How to Add Fractions

The entire method depends on this rule:

The Golden Rule:

You **can't** add fractions unless the **denominators** are **the same**.

If the denominators are **the same**, they **stay the same**, and you **add the numerators**.
Eg:

$$\frac{3}{17}+\frac{5}{17}=\frac{\mathbf{8}}{\mathbf{17}}$$

If the denominators are **not the same**, you first have to **change the fractions** so they are.

1. Find a number **in the times table** of **both denominators**.

Note: Any number in both times tables will work, so if you're stuck, just multiply the two denominators together to find one (eg $\frac{2}{3}$ and $\frac{1}{6}$ could have a common denominator of 18).

Sometimes this is the same as one of the denominators (eg $\frac{2}{3}$ and $\frac{1}{6}$ both can have a common denominator of 6).

2. Convert one or both to **equivalent fractions** that now **have the same denominator**.
To produce an equivalent fraction, just multiply the top and bottom by the same thing.

3. Now you can add them by **adding the numerators** (keep the denominator **the same**).

Eg:

$$\frac{2}{15}+\frac{1}{3}=\frac{2}{15}+\frac{5}{15}=\frac{\mathbf{7}}{\mathbf{15}}$$

In this example, $\frac{1}{3}$ is rewritten as $\frac{5}{15}$ so that both fractions have a denominator of 15.

Eg:

$$\frac{7}{12}-\frac{11}{30}=\frac{35}{60}-\frac{22}{60}=\frac{\mathbf{13}}{\mathbf{60}}$$

In this example, $\frac{7}{12}$ is rewritten as $\frac{35}{60}$ and $\frac{11}{30}$ is rewritten as $\frac{22}{60}$, so that both fractions have a denominator of 60.

The final step in any fractions question is to **simplify** your answer if possible. Divide the top and bottom of the fraction by the same thing and carry on until you can't divide any more.
Eg:

$$\frac{4}{5}-\frac{2}{15}=\frac{12}{15}-\frac{2}{15}=\frac{10}{15}=\frac{\mathbf{2}}{\mathbf{3}}$$

To check you understand, complete this example:

$$\frac{3}{8}+\frac{5}{12}=\frac{[\ \ ]}{[\ \ ]}+\frac{[\ \ ]}{[\ \ ]}=\frac{[\ \ ]}{[\ \ ]}$$

Dealing with Mixed Numbers

A fraction is just a convenient way of writing numbers that you get by dividing.
These are usually not whole numbers, but they can be.

$\frac{8}{2}$ *is usually written as* 4

$\frac{5}{6}$ *is the same as* $5 \div 6$

$\frac{12}{18}$ *gives the same result as* $\frac{2}{3}$

$\frac{7}{4}$ *is the same as* $1 + \frac{3}{4}$

Mixed numbers are often used when a fraction is larger than 1 to make it easier to see how large it really is. For instance, $\frac{12}{5}$ is bigger than 1, but how much bigger is it?

$$\frac{12}{5} = \frac{10}{5} + \frac{2}{5} = 2 + \frac{2}{5} \quad \textit{which is often written in mixed number form: } 2\frac{2}{5}$$

To convert a mixed number into a top-heavy (improper) fraction:

1. Write out in full with an $+$ sign:

$$\mathbf{3\frac{4}{5}} = 3 + \frac{4}{5}$$

2. Write the whole number part as a fraction, then convert to the same denominator:

$$3 + \frac{4}{5} = \frac{3}{1} + \frac{4}{5} = \frac{15}{5} + \frac{4}{5}$$

3. Add the two fractions together, now they are the same type:

$$\frac{15}{5} + \frac{4}{5} = \mathbf{\frac{19}{5}}$$

One way to think about it is:

"Three whole ones is 15 *fifths. Add on another* 4 *fifths to make* 19 *fifths."*

To convert a top-heavy (improper) fraction into a mixed number:

1. Treat the fraction as a division:

$$\mathbf{\frac{19}{5}} = 19 \div 5$$

2. Work out how many of the denominator go into the numerator, and how many are left:

$$19 \div 5 = 3 \; remainder \; 4$$

3. Write the result as the whole number, and the remainder over the denominator:

$$19 \div 5 = 3 + \frac{4}{5} = \mathbf{3\frac{4}{5}}$$

Adding or subtracting with mixed numbers:

Method 1: Convert all mixed numbers to top-heavy fractions, then use your normal method. If necessary, convert back at the end to a mixed number.

Method 2: Write out the calculation in full, writing each mixed number with the 'unwritten' $+$ sign, then add or subtract the appropriate bits as needed. This can be more confusing, so if in doubt, use method 1, but often saves time and effort, especially when the whole number part is large.