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| **UNIT 4: Fractions and percentages**  |

[Return to Overview](#Overview)

**SPECIFICATION REFERENCES**

N1 order positive and negative integers, decimals and fractions; use the symbols =, ≠, <, >, ≤, ≥

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; understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)

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 )

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

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

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

S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use

**PRIOR KNOWLEDGE**

Students should be able to use the four operations of number.

Students should be able to find common factors.

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

Students should be able to define percentage as ‘number of parts per hundred’.

Students should know number complements to 10 and multiplication tables.

**KEYWORDS**

Decimal, percentage, inverse, addition, subtraction, multiplication, division, fractions, mixed, improper, recurring, integer, decimal, terminating, percentage, VAT, increase, decrease, multiplier, profit, loss

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| **4a. Fractions, decimals and percentages**(N1, N2, N3, N8, N10, N12, N13, R3, R9, S2) | **Teaching time**6–8 hours |

**OBJECTIVES**

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

* Use diagrams to find equivalent fractions or compare fractions;
* Write fractions to describe shaded parts of diagrams;
* Express a given number as a fraction of another, using very simple numbers, some cancelling, and where the fraction is both < 1 and > 1;
* Write a fraction in its simplest form and find equivalent fractions;
* Order fractions, by using a common denominator;
* Compare fractions, use inequality signs, compare unit fractions;
* Convert between mixed numbers and improper fractions;
* Add and subtract fractions;
* Add fractions and write the answer as a mixed number;
* Multiply and divide an integer by a fraction;
* Multiply and divide a fraction by an integer, including finding fractions of quantities or measurements, and apply this by finding the size of each category from a pie chart using fractions;
* Understand and use unit fractions as multiplicative inverses;
* Multiply fractions: simplify calculations by cancelling first;
* Divide a fraction by a whole number and another fraction;
* Recall the fraction-to-decimal conversion and convert fractions to decimals;
* Convert a fraction to a decimal to make a calculation easier,
e.g. 0.25 × 8 =  × 8, or  × 10 = 0.375 × 10;
* Recognise recurring decimals and convert fractions such as ,  and  into recurring decimals;
* Compare and order fractions, decimals and integers, using inequality signs;
* Understand that a percentage is a fraction in hundredths;
* Express a given number as a percentage of another number;
* Convert between fractions, decimals and percentages;
* Order fractions, decimals and percentages, including use of inequality signs.

**POSSIBLE SUCCESS CRITERIA**

Express a given number as a fraction of another, including where the fraction > 1.

Simplify .

 × 15, 20 × .

 of 36 m,  of £20.

Find the size of each category from a pie chart using fractions.

Calculate:  × ,  ÷ 3.

Write terminating decimals (up to 3 d.p.) as fractions.

Convert between fractions, decimals and percentages, common ones such as , , ,
 and .

Order integers, decimals and fractions.

**OPPORTUNITIES FOR REASONING/PROBLEM SOLVING**

Questions that involve rates of overtime pay including simple calculations involving fractional (>1, e.g. 1.5) and hourly pay. These can be extended into calculating rates of pay given the final payment and number of hours worked.

Working out the number of people/things where the number of people/things in different categories is given as a fraction, decimal or percentage.

**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**

Emphasise the importance of being able to convert between fractions, decimals and percentages to make calculations easier.

When expressing a given number as a fraction of another, start with very simple numbers < 1, and include some cancelling before fractions using numbers > 1.

Students should be reminded of basic percentages and fraction conversions.

When adding and subtracting fractions, start with same denominator, then where one denominator is a multiple of the other (answers ≤ 1), and finally where both denominators have to be changed (answers ≤ 1).

Regular revision of fractions is essential.

Demonstrate how to the use the fraction button on the calculator.

Use real-life examples where possible.

Use long division to illustrate recurring decimals.