<table>
<tr><td>Outcome</td><td>NF1</td><td>Student can consistently:</td><td>Add, subtract, multiply and divide any two fractions (including mixed numbers).</td></tr>
<tr><td>How the topic is examined</td><td colspan="3">

Examined through test paper questions.
Questions are more likely to appear on a non-calculator paper as otherwise students could just use a calculator.
It is more likely that word problems and problem solving questions appear on calculator papers.

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<tr><td>Prior knowledge</td><td colspan="3">

Students should be confident:

Multiplying and dividing without a calculator.
Converting between mixed numbers and improper fractions.
Equivalent fractions

In addition questions involving fractions can have links to:

Lowest common multiple (NF6)
Algebraic fractions

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<tr><td>Suggested tuition approaches</td><td colspan="3">

Students should understand what a fraction is and it’s links with decimals (division) and ratio (parts)
You might use diagrams with some students to help them understand what they are doing.
It is also important to use the correct language when teaching fractions (e.g. denominator, numerator, improper fractions, etc…). Try and avoid using expressions like ‘top number’, ‘top heavy’ etc…..

<table>
<tr><th>Adding and subtracting fractions</th><th>Multiplying and dividing fractions.</th></tr>
<tr><td>When adding convert each number to an improper fraction
$3\frac{5}{6}+2\frac{3}{4}=\frac{23}{6}+\frac{11}{4}$
Find a common denominator. The most preferable is the lowest common multiple of the denominators given. In this case 12. You could use 24, 36, ….
Find the equivalent fractions. An easy way to do this is to multiply the numerator by whatever number you have</td><td>When multiplying convert each number to an improper fraction
$3\frac{5}{6}\times 2\frac{3}{4}=\frac{23}{6}\times\frac{11}{4}$
Now multiply the numerators together and the denominators. Write your answer as a mixed number in its simplest form.
$\frac{23}{6}\times\frac{11}{4}=\frac{253}{12}=21\frac{1}{12}$</td></tr>
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multiplied the denominator by.

$$\frac{23}{6}+\frac{11}{4}=\frac{46}{12}+\frac{33}{12}=\frac{79}{12}=6\frac{7}{12}$$

Now you can add the numerators to get the answer. Always change your answer back to a mixed number and ensure it is in its simplest form.

If the question was a **subtraction** you would subtract the numerators.

$$\frac{23}{6}-\frac{11}{4}=\frac{46}{12}-\frac{33}{12}=\frac{13}{12}=1\frac{1}{12}$$

Some students might use the method where they add whole parts and fraction parts separately. This is acceptable.

When **dividing** fractions again convert to improper fractions. This time though you find the inverse of the second fraction (some students just 'flip it') and then multiply by the inverse.

$$\frac{23}{6}\div\frac{11}{4}=\frac{23}{6}\times\frac{4}{11}=\frac{92}{66}=\frac{46}{33}=1\frac{13}{33}$$

If students are multiplying or dividing by an integer (whole number) then students might find it helpful if they think of it as a fraction with denominator 1.

e.g. $4=\frac{4}{1}$

Common errors and misconceptions

- When adding and subtracting:
  - Students simply add numerators and denominators. If they do this, it shows they need fractions introducing from first principles.
  - They don't use a common denominator that is the lowest common multiple. This is fine, but the numbers can get really big and cause more issues. Exam questions tend to be written so that it is of great benefit to find the lowest common denominator.
- When multiplying and dividing:
  - Students don't convert to improper fractions first; they simply multiply the whole number by the whole number and fraction by fraction.
  - When multiplying by integers they multiply numerator **and** denominator by the whole number as opposed to just the numerator. The same happens with division.

Suggested resources

- Video tutorials

	○ https://www.youtube.com/watch?v=DYcqDfgpveM ○ https://www.youtube.com/watch?v=1k5Vnj_Gv30 • Questions ○ http://www.cimt.org.uk/projects/mepres/allgcse/bkb11.pdf (pp 249 – 256) ○ https://corbettmaths.files.wordpress.com/2013/02/addition-of-fractions-pdf1.pdf ○ https://corbettmaths.files.wordpress.com/2013/02/multiplying-dividing-fractions-pdf.pdf • Past GCSE Questions ○ https://keshgcsemaths.files.wordpress.com/2013/11/27_fractions_adding_subtracting_multiplying-and-dividing2.pdf