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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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| **4b. Ratio and proportion**  (N11, N12, N13, R2, R3, R4, R5, R6, R7, R8, R10) | **Teaching time**  5-7 hours |

**OBJECTIVES**

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

* Express the division of a quantity into a number parts as a ratio;
* Write ratios in form 1 : *m* or *m* : 1 and to describe a situation;
* Write ratios in their simplest form, including three-part ratios;
* Divide a given quantity into two or more parts in a given part : part or part : whole ratio;
* Use a ratio to find one quantity when the other is known;
* Write a ratio as a fraction and as a linear function;
* Identify direct proportion from a table of values, by comparing ratios of values;
* Use a ratio to compare a scale model to real-life object;
* Use a ratio to convert between measures and currencies, e.g. £1.00 = €1.36;
* Scale up recipes;
* Convert between currencies.

**POSSIBLE SUCCESS CRITERIA**

Write/interpret a ratio to describe a situation such as 1 blue for every 2 red …, 3 adults for every 10 children …

Recognise that two paints mixed red to yellow 5 : 4 and 20 : 16 are the same colour.

When a quantity is split in the ratio 3:5, what fraction does each person get?

Find amounts for three people when amount for one given.

Express the statement ‘There are twice as many girls as boys’ as the ratio 2 : 1 or the linear function *y* = 2*x*, where *x* is the number of boys and *y* is the number of girls.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Problems involving sharing in a ratio that include percentages rather than specific numbers such can provide links with other areas of Mathematics:

In a youth club the ratio of the number of boys to the number of girls is 3 : 2 . 30% of the boys are under the age of 14 and 60% of the girls are under the age of 14. What percentage of the youth club is under the age of 14?

**COMMON MISCONCEPTIONS**

Students often identify a ratio-style problem and then divide by the number given in the question, without fully understanding the question.

**NOTES**

Three-part ratios are usually difficult for students to understand.

Also include using decimals to find quantities.

Use a variety of measures in ratio and proportion problems.

Include metric to imperial and vice versa, but give them the conversion factor,   
e.g. 5 miles = 8 km, 1 inch = 2.4 cm – these aren’t specifically in the programme of study but are still useful.