Toynbee Curriculum
Knowledge Maps

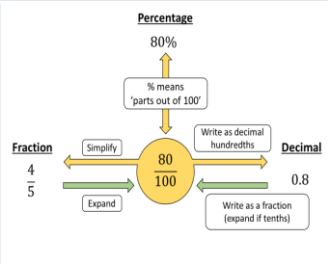
MATHS (Number)

Toynbee School

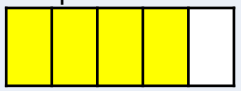
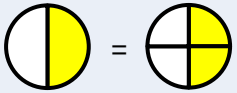
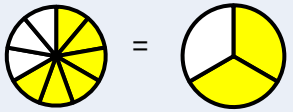
Estimation and bounds

Keywords:	Estimate / bound / Error interval			
Definition / Description:	**Estimate:** To give an approximation of an actual value	**Bound:** A limit eg -3<x<3 means that the value of x is between the limits of -3 and +3	**Error Interval:** Error intervals show the limits of accuracy when a number has been rounded or truncated using inequality signs	
Knowledge points:	**Estimation** All the numbers within the calculation are rounded to one significant figure BEFORE the calculation is performed	**Bounds** This is the range of values that a number could have been before rounding. There is an upper bound (the highest possibility) and a lower bound (the lowest possibility) The given value is halfway between the upper and lower bounds	**Bounds in calculations** Upper and lower limits of values must be calculated BEFORE applying in calculations	**Error interval**
Knowledge point examples:	Estimate the answer to 356 x 44 356 : 1st significant figure is in the hundreds place value so 356 ≈ 400 44 :1st significant figure is in tens place value so 44 ≈40 356 x 40 ≈400 x 40 = 16,000	1) A can of drink weighs 342g to the nearest gram. What are the minimum and maximum weights of the can? (1 gram ÷ 2 = ½ gram) Minimum = 341.5g Maximum = 342.5g 2) 375 is rounded to the nearest 5. What are the upper and lower bounds? (5 ÷ 2 = 2.5) Minimum = 377.5 Maximum = 372.5	1) A can of drink weighs 342g to the nearest gram. What are the minimum and maximum weights of a pack of 12 cans? Minimum can = 341.5g Maximum can = 342.5g Min pack = 341.5 x 12 = 4098g Max pack= 342.5 x 12 = 4110g 2) x and y are both measured to 2 significant figures. x = 230 and y = 400 Work out the greatest possible value of $\frac{x}{y}$. Need greatest x and smallest y 235 ÷395 = 0.47	Write an inequality to show the error interval for n = 8 if it's given to the nearest whole number. **$7.5 \leq n < 8.5$** Frank rounds a number, y, to the nearest ten. His result is 20. Write down the error interval for y. **$15 \leq y < 25$**
Linked Knowledge Maps	Multiples, Primes, Factors / Percentages / Ratio and scale / Inequalities			

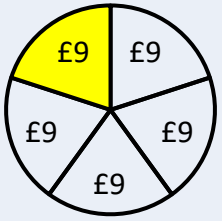
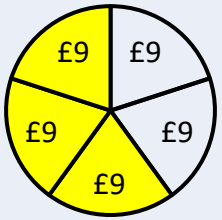
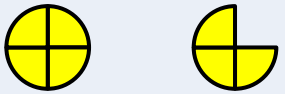
FRACTION DECIMALS PERCENTAGES CONVERSION

Keywords:	Numerator, denominator, divide, decimal place, percent, fraction, terminating, recurring, proportion, equivalent				
Definition / Description:	**Fractions**, decimals and percentages are 3 different ways of expressing a proportion of the whole. **Numerator**: the top number in a fraction / **Denominator**: the bottom number in a fraction / **Simplify**: divide numerator and denominator by a common factor / **Equivalent** fractions: a fraction with the same value as another /**Terminating** decimal: one with a finite number of digits / **Recurring** decimal: one with an infinite number of digits				
Knowledge points:	**Convert between fraction, decimals and percentages**	**Compare value of fractions , decimals and percentages** Convert all proportions to one form	**Convert fractions into recurring decimals** Do a simple division of numerator by denominator	**Use algebraic methods to convert recurring decimals to fractions**	**Interpret fractions and percentages as operators** Use of multipliers and divisors
Knowledge point examples:		Convert each number to the same format: Decimals Place these in order from least to greatest. 0.3 → 25% ÷ 100 → 0.25 → 7/25 × 4 → 28/100 → 0.28 0.3 ③ 0.25 ① 0.28 ② List **original** numbers. 25% 7/25 0.3	Convert this fraction to a decimal using division. $\frac{5}{9} = 5 \div 9$ $9\overline{)5.0^{5}0^{5}0^{5}0^{5}0} = 0.5555\ldots$ $= 0.\dot{5}$ This is a **recurring** decimal.	Convert this decimal to a fraction. $0.\dot{4}\dot{5}$ Let x = 0.45454545… Multiply by 100 so 100x = 45.454545… Subtract x from 100x 100x = 45.4545 x= 0.4545 99x = 45 ÷ 99 $x = \frac{45}{99}$ Simplify $X = \frac{5}{11}$	Multiplying by $\frac{1}{5}$ is the same as dividing by 5 To find 62% of 80, convert 62 % to decimal of 0.62 then multiply 0.62 x 80 = 49.6
Linked Knowledge Maps	Fractions / Percentages				

Fractions: Introduction

Keywords:	Numerator, Denominator, Whole, Improper, Equivalent, Reciprocal					
Definition / Description:	Numerator: The numerator is the top number in a fraction	Denominator: The bottom number in a fraction, it shows what we are dividing by	Whole: An integer, a number without decimals	Improper: An improper fraction has a numerator that is larger than the denominator	Equivalent: Equivalent fractions have different numerators and denominators but have the same value	Reciprocal: The reciprocal is the inverse of any number except 0. This means a fractions numerator and denominator change places
Knowledge points:	What is a Fraction	Simplifying Fractions	Converting Fractions – Improper to Mixed number	Converting Fractions – Mixed number to improper fraction	Four operations (Addition, Subtraction, Multiplication and Division)	
Knowledge point examples:	A Fraction is a part of a whole. Shade $\frac{4}{5}$ of the shape:  Equivalent Fractions: To generate an equivalent fraction, both numerator and denominator must be multiplied by the same amount  $\frac{1}{2} \overset{\times 2}{\underset{\times 2}{}} = \frac{2}{4}$	To simplify a fraction, both numerator and denominator are divided by the same amount:  $\frac{6}{9} \overset{\div 3}{\underset{\div 3}{}} = \frac{2}{3}$	To convert an improper fraction to a mixed number fraction, we divided the numerator by the denominator, we get a whole number, and a remainder, the remainder in the new numerator. $\frac{5}{2} = 2\frac{1}{2}$  5 ÷ 2 = 2 wholes, remainder 1	To convert a mixed number fraction, we multiply the whole number part by the denominator, and add the result to the current numerator. $2\frac{1}{3} = \frac{7}{3}$  2 x 3 = 6 1 + 6 = 7	Addition and Subtraction: To add or subtract fractions, both fractions must have the same denominators. We then add or subtract the numerators only. $\frac{4}{7} + \frac{2}{7} = \frac{4+2}{7} = \frac{6}{7}$ $\frac{5}{7} - \frac{3}{7} = \frac{5-3}{7} = \frac{2}{7}$ Multiplication: To multiply fractions, we multiply numerator by numerator, and denominator by denominator. $\frac{3}{5} \times \frac{2}{7} = \frac{3 \times 2}{5 \times 7} = \frac{6}{35}$ Division: We convert a division to a multiplication by the reciprocal. $\frac{4}{7} \div \frac{2}{7} = \frac{4}{7} \times \frac{7}{2} = \frac{28}{14} = 2$	
Linked Knowledge Maps	Fractions: Manipulation, Multiples Primes and Factors, FDP Conversion					

Fractions: Manipulation

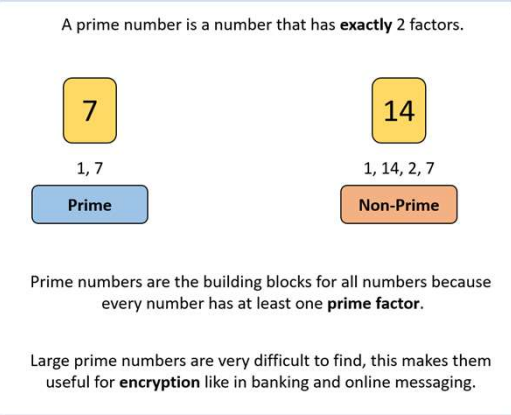
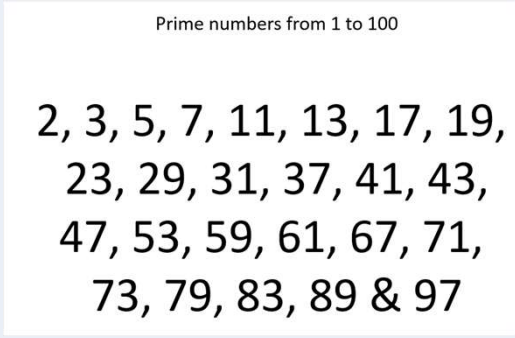
Keywords:	Numerator, Denominator, Whole, Improper, Equivalent, Reciprocal		
Definition / Description:	Refer to Fractions: Introduction Knowledge map		
Knowledge points:	Fraction of an amount	Increase / Decrease by a Fraction	Find the original amount
Knowledge point examples:	To find a fraction of an amount, we divide the amount by the denominator of the fraction, and multiply the result of this division by the fractions numerator. Find $\frac{3}{5}$ of £45 £45 ÷ 5 = £9 which is $\frac{1}{5}$  £9 ($\frac{1}{5}$) x 3 = £27 which is $\frac{3}{5}$  	To Increase / Decrease by a fraction, we follow the steps of Fraction of an amount, and we add the result to the starting amount to Increase, or subtract the result from the starting amount to Decrease. Increase £45 by $\frac{3}{5}$ £45 ÷ 5 = £9 which is $\frac{1}{5}$ £9 ($\frac{1}{5}$) x 3 = £27 which is $\frac{3}{5}$ £45 + £27 = £72 Decrease £45 by $\frac{3}{5}$ £45 ÷ 5 = £9 which is $\frac{1}{5}$ £9 ($\frac{1}{5}$) x 3 = £27 which is $\frac{3}{5}$ £45 - £27 = £18	To find the original amount, we need to identify how many equal parts we now have. We divide the amount by how many parts we have, and multiply by how many we should have had. A price was increase by $\frac{3}{4}$ to £70. How much was the original price? $\frac{4}{4} + \frac{3}{4} = \frac{7}{4}$  As we are dealing with $\frac{1}{4}s$, the original must be $\frac{4}{4}$, and after the increase we have $\frac{7}{4}$ So we divide the amount (£70) by 7 to find $\frac{1}{4}$, and multiply by 4 to find $\frac{4}{4}$ (The original amount) £70 ÷ 7 = £10 £10 x 4 = £40
Linked Knowledge Maps	Fractions: Introduction, Multiples Primes and Factors, FDP Conversion		

INDEX NUMBERS

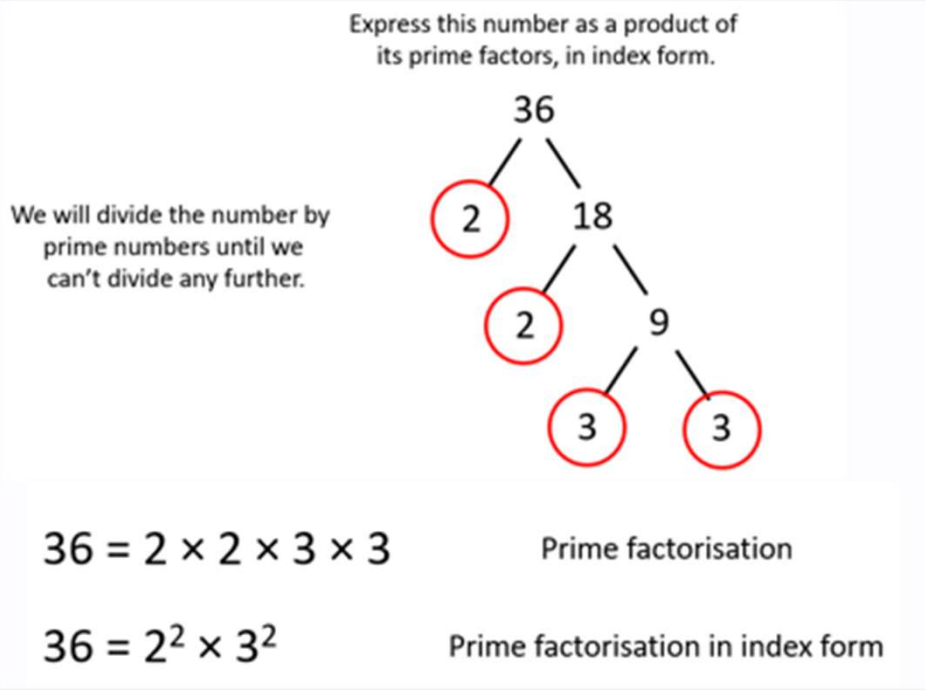
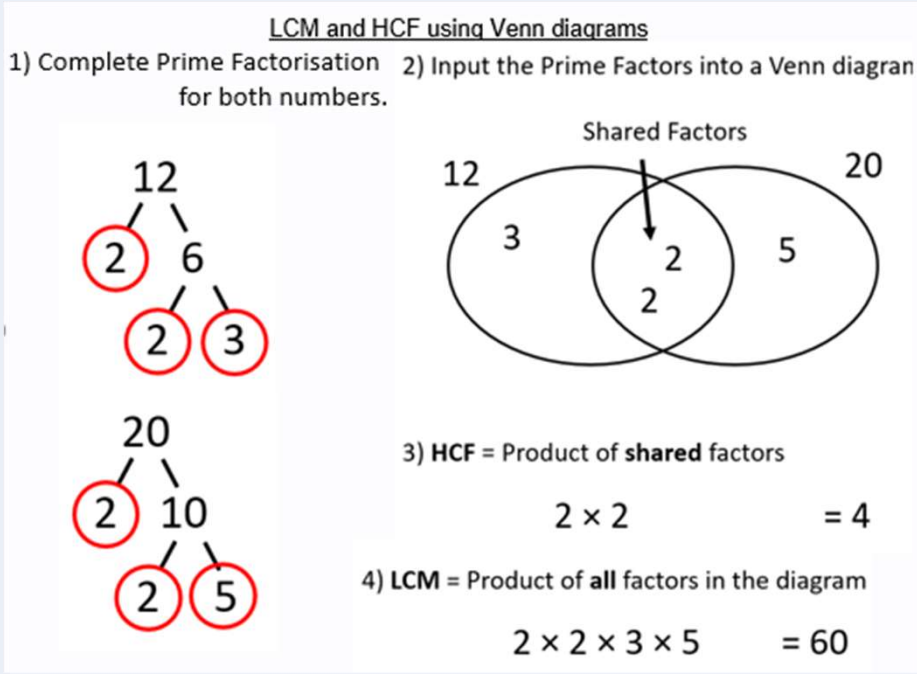
Keywords:	Index / Indices / Power / Exponent / Base / Root / Reciprocal							
Definitions/ Description:	**Index number / Indices (pl)** - the small digit to the top right of a number that tells you the number of times that number is multiplied by itself.	**Base:** the number you apply the power to.		**Reciprocal:** the inverse of any number except 0.		**Root:** root of a number is a number that when multiplied by itself produces the original number		
Knowledge points:	**Understand Index notation** – squares, cubes and roots	**Multiplication Index Law** - when multiplying with the same base, ADD the powers	**Division Index Law** - When dividing with the same base, SUBTRACT the powers	**Brackets Index Law** - when raising a power to another power, MULTIPLY the powers together	**Negative powers** - a negative power performs the reciprocal	**Fractional Powers** - the denominator of a fractional power acts as a 'root' - The numerator of a fractional power acts as the normal power	**Power of 0** - Anything to the power of 0 is 1	**Changing the Base -**
Knowledge point examples:	$3 \times 3 = 3^2 = \underline{9}$ $\sqrt{9} = \pm\underline{3}$ $4 \times 4 \times 4 = 4^3 = \underline{64}$ $\sqrt[3]{64} = \underline{4}$	$a^4 \times a^5 = a^{4+5} = \underline{a^9}$ $5^6 \times 5^7 = \underline{5^{11}}$ $3a^4 \times 5a^6 = \underline{15a^{10}}$	$a^6 \div a^4 = a^{6-4} = \underline{a^2}$ $5^{10} \div 5^7 = \underline{5^3}$ $8a^4 \div 4a^3 = \underline{2a}$	$(a^3)^4 = a^{3x4} = \underline{a^{12}}$ $(5^4)^6 = \underline{5^{24}}$ $(5a^3)^2 = \underline{25a^6}$	$a^{-1} = {}^1/_a$ $5^{-2} = ({}^1/_5)^2 = {}^1/_{25}$ $({}^1/_4)^{-3} = 4^3 = \underline{64}$	$a^{\frac{b}{c}} = (\sqrt[c]{a})^b$ $27^{\frac{2}{3}} = (\sqrt[3]{27})^2$ $= 3^2$ $= \underline{9}$	$a^0 = \underline{1}$ $6^0 = \underline{1}$ $4a^0 = 4 \times 1 = \underline{4}$	Write as a power of 2: $16^5 = (2^4)^5 = 2^{20}$
Linked Knowledge Maps:	Standard Form / Surds / Non-Linear Graphs / Non-Linear Graphs – Quadratic and Cubic							

MULTIPLES FACTORS PRIMES

Keywords:	Multiple, factor, prime, divisible			
Definition / Description:	**Multiple:** a number that is in another number's times table	**Factor:** A whole number which exactly divides another whole number	**Prime:** A whole number that only has 2 factors, itself and 1.	**Divisible:** One number that can be divided exactly by another number

Knowledge points:	Multiples Times Tables	Lowest Common Multiple (LCM)	Factors Identify factors of a number	Find Highest Common factors of numbers	Prime numbers Use tests of divisibility to determine whether a number is prime
Knowledge point examples:	Multiples of 8 are 8, 16, 24, 32, 40, 48, 56, 64, …. Multiples of 10 are 10, 20, 30, 40, 50, 60, 70,…..	To find the LCM of 8 and 10 list the multiples of 8 and 10 and choose the smallest number which is in both lists Multiples of 8 are 8, 16, 24, 32, 40, 48, 56, 64, …. Multiples of 10 are 10, 20, 30, 40, 50, 60, 70,….. LCM of 8 and 10 is **40**	Factors of 12 are 1, 2, 3, 4, 6, 12 1 x 12 = 12 2 x 6 = 12 3 x 4 = 12 Factors of 30 are 1, 2, 3, 5, 6, 10, 15, 30 1 x 30 = 30 2 x 15 = 30 3 x 10 = 30 5 x 6 = 30	To find the HCF of 12 and 30, list all the factors of 12 and 30 and choose the highest number which is in both lists Factors of 12 are 1, 2, 3, 4, 6, 12 Factors of 30 are 1, 2, 3, 5, 6, 10, 15, 30 HCF of 12 and 30 is **6**	 
Linked Knowledge Maps	Indices				

MULTIPLES FACTORS PRIMES

Keywords:	Multiple, factor, prime, prime factor, factor tree, times table, divide, integer, product, divisibility, divisor			
Definition / Description:	**Multiple:** a number that is in another number's times table	**Factor:** A whole number which exactly divides another whole number	**Prime:** A whole number that only has 2 factors, itself and 1.	**Divisible:** One number that can be divided exactly by another number
Knowledge points:	Prime Factor decomposition using factor trees Every integer greater than 1 is prime or can be written as the product of prime numbers		HCF and LCM using Venn Diagrams	
Knowledge point examples:				
Linked Knowledge Maps	Indices			

PERCENTAGES 1

Keywords:	Percentage / conversion / multiplier / equivalent /				
Definition / Description:	**Percentage:** number of parts per 100.	**Conversion:** To change from one form to another	**Multiplier:** a number which is used to calculate a percentage of an amount or used to increase or decrease by a percentage		**Equivalent:** quantities that have the same value but are in different forms
Knowledge points:	**Percentage of Amount Non Calculator Methods:** Using combinations of 10% / 50% /25% / 1% to find percentages	**Percentage of Amount Calculator methods:** Use decimal multipliers to work out percentages	**Increase by a Percentage:** If you start with a given amount (100%) and you increase it by *x*% / then you will end up with (100 + *x*)% of the original amount.	**Decrease by a Percentage:** if you start with a given amount (100%) and you decrease it by x% / then you will end up with (100 – x)% of the original amount.	**Express one number as a percentage of another**
Knowledge point examples:	Key non calculator Percentages Examples 1. Work out 30% of 155. 30% = 3 x 10% 10%: 155 ÷ 10 = 15.5 30%: 15.5 × 3 = 46.5 30% of 155 = **46.5** **2.** Calculate 14% of 200 14% = 10% = 4 x1% 10%: 200 ÷ 10 = 20 1%: 200 ÷ 100 = 2 4%: 2 × 4 = 8 14%: 20 + 8 = 28 14% of 200 = **28**	1.Convert percentages to a decimal by dividing by 100. 2. Multiply amount by decimal Example: 1. Calculate 40% of 120. 40% = $\frac{40}{100}$ = 0.4 0.4 × 120 = **48** 2. Calculate 25.5% of £470 25.5% = 0.255 0.255 x 470 = **£119.85**	Example: To increase £150 000 by 20% we need to find 120% (100+20%) of £150 000. Converting to a multiplier 120% of £150 000 = 1.2 × £150 000 = **£180 000**	Example: To decrease £75 by 30% we need to find 70% (100-30%) of £75. Converting to a multiplier / 70% of £75 = 0.7 × £75 **= £52.50**	Example: There are 25 sweets in a bag. 6 of the sweets are orange flavour. What percentage of sweets are orange flavour? 1.Write the proportion of orange sweets as a fraction. 6 out of 25 = $\frac{6}{25}$ 2.Convert the fraction to a percentage. $\frac{6}{25} \times 100 = \frac{6 \times 100^{4}}{25_{1}} = 24\%$
Linked Knowledge Maps	Fractions / Place Value Decimals Rounding / Estimation Bounds / FDP conversion				

PERCENTAGES 2

Keywords:	Percentage / multiplier / growth / interest / profit & loss / per annum					
Definition / Description:	**Percentage:** 'out of every 100'	**Multiplier:** A decimal equivalent of a percentage	**Growth:** an exponential increase	**Interest:** The cost of borrowing money	**Profit & loss**	**Per annum:** Per year

Knowledge points:

- Simple Interest
  Calculate simple interest of amounts
- Compound Growth and Decay
  Compound Interest and Depreciation
- Reverse Percentage
  Finding the original amount (100%)
- Percentage Change
  Calculating the increase and decrease percentage

Knowledge point examples:

$$I = \frac{P \times R \times T}{100}$$

I = Interest
R = rate of interest
P = Principal
T = time in years

Find the simple interest earned when £600 is invested for 2 years at an annual interest rate of 4%.

$$I = \frac{60 \times 4 \times 2}{100} = \underline{£48}$$

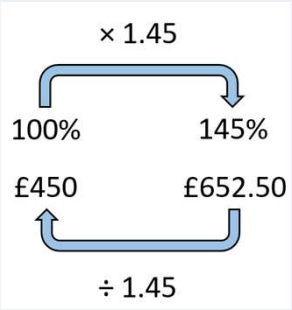
Formula: Time
Quantity × Multiplier

Compound Interest
£8000 is invested at 7% compound interest for 6 years. Find: (a) the amount in the account at the end of the period (nearest £) and (b) the interest accrued (nearest £)
a) 8000 x 1.07^6 = **£12 /006**
b) 12 /006 – 8000 = **£4 /006**

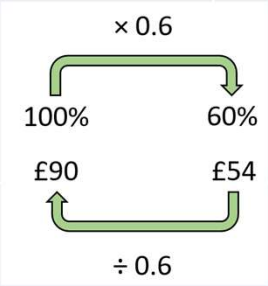
Depreciation
The value of a new car depreciates at a rate of 15% a year.
The car costs £24 000 in 2023
How much will it be worth in 2031?
To decrease the value by 15% we multiply it by 0.85.
There are 8 years between 2023and 2031
After 8 years the value of the car will be **£24 000 × 0.85^8 = £6540 (to the nearest £)**

1.Find the percentage multiplier
2. Divide the amount by the percentage multiplier

I invested some money in the bank and got 45% interest.
At the end of the year I had £652.50.
How much did I put in the bank?



A pair of jeans were 40% off and cost £54.
How much were they before the sale?

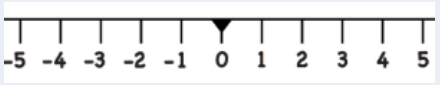
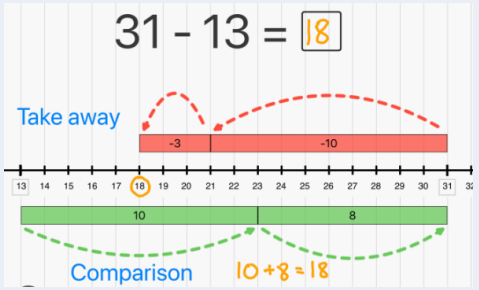
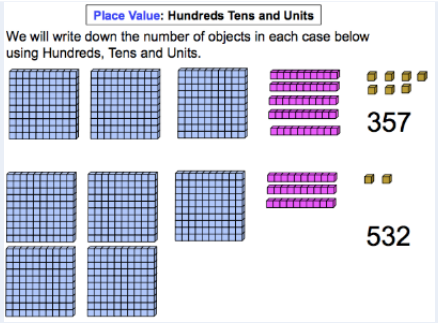
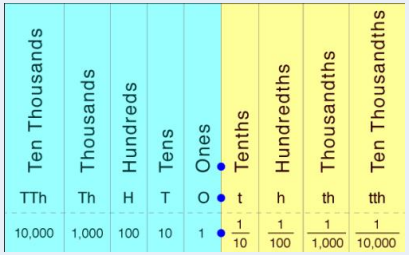
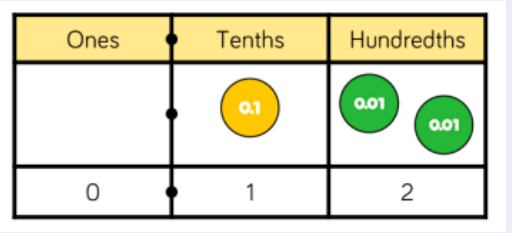
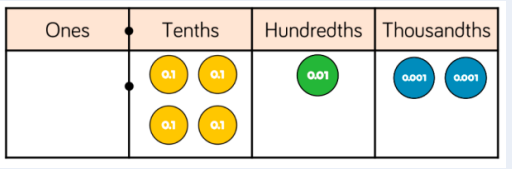


$$\text{Percentage change} = \frac{\text{Change in value}}{\text{Original value}} \times 100$$

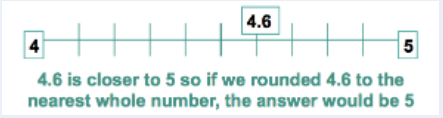
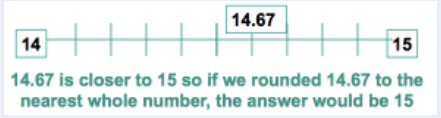
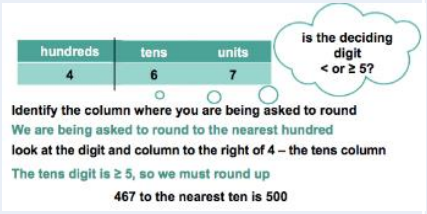
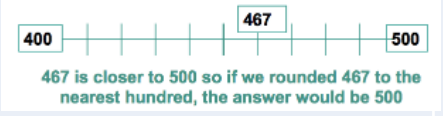
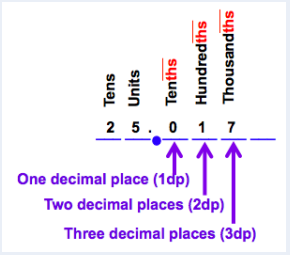
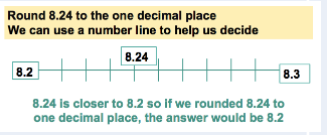
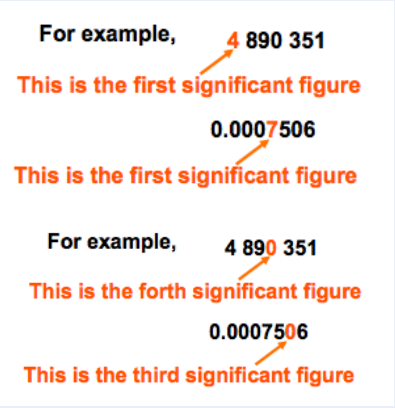
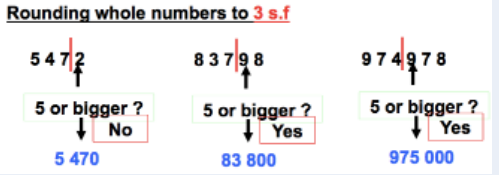
Last year Hazel had £3200 in her bank account. She now has £3360 despite not having paid in any money.
Calculate the rate of interest on her account.
1.Calculate the change in value
3360-3200 = 160
2. Divide the change in value by original amount.
160/3200 = 0.05
3. Multiply by 100 to get %
0.05 x 100 = 5
The rate of interest on Hazel's account was 5%.

Linked Knowledge Maps	Fractions / Place Value Decimals Rounding / Estimation Bounds / FDP conversion

Place value

Keywords:	Place value / digit / placeholder / integer /			
Definition / Description:	**Place Value:** A digits value in relation to its place within a number	**Digit:** A numeral from 0 to 9	**Placeholder:** is a significant zero within a number.	**Integer** is any number that is not a fraction (a whole number).
Knowledge points:	**Number lines** A **number line** is a line on which numbers are presented at intervals / used to illustrate numerical operations	**Place value** refers to the place a digit is in the number which gives it a specific value. **Place value chart** is a table that is used to show the value of each digit in a number based on its position as per the numeral system.	**Decimals – tenths / hundredths and so on** Place value refers to the place a digit is in the number which gives it a specific value. Decimals are the numbers to the right of the decimal point.	
Knowledge point examples:	 	 	 	
Linked Knowledge Maps	Multiples, Primes, Factors / Percentages / Ratio and scale			

Rounding

Keywords:	Rounding / decimal place / significant figure / estimate /			
Definition / Description:	**Rounding**: the process of adjusting a number to make it more convenient but still keeping its value as close to what it was.	**Decimal Place:** The position of a digit after a decimal point	**Significant figure:** refers to the size of the number within the place value chart and not the physical size of the individual number	**Estimate:** To give an approximation of an actual value
Knowledge points:	**Rounding rules** The digit to the right of the digit you are rounding is the deciding digit. If the deciding digit is 5 or above the digit you round up. If the deciding digit is 4 or below the digit you are rounding remains the same	**Rounding to the nearest units / ten / hundred etc** This refers to the column that is to be rounded within the place value chart. Rounding rules are applied to the deciding digit	**Rounding to a given number of decimal places** A decimal place refers to the number of digits to the right of the decimal point	**Rounding to a given number of significant figures** The first significant figure of a number is the first digit which is not a zero. The second / third and fourth significant figures are the digits immediately following the first significant figure / including zeros.
Knowledge point examples:	1) Round 48 to the nearest 10 4 is in the *tens* column → 48 ← 8 is the DECIDING DIGIT (If the deciding digit is greater than or equal to 5, we round up) So 48 is rounded to **50.**  	 	 	 
Linked Knowledge Maps	Multiples, Primes, Factors / Percentages / Ratio and scale / Estimation and Bounds / Place Value			

Sequences

Keywords:	Arithmetic / nth term / Geometric / Term / Quadratic / Iterate					
Definition / Description:	Arithmetic – a sequence where terms are found by adding or subtracting an equal amount.	Nth term – The general rule of a number sequence.	Geometric - A sequence in which you find each term by multiplying the previous term by a fixed value.	Term – a part of an equation, expression or sequence.	Quadratic – A sequence where the difference increases or decrease by an equal amount each time	Iterate - a quantity arrived at by iteration.
Knowledge points:	Nth term of a linear sequence	Finding terms in a sequence	Nth term of a Quadratic sequence	Geometric Progression	Sequences by iteration	
Knowledge point examples:	n: 1 2 3 4 2 5 8 11… +3 +3 +3 *3n - 1* The nth term of a linear sequence is always of the form An ± b, where: *A*, is the difference between each term and the next term. *b* is the difference between the first term and *A*. n: 0 1 2 3 4 13 11 9 7 5 +2 -2 -2 -2 *13 – 2n* In a descending sequence we find the zero term to discover what we are taking *A*n way from.	From the sequence 5, 12, 19, 26, 33… work out the 50th term. The nth term of this sequence is 7n – 2 Find the 50th term by substituting n=50 into the rule, 7n − 2 = 7 × 50 − 2 = 350 −2 = 348.	Find the nth term in the sequence: 5, 9, 15, 23… Term 5 9 15 23 1st Diff. 4 6 8 2nd Diff 2 2 The second differences are constant (2) so the sequence is quadratic and the coefficient of n^2 is 1. So the nth term includes $1n^2$. To find the remainder of the nth term, we subtract $1n^2$ from our sequence and find the nth erm of the linear sequence left over: 5 9 15 23 - - - - 1 4 9 16 4 5 6 7… The nth term of this sequence is n + 3. *Nth term of quadratic sequence* $= n^2 + n + 3$	Geometric progression is a sequence of non-zero numbers where each term after the first is found by multiplying the previous one by a number. Find the next two terms of the sequence 3 6 12 24… x 2 x 2 x 2 The term to term rule here is x2 therefore the next two terms are 24 x 2 = 48 48 x 2 = 96	Find the first four iterations of the iterative formula $x_{n+1} = 3x_n - 2$ with $x_1 = 2$. $x_2 = 3x_1 - 2$ $= 3 \times 2 - 2 = 4$ $x_3 = 3x_2 - 2$ $= 3 \times 4 - 2 = 10$ $x_4 = 3x_3 - 2$ $= 3 \times 10 - 2 = 28$ $x_5 = 3x_4 - 2$ $= 3 \times 28 - 2 = 82$	
Linked Knowledge	Notation and manipulation / Functions / Multiples, Primes, Factors / Index Numbers					

STANDARD FORM

Keywords:	**Standard form / Index / Integer**				
Definition / Description :	**Standard form** is a short-hand way of writing very small or very large numbers, given in the form ***a*** x 10^{n}, where *a* is a number between 1 and 10	**Index** (or power) is the small digit to the top right of a number which tells you the number of times a number is multiplied by itself		**Integer** is a whole number, either positive o negative	
Knowledge points:	**Understand correct standard index form:** Recognise the correct format for standard form as ***a*** x 10^{n}, where 1 ≤ ***a*** < 10	**Convert between ordinary numbers and standard index form:** Use place value to multiply or divide numbers by powers of 10	**Compare numbers in standard form** Use ordering decimals and indices to compare values of ***a*** and ***n***	**Add and subtract numbers in standard form** Use adjusting standard form to add/subtract	**Multiply and divide numbers in standard form:** Use laws of indices to multiply/divide
Knowledge point examples:	***a*** x 10^{n} 1 ≤ ***a*** < 10 ***n*** is an integer 0.25 x 10^{6} is **not** correct standard form (***a*** is not ≥ 1) 25.9 x 10^{8} is **not** correct standard form (***a*** is not < 10) 2.36 x $10^{0.5}$ is **not** correct standard form (***n*** is not an integer)	*Write in standard form:* 379.4 Answer must be in form ***a*** x 10^{n}, so ***a*** must be written as 3.794: 3 . 7 9 . 4 Adjust the place value twice to the right, which is the equivalent of 10 x 10 = 10^{2}: 3.794 x 10^{2} *Write as an ordinary number:* 2.65 x 10^{5} Take the value of ***a*** and multiply the value by the value of ***n***: 2 6 5 0 0 0 . 0 265,000	*Which is larger:* 1.45 x 10^{4} 1.45 x 10^{3} Compare values for ***n*** in 10^{4} and 10^{3} –> 10^{3} is smaller than 10^{4} (10^{3} = 10 x 10 x 10, 10^{4} = 10 x 10 x 10 x 10) 1.45x10^{3} < 1.45x10^{4} *Write these numbers in ascending order:* 4.5 x 10^{3} 2.3 x 10^{3} Compare values for ***a*** in 4.5 and 2.3 -> 2.3 is smaller than 4.5 Therefore: 2.3 x 10^{3}, 4.5 x 10^{3}	*Calculate:* 7 x 10^{3} + 2 x 10^{3} **Method 1**: 7 x 10^{3} = 7000 2 x 10^{3} = 2000 7000 + 2000 = 9000 9000 = 9 x 10^{3} **Method 2:** (7 + 2) x 10^{3} = 9 x 10^{3} *Calculate:* 9.6 x 10^{5} – 3.2 x 10^{4} Adjust 3.2 x 10^{4} to the same power of 10 as 9.6 x 10^{5} -> 0.32 x 10^{5} (9.6 – 0.32) x 10^{5} = 9.28 x 10^{5}	*Calculate:* (3.2 x 10^{2}) x (2 x 10^{4}) [1] Multiply values of ***a*** 3.2 x 2 = 6.4 [2] Multiply powers of 10 using law of indices: 10^{2} x 10^{4} = $10^{(2+4)}$ -> 10^{6} Combine parts [1] and [2]: 6.4 x 10^{6} *Calculate:* (2.8 x 10^{9}) ÷ (4 x 10^{5}) [1] Divide values of ***a***: 2.8 ÷ 4 = 0.7 [2] Divide powers of 1 using law of indices: 10^{9} ÷ 10^{5} = $10^{(9-5)}$ -> 10^{4} Combine parts [1] and [2] and adjust to correct standard form: 0.7 x 10^{4} -> 7 x 10^{3}
Linked	Ordering decimals / Place value / Laws of indices				

SURDS

Keywords:	Rational / Irrational / Root / Surd / Expand / Rationalise					
Definition / Description:	**Rational** – A number that can be expressed as either an integer, a terminating decimal or a fraction	**Irrational** - A number that cannot be expressed as either an integer, a terminating decimal or a fraction	**Root** – A root is a quantity that when multiplied by itself a certain number of times equals a given quantity	**Surd** – An expression that includes a square root	**Expand** – To multiply out a set of brackets.	**Rationalise** – To eliminate an irrational number from the denominator of a fraction.
Knowledge points:	**Simplify Surds** – Simplify by factoring out a square number	**Multiply and Divide Surds** $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ $\sqrt{a \div b} = \sqrt{a} \div \sqrt{b}$	**Add and Subtract Surds** - When adding and subtracting surds the root must be the same number.	**Expand Brackets with Surds** – Multiply each term inside the bracket by the term outside the bracket.	**Rationalise the Denominator 1** – Create an equivalent fraction where the denominator is rational	**Rationalise the Denominator 2** - Use a difference of two squares to rationalise
Knowledge point examples:	$\sqrt{75} = \sqrt{25 \times 3}$ $= \sqrt{25} \times \sqrt{3}$ $= 5 \times \sqrt{3}$ $= 5\sqrt{3}$ $\sqrt{18} = \sqrt{9 \times 2}$ $= \sqrt{9} \times \sqrt{2}$ $= 3 \times \sqrt{2}$ $= 3\sqrt{2}$	$\sqrt{6} \times \sqrt{7} =$ $\sqrt{6 \times 7} =$ $\sqrt{42}$ $\sqrt{50} \div \sqrt{10} =$ $\sqrt{50 \div 10} =$ $\sqrt{5}$ $4\sqrt{6} \times 2\sqrt{5}$ $= 4 \times 2 \times \sqrt{6} \times \sqrt{5}$ $= 8\sqrt{30}$	$5\sqrt{2} + 2\sqrt{2} = 7\sqrt{2}$ $\sqrt{75} - \sqrt{27}$ $= 5\sqrt{3} - 3\sqrt{3}$ $= 2\sqrt{3}$ $\sqrt{98} - \sqrt{50}$ $= 7\sqrt{2} - 5\sqrt{2}$ $= 2\sqrt{2}$	$\sqrt{3}(\sqrt{7} + 5)$ $= \sqrt{21} + 5\sqrt{3}$ $(\sqrt{5} + 4)(\sqrt{5} - 2)$ $= 5 + 4\sqrt{5} - 2\sqrt{5} - 8$ $= 2\sqrt{5} - 3$	$\frac{2}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$ $\frac{3}{2\sqrt{5}} = \frac{3\sqrt{5}}{2 \times 5} = \frac{3\sqrt{5}}{10}$	$\frac{2}{4+\sqrt{2}} =$ $\frac{2(4-\sqrt{2})}{(4+\sqrt{2})(4-\sqrt{2})} =$ $\frac{8-2\sqrt{2}}{4^2-(\sqrt{2})^2} =$ $\frac{8-2\sqrt{2}}{12}$
Linked Knowledge Maps	Index numbers / Place value, decimals, rounding estimation and bounds / Fractions / Pythagoras and Trigonometry					