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| **UNIT 4: Fractions, percentages, ratio and proportion**  |

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**SPECIFICATION REFERENCES**

N1 order positive and negative integers, decimals and fractions; …

N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; …

N3 recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals

N8 calculate exactly with fractions …

N10 work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and  or 0.375 and ); **change recurring decimals into their corresponding fractions and vice versa**

N11 identify and work with fractions in ratio problems

N12 interpret fractions and percentages as operators

N13 use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate

R2 use scale factors, scale diagrams and maps

R3 express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1

R4 use ratio notation, including reduction to simplest form

R5 divide a given quantity into two parts in a given part:part or whole:part ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)

R6 express a multiplicative relationship between two quantities as a ratio or a fraction

R7 understand and use proportion as equality of ratios

R8 relate ratios to fractions and to linear functions

R9 define percentage as ‘number of parts per hundred’; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another; compare two quantities using percentages; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease, and original value problems and simple interest including in financial mathematics

R10 solve problems involving direct proportion; …

**PRIOR KNOWLEDGE**

Students should know the four operations of number.

Students should be able to find common factors.

Students should have a basic understanding of fractions as being ‘parts of a whole’.

Students can define percentage as ‘number of parts per hundred’.

Students are aware that percentages are used in everyday life.

**KEYWORDS**

Addition, subtraction, multiplication, division, fractions, mixed, improper, recurring, reciprocal, integer, decimal, termination, percentage, VAT, increase, decrease, multiplier, profit, loss, ratio, proportion, share, parts

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| **4a. Fractions and percentages**(N1, N2, N3, N8, N10 ,N12, N13, R3, R9) | **Teaching time**11-13 hours |

**OBJECTIVES**

By the end of the sub-unit, students should be able to:

* Express a given number as a fraction of another;
* Find equivalent fractions and compare the size of fractions;
* Write a fraction in its simplest form, including using it to simplify a calculation,
e.g. 50 ÷ 20 =  =  = 2.5;
* Find a fraction of a quantity or measurement, including within a context;
* Convert a fraction to a decimal to make a calculation easier;
* Convert between mixed numbers and improper fractions;
* Add and subtract fractions, including mixed numbers;
* Multiply and divide fractions, including mixed numbers and whole numbers and vice versa;
* Understand and use unit fractions as multiplicative inverses;
* By writing the denominator in terms of its prime factors, decide whether fractions can be converted to recurring or terminating decimals;
* Convert a fraction to a recurring decimal and vice versa;
* Find the reciprocal of an integer, decimal or fraction;
* Convert between fractions, decimals and percentages;
* Express a given number as a percentage of another number;
* Express one quantity as a percentage of another where the percentage is greater than 100%
* Find a percentage of a quantity;
* Find the new amount after a percentage increase or decrease;
* Work out a percentage increase or decrease, including: simple interest, income tax calculations, value of profit or loss, percentage profit or loss;
* Compare two quantities using percentages, including a range of calculations and contexts such as those involving time or money;
* Find a percentage of a quantity using a multiplier and use a multiplier to increase or decrease by a percentage in any scenario where percentages are used;
* Find the original amount given the final amount after a percentage increase or decrease (reverse percentages), including VAT;
* Use calculators for reverse percentage calculations by doing an appropriate division;
* Use percentages in real-life situations, including percentages greater than 100%;
* Describe percentage increase/decrease with fractions, e.g. 150% increase means  times as big;
* Understand that fractions are more accurate in calculations than rounded percentage or decimal equivalents, and choose fractions, decimals or percentages appropriately for calculations.

**POSSIBLE SUCCESS CRITERIA**

Express a given number as a fraction of another, including where the fraction is, for example, greater than 1, e.g.  =  = .

Answer the following: James delivers 56 newspapers.  of the newspapers have a magazine. How many of the newspapers have a magazine?

Prove whether a fraction is terminating or recurring.

Convert a fraction to a decimal including where the fraction is greater than 1.

Be able to work out the price of a deposit, given the price of a sofa is £480 and the deposit is 15% of the price, without a calculator.

Find fractional percentages of amounts, with and without using a calculator.

Convince me that 0.125 is .

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Many of these topics provide opportunities for reasoning in real-life contexts, particularly percentages:

Calculate original values and evaluate statements in relation to this value justifying which statement is correct.

**COMMON MISCONCEPTIONS**

The larger the denominator, the larger the fraction.

Incorrect links between fractions and decimals, such as thinking that  = 0.15, 5% = 0.5,
4% = 0.4, etc.

It is not possible to have a percentage greater than 100%.

**NOTES**

Ensure that you include fractions where only one of the denominators needs to be changed, in addition to where both need to be changed for addition and subtraction.

Include multiplying and dividing integers by fractions.

Use a calculator for changing fractions into decimals and look for patterns.

Recognise that every terminating decimal has its fraction with a 2 and/or 5 as a common factor in the denominator.

Use long division to illustrate recurring decimals.

Amounts of money should always be rounded to the nearest penny.

Encourage use of the fraction button.

Students should be reminded of basic percentages.

Amounts of money should always be rounded to the nearest penny, except where successive calculations are done (i.e. compound interest, which is covered in a later unit).

Emphasise the use of percentages in real-life situations.