

# Spring 2: Directed Number and Fractional Thinking

## Weeks 1 to 3: Directed number

Students will only have had limited experience of directed number at primary school, so this block is designed to extend and deepen their understanding of this. Multiple representations and contexts will be used to enable students to appreciate the meaning behind operations with negative integers rather than relying on a series of potentially confusing "rules". As well as exploring directed number in its own right, this block provides valuable opportunities for revising and extending earlier topics, notably algebraic areas such as substitution and the solution of equations; in particular students will be introduced to two-step equations for the first time in this block.

National curriculum content covered:

- select and use appropriate calculation strategies to solve increasingly complex problems
- use the four operations, including formal written methods, applied to integers, both positive and negative
- recognise and use relationships between operations including inverse operations
- use square and square roots
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- substitute numerical values into formulae and expressions, including scientific formulae
- understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors
- simplify and manipulate algebraic expressions to maintain equivalence
- understand and use standard mathematical formulae

**Interleaving/Extension of previous work**

- use conventional notation for the priority of operations
- forming and solving linear equations, including two-step equations

## Weeks 4 to 6: Fractional thinking

This block builds on the Autumn term study of "key" fractions, decimals and percentages. It will provide more experience of equivalence of fractions with any denominators, and to introduce the addition and subtraction of fractions. Bar models and concrete representations will be used extensively to support this. Adding fractions with the same denominators will lead to further exploration of fractions greater than one, and for the Core strand adding and subtracting with different denominators will be restricted to cases where one is a multiple of the other.

National curriculum content covered:

- move freely between different numerical, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals]
- express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, >, <, ≥, ≤
- select and use appropriate calculation strategies to solve increasingly complex problems
- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
- work interchangeably with terminating decimals and their corresponding fractions

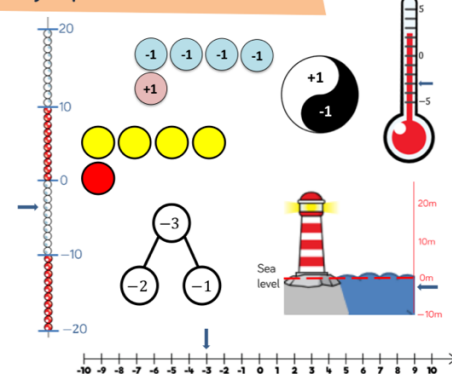
**Interleaving/Extension of previous work**

- finding the range and the median
- substitution into algebraic formulae
- forming and solving linear equations, including two-step equations

## Key Vocabulary – Directed Number

positive	negative	reflection	symmetric
sea level	ascending	descending	smaller / bigger
greater/less than	increase	decrease	difference
add	minus	subtract	partition
zero pair	product	multiply	commutative
inverse	calculator	sign change	$\pm$
fraction button	substitute	expression	order of operations
BIDMAS	solve	equation	balance
solution	function machine	positive/negative solution	indices
brackets	priority	square	square root
power	root	exponent	

### Key Representations



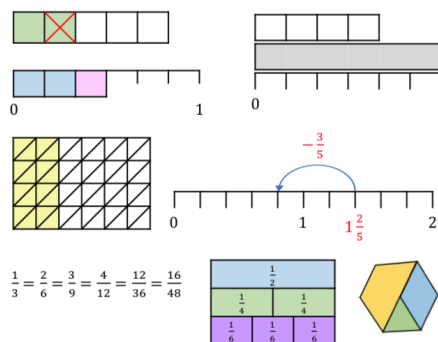
Concrete, pictorial and abstract representations are an important part of developing students' conceptual understanding.

When dealing with directed numbers, it is important to use both horizontal and vertical number lines. The vertical will be familiar from experience of temperature. It is preferable to refer to numbers below zero as e.g. "negative three" rather than "minus three" to try and avoid confusion between numbers and operators and the common misuse of language is a good discussion point.

## Key Vocabulary – Fractional Thinking

equal parts	congruent	divide	denominator
numerator	ascending	descending	smaller/bigger than
greater/less than	positive	negative	unit fraction
whole	multiple	mixed number	addition
subtraction	integer	partition	equivalent
lowest common multiple	common denominator	commutative	improper fraction
sequence	substitute	solve	equation
linear	geometric	inverse	Expression
place value	tenths	hundredths	decimal
simplify	like terms	collect	in terms of

### Key Representations



Concrete, pictorial and abstract representations are an important part of developing students' conceptual understanding.

Here are a few ideas for how you might represent adding and subtracting fractions. Cuisenaire rods are a useful way to introduce adding and subtracting fractions alongside the pictorial representations, such as the bar model and number line.

Fraction tiles and pattern blocks can be useful in exploring equivalent fractions.

The number line is particularly useful for converting an improper fraction to a mixed number, and more generally to reinforce the fraction's position on the number line.