St Joseph's Catholic Academy

Calculation Policy

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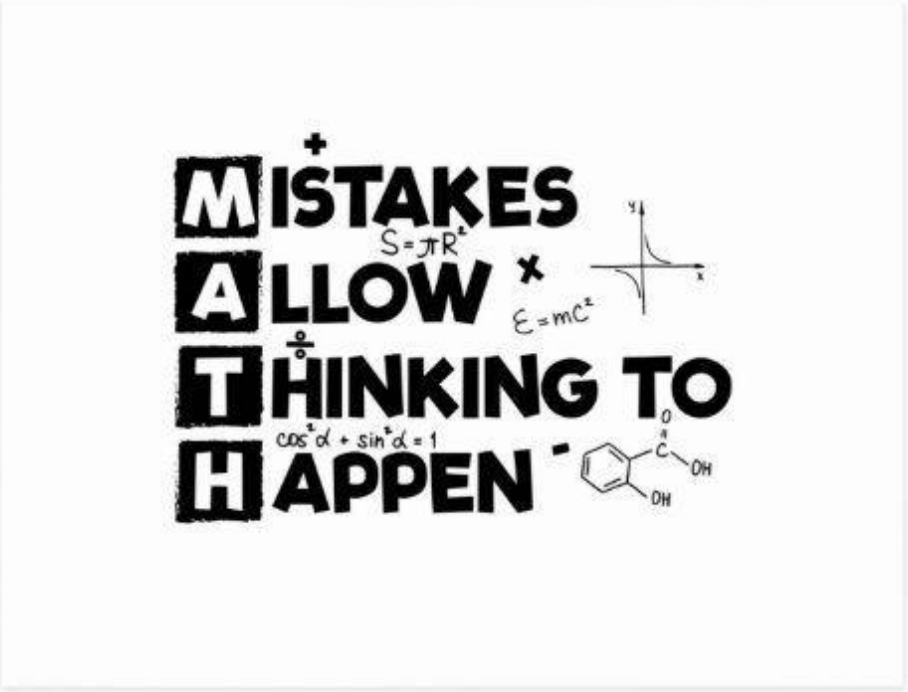
Purpose

The intended purpose of this handbook is to provide mathematics teachers and others who use mathematics in their subject an easy-reference guide to the methods employed in the teaching of mathematics at St Joseph's. We, the mathematics department, feel these are the most commonly used methods for these common mathematical operations. In some cases multiple methods are shown, but one is not superior to another, pupils can use their preferred method.

Aim

Not all areas of the programme of study are covered in this calculation policy, it is aimed at the main calculation methods that pupils will encounter regularly. When pupils are calculating answers they need to ensure that they show their working out on all occasions.

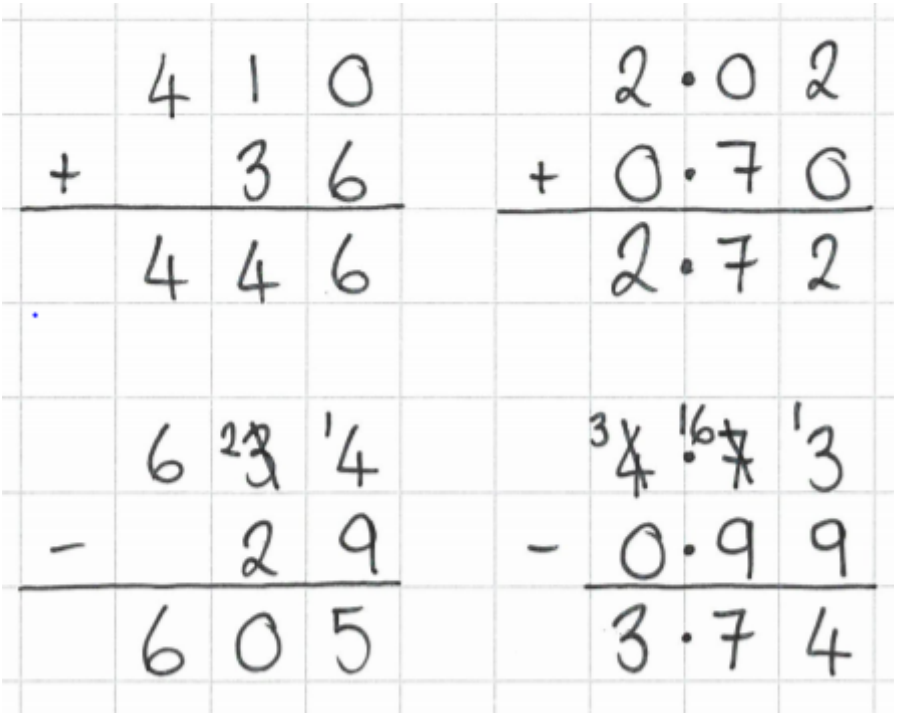


Addition and subtraction

Pupils are taught to add and subtract numbers from an early age. While some easier calculations can be done mentally, pupils are encouraged to show their working out to eliminate mistakes.

Method - column addition and subtraction

- Pupils are taught to write out the question so that the digits in the same place value are in the same column for the addition and subtraction to take place. When adding and subtracting decimals it is easiest to remember to line up the decimal points. Zeros can be added after the last decimal place value without changing the value of the number, but making it easier to add and subtract.
- When subtracting the largest number should be on the top of the calculation and if exchange (often referred to as borrowing) needs to happen then one from the place value column to the left should be exchanged for 10 of the units needed in order to carry out the subtraction.

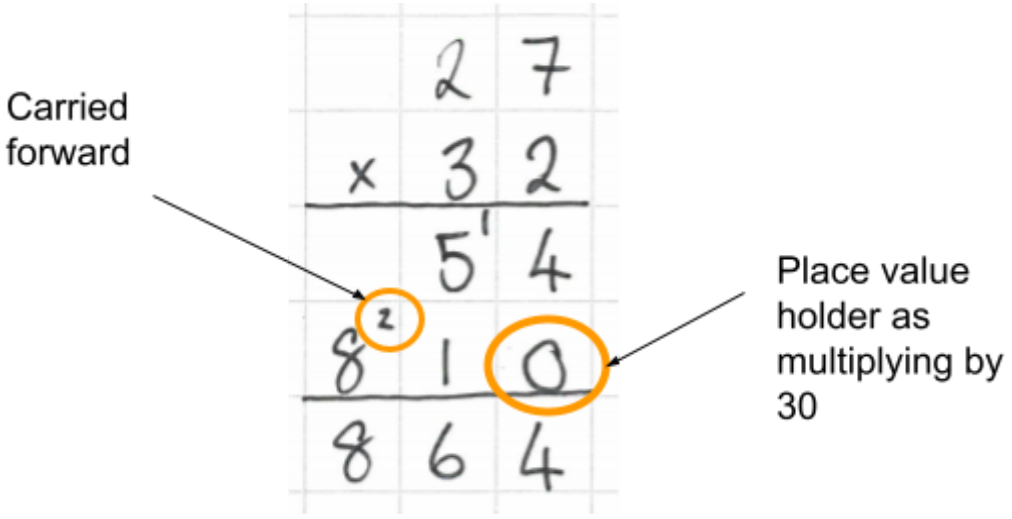


Multiplication

Pupils in primary schools are taught grid multiplication in lower KS2 moving onto the more formal column (sometimes described as short or long) method in Years 5 and 6. Pupils can use the method they feel most comfortable with.

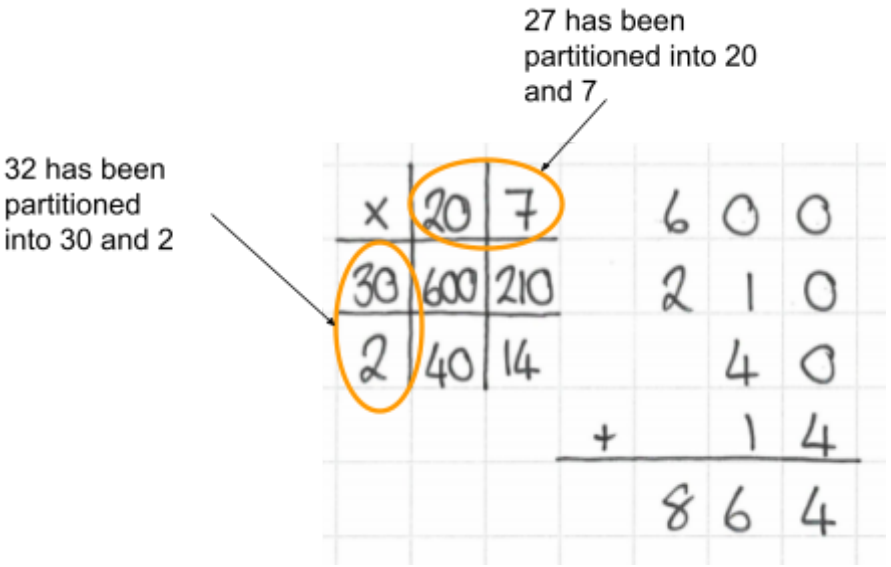
Column method

- This is taught to pupils in upper Key Stage 2. Pupils should set out the multiplication and remember when multiplying by the number in the tens or hundreds place, they should always include a place value holder.

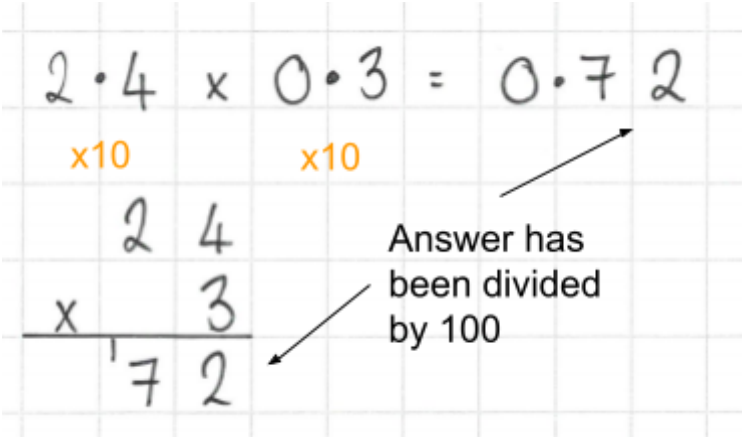


Grid method

- A grid is drawn for the numbers to be partitioned based on place value. For example, 35 would be partitioned into 30 and 5. Using the grid every box is filled by multiplying two numbers. Once the grid is complete the numbers in each box must be added together. ***This method will be used in upper KS3 and KS4 as the method for expanding binomials.***



- When multiplying decimals pupils need to multiply the decimal numbers by a power of 10, then complete the multiplication calculation with integers. They will then need to divide the answer by the combined power of 10 used to make the two numbers whole.

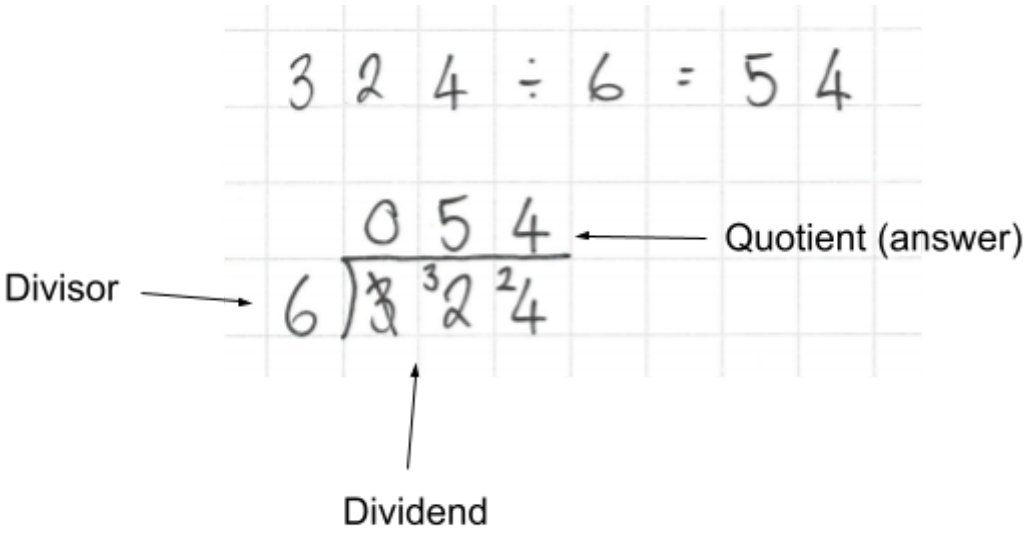


Division

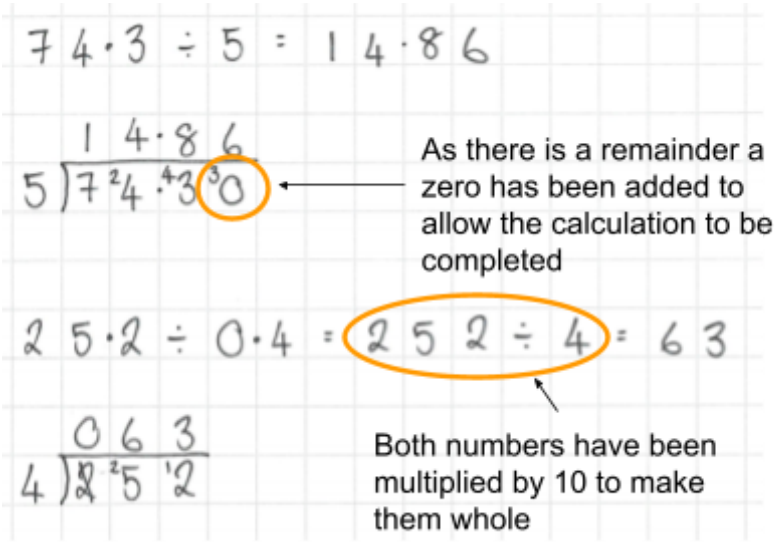
In primary school pupils are taught different methods of division, including short (sometimes referred to as the bus stop method) and long division. We will mostly focus on short division as the preferred method when dividing.

Short division method

- When setting out short division the dividend (number being divided) is required to be 'in the bus stop' and the divisor goes outside. Once at the end of the calculation, pupils may need to put a decimal point and add zeros into the empty place value columns thereafter.



- When dividing a decimal number by a whole number (integer) the same method is used. Pupils need to line up the decimal point in the answer to the one in the question. When dividing a decimal by another decimal pupils should multiply both numbers by a power of 10 so they are both whole numbers. Then carry out the division as above.



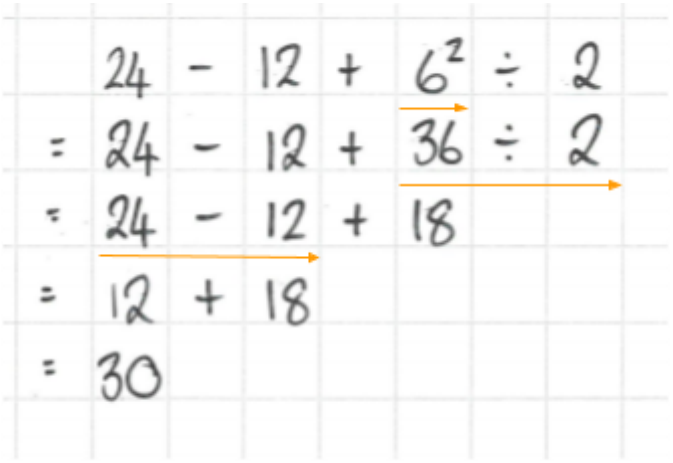
Order of operations

Pupils will be taught the order of operations using the acronym BIDMAS.

B	Brackets
I	Indices
D	Division
M	Multiplication
A	Addition
S	Subtraction

Method - Pupils should underline the part of the calculation they are calculating then write the calculation out again underneath.

Step 1: There are no brackets, so need to deal with indices (square)



Step 2: division

Step 3: subtraction as it is first when reading left to right

Note: Multiplication and division hold equal weighting, as do addition and subtraction. For example, on step 3 in the calculation above pupils just read left to right so complete the subtraction first, followed by addition.

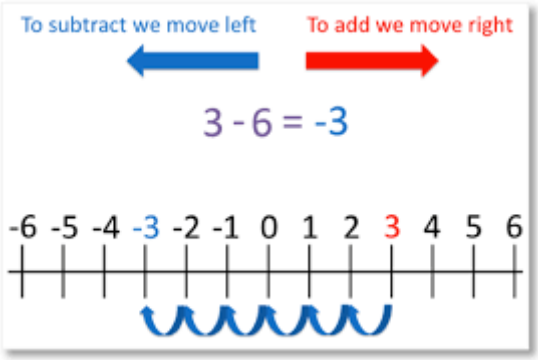
Scientific calculators work using BIDMAS.

Negative Numbers

Negative numbers have been introduced to pupils in primary school, as numbers which are less than zero.

Addition & subtraction

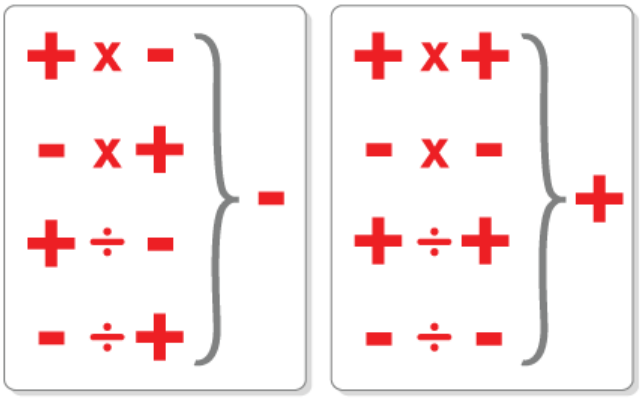
Method - When adding and subtracting numbers which include negatives, pupils should think about their starting point and the direction they will take in order to gain an answer. For example, when calculating **3 - 6** pupils start at 3 then subtract 6 to gain an answer of -3.



When subtracting a negative number pupils will need to add that number. For example, **2 - - 4**, pupils will start at 2, then add 4 on, making the answer 6.

Multiplication & Division

When multiplying and dividing pupils should be encouraged to decide if the answer will be a positive number or a negative one. The simple rule is that if the numbers are the same the answer will be positive and if they are different they will be negative.



For example,

5 x -6 (answer will be negative)
= -30

-3 x -6 (answer will be positive)
= 18

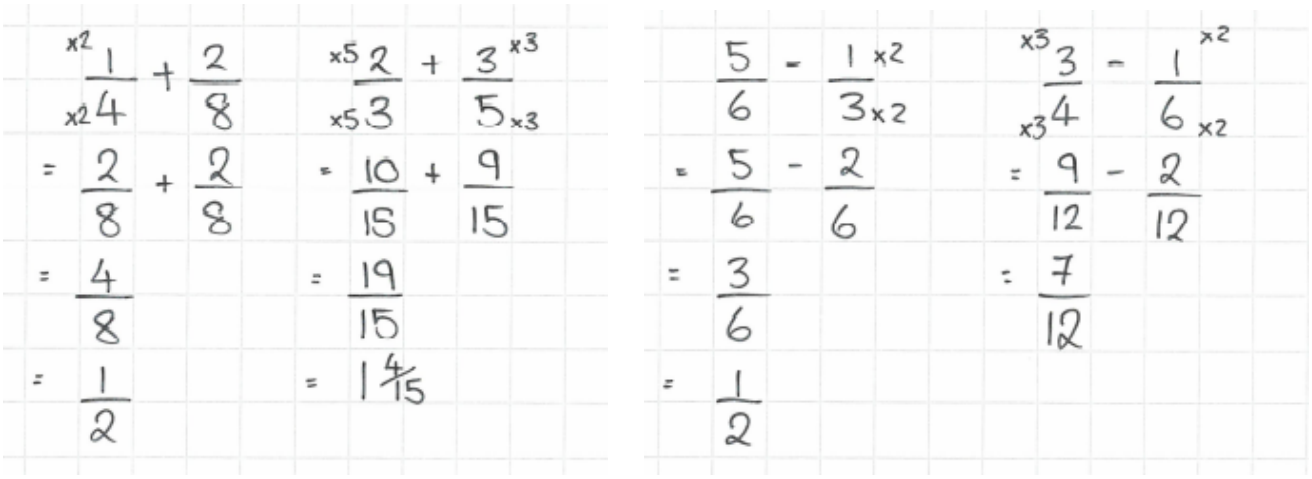
The rules are the same for both division and multiplication.

Fractions

Pupils have been taught to calculate with fractions in primary school, including the use of equivalent fractions for ordering, adding and subtracting fractions. Fractions will have been introduced using pictorial representations, which some pupils may continue to use.

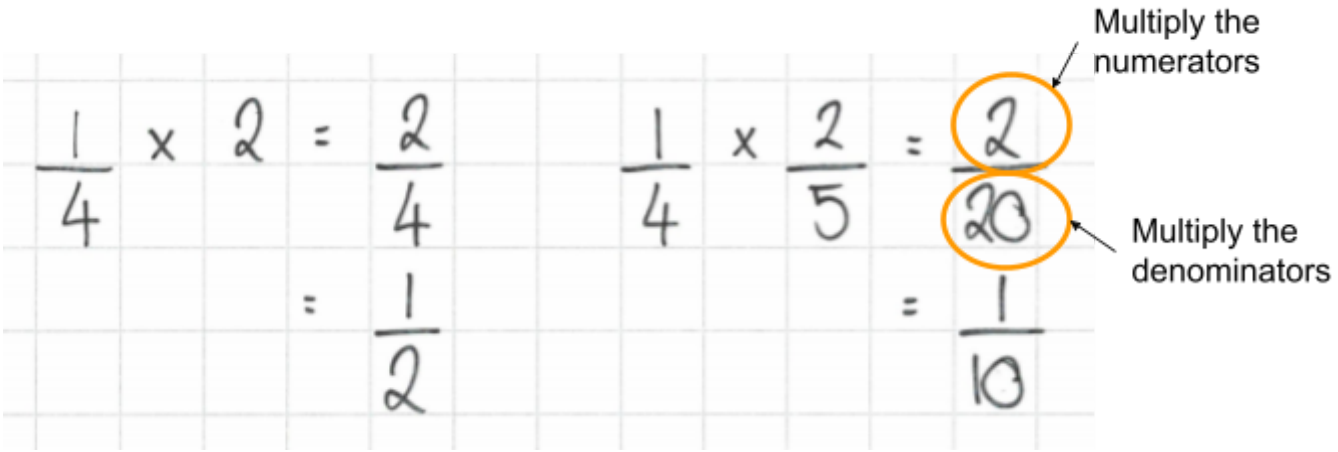
Adding and subtracting

Fractions can only be added when they have the same denominator. This may require the pupils to find a common denominator and then use equivalent fractions. REMEMBER: Whatever number you multiply the denominator by you have to multiply the numerator by.



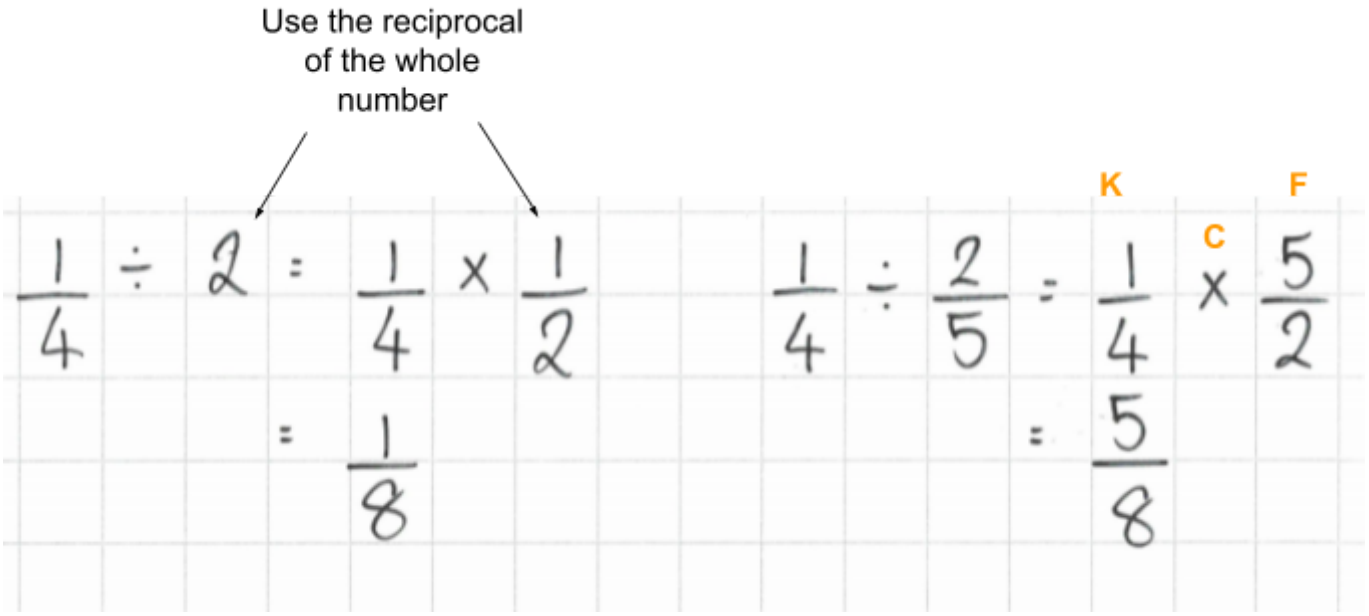
Multiplying fractions

- Pupils will be expected to multiply fractions by integers and other fractions. This builds upon their knowledge of finding fractions of amounts, where pupils divide by the denominator then multiply by the numerator.



Dividing fractions

- As pupils develop an understanding of dividing by fractions they will begin to use the acronym 'KFC' (KEEP the first fractions, FLIP the 2nd fraction and CHANGE divide to multiply).



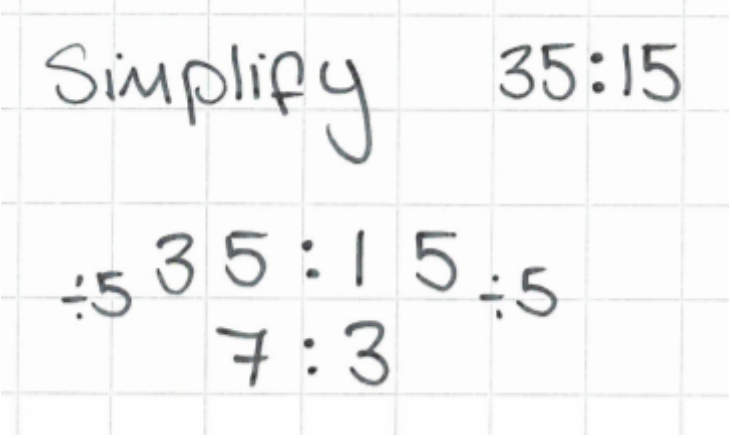
When giving fractions as answers, pupils should alway ***SIMPLIFY***.

Ratio

Pupils are briefly introduced to ratio in primary school. The bar model is a commonly used pictorial method used to represent ratio, and one that is still particularly useful in KS3 and KS4.

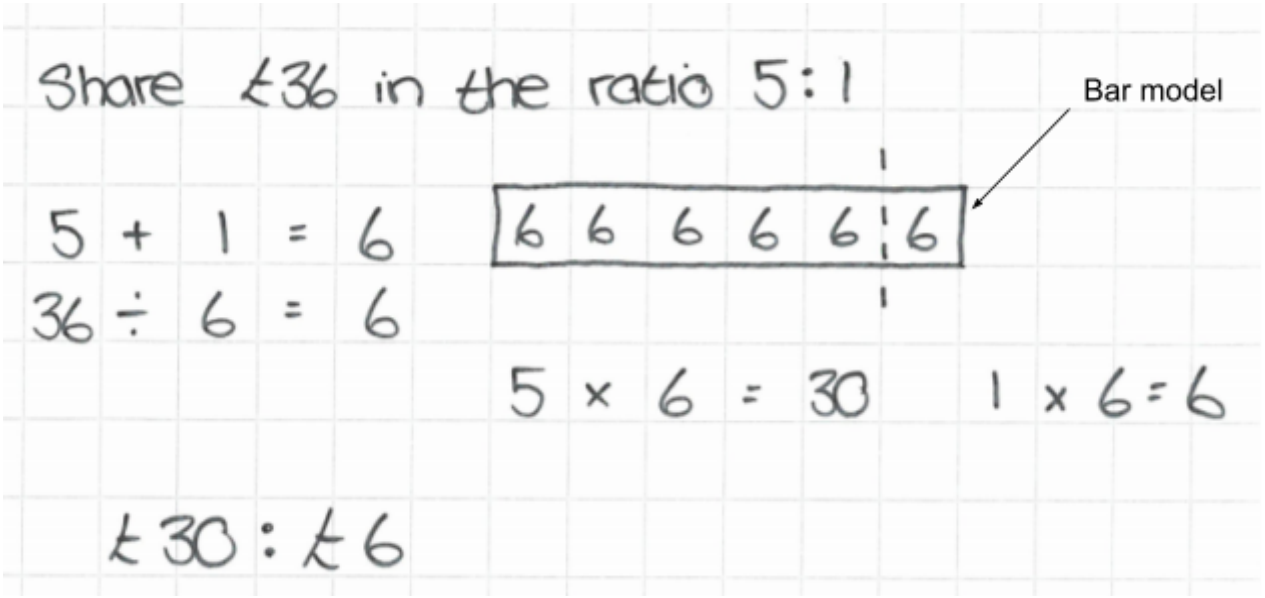
Simplifying ratio

When simplifying a ratio there is a link to simplifying fractions. Find the highest common factor of the numbers in the ratio and divide by the numbers by that.



Dividing into a given ratio

Pupils should draw a bar model with the correct number of 'boxes'. They should then share the amount between each of the boxes equally. This allows ratio questions to be answered more easily.



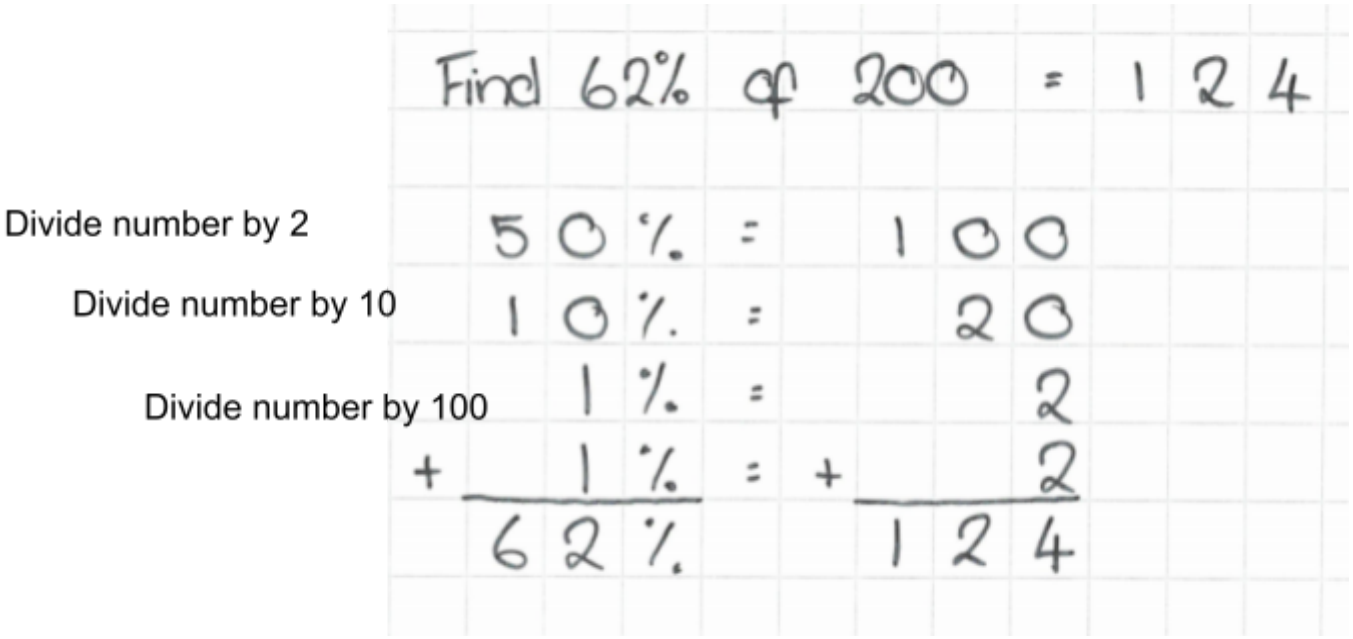
Percentages

Percent means out of 100.

Pupils should be aware of common percentage, fraction and decimal equivalents. These are the common equivalents that pupils should know.

Finding a percentage of amount (non-calculator)

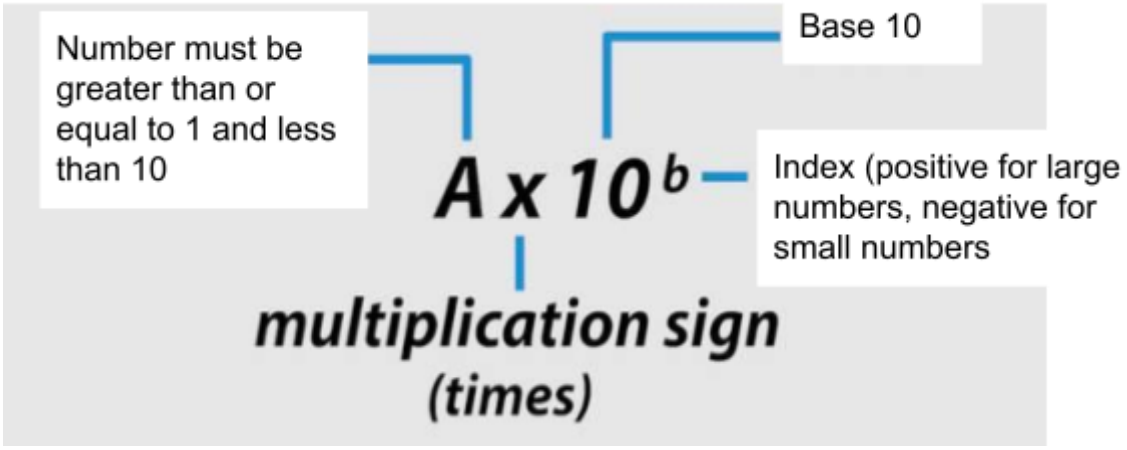
Pupils should be taught to find the following percentages in order to assist them in calculating other percentages - 1%, 5%, 10%, 25%, 50%. Pupils can be taught to find 1% then multiply by the percentage they need to calculate, or they can calculate the required percentages from the list above and add them together.



When using calculators to find percentages pupils can either use a multiplier (decimal equivalent of the percentage required) or the % button on their calculators.

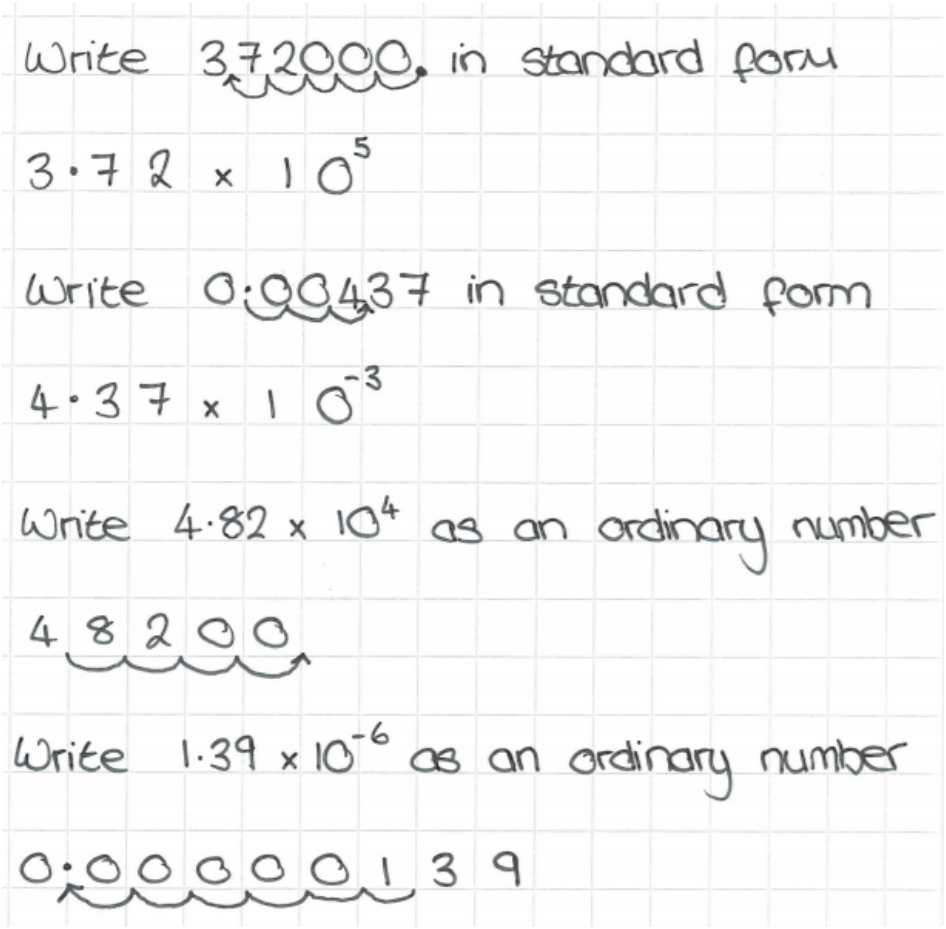
Standard Form

Standard form is used to write really large or small numbers.



Convert between ordinary numbers and standard form

When converting from ordinary to standard form look for the first non-zero digit and then work out how many places it has moved to get to the units column. This is the index.



Pupils will be taught to calculate with numbers in standard form in Year 9. They will be shown how to add and subtract by converting to ordinary numbers then calculating before giving the answer in standard form. When multiplying and dividing they will be expected to use index laws after rearranging the calculation.

Glossary - commonly used terminology in mathematics

Difference - to subtract

Factor - a number that can divide into another number without a remainder

Highest Common Factor (HCF) - the highest number that is a factor of two or more numbers

Index - this is the power that a number or variable is 'raised to'. For example 2^4 means 2x2x2x2. Indices can be integers, fractions or negative numbers.

Integer - whole number

Lowest Common Multiple (LCM) - the lowest multiple that appears in the list of multiples of more than one number.

Multiple - the product of two numbers

Prime factor decomposition - Write a number as a product of prime factors.

Prime number - a number with only 2 factors, itself and 1

Product - to multiply numbers

Sum - to add numbers together