

Scheme of Learning: Year 7 Spring Term

Topic Sequence: Directed Numbers and Fractional thinking

9	10
Operations and equations with directed number	Addition and subtraction of fractions

Topic Overview:

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.

Learning Sequence:

Representations of directed number Students will recognise and use negative numbers in a variety of different representations, including real-life contexts and more abstractly with concrete manipulatives and written notation. Students will be introduced to the reflective nature of positive and negative numbers on the number line e.g. knowing -4 and 4 are equidistant from 0 . To avoid confusion “ -4 ” will be read as “negative 4 ” etc.

Order directed numbers In this step, students will practice ordering directed numbers. Order is established using both vertical and horizontal number lines. The appropriate symbols are then used for comparison. Students will practice ordering negative fractions and decimals on a number line, as well as integers.

Perform calculations that cross zero Students will explore number pairs that add to 0 e.g. $-5 + 5$ to show that one negative and one positive of the same magnitude “cancel each other out”. Students will use number lines to support adding and subtracting through partitioning: e.g. $-8 + 12 = -8 + 8 + 4 = 4$. A number line is also useful to illustrate the difference between two numbers e.g. -3 and $+4$.

Add directed numbers Students will use double sided counters to model adding negative and positive numbers. Introducing zero pairs will be helpful for both addition/subtraction of directed numbers and help with the use of partitioning e.g. $6 + -4$ as $2 + 4 + -4 = 2 + 0 = 2$. Students will then generalise that adding a negative number is equivalent to a subtraction, although the emphasis will be on understanding the calculation rather than memorising rules.

Subtract directed numbers Students will explore sequences of equations in order to generalise and gain a stronger understanding of this concept. Another useful approach will be to have a collection of mixed double-sided counters and see what happens to the total when some/all of the negative counters are removed. They will avoid phrases such as “two negatives make a positive” as this leads to misconceptions such as “ $-1 - 2 = +3$ ”.

Multiplication with directed numbers Students will use jumps on a number line and manipulatives to model multiplication with directed numbers. Drawing a carefully labelled bar model will also help. The result of multiplication of two negatives will be justified with continuing patterns within a multiplication grid.

Multiplication and division Students will continue to use jumps on a number line and manipulatives to model multiplication with directed numbers.

Use a calculator for directed numbers The main reason for this step is to develop students’ calculator proficiency. Students will be introduced to the \pm button through teacher modelling. Students will also be introduced to the fraction button as an alternative to the division button.

Evaluate algebraic expressions This step continues to build on students’ use of the order of operations, now through substitution. As in the previous small step, students will be encouraged to take care in organising their recording of work, ensuring they have substituted accurately and maintained the correct order of calculations throughout. Correct use of brackets around negative numbers will be modelled.

Introducing two step equations Students have met one-step equations and these will be revised in order to move on to two-step equations. Practice of one-step equations will now of course include ones with negative solutions. Students will use concrete manipulatives, such as cups and counters (including ‘zero pairs’) and bar models, to represent the ideas pictorially. These will be used alongside written calculations.

Solve two step equations Students continue to develop their understanding of solving equations in this step, which includes more negative number work and negative solutions. There are opportunities to consider how varying the signs, coefficients and operations in an equations affects its solution. Students will continue to use bar models and concrete representations as appropriate.

Use order of operations Students build on their understanding of the order of operations, now including negative numbers. Students will be encouraged to pay careful attention to their recording of solutions. Discussion of common misconceptions is useful here. A reminder about commutativity will help students to understand why e.g. multiplication and division are of equal priority.

Roots of positive numbers (H) Students will be secure on what a square number is before this small step e.g. by using manipulatives to show why they are called square numbers. Students will logically come to the conclusion that e.g. $x^2 = 16$ has more than one solution by finding the square numbers in the multiplication grid shown. The symbol $\sqrt{\quad}$, however, means positive square root.

Explore higher powers and roots (H) Students will continue to further their understanding of powers by extending their knowledge of square and cube numbers. If appropriate, extend to look at higher powers. Understanding roots as the inverse operation will help understanding of powers. Students will be taught that a radical without a number ($\sqrt{\quad}$) means square root.

Sequence of Learning:		Topic Resources:	
1	Understand and use representations of directed numbers	Knowledge Maps:	Solving Linear Equations
2	Order directed numbers using lines and appropriate symbols		
3	Perform calculations that cross zero		
4	Add directed numbers		
5	Subtract directed numbers		
6	Multiplication of directed numbers	Assessment:	
7	Multiplication and division of directed numbers	Knowledge:	End of Topic test
8	Use a calculator for directed number calculations	Application of Knowledge:	Termly mixed topic assessment
9	Evaluate algebraic expressions with directed number		
10	Introduction to two-step equations	Supportive Reading:	
11	Solve two-step equations	Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
12	Use order of operations with directed numbers		Corbett Maths : www.corbettmaths.com
13	Roots of positive numbers (H)		
14	Explore higher powers and roots (H)		AQA Revision Guide