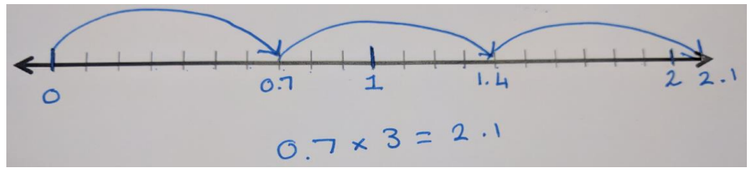
Explore why, for multipliers less than one the result will be smaller than the original and for divisors less than one, the result will be greater than the original.

e.g. apples cost 80p per kg, how much would 0.5kg cost?
0.80 x 0.5 = 0.4
0.75kg of apples costs £4.80, how much would 1kg cost?
4.80 ÷ 0.75 = 6.4

Model multiplication & division of decimals by a decimal.

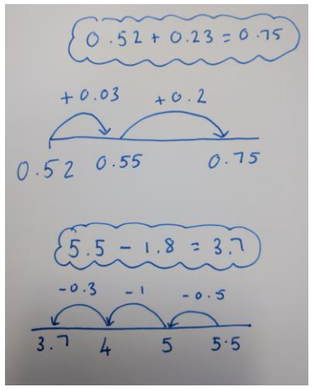
e.g.





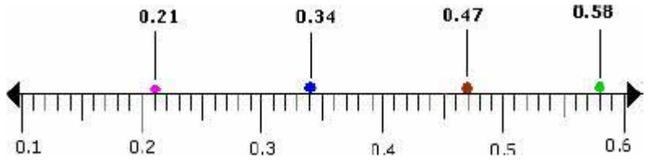
Model addition & subtraction of decimals.

e.g.



Compare and order ragged decimal fractions.

e.g. on a number line



Understand that a decimal fraction can be shown in different ways.

e.g.

1.68

1.4 + 0.28 *$1 + \frac{6}{10} + \frac{8}{100}$*

MNU 3-07a

PERCENTAGES AIM: Use percentages to find amounts and rates of change.

Understand that profit and loss can be calculated as %.

Cost Price (C.P.) £80 Selling Price (S.P.) £100 Profit £20

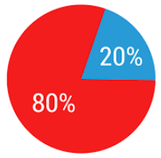
$$\text{Profit Percent} = \frac{\text{Profit}}{\text{C.P.}} \times 100$$

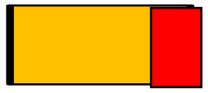
Explore methods such as the box method to find percentages of a number.

Part	%
Whole	100

15	X
75	100

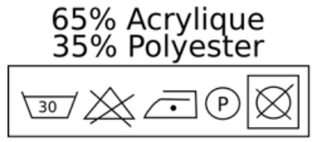
Represent % in a variety of ways such as ratios and proportions.



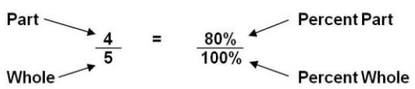


4 out of 5 are red = 4/5 = 80% are red

Interpret and discuss % in everyday usage.



Relate % to a part whole relationship.



40% of 300 = 120

Understand the terms 'rate' (40%), 'base' (300) and 'percentage' (120).

Use a calculator to find % (without using the percent button).

Understand the relationship between base and rate.

10% of £50 is more than 90% of £2

Explore a variety of strategies to find % of a number.

50% = 1/2 of the base = base ÷ 2, 25% = base ÷ 4, 10% = base ÷ 10, 1% = base ÷ 100 96% = 100% - 4%

Relate % to a fraction where the denominator is 100.

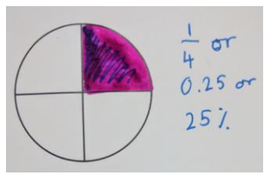
30% of £30= 30/100 of £30 = 3/10 of £30

Find % of an amount by using fractions.

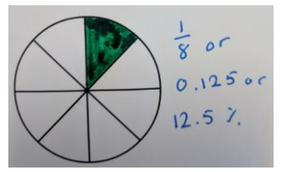
75% = ¾ so 75% of 240 = ¾ of 240

$1\% = \frac{1}{100}$	$66.\dot{6}\% = \frac{2}{3}$
$10\% = \frac{1}{10}$	$75\% = \frac{3}{4}$
$20\% = \frac{1}{5}$	$100\% = 1$
$25\% = \frac{1}{4}$	$150\% = 1\frac{1}{2}$
$33.\dot{3}\% = \frac{1}{3}$	$200\% = 2$
$50\% = \frac{1}{2}$	$250\% = 2\frac{1}{2}$

Link less common % and fractions.



So 12.5% = 0.125 or 1/8



FRACTIONS, DECIMAL FRACTIONS & PERCENTAGES AIM: Solve problems involving a wide range of decimal fractions, fractions and percentage calculations in real life situations.

MNU 3-07a

Select the most effective strategy to calculate more complex percentages of a given amount.

e.g. Find 23% by finding 10% and 1% first and calculate using the answers from these.

Use fractions, decimal fractions and percentages interchangeably in real life situations.

e.g.

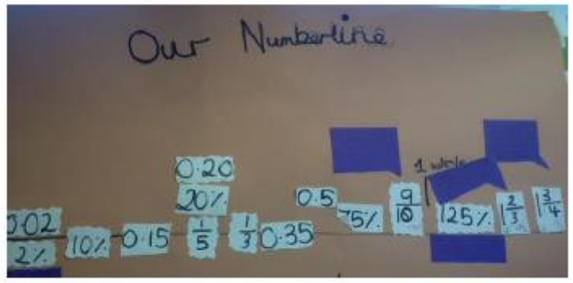
Shopping scenarios – 20% off, buy 1 get 1 half price, $\frac{1}{3}$ extra free

Bank scenarios – 10% interest

Convert between fractions, decimal fractions and percentages to solve problems.

Place a fraction, decimal fraction and percentage in order on a number line correctly.

e.g. $\frac{1}{5}$, *0.35, 40%*



Be able to choose which representation is easiest to use in calculations.

e.g.

40% of £5 or $\frac{2}{5}$ of £5.00 or 10% x 4

Investigate the relationship between fraction notation and decimal fraction notation using materials.

e.g.

TENS	ONES	.	$\frac{1}{10}$	$\frac{1}{100}$
0		.	6	

Understand the relationship between fractions, decimal fractions and percentages.

e.g.

$\frac{51}{100}$ *= 0.51 = 51%*

$\frac{27}{50}$ *= 0.54 = 54%*

Understand how to convert a fraction, decimal fraction and percentage to the same format.

e.g. all decimal fractions, fractions or percentages

MNU 3-08a

RATIO & PROPORTION AIM: Solve problems involving proportion & ratios.

Calculate, use and solve problems using real life situations.

e.g.

Brownie Recipe

45mins

Serves 12

Ingredients:

Butter	100g
Dark Chocolate	200g
Golden Caster Sugar	250g
Plain Flour	100g
Baking Powder	1tsp
Cocoa	30g

Use equivalence ratios.

e.g.

There is 1 part blue paint to 3 parts yellow paint for 10l of paint but 50l is now needed so 1:3 now becomes 5:15.

Reduce ratio to its simplest form.

e.g. 6:9 = 2:3

Record ratio correctly. *e.g.*

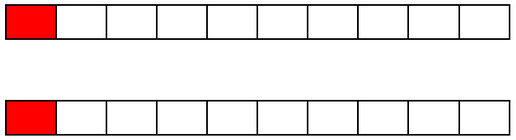
Word Form: 10 to 4

Ratio Form: 10:4

Fraction Form: $\frac{10}{4}$

Record proportions correctly.

e.g.

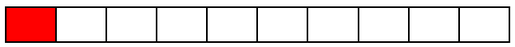


This means 1 in every 10, 2 in every 20 etc

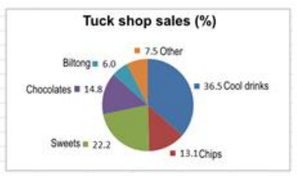
Use a diagram to show proportions.

e.g.

Red	Total
1	10
2	20
3	30
5	?

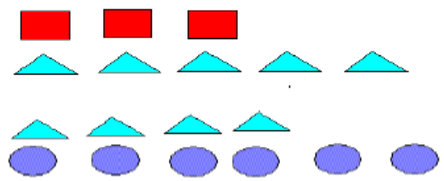


Items	Sales (R)	Percent
Cool drinks	4890	36.5
Chips	1756	13.1
Sweets	2973	22.2
Chocolates	1988	14.8
Biltong	799	6.0
Other	1008	7.5
Total	13 414	100



Use a diagram to show ratio.

e.g.



Understand that using proportion is a way of showing the parts of a quantity compared to the whole.

e.g. In my class there are mainly boys/there are mostly male pupils in the whole class.

Understand that direct proportion is 1 in every x parts.

e.g.

1 litre of petrol lasts 4 miles, so how many does 7 litres last?

Understand what result to expect when the relationship between 2 values is indirect.

e.g. 1 person takes 4 hours to paint a fence, so 3 people will take less time.

Speed – a car travels at 20 mph to travel 60 miles, how long will it take if travelling at 30 mph?

Understand that ratio is the relationship between two groups.

e.g. there are 2 boys for every 3 girls in the class.

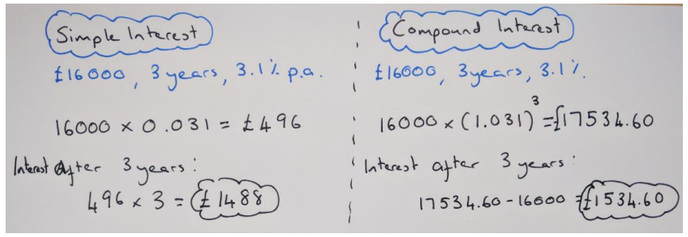
MONEY AIM: Use understanding of effective budgeting, managing money and financial services to make financial decisions using technology if appropriate.

MNU 3-09a & MNU 3-09b

Use financial terms correctly in a context.

e.g. debit, credit & APR.

Using digital technologies, connect the compound interest formula to repeated additions of simple interest.



Investigate foreign currency and exchange rates.

e.g.

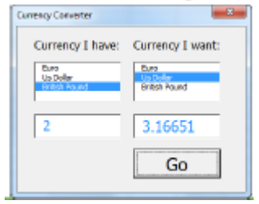
Currency	Buying Notes	Buying T/C	Selling Notes
USA USD	35.03	35.60	36.10
EURO EUR	45.73	45.97	46.86
ENGLAND GBP	68.96	69.86	70.96
JAPAN JPY	0.2875	0.2912	0.2971
SINGAPORE SGD	22.88	22.96	23.66
HONG KONG HKD	4.47	4.50	4.66
AUSTRALIA AUD	27.08	27.26	27.91
NEW ZEALAM NZD	24.18	24.32	25.13
SWITZERLAN CHF	27.99	28.32	28.81
SWEDEN SEK	4.88	5.03	5.18
DENMARK DKK	5.94	6.13	6.25
CANADA CAD	29.65	29.98	30.66
NORWAY NOK	5.43	5.60	5.76
BRUNEI BND	22.16	-	23.66
INDONESIA IDR	0.0025	-	0.005
MALAYSIA MYR	8.53	-	10.76
CHINA CNY	3.70	-	4.97
KOREA KRW	0.029	-	0.043
TAIWAN TWD	0.88	-	1.15
U A E AED	7.75	-	10.25
BAHRAIN BHD	59.63	-	88.35
OMAN OMR	59.41	-	94.21
QATAR QAR	7.67	-	10.22
SAUDI ARABIA SAR	7.58	-	10.19
SOUTH AFRIC ZAR	3.65	-	5.45

Use knowledge of percentages to calculate interest and compare costs.

e.g. save 10% on £15.00

3% bonus over 3 years

Convert between different currencies.*e.g.*

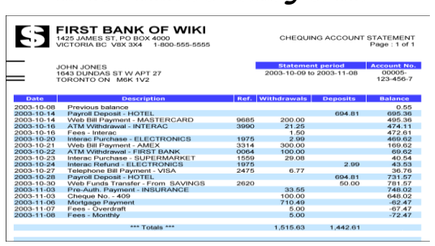


Calculate and compare different offers and choose one that offers best value, justifying choice.

e.g. 3 for 2 offers

10% free etc.

Recognise and explain how to read a bank balance statement. *e.g. use the terms direct debit/standing order*



FIRST BANK OF WIKI
1425 JAMES ST, PO BOX 4000
VICTORIA BC V8X 3X4 1-800-555-5555

CHEQUING ACCOUNT STATEMENT
Page : 1 of 1

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Statement period	Account No.
2003-10-09 to 2003-11-08	00005-123-456-7

Date	Description	Ref.	Withdrawals	Deposits	Balance
2003-10-08	Previous balance				0.55
2003-10-14	Payroll Deposit - HOTEL			694.81	695.36
2003-10-14	Web Bill Payment - MASTERCARD	9685	200.00		495.36
2003-10-16	ATM Withdrawal - INTERAC	3990	21.25		474.11
2003-10-16	Fees - Interac		1.50		472.61
2003-10-20	Interac Purchase - ELECTRONICS	1975	2.99		469.62
2003-10-21	Web Bill Payment - AMEX	3314	300.00		169.62
2003-10-22	ATM Withdrawal - FIRST BANK	0064	100.00		69.62
2003-10-23	Interac Purchase - SUPERMARKET	1559	29.08		40.54
2003-10-24	Interac Refund - ELECTRONICS	1975		2.99	43.53
2003-10-27	Telephone Bill Payment - VISA	2475	6.77		36.76
2003-10-29	Payroll Deposit - HOTEL			694.81	731.57
2003-10-30	Web Funds Transfer - From SAVINGS	2620		50.00	781.57
2003-11-03	Pre-Auth. Payment - INSURANCE		33.55		748.02
2003-11-03	Cheque No. - 409		100.00		648.02
2003-11-06	Mortgage Payment		710.49		-62.47
2003-11-07	Fees - Overdraft		5.00		-67.47
2003-11-08	Fees - Monthly		5.00		-72.47
	*** Totals ***		1,515.63	1,442.61	

Understand the financial implications of independent living by investigating basic living costs.

Bills	Monthly	Weekly
Mortgage	£1,160.00	£290.00
Electricity	£150.00	£37.50
Gas	£150.00	£37.50
TV/Broadband	£75.00	£18.75
Home Insurance	£90.00	£22.50
Life Insurance	£30.00	£7.50
Mobile Phone	£30.00	£7.50
Petrol	£75.00	£18.75
Car Insurance	£40.00	£10.00
Childcare	£80.00	£20.00
Food Shopping	£410.00	£102.50
Extras	£100.00	£25.00

Investigate contracts and offers to determine hidden costs on purchases.

e.g. delivery charges

Investigate the need for financial products, services & contracts.

Explain the advantages & disadvantages of different financial offers.

e.g. a bank account offers discount at various places but charges a monthly fee.

Understand that planning ahead is necessary.

Understand and explain why other choices may be better for different people depending on their situation.

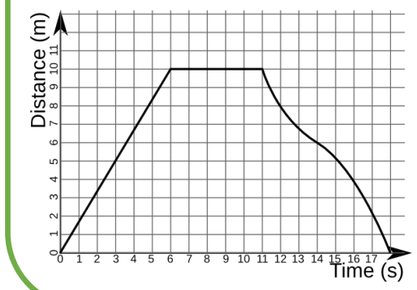
e.g. pay as you go phone contract for someone who is temporarily employed.

TIME AIM: Use the relationships between the distance of a journey, the time taken and the speed, to calculate distances, times and average speeds.

MNU 3-10a

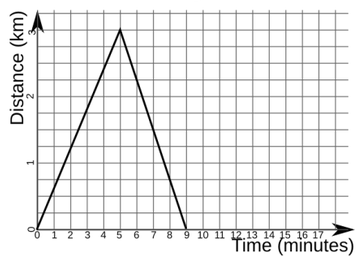
Use a distance /time graph to calculate speed.

e.g.



Create a distance/time graph.

e.g.



In a simple problem use the data given to calculate the missing value.

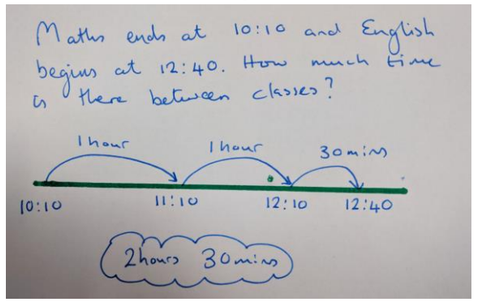
e.g. A motorcyclist averages 45 km/h. How long will it take to cover a distance of 135km?

Convert more complex hours and minutes into a decimal fraction, using a calculator if appropriate.

In a problem where the distance, time & speed is given identify the correct formula to use.

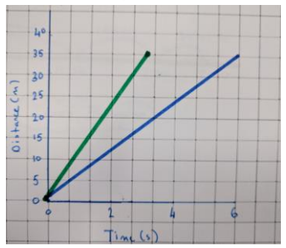
Use an empty number line to calculate time intervals.

e.g.

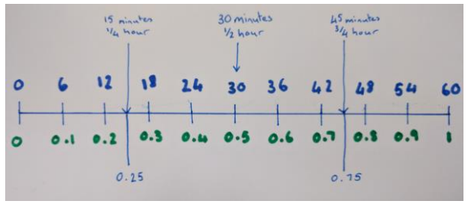


Interpret a simple distance/time graph.

e.g. the steeper the line the faster the speed.



Convert simple hours and minutes into a decimal fraction and vice versa. *e.g.*



Given the distance, time & speed in a problem use a formula to show an average speed, time & distance.

e.g.

Distance = Speed x Time

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Explain the impact of changing times, distance or speed on a journey.

e.g.

If I walk 100m in 2 mins, what will happen if I run?

Understand how to use the speed distance time formula for simple calculations.

e.g. d = s x t where s = 4 km and t = 3 hours

Explore how building a table to find a pattern can help to form a rule.

e.g.

Time	Distance
10	100m
15	150m
20	200m
?	?

Calculate time durations across days and hours.

Understand compatible units.

e.g. distance as km or m, time as hrs or mins

Be able to provide an approximate estimate, before calculating, for an answer to a problem that makes sense.

e.g. that if a person walks 5 mph then it will not take them 7 hours to walk 2 miles.

UNITS OF MEASUREMENT AIM: Solve problems by choosing suitable tools, reading scales accurately and converting answers to appropriate units, rounding as necessary.

MNU 3-11a & MTH 3-11b

Explore the connection between decimal notation and recording measurements.

e.g. the 4 in 1.4m, 1.4kg and 1.4l all mean something different.

Accurately read scales where calibrations are not marked.

Find ways to accurately measure objects that are too big or small for available tools.

e.g. Find the thickness of a single sheet of paper.

Choose appropriate unit of measurement to solve practical problems.

Describe measurements to allow others to accurately carry out a task.

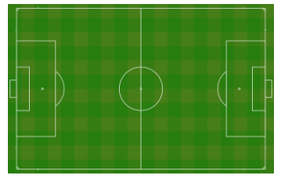
Understand that the unit of measurement relates to the need for accuracy.

e.g. a wall may be measured in metres to calculate paint required but will need measured in millimetres to calculate whether a bookshelf will fit.

Describe when exact measurements can be difficult to calculate.

e.g. volume of a pebble.

Recognise when more accurate measurements will not help.

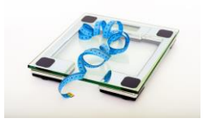


e.g. mm would not be more suitable than m for marking out a pitch.

Recognise when calculations are unlikely to be correct.

= 15kg

Select an appropriate tool giving justification.



Convert between standard units of measurement up to 3 decimal places.

Describe comparisons, recognising that there may be several attributes which are relevant for accuracy.

*e.g. depth **and** circumference*

Read scales to the nearest graduation, including where graduations may not be labelled.

Use knowledge of familiar items to help estimation.

e.g. 1 litre milk = about 1kg

Explain standard notation for measurement linking to metric prefixes.

Centimetre, centigram, centilitre = 1/100 of a metre, gram and litre

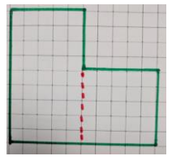
Compare and order length, capacity and mass measurements using standard units.

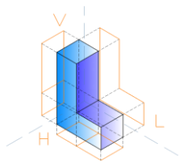
e.g. 1.6kg is heavier than 1250g.

AREA, PERIMETER AND VOLUME AIM: Select, apply and interpret appropriate formula to solve problems involving area, perimeter and volume.

MNU 3-11a & MTH 3-11b

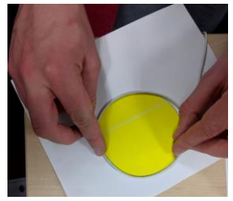
Calculate the area and volume of compound & complex shapes by dissecting into squares, rectangles, triangles, cubes & cuboids.



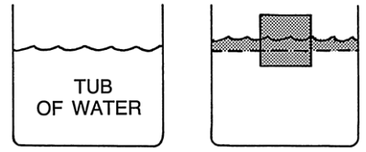


Calculate the area of a 2D shape where units are inconsistent.

Explore circumferences of circles practically to help identify patterns between radius, diameter and circumference.

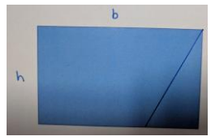


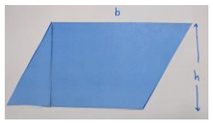
Use liquid displacement to measure and order objects by volume.



Explore the relationship between formula and known understanding of area, perimeter and volume.

Explore area of parallelograms by cutting and rearranging to make rectangles.



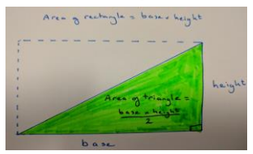


Explore formula to calculate area of parallelograms, rhombuses and kites.

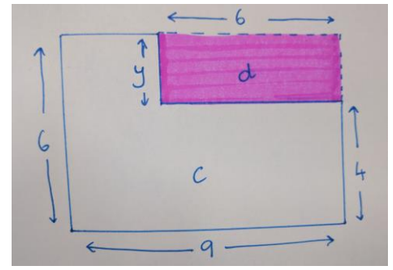
Multiply to calculate the areas of rectangles and volume of prisms including measurements with decimals and fractions.

Explore formula to calculate volume of regular prisms and cuboids.

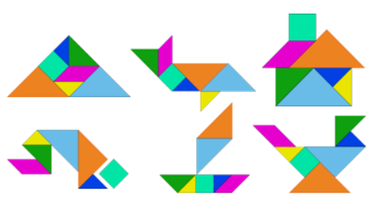
Explore area of triangles by creating imaginary rectangles or cutting and rearranging into rectangles.



Create a rectangular shape from a compound shape to calculate area.



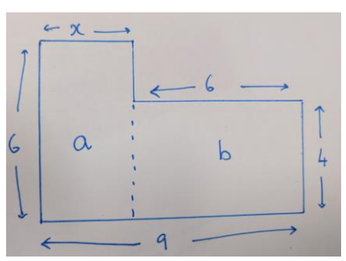
Understand that a unit of area can be rearranged and still be the same unit.



Decide whether a shape is sufficiently close to rectangular so that adding adjacent sides and doubling will be a 'good enough' estimate of perimeter.

Given a rectangle with whole number sides explain why multiplying the length by height gives area and explain the notation cm2, m2 etc.

Dissect a non-rectangular shape that is composed of rectangles by partitioning to calculate area.



MATHEMATICS - ITS IMPACT ON THE WORLD, PAST, PRESENT, FUTURE AIM: Create and deliver a presentation with others detailing the impact that mathematics has had or is having on the world. Explain the impact that mathematicians have had on the world.

MTH 3-12a

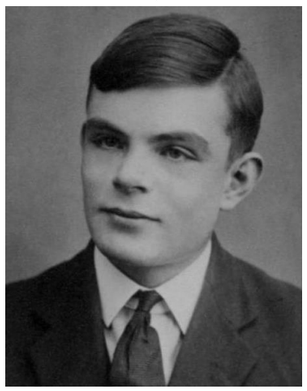
Question others to further own knowledge about the role mathematics plays in the world.

Respond to questioning from others, sharing knowledge of research into impact that mathematics has had on the world.

Create a presentation with others and share findings with others.

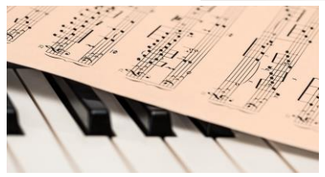
e.g. Prezi, Powerpoint, drama,

Explore mathematicians and the work they are known for.



e.g. Alan Turing, John Napier, Ada Lovelace

Explore the importance of mathematics in leisure pursuits.



e.g. sport, gaming, music

Explore a mathematical area of personal interest.

e.g. Fuzzy logic

This Experience and Outcome should be explored throughout all other experiences and outcomes and at appropriate points in other curricular areas.

There is a great deal of opportunity for learner choice and the suggestions above should not be seen as definitive.

PATTERNS AND RELATIONSHIPS AIM: Identify and generate the rule for the 'nth' term.

MTH 3-13a

Use a systematic approach to identify a rule.

Construct a sequence using the rule and first term.

e.g.

W = 3x + 4

X	4
W	

Express sequence rules in algebraic notation.

e.g. the cost of hiring a car is £75 plus a charge of £0.05 per mile.

C = 0.05m + 75

Construct the rule for the 'nth' term in a sequence.

e.g.

N	4	6	8	14
S	13	17	21	?

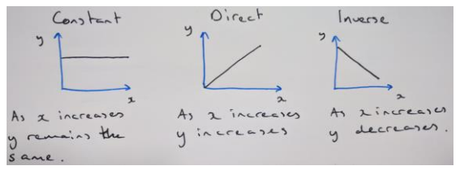
Recognise well known number patterns.

e.g. primes, Fibonacci, Pascal's Triangle

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

Understand different representations of patterns.

e.g.



Wooden Post (W)	1	2	3
Slats (S)	3	6	9

For every wooden post there are 3 slats = wooden posts x 3

S + W x 3

Wooden Post (W)	1	2	3
	4		
Slats (S)	5	8	11

Slats = wooden posts x 3 + 2

S = W x 3 + 2

Create a number pattern using fractions and decimal fractions.

Understand that trial and error and continuing a pattern can be used to solve problems.

Recognise a number pattern using fractions and decimal fractions.

e.g.

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

Understand the inverse relationship can be used to solve problems with a pattern.

e.g.

S = W x 3 + 2 if S =22

EXPRESSIONS AND EQUATIONS AIM: From information contained in a diagram, problem or statement create and evaluate a simple formula.

MTH 3-14a. MTH 3-15a & MTH 3-15b

Gather like terms, including squared terms, to simplify or evaluate.

e.g. 3a + 2b – 4a + 5 is the

Evaluate expressions involving at least two variables using both positive and negative values.

Solve complex formulae involving brackets, roots, indices, fractions.

e.g. $\frac{a+b}{2c^2}$ *where a = 4, b = -2 & c = 3.*

4ab where a = $\frac{1}{4}$*, b = 12*

Construct an equation from a word problem.

e.g. I'm thinking of a number, I add 7 and I now have 11. What nunber did I start with? $x + 7 = 11$

Use BODMAS correctly.

e.g. $2ab^2$ *where a = 3 and b = -2, so -2 must be squared first before any multiplication.*

Create linear equations to model problems.

Solve linear equations. *e.g. ax ± b = c*

Create a simple linear formula representing information contained in a diagram, problem or investigation.

Multiply and divide algebraic terms.

e.g.

3a x 2b = 6ab

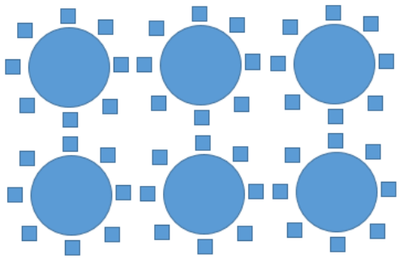
Substitute numbers in a simple formula correctly and evaluate the answer.

e.g. a + b or 3a + 2b

where a = 4 and b = 2

Interpret diagrams correctly.

e.g. If a table has 8 chairs, how many chairs do we need for 6 tables?



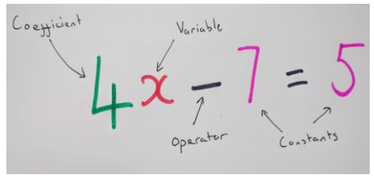
From a word problem, create an appropriate table to investigate using different numbers to determine the rule.

e.g. if a pencil costs x *pence what would 4 cost?*

Understand the difference between an expression and an equation.

e.g. an expression is "if a packet of biscuits contains n biscuits and I eat 2, the expression is n – 2. An equation is "I now have 28 biscuits in a packet and I eat 2 so the equation is n – 2 = 28"

Understand the terminology coefficient, variables, constant & operators.



Show multiplying and dividing unlike terms correctly.

e.g. a x b = ab and a ÷ b as a/b

In a context begin to gather like terms together.

e.g. there are 2 cars and 3 vans in a car park (2c + 3v) then 3 more cars arrive and a van leaves (now 5c + 2V)

Understand from a context that tables can be used to create a formula.

e.g.

Days (d)	1	2	3	4	17
Costs ©	20	40	60	80	?

c = 20d

Third Level Overview

** The numeracy learner statements that are the responsibility of all are shown in italics.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Estimation and Rounding Pg 98	*I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.* *MNU 3-01a*	• *Rounds decimal fractions to three decimal places.* • *Uses rounding to routinely estimate the answers to calculations.*
Place Value Pg 99	*I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.* *MNU 3-07a*	
Calculating Pg 100	*I can use a variety of methods to solve number problems in familiar contexts, clearly communicating my processes and solutions.* *MNU 3-03a* *I can continue to recall number facts quickly and use them accurately when making calculations.* *MNU 3-03b*	• *Recalls quickly multiplication and division facts to the 10th multiplication table.* • *Uses multiplication and division facts to the 12th multiplication table.* • *Solves addition and subtraction problems working with whole numbers and decimal fractions to three decimal places.* • *Solves addition and subtraction problems working with integers.* • *Solves multiplication and division problems working with whole numbers and decimal fractions to three decimal places.* • *Solves multiplication and division problems working with integers.*

Key Aspect	Experiences and Outcomes	National Benchmarks
	I can use my understanding of numbers less than zero to solve simple problems in context. ***MNU 3-04a***	
Multiples, Factors and Primes Pg 101	I have investigated strategies for identifying common multiples and common factors, explaining my ideas to others, and can apply my understanding to solve related problems. **MTH 3-05a** I can apply my understanding of factors to investigate and identify when a number is prime. **MTH 3-05b**	• Identifies common multiples, including the lowest common multiple for whole numbers and can explain method used. • Identifies common factors, including the highest common factor for whole numbers and can explain method used. • Identifies prime numbers to 100 and can explain method used. • Solves problems using multiples and factors. • Writes a given number as a product of its prime factors.
Powers and Roots Pg 102	Having explored the notation and vocabulary associated with whole number powers and the advantages of writing numbers in this form, I can evaluate powers of whole numbers mentally or using technology. **MTH 3-06a**	• Explains the notation and uses associated vocabulary appropriately, for example, index, exponent and power. • Evaluates whole number powers, for example, $2^4 = 16$. • Expresses whole numbers as powers, for example, $27 = 3^3$.

Key Aspect	Experiences and Outcomes	National Benchmarks
Fractions, Decimals and Percentages Pg's 103-106	***I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.*** ***MNU 3-07a*** By applying my knowledge of equivalent fractions and common multiples, I can add and subtract commonly used fractions. **MTH 3-07b** Having used practical, pictorial and written methods to develop my understanding, I can convert between whole or mixed numbers and fractions. **MTH 3-07c**	• ***Converts fractions, decimal fractions or percentages into equivalent fractions, decimal fractions or percentages.*** • Adds and subtracts whole numbers and fractions, including when changing a denominator. • Converts between whole or mixed numbers, improper fractions and decimal fractions. • ***Uses knowledge of fractions, decimal fractions and percentages to carry out calculations with and without a calculator.***
Ratio & Proportion Pg 107	***I can show how quantities that are related can be increased or decreased proportionally and apply this to solve problems in everyday contexts.*** ***MNU 3-08a***	• ***Solves problems in which related quantities are increased or decreased proportionally.*** • ***Expresses quantities as a ratio and where appropriate simplifies, for example, 'if there are 6 teachers and 60 children in a school find the ratio of the number of teachers to the total amount of teachers and children'.***

Key Aspect	Experiences and Outcomes	National Benchmarks
Money Pg 108	*When considering how to spend my money, I can source, compare and contrast different contracts and services, discuss their advantages and disadvantages, and explain which offer best value to me.* *MNU 3-09a* *I can budget effectively, making use of technology and other methods, to manage money and plan for future expenses.* *MNU 3-09b*	• *Demonstrates understanding of best value in relation to contracts and services when comparing products.* • *Chooses the best value for their personal situation and justifies choices.* • *Budgets effectively, using digital technology where appropriate, showing development of financial capability.* • *Demonstrates knowledge of financial terms, for example, debit/credit, APR, pa, direct debit/standing order and interest rate.* • *Converts between different currencies.*
Time Pg 109	*Using simple time periods, I can work out how long a journey will take, the speed travelled at or distance covered, using my knowledge of the link between time, speed and distance.* *MNU 3-10a*	• *Applies knowledge of the relationship between speed, distance and time to find each of the three variables.* • *Calculates time durations across hours and days.*

Key Aspect	Experiences and Outcomes	National Benchmarks
Measurement Pg's 110 & 111	***I can solve practical problems by applying my knowledge of measure, choosing the appropriate units and degree of accuracy for the task and using a formula to calculate area or volume when required.*** ***MNU 3-11a***	• ***Chooses appropriate units for length, area and volume when solving practical problems.*** • ***Converts between standard units to three decimal places and applies this when solving calculations of length, capacity, volume and area.*** • Calculates the area of a 2D shape where the units are inconsistent. • Finds the area of compound 2D shapes constructed from squares, rectangles and triangles. • Finds the volume of compound 3D objects constructed from cubes and cuboids.
Mathematics – its impact on the world, past, present and future Pg 112	I have worked with others to research a famous mathematician and the work they are known for, or investigated a mathematical topic, and prepared and delivered a short presentation. **MTH 3-12a**	• Researches and communicates using appropriate mathematical vocabulary and notation, the work of a famous mathematician or a mathematical topic and explains the relevance and impact they have on society.

Key Aspect	Experiences and Outcomes	National Benchmarks
Patterns and Relationships Pg 113	Having explored number sequences, I can establish the set of numbers generated by a given rule for a given sequence, expressing it using appropriate notation. **MTH 3-13a**	• Generates number sequences from a given rule, for example, T = 4n + 6. • Extends a given pattern and describes the rule. • Expresses sequence rules in algebraic notation, for example, the cost of hiring a car is £75 plus a charge of £0·05 per mile, 'm' driven, *C* = 0.05m + 75.
Expressions and Equations Pg 114	Having discussed ways to express problems or statements using mathematical language, I can construct, and use appropriate methods to solve a range of simple equations. **MTH 3-15a** I can create and evaluate a simple formula representing information contained in a diagram, problem or statement. **MTH 3-15b**	• Collects like terms, including squared terms, to simplify an algebraic expression. • Evaluates expressions involving two variables using both positive and negative numbers. • Solves linear equations, for example, ax ± b = c where a, b and c are integers. • Creates a simple linear formula representing information contained in a diagram, problem or statement. • Evaluates a simple formula, for example, *C* = 0.05m + 75.

Fourth Level Experiences and Outcomes

**** The numeracy learner statements that are the responsibility of all are shown in bold italics.***

Having investigated the practical impact of inaccuracy and error, I can use my knowledge of tolerance when choosing the required degree of accuracy to make real-life calculations.
MNU 4-01a Pg 125

Having recognised similarities between new problems and problems I have solved before, I can carry out the necessary calculations to solve problems set in unfamiliar contexts.
MNU 4-03a Pg 126

I have investigated how introducing brackets to an expression can change the emphasis and can demonstrate my understanding by using the correct order of operations when carrying out calculations.
MTH 4-03b Pg 126

I have developed my understanding of the relationship between powers and roots and can carry out calculations mentally or using technology to evaluate whole number powers and roots, of any appropriate number.
MTH 4-06a Pg 127

Within real-life contexts, I can use scientific notation to express large or small numbers in a more efficient way and can understand and work with numbers written in this form.
MTH 4-06b Pg 127

I can choose the most appropriate form of fractions, decimal fractions and percentages to use when making calculations mentally, in written form or using technology, then use my solutions to make comparisons, decisions and choices.
MNU 4-07a Pgs 128 – 130

I can solve problems involving fractions and mixed numbers in context, using addition, subtraction or multiplication.
MTH 4-07b Pg 128

Using proportion, I can calculate the change in one quantity caused by a change in a related quantity and solve real-life problems.
MNU 4-08a Pg 131

I can discuss and illustrate the facts I need to consider when determining what I can afford, in order to manage credit and debt and lead a responsible lifestyle.
MNU 4-09a Pg 132

I can source information on earnings and deductions and use it when making calculations to determine net income.
MNU 4-09b Pg 132

I can research, compare and contrast a range of personal finance products and, after making calculations, explain my preferred choices.
MNU 4-09c Pg 132

I can research, compare and contrast aspects of time and time management as they impact on me.
MNU 4-10a Pg 133

I can use the link between time, speed and distance to carry out related calculations.
MNU 4-10b Pg 133

I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations.
MNU 4-11a Pg 134

Through investigating real-life problems involving the surface area of simple 3D shapes, I can explore ways to make the most efficient use of materials and carry out the necessary calculations to solve related problems.
MTH 4-11b Pg 134

I have explored with others the practicalities of the use of 3D objects in everyday life and can solve problems involving the volume of a prism, using a formula to make related calculations when required.
MTH 4-11c Pg 134

I have discussed the importance of mathematics in the real world, investigated the mathematical skills required for different career paths and delivered, with others, a presentation on how mathematics can be applied in the workplace.
MTH 4-12a Pg 135

Having explored how real-life situations can be modelled by number patterns, I can establish a number sequence to represent a physical or pictorial pattern, determine a general formula to describe the sequence, then use it to make evaluations and solve related problems.
MTH 4-13a Pgs 136 & 137

I have discussed ways to describe the slope of a line, can interpret the definition of gradient and can use it to make relevant calculations, interpreting my answer for the context of the problem.
MTH 4-13b Pgs 136 & 137

Having investigated the pattern of the coordinate points lying on a horizontal or vertical line, I can describe the pattern using a simple equation.
MTH 4-13c Pgs 136 & 137

I can use a given formula to generate points lying on a straight line, plot them to create a graphical representation then use this to answer related questions.
MTH 4-13d Pgs 136 & 137

Having explored the distributive law in practical contexts, I can simplify, multiply and evaluate simple algebraic terms involving a bracket.
MTH 4-14a Pg 138

I can find the factors of algebraic terms, use my understanding to identify common factors and apply this to factorise expressions.
MTH 4-14b Pg 138

Having discussed the benefits of using mathematics to model real-life situations, I can construct and solve inequalities and an extended range of equations.
MTH 4-15a Pg 138

Points to Consider

When working at Fourth Level teachers are advised to refer to 'Points to Consider' and 'Suggested Written Recording' at Third Level to ensure consistency.

- Pupils should continue to build upon the language used in earlier levels to describe numeracy concepts to **ensure consistency** e.g. use partitioning instead of splitting, negative instead of minus, simplify instead of reduce, evaluate instead of solve, improper fractions instead of vulgar fractions., BIDMAS instead of BODMAS to introduce the term indices.

- **Estimation** should permeate through all subject areas before calculations are attempted. Opportunities should be provided for all learners to develop estimation skills as often as possible. Encouragement should be given to ensure that this is an automatic process for learners.

- Pupils should **experience challenge** through applying their mathematical knowledge in a variety of contexts across the curriculum.

- Pupils are continuing to develop their understanding of the relationships between fractions, decimal fractions and percentages knowledge. Every opportunity should be maximised to **reinforce these links.**

- To support understanding of the relationship between fractions and decimal fractions it can be useful to display place value charts that show tenths, hundredths e.g. include $\frac{1}{10}, \frac{1}{100}$

- Like terms should be gathered together in equations and expressions.

- The use of brackets within operations is critical and time must be taken to ensure pupils have had many opportunities to explore their use.

- Straight line equations should be written in the form y=mx + c.

Suggested Written Recording

Standard written recording that prepares pupils for the expectations of national examinations should be encouraged. **When working at Forth Level teachers are advised to refer to 'Points to Consider' and 'Suggested Written Recording' at Third Level to ensure consistency.**	
• When working with fractions answers should always be simplified e.g. 2/8 x 2 = 4/8 = ½ • Answers should be presented in the same format as the question e.g. if there are mixed numbers in the questions, then the answer should be recorded as mixed numbers.	• Answer should be given to the same number of decimal places as the other numbers in the calculations, unless prompted differently in the question. • Pairs of factors should always be listed with the lowest factor first e.g. (1, 32) (2, 16) (4, 8).

ESTIMATION & ROUNDING AIM: Work with tolerance to discuss, explain and solve problems involving the acceptable range of values in which a measurement will be acceptable.

MNU 4-01a

National 5 Link ~ Rounding to a given number of significant figures.

Uses tolerance to choose the most appropriate degree of accuracy for real-life calculations, selects and communicates processes and solutions.

Have an understanding of the level of tolerance that would be acceptable in different situations.

Justify whether a measurement meets the required tolerance.

When working with decimal numbers, explain your methods and answers using the vocabulary of estimation and rounding including upper and lower bounds.

Express required accuracy using tolerance notation.

Uses a given tolerance to decide if there is an allowable amount of variation of a specified quantity, for example, dimensions of a machine part.

Realise that different degrees of accuracy are acceptable in different situations.

Interpret measurements given in tolerance rotation including percentage limits.

NUMBER & NUMBER PROCESSES AIM: Use knowledge of place value to solve multi-step problems involving the four operations and explain strategies used. Demonstrate an understanding of BIDMAS to solve problems.

MNU 4-03a, MTH 4-03b

National 5 Link ~ Include BIDMAS questions with fractions (incorporating the term 'of')

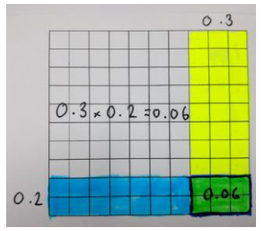
Interprets and solves multi-step problems using the four operations.

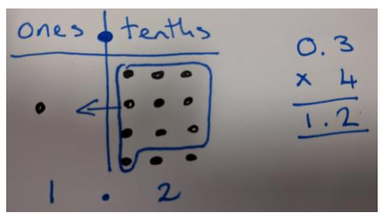
Applies the correct order of operations in all calculations, including those with brackets.

Communicates and justifies use of the most effective strategy for the given task.

Apply knowledge of the number system to solve real life problems and transfer skills from one context to another.

Continue to use knowledge of place value to multiply and divide by decimals.



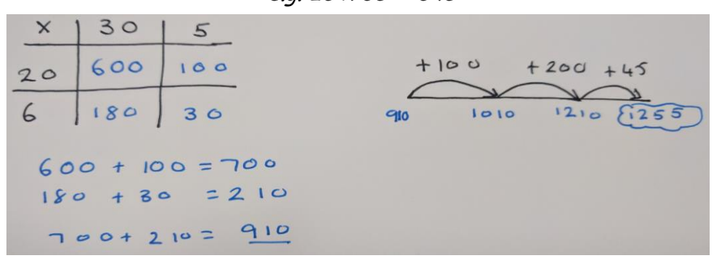


Apply knowledge of order of operations in new and unfamiliar contexts with and without a calculator.

Using knowledge and understanding of different methods, select and justify their choices to solve multi-step problems.

Using knowledge of different methods, select the most efficient strategy to solve multi-step problems and record their working.

e.g. 26 x 35 + 345



Select the appropriate function keys on a calculator and apply them in the correct order.

Use BIDMAS to calculate multi-step calculations including those with brackets.

e.g. (5 x 3) + (24 ÷ 6)

Explore how different oder of operations to lead to a different answer.

e.g. 4 + 2 x 3

Explore the use of key sequences on a calculator.

e.g. the use of brackets, powers, inverse key, square root etc.

Explore rules for the order of operations in number calculations such as *BIDMAS*.

POWERS & ROOTS AIM: While applying knowledge of powers and whole number roots, can evaluate using unfamiliar numbers. Extends the use of powers to express small or large numbers in scientific notation.

MTH 4-06a, MTH4-06b

National 5 Link ~ Introduce Surds

National 5 Link ~ Laws of Indices

Uses knowledge of the relationship between powers and roots to evaluate whole number roots of any appropriate number, for example, $\sqrt[3]{27} = 3$

Shows understanding that square roots of whole numbers can have positive and negative values, for example, $\sqrt{9} = \pm 3$

Solve problems involving numbers written in scientific notation with and without a calculator.

e.g. $(36 \times 10^5) \div (6 \times 10^3)$

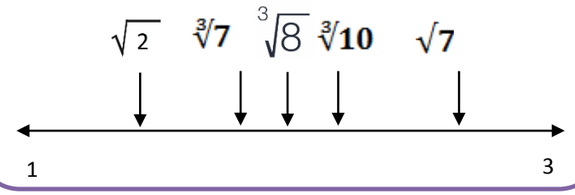
Shows understanding that the square root is the inverse process of squaring a number.

e.g. $If\ \sqrt{4761} = 69.\ Find\ 69^2.$

Apply knowledge of powers and roots to solve problems e.g. Pythagoras' Theorem.

Convert large and small numbers between scientific notation and normal form and vice versa.

Estimate where a root would be placed on a number line.



Write calculations involving powers and roots correctly.

Use the EXP or equivalent buttons to use scientific notation on a calculator.

Mentally or using calculator functions, solve calculations involving powers and roots.

Demonstrate understanding of higher roots.

e.g. cube roots, fourth roots.

Arrange numbers expressed in scientific notation in ascending and descending order.

Uses knowledge of mathematical notation to express numbers in scientific notation.

Become familiar with the EXP or equivalent button on a scientific calculator.

Explore the idea of powers of ten and very simple single digit standard form numbers

e.g. $5000 = 5 \times 10 \times 10 \times 10 \times 10 = 5 \times 10^4$

Understand the relationship between whole number powers and roots.

FRACTIONS & DECIMAL FRACTIONS AIM: Solve problems using the four operations.

MNU 4-07a, MTH 4-07b

National 5 Link ~ Algebraic fractions

Uses calculations to support comparisons, decisions and choices.

Chooses the most efficient form of fractions, decimal fractions or percentages when making calculations.

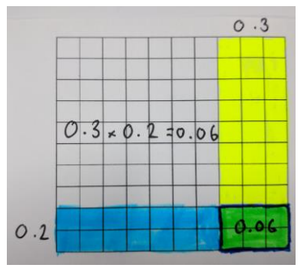
Solve problems using the four operations with decimal fractions.

Use mental and written strategies for the four operations with fractions and mixed numbers.

Applies addition, subtraction and multiplication skills to solve problems involving fractions and mixed numbers.

Use technology to solve problems involving the four operations with fractions and mixed numbers.

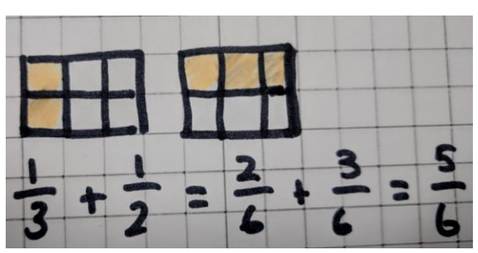
Model multiplication and division of a decimal fraction by a decimal fraction.



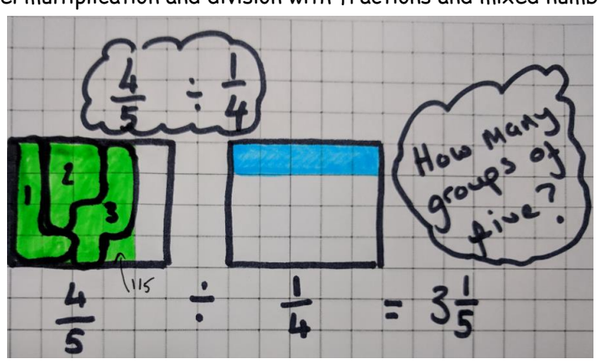
Locate and represent fractions and mixed numbers on a number line.

Produce their own diagrams to show the four operations with fractions and mixed numbers.

Model addition and subtraction of fractions and mixed numbers.



Model multiplication and division with fractions and mixed numbers



PERCENTAGES AIM: Calculate percentage increases/decreases and express one value as a percentage of another.

MNU 4-07a

National 5 Link ~ Reverse percentages

National 5 Link ~ Simple interest

National 5 Link ~ Appreciation/Depreciation

National 5 Link ~ Compound interest

Uses calculations to support comparisons, decisions and choices.

Chooses the most efficient form of fractions, decimal fractions or percentages when making calculations.

Calculates the percentage increase or decrease of a value.

Expresses one value as a percentage of another.

e.g. A new healthy snack bar called "Fibre-crunch is being sold in shops. Each bar weighs 40g and contains 2g of protein, 3g of fat and 35g of carbohydrate. What percentage of protein, fat and carbohydrate does "Fibre-crunch" contain?

Choose the most appropriate method when calculating a percentage and justify the choice.

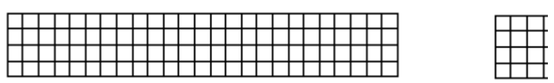
Use knowledge of percentages to solve problems involving percentages in context.

Understand how a percentage relates to a whole unit.

e.g. 53% is 53 parts of the whole unit when split into 100 equal parts

Understand the concept of percentage greater than 100%.

e.g. 112% would be the whole of the object and another 12% (12 parts of the object split into 100 equal parts)



Calculate percentages in a variety of ways including using technology.

FRCATIONS, DECIMALS, PERCENTAGES AIM: Chooses the most appropriate form of fractions, decimal fractions or percentages when solving problems and can justify choice.

MNU 4-07a

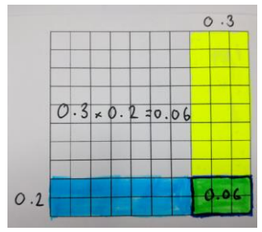
Chooses the most efficient form of fractions, decimal fractions or percentages when making calculations and justifies the methods used.

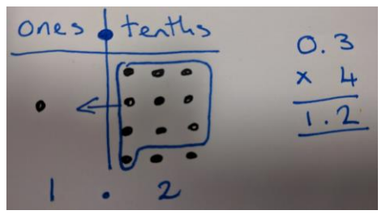
Uses calculations to support comparisons, decisions and choices.

Interpret solutions to make comparisons, decisions and choices.

Choose the most appropriate form of fractions, decimal fractions and percentages to use when making calculations mentally, in written form or using technology.

Model multiplication and division of a decimal fraction by a decimal fraction.

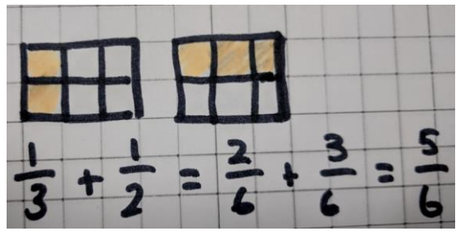


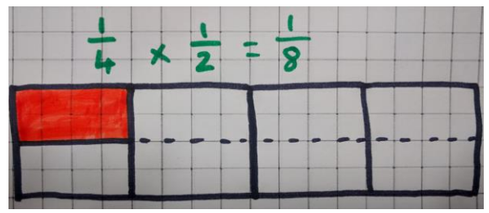


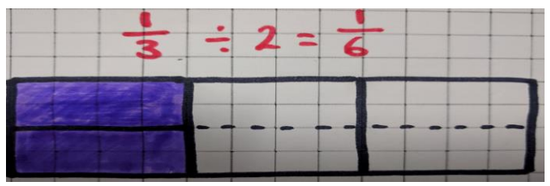
Locate and represent fractions and mixed numbers on a number line.

Place the following fractions on the number line: 1/5, 1/7, 2/9

Produce their own diagrams to show the four operations with fractions and mixed numbers.







Choose whether to represent thinking as a fraction, decimal fraction or percentage and justify.

Understand that changing between fractions, decimals and percentages may be appropriate for the context of the problem.

PROPORTION AIM: Solve problems involving proportion in real-life situations.

MNU 4-08a

Uses knowledge of proportion to solve problems in real-life which involve changes in related quantities.

Example

4 people can paint a fence in 3 hours.

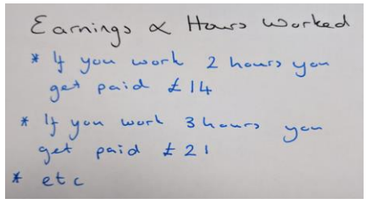
Assuming everyone works at the same rate, how long would it take

6 people to paint the fence?

Solve problems involving direct and inverse proportion.

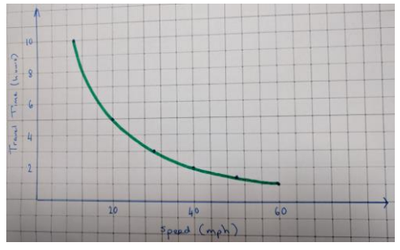
e.g. y is directly proportional to x, and when x = 3 then y = 15. Calculate the constant of proportionality.

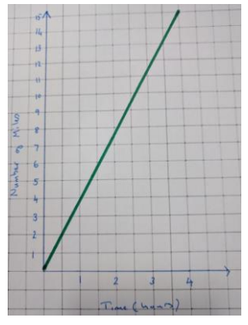
Use numerical methods to illustrate direct and inverse proportion.



Number of Loaders	Hours Taken
2	4
4	2
8	1

Use graphical methods to illustrate direct and inverse proportion.





Recognise when quantities are related in direct or inverse proportion.

Understand the difference between direct and inverse proportion.

MONEY AIM: Use understanding of credit, debit, income, effective budgeting and financial products to make appropriate financial decisions.

MNU 4-09a, MNU 4-09b, MNU 4-09c

National 5 Link ~ Working with reverse percentages

National 5 Link ~ Compound interest

National 5 Link ~ Simple interest

Compares a range of personal finance products.

Calculates net income by selecting appropriate information.

Communicates the impact of financial decisions.

Applies understanding of credit and debit in relation to earnings and deductions.

Uses budgeting skills to manage income effectively and justifies spending and saving choices.

Calculate and compare different offers and choose one that offers best value, giving valid reasons for my choice.

e.g use comparison website to compare insurance deals.

Extend application of such things as: financial services, saving, borrowing, overspending, online spending, debit, credit and scams to make financial decisions.

Connect the compound interest formula to repeated applications of simple interest using appropriate digital technologies.

Applies knowledge of currency conversion to determine best value.

Further develop understanding of tax.

e.g. VAT, Income Tax, National Insurance

Further develop understanding of currency conversion.

e.g. use xe.com to initiate discussion around different currencies and rates.

TIME AIM: Use the relationship between distance, speed and time to carry out calculation involving decimal and decimal fraction hours.

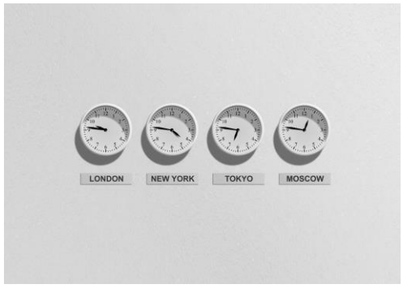
MNU 4-10a, MNU 4-10b

Carries out calculations involving speed, distance and time involving decimal and decimal fraction hours.

e.g. An iceberg and a ship separated by 440 kilometres are moving directly towards each other. The iceberg is floating at 2 kilometres per hour, whereas the ship is travelling at 27 kilometres per hour. Assuming that neither changes course, how long will it be before the two collide?

Identify and apply the correct formula in a variety of situations.

Demonstrates effective time management skills, for example, working with different time zones or making plans, including across midnight.



Calculates time durations across hours, days and months.

Convert hours and minutes to a decimal fraction and vice versa with a calculator if necessary.

MEASUREMENT AIM: Select, apply and interpret appropriate formula to solve problems involving surface area and volume. When applying these during multi-step calculations, display an awareness of rounding implications.

MNU 4-11a, MTH 4-11b, MTH 4-11c

National 5 Link ~ Calculate the area of an arc or the area of a sector of a circle.

National 5 Link ~ Calculate the volume of a standard solid (sphere, cone, and pyramid).

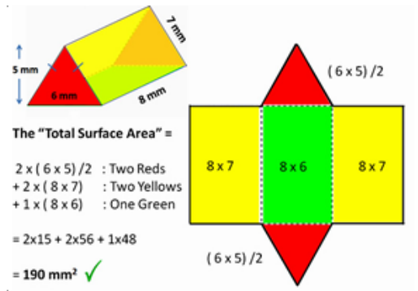
National 5 Link ~ Round to a given number of significant figures.

Uses formulae and calculates the surface area of cylinders, cuboids and triangular prisms.

Calculates the volume of triangular prisms and cylinders using formulae

Demonstrates understanding of the impact of truncation and premature rounding.

Use knowledge of nets and formulae to solve problems involving surface areas.

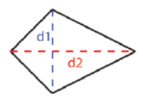


Calculates the area of kites, parallelograms and trapeziums.

Area of a Kite

A kite has two pairs of adjacent sides that are congruent.

$A = \frac{d_1 \times d_2}{2}$



A = Area

d_1 = one of the diagonals

d_2 = the other diagonal

Select the appropriate formula to solve surface area and volume problems.

Determine and justify the level of accuracy required to solve multi-step real life problems involving measurement.

Describe when exact measurements could be difficult to calculate.

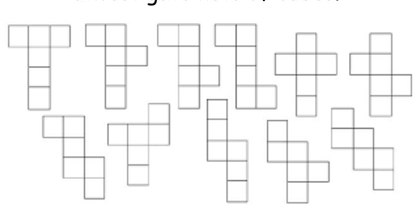
e.g. very large or very small measurements in science.

Know the relationships to create formulae for a surface area & volumes.

Split a net into multiple parts in order to find a surface area.

Understand that a net is made up from known common shapes/objects.

Investigate nets of cubes.



Extend understanding that smaller units of measurement will give more accurate answers.

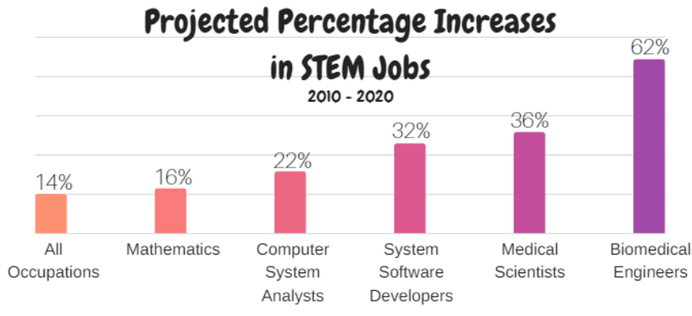
MATHEMATICS – IT'S IMPACT ON THE WORLD, PAST, PRESENT AND FUTURE AIM: Create and deliver a presentation with others detailing the role mathematics plays in everyday life and in the workplace. Explain the links maths has within other curricular areas – particularly the STEM subjects.

MTH 4-12a

Contributes to discussions on the role of mathematics in everyday life and in the workplace.

Contributes to presentations on the role of mathematics in everyday life and in the workplace.

Investigates the mathematical skills required for a range of careers including those in STEM subjects.



Question others to further own knowledge about the role mathematics plays in Employability and STEM.

Respond to questioning from others, sharing knowledge of research into impact that mathematics has within Employability and STEM.

Create a presentation with others and share findings with others on how mathematics can be applied in the workplace.

Explore a mathematical area of its links to within STEM.

Explore the importance of mathematics in the real world.

Explore mathematical skills required for different careers.

PATTERNS & RELATIONSHIPS AIM: Note: This pyramid appears across two pages.

Understand, interpret and calculate the gradient of a straight line. Apply knowledge and use formula y = mx + c to express equation of a line.

MTH 4-13a, MTH 4-13b, MTH 4-13c, MTH 4-13d

National 5 Link ~ Changing the subject of a formula

National 5 Link ~ Determine the equation of a straight line given the gradient and y-intercept.

National 5 Link ~ Working with simultaneous equations (intersection of lines)

Uses a graph of a straight line to interpret real-life situations and solve related problems.

Solve real life examples involving gradients and interpret the answer e.g. ramps.

Uses a given formula to plot a straight line onto a Cartesian diagram.

Draw and interpret straight line graphs to solve problems, including alternative variables.

Use knowledge of gradients to interpret distance/time graphs.

Uses the formula y = mx + c to express the equation of a line.

Calculates the gradient of lines from 2 given coordinates using the gradient formula.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Determines a general formula for the nth term to describe a sequence and uses it to solve related problems, linear examples only.

Given a straight line graph, identify the gradient, y-intercept and then state the equation of the line.

Draws conclusions about the gradient of a line, for example, 'does the ramp meet the building regulations?'.

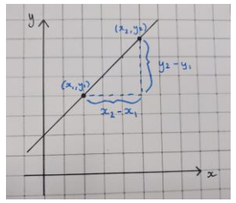
Solve real life examples involving sequences.

Communicates the gradient of vertical and horizontal lines and states the equation of these lines as x = a or y or y = b equivalent.

From an equation of a line, draw a horizontal or vertical line.

Use n^{th} term formulae to generate sequences.

Determines the gradient formula by investigating lines on a co-ordinate diagram.



Given the gradient and y-intercept, state the equation of the straight line.

Create a number pattern using fractions and decimal fractions.

Construct formulae to find the n^{th} term of a non-linear sequence.

Calculates the gradient of lines in a co-ordinate diagram.

Use the equation of a line to describe a horizontal or vertical line.

Compare two gradients to identify which is steeper.

Identify the gradient and y-intercept from the equation of a straight line.

Plot points from a table and observe the connection between the gradient, the y-intercept and the equation of the line in the form y = mx + c.

Understand how to calculate gradients by dividing the vertical distance by the horizontal distance.

Complete a table of values for a given equation.

Select two appropriate points on a straight line to calculate gradient.

Describe a gradient as positive, negative, zero or undefined.

Understand the term y-intercept.

Investigate the pattern of coordinates on horizontal and vertical lines.

Understand the impact changing the scale of the x and y axes has on the appearance of the gradient.

Understand that gradient is the measure of steepness of a slope.

Recognise that there are other types of sequences *e.g. non-linear sequences.*

EXPRESSIONS & EQUATIONS AIM: Employ an appropriate strategy to solve an extended range of linear equations and inequations.

MTH 4-14a, MTH 4-14b, MTH 4-15a

National 5 Link ~ Change the subject of a formula.

National 5 Link ~ Work with simultaneous equations.

National 5 Link ~ Work with algebraic expressions involving expansion of brackets.

National 5 Link ~ Factorise an algebraic expression e.g. non-numerical common factor.

Interpret solutions and check the answer with the original context.

Construct inequations and an extended range of equations to solve problems.

Solve inequations involving negative coefficients of x.

Solves problems by expressing the given information appropriately as an equation, in-equation or formula.

Solve equations/inequations with unknowns on both sides including brackets.

Solves linear inequalities, including on simple closed intervals.

Factorise algebraic expressions.

Factorises expressions with a numeric common factor.

Solves an extended range of linear equations involving the distributive law.
e.g. ax ± b = cx ± d, where a, b, c and d are integers.

Expand and simplify expressions with brackets including a negative multiplier.

Expands brackets using the distributive law and simplifies.

Evaluates algebraic expressions involving a bracket.

Construct an inequation to describe a real life situation
e.g. speed ≤ 40mph.

Show the process of eliminating terms by using inverse operations with equations and inequations
e.g. with 5x – 4 = 2x + 9 you would add 4 to both sides to eliminate the – 4.

Use knowledge of common factors to identify highest common factors in algebraic expressions.

Use the distributive law to simplify an algebraic expression by removing or expanding the brackets.

Evaluate an expression including brackets, given a value for each variable.

Investigate what effect multiplying and dividing inequations by negative numbers has on the symbol.

Model balancing equations with unknowns on both sides.

Understand that factorising is the opposite of expanding brackets.

Recognise that the commutative law applies to algebraic terms
e.g. abc = cba

Model the distributive law in practical contexts
e.g. 3 x (2 + 6) = 3 x 2 + 3 x 6

Understand the symbols <, >, ≤ and ≥ in relation to inequations.

Fourth Level Overview

**** The numeracy learner statements that are the responsibility of all are shown in italics.***

Key Aspect	Experiences and Outcomes	National Benchmarks
Estimation and Rounding Pg 125	***Having investigated the practical impact of inaccuracy and error, I can use my knowledge of tolerance when choosing the required degree of accuracy to make real-life calculations.*** ***MNU 4-01a***	• ***Rounds answers to a specified significant figure.*** • ***Demonstrates that the context of the question needs to be considered when rounding.*** • ***Demonstrates the impact of inaccuracy and error, for example, the impact of rounding an answer before the final step in a multi-step calculation.*** • ***Uses a given tolerance to decide if there is an allowable amount of variation of a specified quantity, for example, dimensions of a machine part, 235 mm ± 1 mm.***
Number and number processes Pg 126	***Having recognised similarities between new problems and problems I have solved before, I can carry out the necessary calculations to solve problems set in unfamiliar contexts.*** ***MNU 4-03a*** I have investigated how introducing brackets to an expression can change the emphasis and can demonstrate my understanding by using the correct order of operations when carrying out calculations. MTH 4-03b	• ***Interprets and solves multi-step problems using the four operations.*** • Applies the correct order of operations in all calculations, including those with brackets.

Key Aspect	Experiences and Outcomes	National Benchmarks
Powers and Roots Pg 127	I have developed my understanding of the relationship between powers and roots and can carry out calculations mentally or using technology to evaluate whole number powers and roots, of any appropriate number. MTH 4-06a Within real-life contexts, I can use scientific notation to express large or small numbers in a more efficient way and can understand and work with numbers written in this form. MTH 4-06b	• Shows understanding that square roots of whole numbers can have positive and negative values, for example, $\sqrt{9} = \pm 3$ • Uses knowledge of the inverse relationship between powers and roots to evaluate whole number roots of any appropriate number, $\sqrt[3]{27} = 3$. • Uses knowledge of mathematical notation to express numbers in scientific notation.
Fractions, Decimals and Percentages Pgs 128 -131	***I can choose the most appropriate form of fractions, decimal fractions and percentages to use when making calculations mentally, in written form or using technology, then use my solutions to make comparisons, decisions and choices.*** ***MNU 4-07a***	• ***Chooses the most efficient form of fractions, decimal fractions or percentages when making calculations.*** • ***Uses calculations to support comparisons, decisions and choices.*** • ***Calculates the percentage increase or decrease of a value.*** • Applies addition, subtraction and multiplication skills to solve problems involving fractions and mixed numbers. • ***Uses knowledge of proportion to solve problems in real-life which involve changes in related quantities.***

Key Aspect	Experiences and Outcomes	National Benchmarks
	I can solve problems involving fractions and mixed numbers in context, using addition, subtraction or multiplication. MTH 4-07b ***Using proportion, I can calculate the change in one quantity caused by a change in a related quantity and solve real-life problems.*** ***MNU 4-08a***	
Money Pg 132	***I can discuss and illustrate the facts I need to consider when determining what I can afford, in order to manage credit and debt and lead a responsible lifestyle.*** ***MNU 4-09a*** ***I can source information on earnings and deductions and use it when making calculations to determine net income.*** ***MNU 4-09b***	• ***Applies understanding of credit and debit in relation to earnings and deductions.*** • ***Uses budgeting skills to manage income effectively and justifies spending and saving choices.*** • ***Calculates net income by selecting appropriate information.*** • ***Compares a range of personal finance products.*** • ***Communicates the impact of financial decisions.*** • ***Applies knowledge of currency conversion to determine best value.***

Key Aspect	Experiences and Outcomes	National Benchmarks
	I can research, compare and contrast a range of personal finance products and, after making calculations, explain my preferred choices. ***MNU 4-09c***	
Time Pg 133	***I can research, compare and contrast aspects of time and time management as they impact on me.*** ***MNU 4-10a*** ***I can use the link between time, speed and distance to carry out related calculations.*** ***MNU 4-10b***	• ***Demonstrates effective time management skills, for example, working with different time zones or making plans, including across midnight.*** • ***Carries out calculations involving speed, distance and time involving decimal fraction hours.*** • ***Calculates time durations across hours, days and months.***
Measurement Pg 134	***I can apply my knowledge and understanding of measure to everyday problems and tasks and appreciate the practical importance of accuracy when making calculations.*** ***MNU 4-11a***	• ***Demonstrates understanding of the impact of truncation and premature rounding.*** • Calculates the area of kites, parallelograms and trapeziums. • Uses formulae and calculates the surface area of cylinders, cuboids and triangular prisms. • Calculates the volume of triangular prisms and cylinders using formulae.

Key Aspect	Experiences and Outcomes	National Benchmarks
	Through investigating real-life problems involving the surface area of simple 3D shapes, I can explore ways to make the most efficient use of materials and carry out the necessary calculations to solve related problems. MTH 4-11b I have explored with others the practicalities of the use of 3D objects in everyday life and can solve problems involving the volume of a prism, using a formula to make related calculations when required. MTH 4-11c	
Mathematics – its impact on the world, past, present and future Pg 135	I have discussed the importance of mathematics in the real world, investigated the mathematical skills required for different career paths and delivered, with others, a presentation on how mathematics can be applied in the workplace. MTH 4-12a	• Contributes to discussions and presentations on the role of mathematics in everyday life and in the workplace. • Investigates the mathematical skills required for a range of careers, including those in STEM subjects.

Key Aspect	Experiences and Outcomes	National Benchmarks
Patterns and Relationships Pgs 136 & 137	Having explored how real-life situations can be modelled by number patterns, I can establish a number sequence to represent a physical or pictorial pattern, determine a general formula to describe the sequence, then use it to make evaluations and solve related problems. MTH 4-13a I have discussed ways to describe the slope of a line, can interpret the definition of gradient and can use it to make relevant calculations, interpreting my answer for the context of the problem. MTH 4-13b Having investigated the pattern of the coordinate points lying on a horizontal or vertical line, I can describe the pattern using a simple equation. MTH 4-13c	• Determines a general formula for the nth term to describe a sequence and uses it to solve related problems, linear examples only. • Calculates the gradient of lines in a coordinate diagram. • Draws conclusions about the gradient of a line, for example, 'does the ramp meet building regulations?'. • Communicates the gradient of vertical and horizontal lines and states the equation of these lines as x = a or y = b or equivalent. • Uses a given formula to plot a straight line onto a Cartesian diagram.

Key Aspect	Experiences and Outcomes	National Benchmarks
	I can use a given formula to generate points lying on a straight line, plot them to create a graphical representation then use this to answer related questions. MTH 4-13d	
Expressions and Equations Pg 138	Having explored the distributive law in practical contexts, I can simplify, multiply and evaluate simple algebraic terms involving a bracket. MTH 4-14a I can find the factors of algebraic terms, use my understanding to identify common factors and apply this to factorise expressions. MTH 4-14b	• Expands brackets using the distributive law and simplifies. • Solves an extended range of linear equations involving the distributive law, for example, ax ± b = cx ± d, where a, b, c and d are integers. • Solves linear inequalities, including on simple closed intervals. • Solves problems by expressing the given information appropriately as an equation, in-equation or formula. • Evaluates algebraic expressions involving a bracket. • Factorises expressions with a numeric common factor.

Key Aspect	Experiences and Outcomes	National Benchmarks
	Having discussed the benefits of using mathematics to model real-life situations, I can construct and solve inequalities and an extended range of equations. MTH 4-15a	

Index

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