National Numeracy and Mathematics Progression Framework
Estimation and rounding

Awareness of size and amount

Concept of estimation

Concept of rounding

Accuracy within rounding

Tolerance
Estimation and rounding

Awareness of size and amount

Why is it important?
Comparing size and amount supports the development of appropriate language relating to quantities. This also supports an understanding of where numbers sit on a number line.

Awareness of size and amount
Estimation and rounding

Awareness of size and amount

What is it?
Comparing different sizes and amounts (quantities) using appropriate vocabulary to describe them in relation to each other.

Previous knowledge and understanding
- Demonstrate an ability to compare items, shapes and groups
- In play, can group or sort items by own criteria
- Can talk about items, shapes or groups in own words, with some evidence of comparative language, e.g. taller, smaller, longer, shorter
Estimation and rounding

Concept of estimation

Why is it important?

Early estimation skills allow for more refined comparisons and for approximations to be made. Estimating is the interpretation of relative size and quantities.
Estimation and rounding

Concept of estimation

What is it?
As this skill becomes more refined, learners will be able to predict solutions and check the accuracy of calculations.

Previous knowledge and understanding
- Can apply knowledge of number in relation to quantities
- Is able to group or segregate items to a given criteria
- Can talk about items, shapes or groups and can use comparative language
Estimation and rounding

Concept of rounding

Why is it important?

The ability to round supports the development of mental agility. It also allows for quick estimations to be made in calculations and to check the reasonableness of a solution.
Estimation and rounding

**Concept of rounding**

**What is it?**
The concept of rounding is the application of understanding of place value and knowing what is the most appropriate whole number (or decimal fraction) to round it to, within a given context.

**Previous knowledge and understanding**
- Have an understanding of place value
- Have an understanding of estimation and approximate values

The ability to round supports the development of mental agility. It also allows for quick estimations to be made in calculations and to check the reasonableness of a solution.
Estimation and rounding

Accuracy within rounding

Why is it important?
Rounding accurately is an essential component of determining the reasonableness of a solution. In different contexts there will be different degrees of accuracy required.
**Accuracy within rounding**

**What is it?**
As this skill becomes more refined, learners will be able to predict solutions and check the accuracy of calculations.

**Previous knowledge and understanding**
- Understand that a rounded value is not equal to the original value
- Can use knowledge of place value to make a decision on how a number should be rounded
- Can explain what rounding means using vocabulary of estimation, e.g. about, nearly, roughly
- Can select and apply appropriate rounding strategy in a given situation, e.g. measurement, time, money
- Using knowledge of number, is able to give an increasingly accurate estimation of the quantity of a given set
- Can determine the reasonableness of an outcome
Estimation and rounding

Why is it important?

To understand that there are acceptable degrees of accuracy required in calculations, including with measurement and real-life contexts.
Estimation and rounding

Tolerance

What is it?
Tolerance intervals are the differences between the greatest and least acceptable values of the measurement. Tolerance is the maximum range of variation allowed within particular situations and contexts and supports the understanding of inaccuracy.

Previous knowledge and understanding
- Knows that depending on the situation, degrees of accuracy in rounding may differ, e.g. when measuring room for a carpet, rounding up should be applied to ensure enough carpet is purchased
- Display an awareness of appropriateness of rounding, e.g. when preparing to arrive for a train journey, rounding up would be inappropriate
- Understand that measurements are not always accurate to varying degrees
Number and number processes

- Awareness of number
  - Numerals
  - Counting
  - Quantity
  - Mental agility
- Place value
- Addition and Subtraction
- Multiplication and Division
- Order of operations
- Negative numbers
- Fractions, decimal fractions and percentages
- Applying across contexts
Number and number processes

Awareness of number

Why is it important?

Numbers are all around us and they are used in many different ways. Developing an understanding of numbers and their role in the description of quantities is fundamental to forming the connections needed to describe a group of objects. To be confident and comfortable with numbers, it is necessary to understand how the number system works and how numbers relate to each other. It is important to understand numbers can be classified into sets called number systems, e.g. natural numbers and real numbers. All numbers can be expressed using the digits: 0,1,2,3,4,5,6,7,8 and 9.
Number and number processes

Awareness of number

What is it?
Learners need to have an awareness of what numbers are through understanding and application of:
- the meaning of numbers
- the relationship between numbers
- comparison and contrast between the relative size (magnitude of numbers)

Here are video exemplars:

Numbers are used in many different contexts. Developing an understanding of numbers and their role in describing quantities is fundamental to forming the connections needed to describe a group of objects. To be confident and comfortable with numbers, it is necessary to understand how numbers relate to each other.

Numbers can be classified into sets of numbers and real numbers. All whole numbers are composed of digits; 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Why is it important?
Numbers are all around us and they are used in many different ways. Developing an understanding of numbers and their role in describing quantities is fundamental to forming the connections needed to describe a group of objects. To be confident and comfortable with numbers, it is necessary to understand how numbers relate to each other. Numbers can be classified into sets of numbers and real numbers. All whole numbers are composed of digits; 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.
Number and number processes

**Numerals**

*Why is it important?*

Developing an understanding that we have both words and symbols for all the numbers we use needs to be understood. This ensures the ability to count accurately and understand one to one correspondence.
Number and number processes

Numerals

What is it?
A numeral is a symbol that represents a number. The move from the real object to the symbols of numbers is one of the first and most abstract concepts that learners meet. Digits make up numbers.

Here are video exemplars:
Number and number processes

Counting

Why is it important?

Develop the ability to count with understanding of one to one correspondence is crucial to develop future ability to carry out the four operations quickly and efficiently.

Counting | The importance of zero | One-to-one correspondence
Developing counting skills | Language | Counting forwards and backwards
Number and number processes

Counting

What is it?
Counting is more than reciting numbers in order. It involves understanding of the number system and being able to apply this knowledge. Using a one-to-one correspondence to link numbers to their amounts or quantities enables the development of counting with understanding. Zero should be included when learning about numbers, to build understanding for future work in developing understanding of place value and decimal fractions.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/counting.asp
Number and number processes

Why is it important?
Developing counting skills is crucial to develop future ability to carry out the four operations quickly and efficiently.

The importance of zero
What is it?
Leaners should be learners in counting from zero and understanding the importance of zero as a quantity and numeral digit used to represent that number (0). Leaners should also understand the value of zero.

Here are video exemplars:
Number and number processes

Counting

Why is it important?
Develop the ability to count with understanding of one-to-one correspondence is crucial to develop future ability to carry out the four operations quickly and efficiently.

One-to-one correspondence

What is it?
Learners need to understand that each object must be counted only once and as the number name is identified by the learner.

Here are video exemplars:
Number and number processes

Developing counting skills

What is it?
When counting a group of items, and then re-counting the same group starting with a different item, the total remains unchanged. This concept is the conservation of number—the arrangement of a group of items does not affect the total. The last number said in a count indicates how many items there are in a group; it does not describe the last item counted. As counting develops, within a known range of numbers and beyond, other techniques can be learned, e.g. counting in jumps, e.g. 2, 4, 6, 8 or 5, 10, 15, 20 etc.

Here are video exemplars:
Number and number processes

Counting

Why is it important?

Developing counting skills is crucial to develop future ability to carry out the four operations quickly and efficiently. Understanding one to one correspondence is fundamental to being able to count.

Language

What is it?

Language should be developed in order to compare size and quantity.

Here is a video exemplar:

http://www.educationscotland.gov.uk/video/n/nnpf/countinglanguage.asp
Number and number processes

Counting

Why is it important?
Develop the ability to count with understanding of one to one correspondence is crucial to develop future ability to carry out the four operations quickly and efficiently.

Counting forwards and backwards

What is it?
This enables learners to use the counting system to count forwards or backwards from any number (including zero).

Here are video exemplars:
Quantity

Why is it important?
The concept of quantity enables the communication of value, amount, size and number of objects.
Number and number processes

Quantity

What is it?
An amount.

Here are video exemplars:
Number and number processes

Quantity
Why is it important?
The concept of quantity enables the communication of value, amount, size and number of objects.

Subitising
What is it?
Recognising a quantity without counting, simply by looking.

Here are video exemplars:
Number and number processes

Quantity

Why is it important?
The concept of quantity enables the communication of value, amount, size and number of objects.

Arrays
What is it?
Identify quantities and patterns to make quick estimates.

Here are video exemplars:
- [link](http://www.educationscotland.gov.uk/video/n/nnpf/quantityarrays1.asp)
- [link](http://www.educationscotland.gov.uk/video/n/nnpf/quantityarrays2.asp)
Quantity

Groupings

What is it?
Recognise the amount of objects in a group and use this information to estimate the amount of objects in a larger group.

Here are video exemplars:
- [Link](http://www.educationscotland.gov.uk/video/n/nnpf/grouping1.asp)
- [Link](http://www.educationscotland.gov.uk/video/n/nnpf/grouping2.asp)

Arrays
Number and number processes

Mental agility

**Why is it important?**

Being able to visualise, hold and manipulate numbers helps to demonstrate an understanding of the number system and how it works.
Number and number processes

Mental agility

What is it?
Mental agility is developed through understanding how to use and select appropriate strategies. The preferred method is often selected until the learner has developed confidence in identifying the most efficient method.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/mentalagility.asp
Number and number processes

Place value

Why is it important?

The language to be used in place value is important for communicating the value of a digit and its place within the number system.
Number and number processes

Place value

What is it?
It is understanding how a number is composed and knowing its relationship to other numbers. It is the place of each of the digit or digits which makes a difference to the value of the number both in whole numbers and decimal fractions.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/placevalue.asp
Number and number processes

Why is the language to be used in place value important?

The language to be used in place value is important for communicating the value of a digit and its place within the number system.

Zero as a place holder

What is it?
The position of a digit gives its value and zero acts as a place holder and determines the value of the number.

Here are video exemplars:

Number and number processes

**Place value**

**Why is it important?**

The language to be used in place value is important for communicating the value of a digit and its place within the number system.

**Language of place value**

**What is it?**

It is the place of the digit or digits which indicates the value of the number, whether a whole number or a decimal fraction. Learners need to be able to work with ones, tens, hundreds etc and tenths, hundredths and thousandths etc.

Here are video exemplars:

Number and number processes

Place value

Why is it important?
The language to be used in place value is important for communicating the value of a digit and its place within the number system.

Grouping and partitioning

What is it?
Both standard (e.g. 76 = 70 + 6) and non-standard (e.g. 76 = 20 + 56 or 40 + 36) partitioning should be taught as both will assist learners in their mental calculations.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/groupingandpartitioning.asp

Mental agility

Numerals

Counting

Quantities

Add/Subtract

Negative numbers

Multiply/Divide

Fractions, decimal fractions and percentages

Applying across contexts

Awareness of number

Place value

Order of operations

Applying across contexts
Number and number processes

- **Awareness of number**
- **Place value**
- **Order of operations**
- **Applying across contexts**

**Why is it important?**
The language to be used in place value is important for communicating the value of a digit and its place within the number system.

**Working with decimal fractions**

**What is it?**
It is the place of a digit or digits which determines the value of the number, whether a whole number or decimal fraction. Zero within a decimal fraction acts as a place holder. The decimal point separates the whole numbers from the fractions e.g. it separates the units (or ones) from the tenths. The decimal point does not move.

**Here are video exemplars:**
Number and number processes

Place value

Why is it important?
The language to be used in place value is important for communicating the value of a digit and its place within the number system.

Mental agility

What is it?
Developing the ability to use efficient methods to calculate mentally and confidently using knowledge of place value within their mental calculations.

Here are video exemplars:

Addition and Subtraction

Why is it important?

Being able to add and subtract mentally and on paper is a key life skill and provides the foundation for the understanding of multiplication and division.
Number and number processes

Addition and subtraction

What is it?
These are inverse operations and must be taught together. Addition is the process of combining two or more quantities to calculate their sum or total. Subtraction is the difference between two quantities. Learners should carry out calculations to solve real life problems in familiar practical contexts and become increasingly fluent in addition and subtraction.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/additionandsubtraction.asp

Why is it important?
Being able to add and subtract mentally and on paper is a key life skill and provides the foundation for the understanding of multiplication and division.

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Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/additionandsubtraction.asp
Addition and subtraction

Why is it important?
Being able to add and subtract mentally and on paper is a key life skill and provides the foundation for the understanding of multiplication and division.

What is it?
Exploring the relationship between addition and subtraction. Addition and subtraction need to be taught together e.g. highlighting that subtraction can be calculated by adding on.

Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.

Here are video exemplars:
Number and number processes

Addition and subtraction

Why is it important?

Being able to add and subtract is a key life skill and provides the foundation for understanding multiplication and division.

Algorithms

What is it?

Algorithms should be introduced after practical experiences and understanding the concepts of addition and subtraction. Reading, writing and interrogating mathematical statements involving +, -, = signs. This includes working out the missing number in a mathematical statement. Written methods support place value and working with larger numbers.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/algorithms.asp
Number and number processes

Multiplication and Division

Why is it important?
Grouping and sharing small quantities to develop understanding of multiplication and division. Doubling number quantities and finding simple fractions of objects, numbers and quantities. Multiplication and division are inverse operations which should be taught together. Multiplication and division are linked initially with repeated addition approaches involving increasing sets or amounts. Division is initially linked to repeated subtraction and involves decreasing quantities by set amounts or sharing equally. Symbols are used to represent multiplication and division (x, ÷).

Multiplication and Division

Relationship between multiplication and division
**Number and number processes**

**Multiplication and Division**

**What is it?**
Grouping and sharing small quantities to develop understanding of multiplication and division. Doubling number quantities and finding simple fractions of objects, numbers and quantities. Multiplication and division are inverse operations which should be taught together. Multiplication and division is linked initially with repeated addition approaches involving increasing sets or amounts. Division is initially linked to repeated subtraction and involves decreasing quantities by set amounts or sharing equally. Symbols are used to represent multiplication and division (\( \times, \div \)).

Here is a video exemplar:
Relationship between multiplication and division

What is it?
Knowing how to find multiplication and division facts, including use of partitioning and the inverse operation. Being able to recall a particular multiplication fact and being able to use this to solve related multiplication and division tasks. The set of related facts is known as a fact family. Using relationships to support recall and being able to manipulate numbers facts mentally, accurately and confidently. Using knowledge of division when working with fractions e.g. ½ of 40. The relationship between digits in the decimals system should be highlighted when multiplying and dividing by 10, 100, 1000 etc.

Why?
Being able to multiply and divide mentally and on paper is a key life skill. Learners should understand the relationship between multiplication, division to be able to carry out calculations efficiently including work with fractions. It is important that children are taught to appreciate and make use of this mathematical relationship when developing and using mental calculation strategies.

Here are video exemplars:

- [http://www.educationscotland.gov.uk/video/n/nnpf/relationshipbetweenmultiplicationanddivisionmandd.asp](http://www.educationscotland.gov.uk/video/n/nnpf/relationshipbetweenmultiplicationanddivisionmandd.asp)
Order of operations

Why is it important?
An understanding of commutative, distributive and associative properties enables the development of more efficient calculations. Rules established to support carrying out calculations that involve more than one operation.
Number and number processes

Order of operations

What is it?
There is a set order of operations used within calculations involving more than one operation, e.g. + and x.

Here are video exemplars:
http://www.educationscotland.gov.uk/video/n/nnp/orderofoperations1.asp
http://www.educationscotland.gov.uk/video/n/nnp/orderofoperations2.asp
Number and number processes

Order of operations

Why is it important?
An understanding of the commutative, distributive and associative properties enables the development of more efficient calculations. Rules established to support carrying out calculations that involve more than one operation.

Understanding and application of the order of operations

What is it?
At the introductory stage the order of operations applies to the four basic operations, where multiplication and division have equal priority and addition and subtraction have equal priority. This can then be extended to include brackets and indices. The use of mnemonics such as BODMAS, BIDMAS and BOMDAS are often used when deciding on the order of operations.

Here are video exemplars:
Number and number processes

Order of operations

Why is it important?
An understanding of the order of operations is important for efficient calculations. It enables the development of more efficient calculations.

Order of operations

Understanding and application of the order of operations

Commutative, distributive and associative properties

What is it?
The commutative law states that you can swap numbers around (within a calculation) and still get the correct answer. The commutative law and inverse relationship develops multiplicative reasoning. The distributive law states that multiplying a number by a group of numbers added together is the same as doing each multiplication separately.

The associative law states:
• It doesn't matter how you group the numbers when you add
• It doesn't matter how you group the numbers when you multiply

Here are video exemplars:
Number and number processes

Negative numbers

Why is it important?
Understanding negative numbers is important for real life applications such as temperature measurements, graphs and charts and budgeting.

- Negative numbers
- Integers
- Ordering
- Calculations
- Application in real life contexts
Understanding negative numbers is important for real life applications such as temperature measurements, graphs and budgeting.

Negative numbers

What is it?
Numbers which are less than zero.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/negativenumbers.asp
Number and number processes

Integers
What is it?
The term integer is used when working with positive and negative whole numbers. Integer calculations set in a context involve an understanding of how to deal with negative numbers within the 4 operations.

Here is a video exemplar: [http://www.educationscotland.gov.uk/video/n/nnpf/integers.asp](http://www.educationscotland.gov.uk/video/n/nnpf/integers.asp)
Number and number processes

Negative numbers

Why is it important?
Understanding negative numbers is important for real life applications such as temperature measurements, graphs and charts and budgeting.

Ordering
What is it?
Recognising the position of negative numbers on a number line or measuring device.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nn pf/ordering.asp
Number and number processes

Negative numbers

Why is it important?
Understanding negative numbers is important for real life applications such as temperature measurements, graphs and budgeting.

Calculations
What is it?
Effect of negative numbers within calculations involving the 4 operations, e.g. double negatives.

Here is a video exemplar: http://www.educationscotland.gov.uk/video/n/nnpf/calculations.asp
Number and number processes

Negative numbers

Why is it important?
Understanding negative numbers is important for real life applications such as temperature measurements, graphs and charts, and budgeting.

What is it?
Applying knowledge and understanding of negative numbers within real life contexts.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/applicationinreallife.asp
Fractions, decimal fractions and percentages

Why is it important?
The ability to see fractions, decimal fraction and percentages as operators rather than just a number. The ability to solve problems involving fractions, decimal fractions and percentages using a wide variety of methods is an important life skill.
Fractions, decimal fractions and percentages

What is it?
Working with fractions involves using times tables skills and the links between multiplication and division facts. Understanding of place value is crucial.

Here are video exemplars:
Number and number processes

Fractions, decimal fractions and percentages

Why is it important?
The ability to see fractions, decimal fractions, and percentages as operators, as well as operators in problems involving money and measures, and using a wide variety of methods is an important life skill.

What is it?
Being able to express and understand the inter-relationship between fractions, decimal fractions, and percentages. Knowing that numbers can be expressed in different forms and how to convert from one form to another.

Here is a video exemplar:
http://www.educationscotland.gov.uk/video/n/nnpf/fdfandpinterrelationships.asp
Number and number processes

Applying across contexts

Why is it important?

Being able to apply numeracy skills across a variety of real life contexts leads to being numerate and being able to function responsibly in everyday life, contribute effectively to society and increase our opportunities within the world of work.

Applying across contexts
Number and number processes

Applying across contexts

What is it?
Exposure to a range of different strategies and methods for applying number processes. Application of the correct strategy to solve one step and multi-step problems using the most efficient methods.

Here are video exemplars:

Why is it important?
Being able to apply numeracy skills across a variety of real life contexts, and being able to contribute effectively to opportunities both at work and within the world of education.
Fractions, decimal fractions and percentages
Concept of a whole and parts

Why is it important?
To develop an understanding of fractions learners must have knowledge and understanding of what is meant by a whole or a part.

- Concept of a whole and parts
- One object, shape or quantity can be shared into parts
- A group of items can be shared out
- Equal parts
Concept of a whole or a part

What is it?
A whole can represent one item or a group of items.

Previous knowledge and understanding
• Awareness of vocabulary related to wholes and parts
• Awareness that a part of an object, shape or group is less than the whole
One object, shape or quantity can be shared into equal parts

What is it?
When an object, shape or quantity is split into two equal parts then each part is one half. When an item is split into two unequal parts then these two parts are not halves. This principle applies to all unitary fractions, e.g. splitting into tenths and each part is an equal 10th.

Previous knowledge and understanding
• Awareness that a part of an object, shape or group is less than the whole
• Understand and demonstrate the concept of sharing
• Understand and demonstrate the concept of sharing fairly
• Have experience of sharing in real life situations, e.g. with siblings, in play situations
Concept of a whole and parts

Why is it important?
To develop an understanding of fractions, learners must have knowledge and understanding of what is meant by a whole or a part.

What is it?
Sharing a collection of items into equal groups and into groups which are not equal.

Previous knowledge and understanding
- Awareness of sharing fairly and splitting a group of items
- Have experience of sharing out items in a variety of contexts
Concept of a whole and parts

Why is it important?

Equal parts

What is it?

Equal parts can form a whole.

Previous knowledge and understanding

Is able to identify and explain when an object, shape or quantity has not been split/shared equally.

Equivalent forms

- Fractions
- Decimal fractions
- Percentages

Fractional notation and vocabulary

Applying across contexts

Relationship between fractions, multiplication and division

Relationships that link fractions, decimal fractions and percentages

Applying across contexts
Fractions, decimal fractions and percentages

Concept of a fraction

Why is it important?

Understanding this concept is needed to appreciate the notation of fractions. When working with a fraction it is essential to understand that the denominator denotes the number of equal parts.

Equal sharing
Fractions, decimal fractions, and percentages

Concept of a fraction
What is it?
That a whole can be separated into equal parts. These parts are called fractions.

Previous knowledge and understanding
- Understand that a whole can be split into smaller parts
- Understand the term equal
Fractions, decimal fractions and percentages

Concept of a fraction

What is it?
Understanding that fractions of a whole are equal parts.

Previous knowledge and understanding
- Understand that a whole can be split into smaller parts
- Understand the term 'equal'
- Is aware of the relationship between equal fractions and the whole

Fractions with equal parts

Sharing with a remainder

Equal sharing
Concept of a fraction

Why is it important?
Understanding this concept is needed to appreciate the notation of fractions. When working with a fraction it is essential to understand that the denominator denotes the number of equal parts.

Sharing with a remainder

What is it?
Awareness that when a group of items is shared equally there may be some ‘left over.’ This is known as the remainder.

Previous knowledge and understanding
• Experience of one to one correspondence
• Understand equal sharing
• Experience of sharing out items in a variety of contexts
Fractions, decimal fractions and percentages

Concept of a fraction

Equal sharing
What is it?
Splitting a group of items equally into a number of smaller groups. This underpins the concept of fractions.

Previous knowledge and understanding
- Understand the term ‘equal’
- Have experience of sharing out items in a variety of contexts

Relationships that link fractions, decimal fractions and percentages

Applying across contexts

Fractional notation and vocabulary

Applying across contexts

Relationship between fractions, multiplication and division

Equivalent forms

Why is it important?
Understanding this concept is needed to appreciate the notation of fractions. When working with a fraction it is essential to understand that the denominator denotes the number of equal parts.
Why is it important?
Understanding fractional notation aids communication, reinforces the concept of equal sharing and can be developed further to investigate equivalent fractions. Understanding what the two numbers that make up a fraction represent, allows for calculations to be made.
Fractions, decimal fractions and percentages

Fractional notation and vocabulary

What is it?
Fractional notation is used to find, name and write fractions of a length, shape, object or quantity.

Previous knowledge and understanding
- Awareness that fractional notation has a top and bottom number, e.g. 1/2

Why is it important?
Understanding fractional notation aids communication, reinforces the concept of equal sharing and can be developed further to investigate equivalent fractions. Understanding what each fraction represent, allows for calculations to be made.
Fractions, decimal fractions and percentages

Fractional notation and vocabulary

Why is it important?
Understanding fractional notation aids communication, reinforces the concept of equal sharing and can be developed further to investigate equivalent fractions. Understanding what the two numbers that make up a fraction represent allows for calculations.

Numerator and denominator

What is it?
Numerator indicates the number of equal parts.
Denominator indicates the number of equal parts the unit is divided into. The greater the numerator the more parts there are. The greater the denominator the more parts the whole has been divided into.

Previous knowledge and understanding
• Understand that the top and bottom number of a fraction mean different things.
Why is it important?
Understanding the link between fractions and multiplication leads to an understanding of percentages and the application of multiplication and division in calculations such as those involving ratio.

Relationship between fractions, multiplication and division
Fractions, decimal fractions and percentages

Relationship between fractions, multiplication and division

What is it?
There is a direct link between finding a fraction of an object or a quantity and multiplication and division.

Previous knowledge and understanding
- Apply multiplication facts and corresponding division facts (inverse operations) to whole numbers
- Understand the role of numerator and denominator in a fraction

Why is it important?
Understanding the link between fractions and multiplication leads to an understanding of percentages and the application of multiplication and division in calculations such as those involving ratio.
Fractions, decimal fractions and percentages

Decimal fractions and place value

Why is it important?
Understanding decimal fractions is important for conversion in measurement and understanding what proportion of a whole is represented. It is also important relative to interpreting answers generated through the use of calculators.
Decimal fractions and place value

What is it?
Learning and teaching about decimal fractions is an extension of learners’ understanding of place value. There is a multiplicative relationship between the decimal places and the value of the positions increases in powers of 10 from right to left. Moving left from the decimal point the powers of 10 increase and moving right from the decimal point the powers of 10 decrease. There are many contexts for learning about decimal fractions, e.g. money and measurement.

Previous knowledge and understanding
• Have a knowledge of place value and its role in calculation
• Have an awareness that not all numbers are whole numbers
Fractions, decimal fractions and percentages

The decimal point

What is it?
In order to successfully manipulate numbers, learners need to have a conceptual understanding of place value, including the role of the decimal point. The decimal point separates the whole numbers from the fractions and is placed between the units (or ones) and the tenths. It is important to ensure that when multiplying or dividing by multiples of 10, learners understand that the decimal point does not move.

Previous knowledge and understanding
• Can talk about the multiplicative relationship between the digits in whole numbers
• Can give examples of where the decimal point can be seen in real life contexts, e.g. money £2.39, measurement 2.5l of paint

Decimal fractions and place value

The decimal point
Fractions, decimal fractions and percentages

Fractions

Why is it important?
Working with fractions is an important skill in the world of work and daily life.
Fractions

What is it?
A proper fraction is when the numerator is less than the denominator e.g. \( \frac{1}{2} \). An improper fraction is when the numerator is more than the denominator, e.g. \( \frac{3}{2} \). A fraction expresses a part of a whole. When carrying out calculations, the most appropriate form of a fraction should be used, e.g. \( \frac{6}{100} \) of 500 (calculate \( \frac{6}{100} \) then multiply by 6, rather than \( \frac{3}{50} \) which is the fraction in its simplest form).

Previous knowledge and understanding
- Apply multiplication facts and corresponding division facts (inverse operations) to whole numbers
- Know that the numerator is the number on the top of a fraction
- Know that the denominator is the number on the bottom of a fraction
- Know that the numerator shows the number of equal parts
- Know that the denominator shows the total number of parts the whole has been split into
- Understand that the larger the denominator is, the greater the number of parts the whole has been split into
Percentages

Why is it important?
Percentages are used in a wide variety of contexts, many of which are used in everyday life. Understanding that percentages are a specific way of representing fractions with a denominator of 100 can support understanding of the relationships between fractions, decimal fractions.
Percentages

What is it?
Percent means out of 100 therefore 100% is equivalent to one whole.

Previous knowledge and understanding
• Have a knowledge of fractions and decimal fractions
• Can give examples of where they have experienced percentages in real life, e.g. 2% battery left, 50% off sale
• Have a knowledge of place value and its role in calculation

Relationships that link fractions, decimal fractions and percentages

Applying across contexts

Fractions, decimal fractions and percentages

Why is it important?
Percentages are used in a wide variety of contexts, many of which are used in everyday life. Understanding that percentages are a specific way of representing fractions with a denominator of 100 can support understanding of the relationships between fractions, decimal fractions, percentages.

Concept of a whole and parts

Fraction

Percentages
Fractions, decimal fractions, and percentages

Equivalent forms

Why is it important?
This understanding leads to confidence when using fractions in calculations and in relation to decimal fractions and percentages. Knowledge and understanding of equivalences can help to make calculations simpler when carrying out calculations in relation to fractions, decimal fractions and percentages.
Equivalent forms

What is it?
Fractions which have the same value, even though they may look different, e.g. \( \frac{1}{2} \) and \( \frac{2}{4} \) are equivalent, because they are both equal to a half. The simplest form of a fraction can be used to support efficient calculation skills.

Previous knowledge and understanding
- Apply multiplication facts and corresponding division facts (inverse operations) to whole numbers
- Know that ‘equivalent’ means an equal value
- Know and understand fractional notation and know the relationship between fractions, decimal fractions and percentages, e.g. \( \frac{3}{4} = 3 \div 4 = 0.75 = 75\% \)
Fractions, decimal fractions and percentages

Relationships that link fractions, decimal fractions and percentages

Why is it important?
The ability to interchange between a fraction, decimal fraction and percentage is a skill that allows for different ways to solve problems efficiently, including mental calculations.
Fractions, decimal fractions and percentages

Relationships that link fractions, decimal fractions and percentages

What is it?
Understand the relationship between fractions, decimal fractions and percentages. Ability to change between the different forms for the most efficient ways of carrying out calculations, in different contexts.

Previous knowledge and understanding
• Is aware that hundredths can be written as a fraction, decimal fraction or a percentage
• Can multiply and divide whole numbers and decimal fractions by multiples of 10
• Be able to place fractions, decimal fractions and percentages on a number line
• Know and understand fractional notation specifically that e.g. $\frac{3}{4} = \frac{3}{4} \div 4 = 0.75$ etc.

Comparisons between fractions, decimal fractions and percentages
Fractions, decimals, and percentages

Relationships that link fractions, decimal fractions and percentages

What is it?
Being able to place different forms in order on a number line and know the relative value of each one.

Previous knowledge and understanding
- When given different representations can convert to most appropriate form
- Have a knowledge of place value with decimals and whole numbers
- Be able to order decimals on a number line
- Knowledge of the concept of hundredths and its equivalent forms
- Can place examples of the same form in order

Comparisons between fractions, decimal fractions and percentages

Concept of a whole and parts

Fractions, decimal fractions and percentages

Relationships that link fractions, decimal fractions and percentages

Applying across contexts

Concept of a whole and parts

Relationships that link fractions, decimal fractions and percentages

Why is it important?
The ability to interchange between a fraction, decimal fraction and percentage is a skill that allows for different ways to solve problems efficiently, including mental calculations.
Fractions, decimal fractions and percentages

Applying across contexts

Why is it important?

Being able to carry out calculations and move between different forms is an important skill. Choosing the most important form to display the answer depends on context.
**Fractions, decimal fractions and percentages**

**Applying across contexts**

*What is it?*
Being able to carry out calculations and move between different forms is an important skill. Choosing the most important form to display the answer depends on context.

**Previous knowledge and understanding**
- Has experience of fractions, decimal fractions and percentages in a range of contexts including new and unfamiliar situations
- Can place examples of the same form in order
- Can convert between forms to assist ordering a variety of fractions, decimal fractions and percentages
- Can select the most appropriate strategy when approaching a calculation
- Can convert between fractions, decimal fractions and percentages to assist ordering when written in different forms
Fractions, decimal fractions and percentages

Applying across contexts

Linking fractions and ratios

What is it?
Understanding how ratio links to fractions. Numbers in a given ratio can be expressed in fractional form. In its fractional form it is easier to make comparisons and carry out calculations.

Previous knowledge and understanding
• Apply multiplication facts and corresponding division facts (inverse operations) to whole numbers
• Know how to construct a ratio from a problem in context
• Apply knowledge of fractions to problems in context
• Awareness of real life examples of ratio vocabulary, e.g. diluting juice
• Knowledge and role of numerator and denominator

Proportion

Relationships that link fractions, decimal fractions and percentages

Concept of a whole and parts

Concept of a fraction

Percentages

Applying across contexts
Fractions, decimal fractions and percentages

Applying across contexts

Why is it important?
Being able to carry out calculations and move between different forms is an important skill. Choosing the most important form to display the answer depends on context.

Previous knowledge and understanding
• Awareness that multiplication and division are inverse operations
• Apply multiplication facts and corresponding division facts (inverse operations) to whole numbers
• Awareness of practical concept of proportion
• Apply multiplication facts and corresponding division facts (inverse operations) to fractions

Proportion
What is it?
Two variables are proportional if a change in one is always accompanied by a change in the other. As one quantity increases or decreases another quantity increases or decreases in proportion.
Developing financial capability

Money

Awareness of money → Coins and notes → Money calculations → Understanding money in a digital world → Understanding risks and rewards → Analyse the impact of financial decisions

Exchange money for goods and services

Developing financial capability
Money

Awareness of money

**Why is it important?**
An early appreciation of the contexts in which money is used is important. This includes an awareness that money is valuable and there is a need to keep it safe. In doing so young people will appreciate the difference between needs and wants.
Money

Awareness of money

What is it?
Working with money is the application of numbers in a specific context. Understanding that money can be used in exchange for goods and services.

Previous knowledge and understanding
- Knowledge of the existence of money
- Awareness of buying and selling

Why is it important?
An early appreciation of the contexts in which money is used. Money is valuable and there is a need to keep it safe. In doing so young people will appreciate the difference between needs and wants.
Coins and notes

Why is it important?

Using notes and coins is an everyday life skill. In many transactions change should be given/received.

- Coins and notes
- Using coins and notes
- Relevant contexts
- The inter-relationship between different sets of coins and notes
Coins and notes
What is it?
Coins and notes have different monetary values and are used to buy products and services, as well as being used to save.

Previous knowledge and understanding
• Awareness that money takes various forms, e.g. coins, notes, cards and vouchers
• Know that money is used in real life to buy items and services
Money

Coins and notes

Why is it important?
Using notes and coins is an everyday life skill. In many transactions change should be given/received.

Using coins and notes

What is it?
The relationship between the value of coins and the cost of goods that are exchanged leads to understanding that different coins and notes have varying values. The ability to exchange an appropriate amount of money for goods or services and estimate/calculate the amount payable and change.

Previous knowledge and understanding
• Know and understand whole number addition and subtraction
• Understand the notion of saving

The inter-relationship between different sets of coins and notes

relevant contexts
Money

Coins and notes

Why is it important?
Using notes and coins is an everyday skill. In many transactions, change should be given/received.

Relevant contexts

What is it?
Apply the knowledge of coins in play and in real life situations.

Previous knowledge and understanding
• Recognise that there are different ways to make exact amounts of money
• Be able to make exact combinations of simple amounts using mental strategies
• Have experienced the concept of giving and receiving change
The inter-relationship between different sets of coins and notes

What is it?
Understanding that different combinations of coins/notes create a total amount, e.g. five 20p coins have the same value as a £1 coin, two £10 notes have the same value as a £20.

Previous knowledge and understanding
- Be able to use a range of addition and subtraction strategies with money
- Knowledge and understanding of whole numbers and their relative values
- Awareness of the units of money

Using notes and coins is an everyday life skill. In many transactions change should be given/received.

Relevant contexts
- The inter-relationship between different sets of coins and notes

Developing financial capability

Analyse the impact of financial decisions

Money calculations
**Money**

**Exchange money for goods and services**

**Why is it important?**

Understanding that, in order to purchase goods or services, money has to be exchanged. Developing an awareness of where money comes from. Awareness of the difference between needs and wants.

- Exchange money for goods and services
- Application in everyday life

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**Developing financial capability**
Exchange money for goods and services

What is it?
Knowing how much money is available and what can be purchased with it.

Previous knowledge and understanding
- Understand that money includes coins, notes, cards and vouchers
- Be able to calculate the costs of items by adding the prices together using the most appropriate strategies
- Be able to use a range of strategies to add and subtract
- Be able to confidently use vocabulary: more, less etc.
Money

Exchange money for goods and services

Why exchange money for goods and services?
Understanding the value of money and how it relates to the value of goods and services. Understanding the concept of exchange and how it impacts purchasing decisions.

Previous knowledge and understanding
- Has experience of working with money through relevant contexts
- Is able to estimate and calculate costs
- Is able to estimate and calculate change
- Understands that affordability is based on money available

Application in everyday life
The ability to solve contextualised problems. Applying mental agility skills to solve abstract problems. When exchanging money for goods or services, being able to calculate change.

Exchange money for goods and services

Application in everyday life
Money calculations

Why is it important?
Developing confidence in mental and written calculations involving money is an important skill in everyday life.

- Money calculations
- Applying the four operations in calculations involving money
Money calculations

What is it?
Money calculations are any calculations involving addition, subtraction, multiplication or division (or a combination of these operations.) Mental strategies can involve rounding. Written calculations can involve decimal fractions.

Previous knowledge and understanding
- Use a range of strategies to be able to add, subtract, multiply and divide using whole numbers
- Understand that monetary amounts can be written with no more than 2 decimal places
- Use a range of strategies to be able to add, subtract, multiply and divide numbers to 2 decimal places
Money calculations

Why is it important?
Developing confidence in mental and written calculations involving money is an important skill in everyday life.

Previous knowledge and understanding

- Use a range of strategies to be able to add, subtract, multiply and divide numbers to 2 decimal places
- Estimate amounts using rounding strategies

What is it?
Using money as a context for the application of number skills, including decimal fractions and percentages. Estimation or calculating the total cost of goods or services purchased.
Why is it important?
The increased variety of methods of payment has changed money from a concrete to a more abstract concept.
Developing financial capability

Money

Analyse the impact of financial decisions

Understanding risks and rewards

Awareness of money

Coins and notes

Exchange money for goods and services

Money calculations

Understanding money in a digital world

Why is it important?
The increased variety of methods of payment has changed money from a concrete to a more abstract concept.

Understanding money in a digital world

What is it?
Recognising the advantages and disadvantages of debit and credit cards.

Previous knowledge and understanding
- Understand the various methods of paying for goods and services
- Understand the terms credit/debit and debt

Best value

Online shopping

Online banking

MAIN MENU
Online shopping

What is it?
Using cards to make payments for goods online. Making comparisons between different websites and shops.

Previous knowledge and understanding
- Use a range of strategies add/subtract/multiply and divide numbers to 2 decimal places to compare costs

Understanding money in a digital world
Online shopping
Online banking
Best value
Understanding money in a digital world

Why is it important?
The increased variety of money from a concrete world has changed the way we think about money.

Online banking
What is it?
This involves keeping track of online banking, transactions using cards (including contactless technologies) and withdrawals from ATMs.

Previous knowledge and understanding
- Recognise and understand how to read a bank balance statement
- Use IT to login to secure websites
- Understanding of importance of online security
Developing financial capability

Money

Analyse the impact of financial decisions

Understanding risks and rewards

Awareness of money

Coins and notes

Exchange money for goods and services

Money calculations

Understanding money in a digital world

Why is it important?
The increased variety of methods of payment has changed money from a concrete to a more abstract concept.

Best value
What is it?
Making comparisons between different websites, shops and online savings accounts.

Previous knowledge and understanding
- Use a range of strategies add/subtract/multiply and divide numbers to 2 decimal places to compare costs
- Understand the concept of benefits and comparing these with overall costs

Online banking
Money

Understanding risks and rewards

Why is it important?
Spending and saving money responsibly involves budgeting, incomes and expenditure over a period of time.

- Understanding risks and rewards
- Risks and rewards of online shopping
- Personal financial products
- Borrowing

Developing financial capability
Understanding risks and rewards

What is it?
Recognising that there are a range of rewards for saving and investing money, as well as risks involved in borrowing. This includes calculations involving varying rates of interest and transactions.

Previous knowledge and understanding
• Understand the terms save, invest and borrow
• Understand the concept of debt
• Use a range of strategies add/subtract/multiply and divide numbers to 2 decimal places
• Use knowledge of percentages to calculate interest and compare costs
Money

Understanding risks and rewards

What is it?
There can be financial benefits of purchasing goods and services online. There can be hidden costs e.g. delivery charges.

Previous knowledge and understanding
- Use a range of strategies add/subtract/multiply and divide numbers to 2 decimal places to compare costs
- Able to use literacy skills to determine hidden costs such as delivery
Developing financial capability

Money

Understanding risks and rewards

Why is it important?
Spending and saving money, incomes and expenditure.

Previous knowledge and understanding
- Understand the terms associated with financial products
- Use knowledge of percentages to calculate interest and apply as interest
- Understand the concept of insurance
- Use knowledge of vague, robust and misleading information to inform choices

Personal financial products

What is it?
Making informed choices around basic bank accounts, insurance products, credit/debit cards, investments and loans.

Borrowing

Exchange money for goods and services

Understanding money

Coins and notes

Money calculations

Understanding money in a digital world

Analysing the impact of financial decisions

Main Menu
Money

Borrowing
What is it?
Borrowing money can be appropriate if the benefits that come from the expenditure are in line with the loan period.

Previous knowledge and understanding
- Use knowledge of vague, robust and misleading information to inform choices
- Use knowledge of percentages to calculate interest and apply as interest

Why is it important?
Spending and saving money responsibly involves budgeting, incomes and expenditure over a period of time.
Developing financial capability

Money

Analyse the impact of financial decisions

Why is it important?
The ability to analyse the impact of financial decisions ensures greater responsibility for individual economic wellbeing.
Developing financial capability

Money

Analyse the impact of financial decisions

What is it?
Financial decisions impact on the development of financial capability. This includes being able to analyse the impact of individual financial decisions on others as well as the impact that the financial decisions of others have on individuals.

Previous knowledge and understanding
- An understanding of ethical trading, tax (including direct and indirect taxation), National Insurance
- Applying understanding of financial services, saving, borrowing, overspending, online spending, debit, credit and scams to make financial decisions

Why is it important?
The ability to analyse the impact of financial decisions ensures greater responsibility for individual economic wellbeing.
Developing financial capability

Why is it important?
Developing financial capability involves;
• Financial understanding
• Financial competence
• Financial responsibility
• Financial enterprise

These four aspects are interconnected and mutually supportive and outline a framework for developing skills, attitudes and behaviours that will support learners as employees, employers, entrepreneurs or voluntary workers.

The ability to make decisions on spending and saving money is vital in order to balance lifestyle with the cost of living.
Developing financial capability

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Financial understanding

What is it?

Developing financial understanding is the first step in ensuring young people leaving school have the skills required to deal confidently with everyday financial issues. It will also help them to make informed decisions and choices about their personal finances.

• This milestone includes knowledge, understanding and skills from across the curriculum

This video clip highlights the impact of Financial Education on young people and their families. It includes learners conversations with advice and support for practitioners.

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**Financial competence**

**What is it?**

This means being able to apply knowledge and understanding of financial matters across a range of contexts, using digital technologies where appropriate. Being financially competent includes being able to identify and tackle problems or issues with confidence and being able to manage financial situations effectively and efficiently.

- This milestone includes knowledge, understanding, and skills from across the curriculum.

This video clip highlights the impact of Financial Education on young people and their families. It includes learners’ conversations with advice and support for practitioners.

http://www.educationscotland.gov.uk/video/n/nnpf/money.asp
Developing financial capability

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Financial responsibility

What is it?
This means having a caring and responsible attitude with regard to the use of resources. Children and young people who budget wisely and plan for the future will be responsible citizens who look after themselves.

• This milestone includes knowledge, understanding and skills from across the curriculum

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These four aspects are interconnected and mutually supportive and outline a framework for developing skills, attitudes and behaviours that will support learners as employees, employers, entrepreneurs or voluntary workers.

The ability to make decisions on spending and saving money is vital in order to balance lifestyle with the cost of living.

**Financial enterprise**

**What is it?**

Financial enterprise is about being able to deploy resources in an imaginative and confident manner. Financially enterprising behaviours will involve recognising risks and rewards and making decisions based on informed thought enabling children and young people to contribute effectively to the development of Scotland’s wealth.

- This milestone includes knowledge, understanding and skills from across the curriculum

This video clip highlights the impact of Financial Education on young people and their families. It includes learners conversations with advice and support for practitioners.

Time

- Concept of time
- Recording and displaying
- Units of time
- Telling the time
- Duration of time
- Calendars
- Converting units of time
- Time, calculations including more complex durations
- Using appropriate units of time
- Time/speed/distance
- Time management
Concept of time

Why is it important?
Developing an understanding of time and the passing of time supports the skills necessary for calculating durations and recording time.
Concept of time

What is it?
Awareness of patterns of time and the passing of time in relation to years, seasons, months, weeks, days, hours, minutes and seconds.

Previous knowledge and understanding
- Have experience of routines, e.g. night and day, routines at home
- Recognise and understand that clocks, watches, digital displays etc. are used to tell the time

Why is it important?
Developing an understanding of time and the passing of time supports the skills necessary for calculating durations and recording time.
Why is it important?
Recording and displaying the time is an essential life skill that allows organisation of events and activities.
Time

Recording and displaying time

What is it?
Recording time involves expressing time using numbers and words. Displaying time is representing the time on a clock face or on a digital display.

Previous knowledge and understanding
- Be able to recognise and understand that clocks, watches and digital displays are used to tell the time
- Be able to recognise and understand that calendars and diaries are used for recording events in time
- Be able to recognise the numerals 1-12, 1-24 then 1-60 as appropriate to learning as required

Why is it important?
Recording and displaying the time is an essential life skill that allows organisation of events and activities.
Units of time

Why is it important?
Use of units of time allows communication using a common language and understanding.
Units of time

What is it?
The ways in which we record time using the appropriate vocabulary. Knowledge of the relationship between different units of time.

Previous knowledge and understanding
- Understand routines
- Recognise and understand that there are different styles of clocks, e.g. analogue and digital
- Recognise and understand when calendars and diaries are used
- Be able to name the days of the week
- Be able to name the months of the year
- Be able to name the seasons
Time

Concept of time

Units of time

Why is it important?

Use of units of time allows communication using a common language and understanding.

Relationships

What is it?
The relationship between different units of time e.g. number of days in a year, minutes in an hour etc.

Previous knowledge and understanding

- Know key time vocabulary, e.g. seconds, hours, decades, millennia etc.
- Know the ordinal number of the months, e.g. January 1st month
- Have an awareness of a variety of patterns of time, e.g. day follows night, Monday follows Sunday, December follows November, Autumn follows Summer

Using appropriate units of time

Appropriate use

Calendars
Time

Units of time

Why is it important?
Use of units of time allows communication using a common language and understanding.

Appropriate use

What is it?
Using the appropriate unit of time depending on the context and situation.

Previous knowledge and understanding
- Know the days of the week
- Know the numbers 1-60
- Know time facts such as: there are 7 days in a week, 365 days in a year and 366 in a leap year, 4 seasons in the year etc.
- Know the reason why there is a leap year
- Understand the terms seconds, minutes, hours, days, weeks, months, years
- Interpret a variety of date formats, e.g. 12.3.15, 12th March 2015
Telling the time

Why is it important?
Supports the development of skills in effective time management.
Telling the time

What is it?
Understanding time displays of various types and being able to express this using the correct vocabulary and in relation to specific times of the day e.g. morning or afternoon.

Previous knowledge and understanding
- Know the numbers 1-60, e.g. 1-12 for hours on an analogue clock, 0-60 for minutes
- Recognise and understand that there are different styles of clocks, e.g. analogue and digital and different types of timers
- Be able to count in 5s
- Be able to round appropriately
- Know that there are 24 hours in a day, 60 minutes in an hour and 60 seconds in a minute
- Have an understanding of ¼, ½ and ¾ turn
Time

An analogue and digital clock

What is it?
Understand the position of and relationship between the hour and minutes hands. Familiarisation with the position of the hands and the vocabulary of half past and quarter to/past. Understanding the link between analogue and the 24 hour digital clock.

Previous knowledge and understanding
- Recognise different types of displays which indicate time
- Know that an analogue clock has an hour hand and a minute hand
- Be able to count on and back
- Understand on a standard analogue clock the main increments are in 5s
- Understand that am is before midday
- Understand that pm is after midday
- Have an understanding of \( \frac{1}{4}, \frac{1}{2}, \frac{3}{4} \) in fractions and are able to relate this to quarter past, half past and quarter to

Telling the time

Analogue and digital
Duration of time

**Why is it important?**

Understanding duration of time helps to plan and organise events and activities effectively. Understanding the duration of time introduces start and finish times and leads to being able to work out how long events last. The ability to calculate the length of time taken is essential for planning and organising events in daily life. Using timetables helps to develop mental agility in relation to time calculations and develops skills in estimation and in rounding.
Time

Duration of time

What is it?
The length of time between the start and finish point.

Previous knowledge and understanding
• Know that there are 60 minutes in an hour, 120 minutes in two hours and so on
• An awareness of quantity
• Know and be able to respond to the instructions start and stop/beginning and end
• Be able to count on and back

Understanding duration of time helps to plan and organise events and activities effectively. Understanding the duration introduces start and finish times and leads to calculating how long events last. The ability to estimate duration is essential for planning using timetables helps to develop mental agility in relation to time calculations and develop skills in estimation and rounding.

Why is it important?
Understanding duration of time is essential for planning and organising events and activities. It helps in estimating how long events last and is crucial for accurate time calculations, which is essential in daily life. Using timetables is a practical way to help in mental agility, estimation, and rounding skills.
**Time**

**Duration of time**
Understanding duration of time helps to plan and organise events and activities effectively. Understanding the duration of time introduces start and finish times and leads to being able to work out how long events last. The ability to calculate the length of time taken is essential for planning and organising events in daily life. Using timetables helps to develop mental agility in relation to time calculations and develops skills in estimation and in rounding.

**Timing of tasks**
**What is it?**
Linking the chosen unit of time to the most appropriate timing device. Degree of accuracy is dependent on the situation.

**Previous knowledge and understanding**
- Have an understanding of place value
- Have an awareness of different units of time
- Recognise different tools for measuring, e.g. stopwatch, wrist watch, clocks, calendars
- Recognise different displays, e.g. analogue, digital

**Simple timetables**

**Calendars**

**Main menu**

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**Concept of time**

**Time management**
Duration of time

**Why is it important?**
Understanding duration of time, which is how long events and activities last, is important as it introduces start and finish times. Being able to work out how long events last and how long activities take can help organise events and activities effectively.

**Previous knowledge and understanding**
- Have experience of displays, e.g. seasons of the year
- Have an understanding of place value
- Can calculate simple time durations
- Recognise different displays, e.g. analogue, digital, 12 hour, 24 hour time

**Simple timetables**

**What is it?**
Timetables and schedules provide information including start and finish times for journeys. They can be used to plan events and demonstrate the importance of 24 hour time.

**Estimating duration**

**Timing of tasks**

**Simple timetables**

**Calendars**

**Concept of time**

**Time management**
Time

Duration of time

Estimating duration

What is it?
The ability to estimate how long an event took or will take, using non-standard or standard units of time. Developing a sense of how long a task will take, by using familiar benchmarks.

Previous knowledge and understanding
- Know and understand the units of time, e.g. seconds, minutes, hours, days
- Understand the cyclical nature of time
- Be able to count on and back (in steps of 1 or more)
- Have experience of how long something takes within familiar contexts, e.g. interval/playtime compared to lunchtime

Understanding duration helps to plan and organise events and activities effectively. Understanding the duration of time introduces start and finish times and leads to the ability to calculate the length of time an event lasts. The ability to calculate the length of time an event lasts is essential for planning events. Using timetables helps to develop mental agility in relation to time calculations and develops skills in estimation and in rounding.

Estimating duration

What is it?
The ability to estimate how long an event took or will take, using non-standard or standard units of time. Developing a sense of how long a task will take, by using familiar benchmarks.

Previous knowledge and understanding
- Know and understand the units of time, e.g. seconds, minutes, hours, days
- Understand the cyclical nature of time
- Be able to count on and back (in steps of 1 or more)
- Have experience of how long something takes within familiar contexts, e.g. interval/playtime compared to lunchtime

Simple timetables

Calendars

Concept of time

Time management
Calendars

Why is it important?
Use of calendars to organise daily routines, events and activities.
Calendars

What is it?
Calendars are a structured representation of the months of the year. They reinforce the order of and number of days in the months of the year and can be used to illustrate the irregularity of number patterns in the months. Calendars can also be used to calculate elapsed time.

Previous knowledge and understanding
- Have experience of displays, e.g. seasons of the year
- Be able to count on and back
- Know the days of the week, months of the year
- Know the ordinal number of the months, e.g. January 1st month
- Understand the cyclical nature of time
- Know important events in learners’ own lives, e.g. birthdays
- Select the most appropriate duration to count in, e.g. seconds, minutes, hours, days or years
Converting units of time

Why is it important?
Converting between units of time is necessary when identifying and carrying out time calculations.
**Converting units of time**

**What is it?**
Knowledge that there are 60 seconds in a minute, 60 minutes in an hour and 24 hours in a day are essential when estimating or calculating lengths of time.

**Previous knowledge and understanding**
- Know and understand the relationships between the different units of time, e.g. 60 seconds in a minute, 60 minutes in an hour
- Understand values of time, e.g. that seconds are smaller than minutes and years are longer than months
Time calculations including more complex durations

Why is it important?
Using information from a variety of sources to plan and schedule events and activities, including journeys, for personal lives and for work and leisure is an important life skill. Calculating journey times is an introduction to establishing the relationship between time, speed and distance and sets the foundation for more complex calculations and estimation.
Time calculations including more complex durations

What is it?
Using the four operations accurately to do calculations in relation to time, using the most efficient method and unit.

Previous knowledge and understanding
- Be able to tell the time
- Be able to apply the four operations
- Be able to convert times into a common unit, e.g. 2hrs and 90 mins = 2 hours and 1.5 hours
- Have an understanding of decimal fractions
- Have an understanding of place value
Time calculations including more complex durations

**Calendars and timetables**

**What is it?**
Identifying and then using specific information in order to calculate durations of journeys or events.

**Previous knowledge and understanding**
- Understand that timetables and calendars can both be used to represent time durations
- Can identify information from a table of data
- Can use simple timetables and calendars
- Understand the difference between 12 hour and 24 hour notation
- Be able to count on and back in a variety of units
Time calculations including more complex durations

Why is it important?
Time calculations including more complex durations are vital for managing time effectively. They help in organizing events and activities, including personal lives, work, and leisure. Calculating journey times is an essential introduction to establishing the relationship between time, speed, and distance, setting the foundation for more complex calculations and estimations.

Journey times

What is it?
Using the start and finish times to calculate how long a journey will last.

Previous knowledge and understanding
- Be able to tell the time
- Be able to identify 12 and 24 hour notation
- Can convert between 12 and 24 hour notation as appropriate
- Know and be able to use the four operations
- Have an understanding of decimal fractions
- Understand the relationship between the units of time
- Be able to convert times into a common unit, e.g., 2 hours and 90 minutes = 2 hours and 1.5 hours
Using appropriate units of time

Why is it important?
Understanding that using appropriate units of time helps when selecting the most appropriate form to calculate and express the answer, dependent on the context.
Using appropriate units of time

What is it?
Being able to select and use the most appropriate and efficient unit of time for the situation and context.

Previous knowledge and understanding
- Know the units of time
- Understand values of time, e.g. that seconds are smaller than minutes and years are longer than months
- Understand the differences and relationships between units of time
- Know how to convert between the different units of time

Why is it important?
Understanding that using appropriate units of time helps select the most appropriate form to calculate and express the answer, dependent on context.
Time/speed/distance

Why is it important?
It is important in some aspects of travel and leisure to be able to estimate time taken, speed and distance travelled. More accurate time, speed and distance calculations are required for a range of real life contexts.
Why is it important?

It is important in some aspects of travel and leisure to be able to estimate time taken, speed and distance travelled. More accurate time, speed and distance calculations are required for a range of real life contexts.

Time/speed/distance

What is it?
Using the standard formula to calculate the unknown value when given the other two.

Previous knowledge and understanding
- Know units of time
- Know units of speed, e.g. mph, km/h
- Know units of distance
- Know and understand inverse operations
- Have experience of exploring a range of approaches to calculating speed, distance or time
Time

Concept of time

Units of time

Converting units of time

Recording and displaying

Telling the time

Time, calculations including more complex durations

Duration of time

Using appropriate units of time

Calendars

Time/speed/distance

Why is it?
It is important in some aspects of travel and leisure to be able to estimate time taken, speed and distance travelled. More accurate time, speed and distance calculations are required for a range of real life contexts.

Estimation in relation to distance/speed/time

What is it?
Estimations are used in daily situations to determine either an approximate arrival time, speed or distance for a journey.

Previous knowledge and understanding
• Have experience of estimating appropriately
• Have experience of rounding
• Know and understand the relationship between speed, distance and time, and how this relates to the units of measure
• Apply the four operations in calculations

Calculations

Graphs
Time/speed/distance

Why is it important?
It is important in some aspects of travel and leisure to estimate time taken, speed and distance. More accurate time, speed and distance calculations are required for a range of real life contexts.

Calculations

What is it?
Calculations are required for specific situations, e.g. areas of employment where this is a necessary part of daily business. Formula can be used to calculate one quantity given the other two.

Previous knowledge and understanding
- Be able to use the four operations
- Understand the inverse relationships between the four operations
- Have experience of using the speed distance time formula

Graphs

Concept of time
Time distance graphs can be used to investigate the relationships between distance, speed and time. Used to describe the features of a journey.

**Previous knowledge and understanding**
- Apply knowledge of graphs (link to data and analysis)
- Be able to interpret simple graphs
- Understand that a line graph shows a continuous measure
- Can estimate appropriately

It is important in some aspects of travel and leisure to be able to estimate time taken, speed and distance travelled. More accurate time, speed and distance calculations are required.
Time management

Why is it important?
Time management is an essential skill for life, learning and work. Time management is important in business in terms of meeting deadlines for submitting projects and in life for coordinating leisure activities.
Time management

What is it?
Planning for different real-life situations. Flexible planning is taken into account when any adjustments are required. Responsive planning is necessary in order to address any unexpected events or changes.

Previous knowledge and understanding
- Be able to use a range of timetables in a variety of contexts
- Be able to tell the time from different displays
- Be able to calculate durations
- Have an understanding of the different types of calendars and be able to use them effectively
- Understand the appropriateness of rounding in relation to time
- Have experience of scheduling tasks within a given time

Time management is an essential skill for life, learning and work. Time management is important in business in terms of meeting deadlines for submitting projects and in life for coordinating leisure activities.
Measurement

Awareness of size and amount

Why is it important?
An understanding of how measurements can be taken and applied in everyday contexts in an important life skill. Developing an awareness of size and amount promotes an understanding of spacial awareness and develops the specific vocabulary needed to make comparisons.
Measurement

Awareness of size and amount

What is it?
Use appropriate vocabulary to describe the features of shapes and objects, linking to size and amount. Use the language of opposites and comparisons, particularly within practical situations, to develop understanding of these concepts and how they can be applied.

Previous knowledge and understanding
• In play, can group or segregate items by own criteria

Why is it important?
An understanding of how measurements can be taken and applied in everyday contexts is an important life skill. Developing an awareness of size and amount promotes an understanding of spatial awareness and develops the specific vocabulary needed to make comparisons.

Standard units

Concept of area

Concept of volume

Convert units

Calculations involving measurement

Non-standard units

Formula and inter-relationships

Tolerance in measurement
Comparison of size and amount

Why is it important?
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts.
Comparison of size and amount

What is it?
Use appropriate vocabulary to describe the features of shapes and objects, linking to size and amount.

Previous knowledge and understanding
- Can talk about objects and shapes in own words and has a basic awareness of the vocabulary of comparison, e.g. taller, smaller, less, more
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts. Ordering

What is it?
Develop vocabulary associated with comparison and order objects according to set criteria and for different purposes.

Previous knowledge and understanding
- Can describe objects and shapes using own language and
- Through play, can show an ability to sort and order items by own criteria.
Comparison of size and amount

Why is it important?
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts.

Conservation of size, weight and volume

What is it?
Recognise that shapes and objects that look different can have equal length, weight or volume.

Previous knowledge and understanding
• Can compare and contrast objects and shapes to identify common properties
• Can group objects and shapes with identical properties together
• Can compare and order objects according to set criteria
Non-standard units

Why is it important?
Measuring and estimating with non-standard units develops understanding of why standard units are necessary and help to provide an estimation of size. This leads to developing an understanding of the concept of standard units.
Measurement

Non-standard units
What is it?
Non-standard measurements can be used to develop the concept that measure and estimate of surface area can be described in terms of numerical values.

Previous knowledge and understanding
• Can apply counting skills

Why is it important?
Measuring and estimating with non-standard units develops understanding of why standard units are necessary and helps lead to developing an understanding of the concept of standard units.
Concept of area

Why is it important?
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts.
Measurement Tolerance in measurement

Formula and inter-relationships

Awareness of size and amount

Comparison of size and amount

Concept of area

What is it?
Develop an understanding of the concept of area through practical activities, investigation and discussion. This is related to geometric concept of enclosed area.

Previous knowledge and understanding
• Through play, have experience of investigating and comparing different objects and the amount of space they cover.

Concept of area

Why is it important?
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts.

Units of area

Conversion of units

Calculations involving measurement

Standard units

Concept of area

What is it?
Develop an understanding of the concept of area through practical activities, investigation and discussion. This is related to geometric concept of enclosed area.

Previous knowledge and understanding
• Through play, have experience of investigating and comparing different objects and the amount of space they cover.

Concept of area

Why is it important?
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts.
Understanding area

What is it?
Area is used to describe the size of any surface. This includes the surface within any given 2D shape. The conservation of area is knowing that when any surface is split into smaller parts then the total area of the parts is equal to the original surface area.

Previous knowledge and understanding
- Can describe area as the amount of space covered by an object
- Understand that the amount of space taken up by a 2D object is known as area
- Understand that objects can look different but have equal areas
Measurement

Concept of area

Why is it important?
The ability to compare size and amount leads to a deeper understanding of relationships between measurements and how these can be applied to a range of situations and contexts.

Estimating area

What is it?
Use non-standard units to build an understanding of estimating the area of a surface. Then select the most appropriate standard unit for the context.

Previous knowledge and understanding
• Have an awareness of vocabulary of comparison
• Understand that an estimated value is not exact
• Can use knowledge of sizes of common objects to compare size, e.g. is bigger than, smaller than
• Understand area is the size of any surface, including the space within any 2D shape
Units of area

What is it?
Conventions for describing and recording experiential measurements of area are introduced when it is recognised that there is a need for a standard unit of area and initially in context to build from non-standard to standard.

Previous knowledge and understanding
- Have experience of talking about and recording area using a variety of non-standard units, e.g. hands, cubes, sticks
- Have explored a range of measuring instruments, e.g. cubes, sticks, jugs, buckets
- Can use non-standard units accurately when measuring a length
- Can apply counting skills
Measurement

Concept of volume

Why is it important?
Volume links with spatial awareness and impacts on a variety of objects encountered daily. The skills required to solve problems relating to volume are skills needed for learning, life and work.

- Concept of volume
- Unit of volume
- Estimating volume
- Capacity
- Mass
Concept of volume

What is it?
Volume is the measure of space taken up by a 3D object. The conservation of volume is knowing that when any object is split into smaller parts then the total volume of the parts is equal to the original volume.

Previous knowledge and understanding
- Through play, have experience of investigating the amount different objects and containers can hold
- Explore objects with same volume but different dimensions to develop awareness of conservation of volume
- Can give examples of objects/containers where volume could be measured in relation to real-life, e.g. lunch box, water bottle, sand pit
Unit of volume

What is it?
Conventions for describing and recording measurements of volume should be introduced when appropriate and initially in context.

Previous knowledge and understanding
- Understand that the amount of space taken up by a 3D object is known as volume
- Understand that objects can look different but have equal volume
- Have experience of talking about and recording volume using a variety of non-standard units, e.g. bean bags, handfuls of sand
- Can use non-standard units accurately to measure and record a range of volume
- Can apply counting skills

Concept of volume
Unit of volume
Estimating volume
Capacity
Mass
Estimating volume

What is it?
The ability to estimate volume is built on an understanding of how to estimate other properties of shapes, e.g. length, breadth, depth, area.

Previous knowledge and understanding
- Understand and use vocabulary of comparison
- Understand that an estimated value is not exact
- Can use knowledge of volume of common objects/containers to compare size, e.g. It has less space than this bucket
- Apply knowledge of length and area to provide an estimation of size
- Be able to estimate properties of 2D shapes, e.g. length, breadth and area
Measurement

Concept of volume

Capacity
What is it?
Spatial awareness of 3D objects and the amount they can contain. Interior volume of an object.

Previous knowledge and understanding
• Understand that the amount of space taken up by a 3D object is known as volume

Capacity
Mass

Estimating volume

Why is it important?
Volume links with spatial awareness and impacts on a variety of objects encountered daily. The skills required to solve problems relating to volume are skills needed for learning, life and work.
Concept of volume

Why is it important?
Volume links with spatial awareness and impacts on a variety of objects encountered daily. The skills required to solve problems relating to volume are skills needed for learning, life, and work.

Mass
What is it?
A large body of matter with no definite shape. The amount of matter in an object.

Previous knowledge and understanding
• Understand and use the vocabulary of volume and capacity
• Calculate the volume of a range of prisms
• Understand the concept of capacity

Capacity
Mass
Why is it important?
Using standard units ensures a universal system of measurement which helps us to interpret, communicate and calculate measurements.
Standard units
What is it?
Standard units are the universal system of measurement.

Previous knowledge and understanding
- Have experience of talking about and recording measurement using a variety of non-standard units, e.g. hands, cubes, sticks, handfuls of sand
- Can estimate and use non-standard units accurately when measuring and recording
- Can apply counting skills
- Have experienced standard units of measure in their own environment even if they do not understand the meaning, e.g. 2litre bottle of Cola, 25g packet of crisps
Measure using standard units

What is it?
Use of a wide range of measuring instruments to accurately measure length, weight and volume. Awareness of a variety of types of scales should include analogue and digital and the most effective and efficient measuring instruments to be used.

Previous knowledge and understanding
• Through play, have an experience of a wide range of measuring instruments
• Understand that an agreed unit of measure is essential
• Be aware of common standard units and the appropriate use
• Understand that different measurements are required for different types of objects/shapes
• Can select an appropriate unit of measure, e.g. strides to measure the length of a classroom, cubes to measure the length of a pen

Standard units
Measure using standard units
Inter-relationships between units of measurement

Link between concept and formula of area
**Standard units**

**Why is it important?**
Using standard units ensures a universal system of measurement which helps us to interpret, communicate and calculate measurements.

**Inter-relationships between units of measurement**

**What is it?**
Understanding the relationship between units of measure e.g. 10mm=1cm, 100cm=1m.

**Previous knowledge and understanding**
- Can describe measurements using a range of units as appropriate, e.g. mm, cm, m, km, g, ml
- Understands that the metric system is structured in multiples and powers of 10
- Have an understanding of decimals and place value
Link between concept and formula of area

**What is it?**
More efficient ways of calculating surface area. Methodology should not detract from the concept of area.

**Previous knowledge and understanding**
- Understand the concept of area
- Be able to calculate the area of common shapes using a range of methods, e.g. cover with cubes then count, counting squares
- Understand that areas of common shapes can be calculated using a standard process
- Can apply multiplication and division facts (inverse operations) to whole numbers, fractions and decimal fractions
Measurement

Convert units

Why is it important?
Ability to convert between units enables the most efficient and appropriate unit or measurement to be used. It underpins the rules and concepts in many areas, e.g. science, engineering and technology.

- Convert units
- Selecting appropriate units

Awareness of size and amount
Comparison of size and amount
Formula and inter-relationships
Tolerance in measurement
The metric system is the internationally agreed system of units. Knowledge and understanding of the inter-relationship between different units. Knowledge of appropriate prefixes and understanding the language of measurement and notation.

Previous knowledge and understanding:
- Can apply multiplication and division facts (inverse operations) to whole numbers, fractions and decimal fractions
- Understand the relationship between the units within the metric system

Convert units

What is it?
The most efficient and appropriate unit or measurement to be used. It underpins the rules and concepts in many areas e.g. science, engineering and technology.

Why is it important?
Ability to convert between units enable the most efficient and appropriate unit or measurement to be used. It underpins the rules and concepts in many areas e.g. science, engineering and technology.

Previous knowledge and understanding:
- Can apply multiplication and division facts (inverse operations) to whole numbers, fractions and decimal fractions
- Understand the relationship between the units within the metric system
Selecting appropriate units

What is it?
Use the most appropriate unit of measurement in relation to individual contexts. The most appropriate unit of measurement is used to carry out a calculation.

Previous knowledge and understanding
• Understand the relationship between the unit of measure and the measuring instrument, e.g. cm – ruler, m – metre stick
• Understand that different objects require different units of measure
• Be able to describe common uses for the different units of measure
• Understand that changing the unit of measure impacts on the numerical value of the measure
Measurement

Calculations involving measurements

Why is it important?
Calculations involving perimeter, area and volume are needed in real life contexts and enable us to work out accurate amounts.

- Calculations involving measurements
- Select the most appropriate calculation dependent on the situation

Awareness of size and amount
Comparison of size and amount
Formula and inter-relationships
Tolerance in measurement
Calculations involving measurements

What is it?
Carrying out calculations using the four operations involving perimeter, area and volume. Using whole numbers, fractions, decimal fractions or percentages according to context.

Previous knowledge and understanding
- Understand the terms perimeter, area and volume
- Can apply the four operations to whole numbers, fractions, decimal fractions or percentages
- Select the appropriate unit of measure
- Can convert between standard units
- Understand that using a common standard unit across all dimensions can simplify a calculation, e.g. \( l = 2\text{m} \) \( b = 90\text{cm} \) \( l = 200\text{cm} \) \( b = 90\text{cm} \)
Why is it important?
Calculations involving measurement are needed in real life contexts and enable us to work out accurate amounts.

Select the most appropriate calculation dependent on the situation

What is it?
Being able to apply the right calculation to fit the situation or context. Selecting the appropriate calculation, perimeter, area, or volume taking account of the dimensional aspect of the situation or context.

Previous knowledge and understanding
- Select the appropriate unit of measure
- Can apply the four operations to problems involving measure

Calculations involving measurements
Select the most appropriate calculation dependent on the situation
Why is it important?
Formula is used to simplify the process of calculations and to calculate an unknown variable. Awareness of the inter-relationship between different formulae supports further calculations to be made, e.g. diameter=2 x radius C=πD or C=2πr.
Formula

What is it?
Specific formula are used to carry out calculations involving measurement. These provide a method for accurately and efficiently calculating perimeter area and volume. Use knowledge of the formula to be able to undertake a number of related calculations associated with length, breadth, height, area and volume. Understand the interconnectivity between the variances in the formula.

Previous knowledge and understanding
- Can apply the four operations to problems involving measure
- Understand that a common strategy can be applied to the same shape but with different dimensions, e.g. the same formula can be applied to rectangles of all sizes
- Be able to describe dimensions of shapes using length, breadth, height etc.
Inter-relationships

What is it?
Understand the links between perimeter and area. Being able to work backwards and forwards when calculating measurements. Knowledge and understanding of relationships between dimensions and how to manipulate formula dependent on the context.

Previous knowledge and understanding
• Can apply common formula to calculate perimeter/area/volume of common shapes
• Can apply the four operations to problems involving measure

Formula
Inter-relationship
Tolerance in measurement

Why is it important?
Relates to acceptable margins of error when measuring, estimating or calculating measurements. Understanding of tolerance in measurement is appreciation of accuracy when making calculation.
Measurement

Tolerance in measurement

What is it?
To understand margins of error are acceptable in different contexts and the impact this could have.

Previous knowledge and understanding
- Describe when exact measurements could be difficult to calculate
Data and analysis

- Concept of data analysis
- Collect and organise
- Interrogate
- Display and communicate
- Drawing conclusions
Data and analysis

Concept of data analysis

Why is it important?
Data and analysis is an essential aspect of everyday life. The ability to read and analyse data is an important life skill.
Data and analysis is an essential aspect of everyday life. It is the ability to use a range of information presented in various forms.

**Concept of data analysis**

**What is it?**
Using data to make informed choices and decisions. Exploring data to make sense of the world around us.

**Previous knowledge and understanding**
- Understand the need to organise objects and/or information
- Awareness of different displays of data, and the use of these to make choices in everyday situations
- Awareness of appropriate vocabulary to talk about and organise data by their own criteria
- Awareness of the existence of information in different forms
Data and analysis

Collect and organise

**Why is it important?**
Collecting and organising data and information supports decision making relevant to the context.

- Collect and organise
- Matching, sorting and comparing
- Gathering and organising

Interrogate
Collect and organise

What is it?
Gathering information from a variety of sources and organising it in a way that suits the audience.

Previous knowledge and understanding
- Awareness of the existence of various sources of information, e.g. self-registration, giving and receiving party invitations
- Awareness of being able to gather information by appropriate means
- Awareness of the need to organise information
- Awareness of appropriate vocabulary to collect data and begin to organise it
Data and analysis

Matching, sorting and comparing

What is it?
Matching objects which have the same characteristics. As criteria increases then this become sorting, e.g. matching more than two objects. Sorting involves separating objects into groups according to their similarities or differences. Progression is made when moving from comparing individual items to comparing groups. This becomes increasingly sophisticated as learners progress their understanding.

Previous knowledge and understanding
- In play, have experience of matching, sorting and comparing using own criteria
- Have an understanding of characteristics that they are being asked to match, sort and compare with, e.g. size, colour
- Understand that objects (and data) have different characteristics (colour, size, etc.)
- Recognise these characteristics, and be able to differentiate objects based on these

Collect and organise
Matching, sorting and comparing
Gathering and organising

Interrogate
Data and analysis

Collect and organise

Why is it important?
Collecting and organising data and information supports decision making relevant to the context.

Gathering and organising

What is it?
A range of information and data can be collected from a variety of appropriate sources and for many purposes. This is organised into an appropriate form; table, chart or diagram to support interrogation and analysis. Data can be organised into groups depending on the context.

Previous knowledge and understanding
- Know that data must be sourced
- Understand that, to make sense of data, one must organise it
- Have had experience of organising techniques, e.g. sorting, matching, comparing
- Understand that organisation of the data is preparation for further communication

Collect and organise

Matching, sorting and comparing

Gathering and organising

Interrogate
Why is it important?
Accuracy in displaying and communicating data is important to ensure it is clear and easily understood by the audience.
Data and analysis

Display and communicate

What is it?
Sharing information in a variety of forms that can be understood by the intended audience.

Previous knowledge and understanding
- Demonstrate knowledge of appropriate organising techniques
- Know how to design a survey appropriate to level, e.g. question(s), organising response(s)
- Understand that the purpose of displaying data is communication
- Have had experience of different types of chart/graph of appropriate complexity to the learner’s level

Types of display

Communicating findings

Why is it important?
To share information and findings in a logical form.
Data and analysis

Display and communicate

Why is it important?
To share information and findings in a logical form.

Types of display

What is it?
The choice of how to display information will vary and should be appropriate for the context and the intended audience. Progression from simple bar graphs and picture charts to venn diagrams and pie charts.

Previous knowledge and understanding

- Awareness that there are different types of displays
- Understand that the purpose of displaying data graphically is to ease communication
Data and analysis

Display and communicate

Why is it important?
To share information and findings in a logical form.

Types of display

Communicating findings

What is it?
Presenting the findings and conclusions from the collation of information and data.

Previous knowledge and understanding
- Know how to construct diagrams/charts
- Know how to interpret diagrams/charts
- Know how to select the most appropriate display method to fit a given purpose/data set
- Understand how to compare data displays
- Understand and recognise that data collecting has a purpose
- Use appropriate vocabulary to describe displays and comparisons e.g. more than, most
Data and analysis

Interrogate

Why is it important?
In real life situations information is provided in a variety of ways. To interrogate the information enables choices and decisions to be made.
Interrogate

What is it?
Simple interrogation of data is reading and extracting key information from tables, charts, graphs etc. This enables decisions around the validity and reliability of the data, e.g. in relation to sample size.

Previous knowledge and understanding
- Know where to find data in relevant displays, e.g. timetable, bar chart, pictograph
- Understand and interpret information from displays at a level appropriate to the learner
- When considering the data, have an awareness of reliability and validity, e.g. what is the sample size?
Critical analysis of data

What is it?
Critical analysis is an indepth scrutiny of data which could include looking at trends, correlations and relationships between data.

Previous knowledge and understanding
- Knowledge and understanding of different comparison techniques
- Demonstrate ability to compare data sets in context, and with purpose, e.g. back to back stem and leaf diagram
- Understand and interpret various graphs and charts, e.g. pie charts, line graphs, scatter graphs
Data and analysis

Drawing conclusions

Why is it important?
Knowing how to draw conclusions from data helps make informed choices.

Drawing conclusions
Reliability and validity
Bias and sample size
Statistical calculations

Interrogate
Drawing conclusions

What is it?
Using the information presented in different forms and its source to draw conclusions which could affect decision making.

Previous knowledge and understanding
- Knowledge and understanding of the most appropriate graphical representation for data (line graphs, pie charts etc.)
- Knowledge and understanding of spread of data/account for outliers
- Demonstrate ability to compare data sets in context, and with purpose
Data and analysis

Reliability and validity

What is it?
Reliability is the credibility of the source as well as the collation of the data. Reliability is the repeatability of a particular set of findings e.g. how accurate would the information be in a second identical information gathering activity? Reliability is a necessary ingredient for determining the overall validity of an investigation or survey and enhancing the strength of the results.

Previous knowledge and understanding
- Know how to obtain information from real life sources
- Demonstrate an awareness that not all information is equally reliable
- Understand different types of average and how these can be misleading due to the existence of outliers
- Be able to use calculations to interpret data
- Demonstrate knowledge of how to make predictions based on the data supplied

Statistical calculations

Reliability and validity

Drawing conclusions

Bias and sample size

Interrogate
**Data and analysis**

**Drawing conclusions**

*Why is it important?*

Drawing conclusions from data to help make informed choices.

**Bias and sample size**

*What is it?*

Bias is who or what is included in the intended sample. A biased sample can result in a non-valid data set. The size of the group can have an impact on the validity of the survey.

**Previous knowledge and understanding**

- Awareness of word bias
- Know how to design and interpret surveys
- Know how to display data
- Know how to draw conclusions
- Awareness of sample size
- Understand reliability of data

**Statistical calculations**

**Reliability and validity**

**Bias and sample size**

**Interrogate**
**Statistical calculations**

**What is it?**
Statistical calculations support the evaluation and interpretation of data and draw conclusions from data.

**Previous knowledge and understanding**
- Has experienced working with fractions, decimal fractions and percentages in a range of contexts
- Knowledge and understanding of a range of strategies to carry out calculations
- Apply knowledge and understanding of integers, e.g. temperature
- Understanding of what averages are intended to represent

**Why is it important?**
Drawing conclusions from data to help make informed choices.
Ideas of chance and uncertainty

Simple choice and decision making
Predicting and describing likelihood
Choice and decision making based on likelihood
Probability
Applying knowledge of probability
Ideas of chance and uncertainty

Simple choice and decision making

Why is it important?
Using everyday language to identify outcomes of familiar events supports the development of critical thinking skills. This enables discussion around choices and consideration of alternative options when making choices and decisions.
Ideas of chance and uncertainty

Simple choice and decision making

What is it?
Describing the possible outcomes using everyday language, e.g. will happen, won’t happen, always, never, sometimes.

Previous knowledge and understanding
- Understand that you can make choices

Applying knowledge of probability
Ideas of chance and uncertainty

Predicting and describing likelihood

**Why is it important?**
Predicting and describing the likelihood of events occurring can help develop the ability to make informed choices and mathematical thinking.
Ideas of chance and uncertainty

Predicting and describing likelihood

What is it?
Using information to determine possible outcomes.

Previous knowledge and understanding
- Know and understand appropriate vocabulary for simple choice and decision making
- Have an awareness of the reasonableness of an outcome
- Be able to make simple choices and decisions
Ideas of chance and uncertainty

Predicting and describing likelihood

Why is it important?
Predicting and describing the likelihood of events occurring can help develop the ability to make informed choices and mathematical thinking.

Language of chance

What is it?
Being able to classify outcomes using appropriate language, e.g. likely, certain.

Previous knowledge and understanding
- Know and understand appropriate vocabulary of chance
- Be able to make and justify simple choices and decisions
- Verbally justify reasons for outcomes using appropriate vocabulary

Simple choice and decision making

Applying knowledge of probability
Ideas of chance and uncertainty

Predicting and describing likelihood

Why is it important?
Predicting and describing the likelihood of events occurring can help develop the ability to make informed choices and mathematical thinking.

Scale

What is it?
Knowledge of the numerical scale to describe probability 0-1.

Previous knowledge and understanding
An awareness of scale
Understand the concepts of certainty and impossibility
Awareness the vocabulary of chance and uncertainty

Simple choice and decision making

Applying knowledge of probability
Ideas of chance and uncertainty

Choice and decision making based on likelihood

**Why is it important?**
Developing an understanding of how likely an event is to happen will support the decision making process.

- Choice and decision making based on likelihood
- Conducting chance experiments
- Order the chance of specified outcomes
Choice and decision making based on likelihood

What is it?
Likelihood is the probable chance of an event occurring and using this information to make informed choices.

Previous knowledge and understanding
Know and understand appropriate vocabulary for likelihood, e.g. impossible, possible, certain
Understand their predictions of outcomes based on past experiences
Have an awareness that you can predict probability based on described likelihood of past events

Why is it important?
Developing an understanding of how likely an event is to happen will support the decision making process.
Ideas of chance and uncertainty

Simple choice and decision making

- Predicting and describing likelihood
- Choice and decision making

Why is it important?
Developing an understanding of how likely an event is to happen will support the decision making process.

Conducting chance experiments

What is it?
Practical experiments to support understanding of possible outcomes and the likelihood of an event occurring.

Previous knowledge and understanding
- Know and understand appropriate vocabulary for likelihood, e.g. impossible, possible, certain
- Understand how to predict probability based on described likelihood of past events
- Know how to explain possible outcomes in the context of probability
- Awareness of desired outcome(s), e.g. picking a red counter from a bag of red, blue and green
- Understand certainty and impossibility

Applying knowledge of probability

Choice and decision making
Conducting chance experiments
Order the chance of specified outcomes
Ideas of chance and uncertainty

Choice and decision making based on likelihood

Why is it important?
Developing an understanding of how likely an event is to happen will support the decision making process.

Order the chance of specified outcomes

What is it?
Use the numerical value to order events from most likely to least likely.

Previous knowledge and understanding
- Know the scale between 0-1
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive, using the appropriate language, e.g. possible, certain, evens
- Demonstrate ability to order probabilities of particular events, appropriate to level using appropriate language, e.g. possible
- Know and understand place value with especially decimal fractions
- Know the interrelationship between fractions, decimal fractions and percentages

Choice and decision making
Conducting chance experiments
Order the chance of specified outcomes
Ideas of chance and uncertainty

Probability

Why is it important?
Calculating theoretical probability helps build an understanding of the consequences of events and likelihood of an event occurring.
Probability

What is it?
The likelihood of an event occurring. Many events cannot be predicted with total certainty.

Previous knowledge and understanding
- Know and understand appropriate vocabulary for probability, e.g. impossible, possible, certain
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive
- Understand the concepts of mathematical certainty and impossibility
- Be able to describe a simple outcome's probability by placing it on the scale, with divisions appropriate to level

Calculating theoretical probability helps build an understanding of the consequences of events and likelihood.

Why is it important?
Probability helps in making decisions based on likelihood.
Assigning numerical values

What is it?
A probability scale is used to numerically represent the probability of an event occurring. The numerical representation can be in the form of fractions, decimal fractions or percentages within a scale of 0-1 or 0-100%. The probability of any possible mutually exclusive event happening is 1, i.e. certain.

Previous knowledge and understanding
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive
- Be able to describe a simple outcome’s probability by placing it on the scale, with divisions appropriate to level
- Know how to construct a numerical representation of probability
- Know and understand appropriate vocabulary for probability, e.g. mutually exclusive
- Relate vocabulary to the probability scale fluently
- Understand and be able to use fractional notation
- Know and understand place value especially decimal fractions
- Know and understand the interrelationship between fractions, decimal fractions and percentages
Ideas of chance and uncertainty

Simple choice and decision making

Predicting and describing likelihood

Choice and decision making based on likelihood

Probability

Why is it important?
Calculating theoretical probability helps build an understanding of the consequences of events and likelihood of an event occurring.

Interpreting probability
What is it?
Using the numerical representation to determine the likelihood of the event happening to inform decision making.

Previous knowledge and understanding
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive
- Be able to describe a simple outcome’s probability by placing it on the scale, with divisions appropriate to level
- Know how to construct a numerical representation of probability
- Awareness that the numerical representation of an outcome can predict future outcomes

Assigning numerical values
Interpreting probability
Notation
Ideas of chance and uncertainty

**Notation**

*What is it?*
A method of expressing the probability of an event occurring using a mathematical statement.

**Previous knowledge and understanding**
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive
- Know how to construct a numerical representation of probability
- Know how to order probabilities based on numerical scale 0-1
- Understand place value especially decimal fractions
- Know and understand the interrelationship between fractions, decimal fractions and percentages

**Calculating theoretical probability helps build an understanding of the consequences of events and likelihood**

**Assigning numerical values**

**Interpreting probability**
Ideas of chance and uncertainty

Applying knowledge of probability

Why is it important?
Understanding and being able to quantify risks helps us to make more informed decisions.

- Applying knowledge of probability
- Formula
Applying knowledge of probability

What is it?
The ability to assess risk involves considering all the possible outcomes and planning for them. This would include understanding of chance experiments involving repeated trials often with the use of technology.

Previous knowledge and understanding
- Know and understand how to use numerical representations of probability
- Know how to give the probability of an event happening or not occurring
- Demonstrate awareness of how influencing the possible outcomes affects the probability of the desired outcome
- Know the difference between theoretical and experimental probability, e.g., you can toss a coin 3 times and get 3 heads.
- Awareness of the concept of risk, and how this affects real life, e.g., insurance
- Understand chance and experiments
- Understand sample size and its relationship to reliability and validity

Why is it important?
Understanding and being able to quantify risks helps us to make more informed decisions.
Ideas of chance and uncertainty

Simple choice and decision making

Predicting and describing likelihood

Choice and decision making based on likelihood

Probability

Applying knowledge of probability

Why is it important?
Understanding and being able to quantify risks helps us to make more informed decisions.

Formula
What is it?
Is used to calculate the probability of an event occurring.

Previous knowledge and understanding
- Know that probability can be represented by a numerical scale from 0 to 1 inclusive
- Be able to describe a simple outcome’s probability by placing it on the scale, with divisions appropriate to level
- Know how to construct a numerical representation of probability
- Know and understand appropriate vocabulary for probability, e.g. mutually exclusive
- Relate vocabulary to the probability scale fluently
- Understand sample size and its relationship to reliability and validity
Expressions and equations
Initial algebraic thinking

Why is it important?
Developing early algebraic thinking will lay the foundations for learners to be more successful in achieving the associated key milestones for the progression pathway in algebra.

Mathematical Modelling
Factors of algebraic expressions
Solution Sets
Developing early algebraic thinking will lay the foundations for achieving the associated key milestones for the progression pathway in algebra.

**Initial algebraic thinking**

**What is it?**

Initial algebraic thinking is understanding the order of numbers, their place on the number line and how they can be combined. This is an essential step to developing algebraic capabilities.

**Previous knowledge and understanding**

- Basic number bonds
- The concept of the number line
- The order of numbers on a number line
Mathematical operators

Why is it important?
Being able to use and interpret mathematical symbols is a necessary skill in developing an understanding of algebra.
Expressions and equations pathway showing milestones

Mathematical operators
What is it?
Symbols are part of the universal language of mathematics.

The four operators +, −, ×, ÷ are the first set of symbols that learners usually become familiar with. These symbols allow mathematical statements to be expressed in as short and concise a way as possible.

Mathematics is a necessary skill in developing an understanding of algebra.
Expressions and equations pathway showing milestones

Mathematical operators

**Equality and balance**

*What is it?*
The equal sign indicates that one quantity is the same as another. Visualising the equals sign (=) as a balance point is very useful as algebraic operations progress and extend to more challenging equations.

- **Mathematical operators**
- **Equality and balance**
- **Inequality and imbalance**
- **Greater than/less than**
Expressions and equations pathway showing milestones

Mathematical operators

Why is it important?
Being able to use and interpret mathematical symbols is a necessary skill in developing an understanding of algebra.

Inequality and imbalance
What is it?
A symbol for “is not equal to” (≠) is required when quantities on either side do not have the same value.
Expressions and equations pathway showing milestones

Mathematical operators

Why is it important?
Being able to use and interpret mathematical symbols is a necessary skill in developing an understanding of algebra.

Greater than/less than

What is it?
Symbols to represent ‘greater than’ (>), ‘less than’ (<), ‘greater than or equal to’ (≥) and ‘less than or equal to’ (≤) are also part of the language of algebra.

Previous knowledge and understanding
• Recognising the four operations
• Confidence with number bonds
• The order of numbers on the number line
Expressions and equations pathway showing milestones

**Pictures and symbols**

**Why is it important?**

Understanding that numbers, and operators, can be replaced by pictures or symbols is fundamental to all algebraic thinking. Introducing the concept of ‘finding the unknown quantity’, or operator, is an essential step in developing the ability to work with expressions and solve equations.
Understanding that numbers, and operators, can be replaced by pictures or symbols is fundamental to all algebraic thinking. Introducing the concept of 'finding the unknown quantity', or operator, is an essential step in developing the ability to work with expressions and solve equations.

**Pictures and symbols**

**What is it?**
A picture or symbol that replaces a certain number, or operator, in one equation or expression can have a completely different value in another equation or expression. A picture or symbol can represent a number or operator but not necessarily the same number all the time. The understanding of variability is important in algebra.

**Previous knowledge and understanding**
- The concept of greater than and less than when relating to the number line

**Abstract Thinking**
Understanding that numbers and operators can be represented by pictures or symbols is fundamental to all algebraic thinking. Introducing the concept of ‘finding the unknown quantity’, or operator, is an essential step in developing the ability to work with expressions and solve equations.

**Abstract Thinking**

**What is it?**

Abstract thinking is about thinking logically without the use of concrete material or visual representations.
Simple algebraic equations

Why is it important?
Moving from pictures or symbols to letters paves the way for solving algebraic equations and evaluating algebraic expressions. This also helps develop an understanding of variables and constants.
Expressions and equations pathway showing milestones

Simple algebraic equations

Why is it important?

Simple algebraic equations

What is it?
Simple algebraic equations (variables to a power are not included) that have one variable or one letter have one correct solution, e.g. \(4 + x = 9\).
Moving from pictures or symbols to letters paves the way for solving algebraic equations and evaluating algebraic expressions. This also helps develop an understanding of variables and constants.

### Developing approaches to solving equations

**What is it?**
A sound knowledge of number facts will support the ability to solve simple algebraic equations. Learners may use their knowledge of inverse operations to find solutions when the equations become progressively more challenging.

**Previous knowledge and understanding**
- Using pictures to represent numbers
- Number bond problems involving pictures or symbols
- The significance of the = sign and its link to balance

### Simple algebraic equations

- Developing approaches to solving equations
Simplifying algebraic terms

Why is it important?
Many problems involve a number of algebraic terms, some of which have common variables. Being able to simplify this combination of terms makes solving the problem considerably less challenging.
Expressions and equations pathway showing milestones

Simplifying algebraic terms

What is it?
The simplification of like terms, or collecting like terms, is the process of writing a combination of different algebraic terms in as compact a way as possible.

Previous knowledge and understanding
- Familiarity with algebraic conventions, e.g. $a + a = 2a$ and $1a$ is always written as $a$
- The properties of basic geometric shapes for context
Evaluate algebraic expressions

Why is it important?
Substituting given values into algebraic expressions and consequently obtaining a value for the expression is important in mathematical modeling. Understanding that the values to be substituted into the expressions can change allows different problems to be solved.
Evaluate algebraic expressions

Why is it important?

Evaluating is performing the calculations which are implied in the expression to find the value of an algebraic expression.

Substitution

Variables
Evaluate algebraic expressions

Why is it important?
Substitution is replacing a letter in an algebraic expression with a numerical value. Different letters can be assigned different numerical values, unless they are constants such as Pi (π). If a letter appears more than once in an expression, the same numerical value is assigned each time.

Substitution

What is it?
Substitution is replacing a letter in an algebraic expression with a numerical value. Different letters can be assigned different numerical values, unless they are constants such as Pi (π). If a letter appears more than once in an expression, the same numerical value is assigned each time.
Evaluate algebraic expressions

Why is it important?
Substituting given values into an algebraic expression and consequently obtaining a value is important in mathematical modeling. Understanding that the values to be substituted in the expression can change allows different problems to be solved.

Variables

What is it?
A variable quantity, as its name suggests, can change in value. In algebra, letters can be assigned a number.

Previous knowledge and understanding
- Familiarity with algebraic convention, e.g. $3c = 3 \times c = c + c + c$
- Simplifying groups of like terms
- Using the four operations
Equations

Why is it important?
Translating a real problem from words into a simple equation demonstrates the importance and relevance of mathematics. Being able to form equations from written, pictorial or spoken information is fundamental to mathematical modelling.
Expressions and equations pathway showing milestones

Equations

Why is it important?

Equations

What is it?
Equations use letters, numbers, signs and symbols and allow given situations or conditions to be expressed in the most concise way possible.

- Forming simple equations from statements and problems
- Solving equations

Why is it important?
Translating a real problem from words into a simple equation demonstrates the importance and relevance of mathematics. Being able to form equations from written, pictorial or spoken information is fundamental to mathematical modelling.

- Initial algebraic thinking
- Mathematical operators
- Simplifying algebraic terms
- Mathematical Modelling
- Factors of algebraic expressions
- Solution Sets
Expressions and equations pathway showing milestones

Equations

Forming simple equations from statements and problems

Why is it important? Translating a real problem from words into a simple equation demonstrates the importance and relevance of mathematics. Being able to form equations from written, pictorial or spoken information is fundamental to mathematical modelling.

What is it? Letters are assigned to each variable and appropriate mathematical signs are used to imply the correct calculation. Simple equations will normally have one variable and one solution. Familiarity with integers and fractions allows scope for forming equations that may not have whole number solutions. The facts and properties of geometric shapes can be used to form simple equations.
Expressions and equations pathway

Equations

Why is it important?
Translating a real problem from words into a simple equation demonstrates the importance and relevance of mathematics. Being able to form equations from written, pictorial or spoken information is fundamental to mathematical modelling.

Solving equations

What is it?
An equals symbol ( = ) and language such as 'solve' would indicate that a numerical value has to be found. An equation can be solved using different procedures. Solutions to equations can be found algebraically or graphically. Solving an equation or inequation can result in a unique solution (one answer), an interval of values or a choice of individual values.

Previous knowledge and understanding
- Solving simple equations
- The properties of geometric shapes for context
Formulae

Why is it important?
Being able to use formulae is essential in many areas of the curriculum and beyond. Being able to construct a formula supports the type of problem solving skills needed in many occupations in the modern world.
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Being able to use formulae is essential in many areas of the curriculum and beyond. Being able to construct a formula supports the type of problem solving skills needed in many occupations in the modern world.

Formulae
What is it?
Formulae show the proven relationship between quantities using letters, signs and symbols and describe the calculations needed to evaluate any given quantity. Some formulae can have constants involved as well as letters for each variable. Formulae can involve a combination of constants and letters.
Creating formulae and generating solutions

What is it?
Formulae are created by comparing the relationship between different quantities and obtaining a rule that links these quantities. Solutions can be found from the calculations involved in using formulae. Formulae are a mechanism for producing different output values dependent on the values substituted in the first place. Simple formulae are ideal for comparing changes in output with changes in input.

Previous knowledge and understanding
• Letters can represent quantities, e.g. P can represent perimeter (important reminder: if the perimeter was 20cm then P would represent 20 and Pcm would be 20cm)
• Algebraic conventions, e.g. abc means $a \times b \times c$, $a \times a = a^2$
Factors of algebraic expressions

Why is it important?
The ability to factorise algebraic expressions enables more complex equations to be solved in an efficient manner.
Factors of algebraic expressions

What is it?
This development builds on the previous work and now involves common algebraic factors as well as numerical factors and the use of brackets to represent the factorised terms.

Why is it important?
The ability to factorise algebraic expressions enables more complex equations to be solved in an efficient manner.
Factors of algebraic expressions

Recognising common factors

What is it?
When comparing the factors of two or more terms, being able to list factors that are common, is important. The concept of a ‘highest common factor’ is critical to factorising fully an expression.

Mathematical Modelling

Solution Sets

Factors of algebraic expressions
Recognising common factors
Understanding the distributive law

Initial algebraic thinking
Mathematical operators
Simplifying algebraic terms
Factors of algebraic expressions

Expressions and equations pathway showing milestones
Factors of algebraic expressions

Why is it important?
The ability to factorise algebraic expressions enables more complex equations to be solved in an efficient manner.

Understanding the distributive law

What is it?
The distributive law highlights a basic mathematical process and its equivalent inverse process. Multiplying the sum of two numbers by a third number is the same as multiplying the two numbers individually by the third number first and then finding the sum of the two new numbers formed. $a(b + c) = ab + ac$

Previous knowledge and understanding
- The factors of a number
- Listing common factors for two or more numbers
- Recognising the highest common factor
- Algebraic convention, e.g. $6a = 3 \times 2a$
Mathematical modelling

Why is it important?
Many problems in manufacturing, engineering, technology and science require the skills involved in mathematical modelling. This ability to construct, interpret and solve equations or inequations that represent a real life, or theoretical, situation are fundamental to the process.
Mathematical modelling

What is it?
Mathematical modelling is a skill that involves translating a complex problem into the most concise algebraic form. It is the ability to read and interpret a problem, to express the information appropriately as an equation, inequation, inequality or formula, to solve it and to be able to communicate the answer using the context of the original information.
Solving inequalities

What is it?
Solving inequalities is the idea of a set of possible solutions. An inequality does not have an 'equality' sign but instead uses either 'greater than' sign, 'greater than or equal to' sign, 'less than' sign or 'less than or equal to' sign. The same concepts and skills used to solve equations can help to solve inequalities. It is important to stress that attention should be paid to the conditions that are applied to the inequality as this will impact on what is permitted in the solution set.

e.g. \( x \geq 5 \), where \( x \) is a single digit whole number

Previous knowledge and understanding
- Changing words and diagrams into algebraic form
- The properties of geometric shapes for context
- Angle classifications, e.g. complementary and supplementary angles
Many mathematical problems can have more than one solution. The ability to list all possible solutions is essential in mathematical problems of this type.
Solution sets

What is it?
A solution set is a set of numbers that lists all possible solutions to a given mathematical problem. In many cases the solution lies within defined mathematical sets.
E.g. Whole numbers \(\{0, 1, 2, 3, \ldots\}\), Natural numbers \(\{1, 2, 3, \ldots\}\), Integers \(\{\ldots, -2, -1, 0, 1, 2, \ldots\}\) and Real numbers \{all points on an infinitely long number line (e.g. fractions, decimal fractions, roots, \(\pi\), \(\ldots\)\}.

Previous knowledge and understanding
- Equations, inequations and formulae
Angles, symmetry and transformation

- Positions language
- Directions and turnings
- Angles
  - Angle relationships
  - Bearings
- Scale
  - Enlargement and reduction
  - Similarity
- Understanding symmetry
  - Symmetry
- Grid references
  - Coordinate system
  - Transformations
Angles, symmetry and transformation

Positional language

Why is it important?
The use of positional language is one of the first steps in understanding spatial awareness.
Angles, symmetry and transformation

**Positional language**

**What is it?**
Understanding the position of something in relation to something else and using language such as in front of, behind, above, below.

**Previous knowledge and understanding**
- Vocabulary of position through personal experience.
Directions & turnings

Why is it important?
Being able to follow and give directions is a necessary life skill that allows local areas to be efficiently navigated. It also develops basic map reading skills.
Directions & turnings
What is it?
A description of personal locations, following and giving directions using language such as forwards, backwards, left, right, clockwise, anti-clockwise as well as North, South, East and West.
Directions & turnings

Why is it important?
Being able to follow and give directions is a necessary life skill that allows local areas to be efficiently navigated. It also develops basic map reading skills.

Cardinal compass points

What is it?
Understanding that the points of the compass can be used to describe and give directions.

Previous knowledge and understanding
• Understand and follow instructions
Angles, symmetry and transformation

Angles

Why is it important?
A knowledge of angles is required for the understanding of position and geometrical properties of shapes.
Angles, symmetry and transformation

Angles
What is it?
An angle measures amount of turning. Understanding the relationship between the vocabulary of direction and the associated angle, e.g. ¼ turn = 90°.

Previous knowledge and understanding
• Vocabulary associated with position: to the right of etc.
Why is it important?
A knowledge of angles is required for the understanding of position and geometrical properties of shapes.

Classifying angles
What is it?
Angles can be classified depending on their size, e.g. acute is less than 90°.
Angles, symmetry and transformation

Angles

Why is it important?
A knowledge of angles is required for the understanding of position and geometrical properties of shapes.

Measuring Angles

What is it?
Angles are measured in degrees (°) using a protractor.

Measuring Angles

What is it?
Angles are measured in degrees (°) using a protractor.
Angles, symmetry and transformation

**Angles**

*Why is it important?*
A knowledge of angles is required for the understanding of position and geometrical properties of shapes.

*Drawing Angles*
*What is it?*
Making use of ruler and protractor to accurately measure and draw a given angle.
Angles, symmetry and transformation

Angles

Why is it important?
A knowledge of angles is required for the understanding of position and geometrical properties of shapes.

Compass points and angles
What is it?
Investigate the angle between two compass points.
Angles, symmetry and transformation

Angle Relationships

Why is it important?
An understanding of the angle relationships in 2D diagrams allows for the calculation of missing angles.
Angles, symmetry and transformation

Angle Relationships
What is it?
Knowledge of the sum of the angles in 2D shapes.

Why is it important?
An understanding of the angle relationships in 2D diagrams allows for the calculation of missing angles.
An understanding of the angle relationships in 2D diagrams allows for the calculation of missing angles.

**Naming angles**

What is it?

Angles are named using three letters. These are written at the vertex and at the ends of the two arms that form the angle. The vertex is always the middle of the three letters.

This angle is made from two arms, AB and BD, with vertex at B. <DBA or <ABD

D

B

A

Why is it important?

An understanding of angle relationships helps in solving geometric problems and determining unknown angles in shapes.
Angles, symmetry and transformation

Angle Relationships

Why is it important?
An understanding of the angle relationships allows for the calculation of missing angles.

Angles in geometric shapes and intersecting lines

What is it?
- Knowledge of the sum of the angles in 2D shapes.
- The conditions for complementary (add up to 90º) and supplementary (add up to 180º) angles.
- The occurrence of corresponding and alternate angles in parallel lines.
- The occurrence of vertically opposite angles.

(F, Z and X angles)
Angle Relationships

Why is it important?
An understanding of the angle relationships in 2D allows for the calculation of missing angles.

Angles and circles

What is it?
A tangent is a straight line that touches the diameter of a circle at one point only. If a radius is also drawn to this point then the resulting angle between radius and tangent is right-angled and so the tangent is perpendicular to the radius at the point of contact. Understand that a triangle formed using the end-points of the diameter of a circle and the third point rests on the circumference of the circle will always be right-angled.

Previous knowledge and understanding
• The meaning of perpendicular
Angles, symmetry and transformation

Bearings

Why is it important?
Understanding bearings is essential for the daily safety of millions when travelling on planes or ships at sea.

- Positions language
- Symmetry
- Grid references
- Coordinate system
- Transformations

Why is it important?
Understanding bearings is essential for the daily safety of millions when travelling on planes or ships at sea.

Bearings
Why is it important?
Understanding bearings is essential for the daily safety of millions when travelling on planes or ships at sea.

Bearing
What is it?
Understanding the convention used when describing a bearing. Being able to link all standard compass points with their associated bearings. Being able to construct accurate scale drawings for journeys involving distances and bearings.

Previous knowledge and understanding
• Scale drawing
• Points on a compass
• Measuring angles
• Complimentary and supplementary angles
Angles, symmetry and transformation

Scale

Why is it important?
Scale is essential for regularly encountered contexts such as maps, plans and modelling.
Angles, symmetry and transformation

**Scale**

**What is it?**
Understanding scale factors and using them to solve problems that relate to similar objects, shapes, maps and plans. Choose an appropriate scale to draw journeys where all actual information is given.

**Previous knowledge and understanding**
- Ratio
- Measuring and drawing angles

Scale is essential for regularly encountered context such as maps, plans and modelling.
Angles, symmetry and transformation

Enlargement and Reduction

Why is it important?
Enlargement of molecular structures assists with investigations into cells and supports medical advancements. Reduced scale models are commonly used in wind tunnels to determine wind resistance etc.
Angles, symmetry and transformation

Enlargement and reduction

What is it?
Being able to enlarge and reduce a given diagram or model by a scale factor, understanding the application of scale factor to all lengths. Understand that there is conservation of angles within reduction and enlargement.

Why is it important?
Enlargement of molecular structures assists with investigations into cells and supports medical advancements.
Reduced scale models are commonly used in wind tunnels to determine wind resistance etc.

Positional language

Scale
Grid references
Coordinate system
Transformations
Angles, symmetry and transformation

Similarity

Why is it important?
Appreciating that two objects which are similar will share key properties, underpins the practice of modelling. This allows wind tunnels, wave tanks etc. to be used on scaled down models knowing results obtained will mirror real-life outcomes.
**Similarity**

**What is it?**
Being able to calculate and use a scale factor that connects two similar figures. Understand that problems involving the area of similar figures requires the scale factor to be squared. Possible extension: problems that compare the volumes of two similar objects require the scale factor to be cubed.

**Previous knowledge and understanding**
- Ratio
- Scale factors
- Solving basic scale problems
- Squaring and cubing fractions
Understanding symmetry

Why is it important?
Interpreting and drawing symmetrical patterns, shapes and pictures develops an understanding of the relationship between reflection and symmetry.
Angles, symmetry and transformation

Understanding symmetry
What is it?
Exposure to constructing symmetrical patterns, shapes and pictures to help develop an elementary understanding of symmetry. Exploring mirror symmetry and recognising that size, shape and distances from the centre line are preserved in symmetry.
Angles, symmetry and transformation

Symmetry

Why is it important?
Investigating symmetrical patterns and designs enhances an understanding and appreciation of the natural world and art. It is also fundamental to developing skills associated with geometrical reasoning.
Angles, symmetry and transformation

Symmetry
What is it?
Recognising that symmetrical patterns have proportion and balance.

Symmetry
Line symmetry
Rotational symmetry

Investigating symmetrical patterns and designs enhances an understanding and appreciation of the natural world and is fundamental to developing skills associated with geometrical reasoning.
Angles, symmetry and transformation

Line symmetry

Why is it important?
Investigating symmetrical patterns and designs enhances an understanding and appreciation of the natural world and art. It is fundamental to developing skills associated with geometrical reasoning.

What is it?
Recognising that a line of symmetry divides a shape into two congruent parts, each of which is the mirror image of the other. The line of symmetry can be horizontal, vertical or inclined.
Angles, symmetry and transformation

**Symmetry**

**Why is it important?**
Investigating symmetrical patterns and designs enhances an understanding and appreciation of the natural world and art. It is also fundamental to developing skills associated with geometrical reasoning.

**Rotational symmetry**

**What is it?**
A shape has rotational symmetry if it can be rotated through an angle to fit exactly on to its original outline. The order of rotational symmetry is the number of times a shape can be rotated and fit exactly on top of its original position within a complete turn. The centre of symmetry is the fixed point about which the shape is rotated.
Grid References

Why is it important?
Understanding how different grids operate is essential when locating seats on planes or trains, participating in games such as battleships or locating buildings in cities, such as New York.
Angles, symmetry and transformation

Grid References

What is it?
Using grids to help identify position relative to a scale in the horizontal and vertical directions on a page or screen. The scale can use letters or numbers or a combination of both.

Why is it important?
Understanding how different grids operate is essential when locating seats on planes or trains, participating in games such as battleships or locating buildings in cities, such as New York.
Co-ordinate system

Why is it important?
Co-ordinate grids provide the foundation for describing a unique point and are essential for graphing and transforming geometrical shapes.
Angles, symmetry and transformation

Co-ordinate system

What is it?
Labeling and numbering axes. Emphasize the numbering of lines and not spaces in-between. Be able to plot points and give the co-ordinates of a group of points. Be able to extend a one quadrant grid to one with four quadrants.

Previous knowledge and understanding
- Understanding grids
- Know the numbers on the number line
- Understand negative numbers

Co-ordinate system
Angles, symmetry and transformation

Transformations

Why is it important?
Transformation of points and 2D shapes is key to integrating all previous geometrical skills and knowledge.
Angles, symmetry and transformation

Transformations
What is it?
Carry out transformations on 2D shapes and points within a four quadrant grid involving reflection and translation. The rotation of points and 2D shapes should be considered as a possible extension.
Multiples, factors and primes
Multiples, factors and primes

Multiples and Factors

Why is it important?
Understanding of multiples and factors is essential to support work in fractions. A clear understanding of the links within the multiplication tables and the use of inverse processes are essential.
Understanding of multiples and factors is essential to support work in fractions. A clear understanding of the links within the multiplication tables and the use of inverse processes are essential.

**Multiple and factors**

**What is it?**
A multiple can be found in the multiplication tables eg the multiples of 7 are 14, 21, 28... The multiples are never ending.

The factors of a number are any numbers that divide exactly into a larger number.

**Previous knowledge and understanding**
- Multiplication tables
- Division with or without a remainder
Common multiples and factors

Why is it important?
Common multiples and factors help and support learners when working with fractions and algebraic manipulations.

- Common multiples and factors
- Lowest common multiple
- Highest common factor
Common multiples and factors

What is it?
A common multiple is a number that is a multiple of two or more numbers. If numbers share one or more factors, then they are called the common factors of those numbers.
Multiples, factors and primes

Common multiples and factors

Why is it important?
Common multiples and factors help and support learners when working with fractions and algebraic manipulations.

Lowest common multiple
What is it?
The lowest common multiple (LCM) is the lowest multiple which two or more numbers have in common.

Common multiples and factors
Lowest common multiple
Highest common factor
Multiples, factors and primes

Common multiples and factors

**Why is it important?**
Common multiples and factors help and support learners when working with fractions and algebraic manipulations.

**Highest common factor**

**What is it?**
The largest common factor of two or more numbers is called the highest common factor (HCF).
Prime numbers

Why is it important?
Prime numbers are the building blocks of the number system. The link with factors will establish that every whole number greater than 1 is either prime or is a product of prime numbers. This is the Fundamental Theorem of Arithmetic. Prime numbers are used to encrypt information through communication networks utilised by mobile phones and the internet.
Prime numbers

Prime Numbers
What is it?
Prime numbers have only two distinct factors. Prime numbers are whole numbers greater than 1. A prime number can only be divided by itself and 1 to give a whole number solution.

Previous knowledge and understanding
• Being able to list all the factors of a number
Patterns and relationships

- Patterns
- Number patterns
- Number sequences
- Formulae
- Creating graphical representations
- Gradient
- Equations of straight lines
Recognising and using patterns is an essential building block for algebraic thinking and understanding numbers.
Patterns

What is it?
A pattern is a repetitive sequence of events, shapes or numbers which can be continued.

Previous knowledge and understanding
- Personal experiences of looking for patterns in the environment
- Vocabulary of next, before, after
- Knowledge of colour and simple shapes
- Able to count in order

Recognising and using patterns is an essential building block for algebraic thinking and understanding numbers.
Patterns and relationships

Number Patterns

Why is it important?
Recognising and using number patterns is an essential building block for algebraic thinking, algebraic sequencing, generating formulae and graphical representation.

Number pattern
Exploring number patterns

Patterns
Equations of straight lines
Patterns and relationships

Patterns

Number patterns

Formulae

Creating graphical representations

Number sequences

Gradient Equations of straight lines

Why is it important?

Recognising and using number patterns is an essential building block for algebraic thinking, algebraic sequencing, generating formulae and graphical representation.

Number pattern

What is it?

A number pattern is a set of numbers that is governed by a rule which makes the pattern predictable, e.g. odds and evens, times tables etc.

Previous knowledge and understanding

- Know odd and even numbers
- Able to add, subtract, multiply and divide
- Multiples
Patterns and relationships

Number Patterns

Why is it important?
Recognising and using number patterns is an essential building block for algebraic thinking, algebraic sequencing, generating formulae and graphical representation.

What is it?
Explore and extend prominent number patterns, such as square, triangular and Fibonacci numbers.

MAIN MENU

Patterns

Exploring number patterns

Equations of straight lines

Number pattern

Exploring number patterns
Patterns and relationships

**Number sequences**

**Why is it important?**
Understanding number sequences allows us to generate algebraic formulae either pictorially, orally or using algebraic notation.
Number sequences

What is it?
A number sequence has a rule, which can be used to find the value of each term. It is important to understand and explain the rule associated with a number sequence and use the rule to predict any number in the sequence. This is usually developed pictorially, orally or using algebraic notation.

Previous knowledge and understanding
• Able to spot and continue number patterns
• Confidence in using the 4 operations
Patterns and relationships

Number sequences

Why is it important?
Understanding number sequences allows us to generate algebraic formulae either pictorially, orally or using algebraic notation.

Modelling
What is it?
Generating a number sequence illustrated by a physical or pictorial pattern and determining the equation that the sequence represents. The formula is used to determine information about the items at any position in the sequence to make evaluations and solve problems.
Patterns and relationships

Formulae

Why is it important?
Formulae are fundamental in developing mathematical modelling and underpin all graphical representation.

- Formulae
- Generating a set of outputs using a formula
- Determining a formula from a table of values
Formulae
What is it?
A formula is a special type of equation that shows the relationship between different variables. Using a formula is the most efficient way of solving problems that compare different sets of variables.
e.g. Area of rectangle = length \times \text{ breadth},
Volume of a cuboid = l \times b \times h

Previous knowledge and understanding
• Knowing the convention of algebra, e.g. \( ab \) means \( a \times b \), \( a^2 \) means \( a \times a \)
Patterns and relationships

Formulae

Why is it important?
Formulae are fundamental in developing mathematical modelling and underpin all graphical representation.

What is it?
Use a given set of inputs to generate a set of outputs. This combination of inputs and outputs allows for graphical representations to be developed.

Generating a set of outputs using a formula

Determining a formula from a table of values

Generating a set of outputs using a formula
Patterns and relationships

**Formulae**

*Why is it important?*
Formulae are fundamental in developing mathematical modelling and underpin all graphical representations.

*What is it?*
Being able to construct a formula is a fundamental algebraic process and permits the expansion of any input/output.

**Determining a formula from a table of values**

Generating a set of outputs using a formula

Determining a formula from a table of values
Patterns and relationships

Creating graphical representations

Why is it important?
Creating graphical representations is the most efficient way of representing the comparison between two variables and presenting it in a visual form. It helps develop the fundamental skills of interpolation and extrapolation.
Creating graphical representations

What is it?
It is the most efficient method of comparing two related variables, in a visual way.

Previous knowledge and understanding
- Plotting points
- Constructing appropriate formulae
Patterns and relationships

Creating graphical representations

Why is it important?
Creating graphical representations is the most efficient way of representing the comparison between two variables and presenting it in a visual form. It helps develop the fundamental skills of interpolation and extrapolation.

Determining a general formula
What is it?
The ability to generate a formula for a given sequence of numbers allows any number in the sequence to be determined without having to calculate all previous numbers.

Creating graphical representations

Determining a general formula
Patterns and relationships

Gradient

Why is it important?
Through the ability of allocating a numerical value to a slope, it allows limits to be placed for design and safety considerations, e.g. a mobility ramp access to buildings, slopes of roofs, incline of roads.
Gradient

What is it?
The rate at which vertical height changes with respect to horizontal distance covered, numerically represented as a fraction, decimal fraction or percentage. The gradient can be found by inspection of co-ordinate diagrams or the gradient formula. Understand that a straight line that rises from left to right has a positive gradient and a straight line that falls from left to right has a negative gradient. It should be understood that a horizontal line has a gradient of zero whereas the gradient of a vertical line is undefined.

Previous knowledge and understanding
- Be able to calculate the change between two values
- Be able to plot given points
Patterns and relationships

Equations of straight lines

Why is it important?
Understanding equations of straight lines enables comparisons to be made using graphical representations and allows for informed decisions. Familiarisation with linear equations enables more complicated equations to be investigated.
Equations of straight lines

What is it?
A form of the equation of the straight line is $y = mx + c$. Graphically, $m$ represents the gradient and $c$ represents the 'point where the line intercepts the y-axis' (y-intercept). Horizontal and vertical lines are special cases of $y = mx + c$.

Previous knowledge and understanding
- Be able to calculate the gradient between 2 points
- Understand the vocabulary of intercept on the x-axis and y-axis
Patterns and relationships

Equations of straight lines

Why is it important?

Understanding equations of straight lines enables comparisons to be made using graphical representations and allows for informed decisions. Familiarisation with linear equations enables more complicated equations to be investigated.

Locus

What is it?

Determining a few points from the equation of a straight line allows us to join these points and therefore identify the locus of all points that conform to the formula.
Powers and roots
Powers and roots

Powers

Why is it important?
Powers enable large numbers to be expressed more concisely.
Powers

What is it?
Understanding that the shorthand notation for repeated multiplication can be expressed in power notation.

Possible extension work could include:
- Fractions to whole number powers
- Negative numbers to whole numbers powers, e.g. \((-2)^3 = -8\)
- Negative powers, for example, \(4^{-2} = \frac{1}{16}\)
- The concept of a zero power, e.g. \(5^0 = 1\)
- Introducing the laws of indices

Previous knowledge and understanding
- Knowledge of square numbers, noting the link to area
- The concept of repeatedly multiplying the same number, e.g. \(8 \times 8 \times 8 = 8^3 = 512\), noting the link to volume
- Knowledge of place value and multiplication by 10
Powers and roots

Scientific Notation

**Why is it important?**
Scientific notation enables large and small numbers to be written in a shorter form. Problems involving multiplication and division of large or small numbers become more manageable through the use of scientific notation. It also allows very large or very small numbers to be displayed on calculator screens when they would otherwise overflow.
Scientific Notation

Why is it important?

Scientific notation is a standardised method of writing numbers in the form $a \times 10^n$ Where $1 \leq a < 10$ and $n$ is an integer.
Powers and roots

Scientific Notation

Calculations involving scientific notation

Why is it important?
Scientific notation enables large and small numbers to be written in a shorter form. Problems involving multiplication and division of large or small numbers become more manageable through the use of scientific notation. It also allows very large or very small numbers to be displayed on calculator screens when they would otherwise overflow.

What is it?
Undertake calculations with numbers written in scientific notation.

Previous knowledge and understanding
- Place value
- Multiplying by powers of 10
- Dividing by powers of 10
Powers and roots

**Roots**

**Why is it important?**
Roots are an essential tool when performing calculations and develop the understanding of the inverse operation of powers.
Powers and roots

Roots
What is it?
Roots are the inverse process of powers.

Previous knowledge and understanding
• The concept of powers
• The concept of inverse operations
Powers and roots

**Roots**

Why is it important?
Roots are an essential tool when performing calculations and develop the understanding of the inverse operation of powers.

**Roots**

- **Cube roots**
- **Square roots**
- **Higher roots**

**Square roots**

What is it?
Finding the square root is the inverse process of squaring a number. The square root of all positive numbers has two solutions, one negative and one positive. Square roots can be evaluated mentally within the commonly known multiplication tables.

**Previous knowledge and understanding**

- Knowledge of square numbers
Powers and roots

Roots

Why is it important?
Roots are an essential tool when performing calculations and develop the understanding of the inverse operation of powers.

Cube roots

What is it?
Finding the cube root is the inverse process of cubing a number.

Previous knowledge and understanding
- Knowledge of trial and improvement as a strategy, e.g. 64, student could try $2 \times 2 \times 2 \neq 64$, $3 \times 3 \times 3 \neq 64$
Powers and roots

Roots

Why is it important?
Roots are an essential tool when performing calculations and develop the understanding of the inverse operation of powers.

Higher roots

What is it?
Higher roots work in the same way as cube roots and common roots can be evaluated within the commonly known multiplication tables.

Previous knowledge and understanding
- Knowledge of trial and improvement as a strategy
- Use of a calculator
Properties of 2D shapes and 3D objects
Properties of 2D shapes and 3D objects

Awareness of 2D shapes and 3D objects

Why is it important?
It links personal experiences and observations with a more structured way of investigating 2D shapes and 3D objects.

- Awareness of 2D shapes and 3D objects
- 2D shapes
- 3D objects
Properties of 2D shapes and 3D objects

Awareness of 2D shapes and 3D objects

What is it?
Awareness of 2D shapes and 3D objects is the informal and experiential aspect of learning. It involves naming and identifying shapes and objects in the world beyond the classroom or play setting.
Properties of 2D shapes and 3D objects

**Awareness of 2D shapes and 3D objects**

**Why is it important?**
It links personal experiences and observations with a more structured way of investigating 2D shapes and 3D objects.

**2D shapes**

**What is it?**
2D shapes have only two dimensions and are flat.

- **Awareness of 2D shapes and 3D objects**
- **2D shapes**
- **3D objects**
- **Circles**

**Formulae and inter-relationships within triangles**

**Accurate drawing of 2D shapes**

**Nets of 3D objects**

**Using 2D shapes and 3D objects**

**Representation of 2D shapes and 3D objects**

**Circles**
Properties of 2D shapes and 3D objects

Awareness of 2D shapes and 3D objects

Why is it important?
It links personal experiences and observations with a more structured way of investigating 2D shapes and 3D objects.

3D objects
What is it?
3D objects have three dimensions. The sides, or faces, of many 3D objects are made up of 2D shapes. 3D objects can be stacked or rolled and items can be put inside some 3D objects. They can also be combined to make models.

Previous knowledge and understanding
• Experience of outdoor learning
• Observational skills
• Basic vocabulary
Properties of 2D shapes and 3D objects

Why is it important?
Understanding the properties of 2D shapes and 3D objects enables more sophisticated identification and sorting by their features. An understanding of the properties of 2D shapes and 3D objects will enable learners to appreciate how they fit together and how they are used in everyday life.

- Properties of 2D shape and 3D objects
- Tiling

Awareness of 2D shapes and 3D objects
Properties of 2D shapes and 3D objects
Nets of 3D objects
Accurate drawing of 2D shapes
Formulae and inter-relationships within triangles
Circles
Properties of 2D shapes and 3D objects

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Properties of 2D shape and 3D objects

What is it?
Knowing the properties of 2D shapes and 3D objects develops a problem solving approach to solving many geometric problems.

Previous knowledge and understanding
- Name 2D shapes and 3D objects
- Recognise 2D shapes and 3D objects in the environment

Tiling
Properties of 2D shapes and 3D objects

Why is it important?
Understanding the properties of 2D shapes and 3D objects enables more sophisticated identification and sorting by their features. An understanding of the properties of 2D shapes and 3D objects will enable learners to appreciate how they fit together and how they are used in everyday life.

Tiling
What is it?
Determining which 2D shapes are suitable for tiling is a key step in extending geometrical knowledge of 2D shapes.

Previous knowledge and understanding
• Understanding how shapes fit together
Using 2D shapes and 3D objects

Why is it important?

Understanding why certain shapes and objects are more suited to specific areas of use helps link the main properties of the shapes and objects with the key requirements of their usage. This has major implications in product design and efficient use of resources.
Using 2D shapes and 3D objects

Why is it important?
Understanding why certain shapes and objects are more suited to specific areas of use helps link the main properties of the shapes and objects with the key requirements of their usage. This has major implications in product design and efficient use of resources.

What is it?
Determining when and where triangles are used in the construction of buildings links the properties of triangles with the strength of triangular frames. Understanding why cuboids are more commonly used in packaging than spheres recognises that the ability to stack objects is crucial in the retail business.
Using 2D shapes and 3D objects

Why is it important?
Understanding why certain shapes and objects are more suited to specific areas of use helps link the main properties of the shapes and objects with the key requirements of their usage. This has major implications in product design and efficient use of resources.

Properties of triangles

What is it?
The ability to classify triangles as acute, obtuse, equilateral, isosceles, right-angled and scalene develops the ability to match properties with agreed definitions.
Properties of 2D shapes and 3D objects

Nets of 3D Objects

Why is it important?
Develops the spacial awareness that allows a 3D object to be unpacked to form a combination of 2D surfaces. This has important applications in the packaging industry.
Properties of 2D shapes and 3D objects

Nets of 3D objects

What is it?
A net is the 2D representation of an unpacked 3D object. The lengths and angles in the 3D object are conserved within the net.

Previous knowledge and understanding
- Properties of 2D shapes
- Understanding edges, faces and vertices

Why is it important?
Develops the spacial awareness that allows a 3D object to be unpacked to form a combination of 2D surfaces. This has important applications in the packaging industry.
Properties of 2D shapes and 3D objects

Representation of 2D shapes and 3D objects

Why is it important?
This develops spatial awareness and promotes the concepts of equal lengths and angles when they are distorted in the 2D representations.

Representation of 2D shapes and 3D objects
Properties of 2D shapes and 3D objects

Representation of 2D shapes and 3D objects

What is it?
Using sketches, isometric paper or computer packages to draw 3D objects on a 2D plane.

Previous knowledge and understanding
- Familiarity with the properties of 3D objects
- Properties of 2D shapes
- Experience of perspective in art (drawing)
Properties of 2D shapes and 3D objects

Accurate drawing of 2D shapes

Why is it important?
Drawing accurately develops dexterity, reading scales and the ability to follow instructions. It is an essential life skill in architecture and many areas of the construction industry.
Properties of 2D shapes and 3D objects

Accurate drawing of 2D shapes

What is it?
This requires the scaling of the lengths and the conservation of the angles.

Previous knowledge and understanding
- Measure lengths accurately
- Know how to name angles
- Measure angles accurately

Why is it important?
Drawing accurately develops dexterity, reading scales and following instructions. It is an essential life skill in architecture.
Properties of 2D shapes and 3D objects

Accurate drawing of 2D shapes

Why is it important?
Drawing accurately develops dexterity, reading scales and following instructions. It is an essential life skill in architecture and many areas of the construction industry.

Drawing triangles and quadrilaterals

What is it?
Drawing a range of triangles with different properties.
Drawing a range of quadrilaterals with different properties and investigating how the diagonals intersect.

Previous knowledge and understanding
- Able to use relevant instruments
- Able to measure accurately

Accurate drawing of 2D shapes

Drawing triangles and quadrilaterals

Regular and irregular polygons

Circles
Properties of 2D shapes and 3D objects

Accurate drawing of 2D shapes

Why is it important?
Drawing accurately develops dexterity, reading scales and following instructions. It is an essential life skill in architecture and many areas of the construction industry.

Regular and irregular polygons

What is it?
Understanding the difference between regular and irregular polygons. Demonstrating the properties of regular polygons to draw accurate representations. Understand that all polygons can be constructed through a summation of triangles.

Previous knowledge and understanding
- Understand the term ‘regular’ when describing 2D shapes
- Accurately measure angles
Properties of 2D shapes and 3D objects

Formulae and inter-relationships within triangles

Why is it important?
This milestone develops the mathematical concepts associated with Pythagoras’ Theorem and trigonometry. These concepts are fundamental, as much of the mathematics encountered after this will be built upon these foundations.

- **Formulae and inter-relationships within triangles**
- **Pythagoras’ theorem and Converse of Pythagoras**
- **Trigonometry within right-angled triangles**

Circles
Properties of 2D shapes and 3D objects

Formulae and inter-relationships within triangles

What is it?
Through investigating the lengths of sides in right-angled triangles the theorem and converse of Pythagoras are developed. Building on similar triangles and investigating ratios of different pairs of sides leads to right-angled trigonometry.

Previous knowledge and understanding
- Name and identify different triangles
- Know the properties of different types of triangles

Why is it important?
This milestone develops the mathematical concepts associated with Pythagoras' Theorem and trigonometry. These concepts are fundamental, as much of the mathematics encountered after this will be built upon these foundations.

Formulae and inter-relationships within triangles

Pythagoras' theorem and Converse of Pythagoras

Trigonometry within right-angled triangles

Circles
Pythagoras' theorem and Converse of Pythagoras

**What is it?**
Applying Pythagoras' Theorem enables the length of one side of a right-angled triangle to be calculated, given the lengths of the other two sides. The converse can also be used to establish if a triangle is right-angled.

**Previous knowledge and understanding**
- Algebra
- Number processes/operations
- Know and understand square and square root

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Why is it important?
This milestone develops the mathematical concepts associated with Pythagoras' Theorem and trigonometry. These concepts are fundamental, as much of the mathematics encountered after this will be built upon these foundations.
Properties of 2D shapes and 3D objects

Formulae and inter-relationships within triangles

Why is it important?
This milestone develops the mathematical concepts associated with Pythagoras’ Theorem and trigonometry. These concepts are fundamental, as much of the mathematics encountered after this will be built upon these foundations.

What is it?
Enables the length of a side to be calculated, given the length of another side and the size of either of the acute angles. It also enables the calculation of an angle, given the length of any two of the triangle’s sides.

Previous knowledge and understanding
- Algebraic manipulation
- Number processes/operations
- Similar triangles

Possible Extension
- Although this building block concentrates on trigonometry within right-angled triangles, students can be encouraged to investigate trigonometry within all triangles. This naturally leads on to problems involving the sine and cosine rule.
Properties of 2D shapes and 3D objects

Circles

Why is it important?
The circle is a commonly used shape that occurs both in nature and everyday life. Its importance is based on the fact that a circle encloses the maximum area for a given perimeter. The circle, despite being one of the simplest shapes, has numerous geometric properties. An understanding of these properties, and associated formulae, provides a foundation for further learning in geometry.

- Circles
- Circumference and arcs
- Area and sectors
Properties of 2D shapes and 3D objects

Circles

What is it?
Circle calculations are interrelated. Given any one of radius, diameter, circumference or area all the others can be calculated.

Previous knowledge and understanding
• Vocabulary: radius, diameter, circumference and area
• Know the relationship between a radius and a diameter

Why is it important?
The circle is a commonly used shape that occurs both in nature and everyday life. Its importance is based on the fact that a circle encloses the maximum area for a given perimeter. The circle, despite being one of the simplest shapes, has numerous geometric properties. An understanding of these properties, and associated formulae, provides a foundation for further learning in geometry.
Properties of 2D shapes and 3D objects

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Circumference and arcs
What is it?
Investigate the significance of π and establish the formula connecting the radius, diameter and circumference of a circle. Investigate arc lengths.

Area and sectors
Properties of 2D shapes and 3D objects

Circles

Why is it important?
The circle is a commonly used shape that occurs both in nature and everyday life. Its importance is based on the fact that a circle encloses the maximum area for a given perimeter. The circle, despite being one of the simplest shapes, has numerous geometric properties. An understanding of these properties, and associated formulae, provides a foundation for further learning in geometry.

Area and sectors

What is it?
Investigate the significance of π and establish the formula connecting the radius, diameter and area of a circle. Investigate the area of sectors of circles.
Mathematics—it’s impact on the world past, present and future

- Mathematics in the environment
- Numbers through history
- Uses of mathematics
- Famous mathematicians

Careers and mathematics in the workplace
Mathematics in the environment

Why is it important?
It is important that learners recognise mathematics in their environment as it provides the foundations for exploring the use of mathematics in their everyday lives.
Mathematics—its impact on the world past, present and future

Mathematics in the environment

What is it?
This is the awareness of the vast amount of mathematics and mathematical information in the environment which provides information to help with real-life, everyday situations. It also reinforces the concept of mathematics being relevant and important to future learning.
Numbers through history

Why is it important?
It is important learners know the origins of their own number system through exploring those from the past to understand how they have evolved, changed and improved. It also highlights the multi-cultural nature of mathematical development and how other great civilisations contribute.
Why is it important?
It is important learners know the origins of their own number system through exploring those from the past to understand how they have evolved, changed and improved. It also highlights the multi-cultural nature of mathematical development and how other great civilisations contribute.

What is it?
Number systems from around the world have evolved over time and become more efficient. This includes number systems used in the computer age, such as binary.
Numbers through history

Why is it important?
It is important learners know the origins of their own number system through exploring those from the past to understand how they have evolved, changed and improved. It also highlights the multi-cultural nature of mathematical development and how other great civilisations contribute.

Decimal number system

What is it?
Based on 10 digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9). It is the place of the digit(s) which makes the difference to the value of the number, both in whole numbers and decimal fractions. Zero is important as a placeholder.
Why is it important?
It is important learners understand the vast uses of mathematics in their everyday lives. This should ensure their learning is relevant and purposeful.
Mathematics—its impact on the world past, present and future

Mathematics in the environment

Numbers through history

Careers and mathematics in the workplace

Uses of mathematics

What is it?
Mathematics enables learners to model real-life situations and make connections and informed predictions. It also equips learners with the skills needed to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions.
Why is it important?

Learners should understand how a large number of mathematicians have contributed to the present reservoir of mathematical knowledge. It is important to evaluate how mathematical discoveries were, and still are, important in daily life. To motivate the learners of today, it is also important to stress that many new mathematical discoveries will happen in the future and they could contribute to new discoveries. Chaos theory, string theory and fuzzy logic are recent developments that have been taken forward by creative, young mathematicians.
Famous mathematicians

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Learners should understand how a large number of mathematicians have contributed to the present reservoir of mathematical knowledge. It is important to evaluate how mathematical discoveries were, and still are, important in daily life. To motivate the learners of today, it is also important to stress that many new mathematical discoveries will happen in the future and they could contribute to new discoveries. Chaos theory, string theory and fuzzy logic are recent developments that have been taken forward by creative, young mathematicians.

What is it?
Famous mathematicians are recognised for their special aptitude and creativity in mathematics and have used this to contribute significantly to society. Investigations into famous mathematicians should be linked to areas of the curriculum being studied.
Why is it important?
Mathematics plays an important role in the fields of science and technologies, and is vital to research and development in engineering, computing science, medicine and finance. Promoting awareness and interest in such careers is of vital importance for economic development.
Mathematics—its impact on the world past, present and future

Mathematics in the environment

Numbers through history

Careers and mathematics in the workplace

Why is it important?
Mathematics plays an important role in the fields of science and technologies, and is vital to research and development in engineering, computing science, medicine and finance. Promoting awareness and interest in such careers is of vital importance for economic development.

Careers and mathematics in the workplace

What is it?
Standard algorithms, formulae, problem solving and teamwork are generic transferrable mathematical skills which have important practical applications in many careers, particularly science, technology and engineering.
Mathematics—its impact on the world past, present and future

Careers and mathematics in the workplace

Why is it important?
Mathematics plays an important role in the fields of science and technology, and is vital to research and development in engineering, computing science, medicine and finance. Promoting awareness and interest in such careers is of vital importance for economic development.

Careers in mathematics
What is it?
Understanding which careers depend on mathematical skills. Obvious ones such as the STEM subjects should be investigated as well as less obvious career paths in the arts, business and climatology.
Mathematics—its impact on the world past, present and future

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Workplace mathematics
What is it?
Discussing different workplace situations and identifying the mathematical skills regularly used, e.g. hairdressers use ratio when mixing hair dyes.