Common student misconceptions

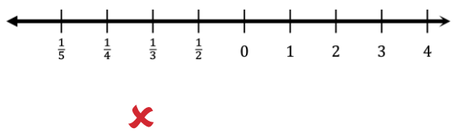
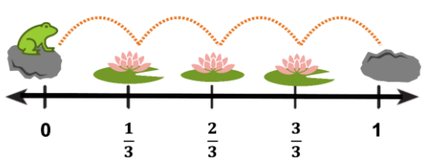
ACiQ v9.0

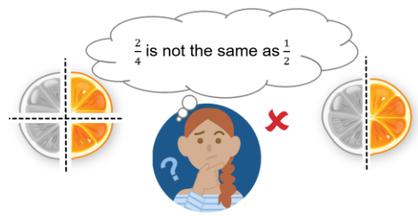
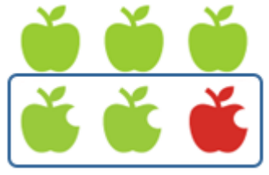
Introduction to thinking about fractions

Fractions are a key aspect of numeracy in the 21st century and have everyday relevance, even for young students.

This factsheet summarises some common misconceptions that can form in the early stages of students learning to think about fractions. These misconceptions can be a barrier to students' progress.

Misconceptions can be hard to spot because students with misconceptions about fractions might still obtain a correct answer. So, it can be helpful to use and create classroom activities that involve students sharing their thinking about fractions. Teachers can also conduct one-on-one conferences with students to gain this insight, which can be used to provide extra support for groups of students and individuals.

Common misconceptions	Example	Explanation	Fraction construct/s*	Related content description/s
Equality of the parts		Students may associate the word 'half' with the process of splitting into two, rather than creating two equal parts. In the first example, the banana has been split in two, but the two parts are not equal in size. If the banana had been halved, they would have two equal parts. In the second example, the circle would need to be divided into four equal parts before one-fourth of the circle could be coloured.	Part-whole	Recognise and describe one-half as one of two equal parts of a whole and connect halves, quarters and eighths through repeated halving AC9M2N03 Identify common uses and represent halves, quarters and eighths in relation to shapes, objects and events (AC9M2M02) Recognise and represent unit fractions including $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ and $\frac{1}{10}$, and their multiples in different ways; combine fractions with the same denominator to complete the whole (AC9M3N02)
Quantity of the parts		Students may recognise that parts of a whole are different from each other, but they do not consider the quantity of the parts. In the example, the student has noticed that that the pentagon has parts that are blue and parts that are white. However, the pentagon has been divided into five parts, so three-fifths of the pentagon is blue.	Part-whole	Recognise and describe one-half as one of two equal parts of a whole and connect halves, quarters and eighths through repeated halving AC9M2N03 Identify common uses and represent halves, quarters and eighths in relation to shapes, objects and events (AC9M2M02) Recognise and represent unit fractions including $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ and $\frac{1}{10}$, and their multiples in different ways; combine fractions with the same denominator to complete the whole (AC9M3N02)
Fractions are always less than one	Incorrect reasoning: '$\frac{3}{2}$ is not a fraction, the fraction part is $\frac{1}{2}$, ✗	Students may believe that fractions describe only the fractional part of a quantity and are, therefore, always less than one. In the example, the student treats $\frac{3}{2}$ as 'one and a half', identifying only the $\frac{1}{2}$ as the fraction. However, $\frac{3}{2}$ is itself a fraction.	Part-whole, measure	Count by fractions including mixed numerals; locate and represent these fractions as numbers on number lines (AC9M4N04) Compare and order fractions with the same and related denominators including mixed numerals, applying knowledge of factors and multiples; represent these fractions on a number line (AC9M5N03)
Misplacing fractions on number lines	 ✗	Students may reason that fractions are small, so they are less than zero. In the example, the student has placed the fractions below 0 rather than between 0 and 1. In addition, the spacing between the fractions does not represent the proportional size of the fractions. Although the fractions are in the correct order, the distances between them do not reflect how far each fraction is from zero, or from each other.	Part-whole, measure	Count by fractions including mixed numerals; locate and represent these fractions as numbers on number lines (AC9M4N04) Compare and order fractions with the same and related denominators including mixed numerals, applying knowledge of factors and multiples; represent these fractions on a number line (AC9M5N03)
Parts versus marks on number lines	 ✗	Students may assume that the number of marks on the number line is equivalent to the number of parts. In the example, the student counts the three marks between 0 and 1 and labels them as $\frac{1}{3}$, $\frac{2}{3}$ and $\frac{3}{3}$. However, the diagram shows that it is the four equal spaces between the marks that represent the parts of the frog's journey, so the marks should represent quarters of the distance.	Measure	Count by fractions including mixed numerals; locate and represent these fractions as numbers on number lines (AC9M4N04)

Common misconceptions	Example	Explanation	Fraction construct/s*	Related content description/s
Changing the whole	 Mislabelling $\frac{1}{2}$ by changing the whole.	Students may assume that the value of the whole is always one. In the example, the student has labelled the number line as if the whole is 1. However, the whole is 2. Therefore, the first tick mark should be labelled as $\frac{1}{2}$ because it is halfway to 1.	Measure	Find equivalent representations of fractions using related denominators and make connections between fractions and decimal notation (AC9M4N01) Count by fractions including mixed numerals; locate and represent these fractions as numbers on number lines (AC9M4N04)
Describing equivalent fractions		Students may believe that equivalent fractions must have the same denominator, because the denominator indicates how many parts the whole is divided into. In the example, the student reasons that $\frac{1}{2}$ and $\frac{2}{4}$ cannot be equivalent because one orange is cut into two equal parts while the other is cut into four equal parts, rather than recognising that the shaded portions represent the same amount.	Measure	Find equivalent representations of fractions using related denominators and make connections between fractions and decimal notation (AC9M4N01) Compare and order fractions with the same and related denominators including mixed numerals, applying knowledge of factors and multiples; represent these fractions on a number line (AC9M5N03)
Relative size of units	 Incorrect reasoning: '2 is smaller than 8, therefore $\frac{1}{2}$ is smaller than $\frac{1}{8}$'	Students may think that a larger denominator means a bigger fraction. In the example, $\frac{1}{2}$ of the pizza on the left has been eaten and $\frac{1}{8}$ of the pizza on the right has been eaten. However, a student might incorrectly reason that because 2 is smaller than 8, therefore $\frac{1}{2}$ is smaller than $\frac{1}{8}$. The student has not realised that if you cut the pizza (the whole) into eight equal parts, then each part will be smaller than when the pizza is cut into only two equal parts.	Part-whole, Division	Recognise and describe one-half as one of 2 equal parts of a whole and connect halves, quarters and eighths through repeated halving (AC9M2N03) Recognise and represent unit fractions including $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ and $\frac{1}{10}$, and their multiples in different ways; combine fractions with the same denominator to complete the whole (AC9M3N02) Find equivalent representations of fractions using related denominators and make connections between fractions and decimal notation (AC9M4N03) Compare and order fractions with the same and related denominators including mixed numerals, applying knowledge of factors and multiples; represent these fractions on a number line (AC9M5N03)
Relative size of common fractions	 $\frac{5}{6}$ of the apples are green. $\frac{1}{2}$ of the apples have a bite missing. Incorrect reasoning: '$\frac{1}{6}$ is smaller than $\frac{1}{2}$ so $\frac{5}{6}$ must also be smaller than ½'	Students may understand that 'the larger the denominator, the smaller the fraction', but they overlook the effect of the numerator on the size of the fraction. In the example, the student has incorrectly reasoned that sixths must be smaller than a half because the denominator is larger. However, the diagram shows that five of the six apples are green, while only three of the six apples have a bite missing, so $\frac{5}{6}$ represents the larger quantity.	Division, Operators	Recognise and represent unit fractions including $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$ and $\frac{1}{10}$, and their multiples in different ways; combine fractions with the same denominator to complete the whole (AC9M3N02) Find equivalent representations of fractions using related denominators and make connections between fractions and decimal notation (AC9M4N03) Count by fractions including mixed numerals; locate and represent these fractions as numbers on number lines (AC9M4N04)
Double count	**Leigh eats $\frac{1}{2}$ of the pie and Ari eats $\frac{1}{4}$. How much has been eaten?** Incorrect reasoning: $\frac{1}{2} + \frac{1}{4} = \frac{1+1}{2+4} = \frac{2}{6}$ 	Students may treat the numerators and denominators as separate whole numbers. In the example, the student assumes that one pie is cut into two pieces, and a second pie is cut into four pieces, instead of recognising that both fractions describe parts of the same pie. The student thinks there are six available pieces of pie, and two have been eaten. In fact, there is only one pie cut into four equal slices (or parts), where half ($\frac{1}{2}$) of the pie is equivalent to $\frac{2}{4}$. So, to work out how much pie had been eaten, the correct operation would be: $\frac{2}{4} + \frac{1}{4} = \frac{3}{4}$.	Measure	Find equivalent representations of fractions using related denominators and make connections between fractions and decimal notation (AC9M4N01) Solve problems involving addition and subtraction of fractions with the same or related denominators, using different strategies (AC9M5N05) Solve problems involving addition and subtraction of fractions using knowledge of equivalent fractions (AC9M6N05)

*For further information on fraction constructs, refer to the QCAA resource *Improving thinking about fractions in Years 2–6.*