Understand proportionality

As students' understanding of multiplicative relationships matures, they can work with more complex contexts and use algebraic notation to generalise. An important awareness here is that there is one unifying structure which connects fractions, percentages and ratio, and that this one structure can be described by the algebraic formulae $x \times k = y$ or alternatively $k = \frac{y}{x}$, where x and y are the quantities in proportion and k is the constant of proportionality. While exploring a wide range of examples of proportionality (including examples of *'what it's not'*) it will be important to make the distinction between linear relationships which are not proportional (i.e. of the form $y = mx + c$ rather than $y = kx$) and also to become aware of situations where the variables are inversely proportional (i.e. $y = k \times \frac{1}{x}$ or $y = \frac{k}{x}$).

In formalising this generalisation, students are able to use the underlying structure to develop an awareness that there are different types of proportionality, particularly inverse proportionality.

Key ideas

- Understand the connection between multiplicative relationships and direct proportion
- Recognise direct proportion and use in a range of contexts, including compound measures
- Recognise and use inverse proportionality in a range of contexts

Exemplified significant key ideas

Calculate percentage changes (increases and decreases)

Common difficulties and misconceptions: students should be confident with using informal additive methods to increase or decrease an amount using a percentage. While it is important for students to be able to work flexibly with percentages, it is important for efficiency and depth of understanding that students understand there exists a single multiplier linked to any percentage change and recognise them as examples of multiplicative relationships.

Some students have difficulties using the additive method as they fail to find the final amount by adding or subtracting the increase/decrease to the original amount. Some students have difficulties with identifying the multiplier for single-digit percentages, such as 5%.