What is a Fraction

A fraction is just a part of a whole. The bottom number of the fraction (which we call the denominator) tells you how many parts the whole is divided into, while the top number of the fraction (which we call the numerator) tells you how many of those parts you have.

If the numerator of our fraction is smaller than the denominator the fraction is less than one, and we call it a proper fraction. For example, ¼ is a proper fraction because our numerator (1) is smaller than...
our denominator (4). To illustrate this fraction note that the circle below has been divided into four parts, one of which has been shaded. So the shaded area is \( \frac{1}{4} \) of our whole:

![Fraction Example]

A fraction is just a part of a whole. The bottom number of the fraction (which we call the denominator) tells you how many parts the whole is divided into, while the top number of the fraction (which we call the numerator) tells you how many of those parts you have.

If the numerator of our fraction is smaller than the denominator the fraction is less than one, and we call it a proper fraction. For example, one quarter is a proper fraction because our numerator (1) is smaller than our denominator (4). To illustrate this fraction note that the circle shown has been divided into four parts, one of which has been shaded. So the shaded area is one quarter of our whole.

### Other Types of Fractions

If the numerator of our fraction is bigger than the denominator the fraction is greater than one, and we call this an improper fraction. Improper fractions can also be expressed either as mixed numbers (i.e. a whole number and a proper fraction together), or just as whole numbers.

For example, the improper fraction \( \frac{5}{4} \) can also be written as the mixed number \( 1 \frac{1}{4} \), as these represent the same amount.

\[
\frac{5}{4} = 1 \frac{1}{4} = \text{Shaded area}
\]

On the other hand, the improper fraction \( \frac{8}{4} \) can be written as the whole number 2.

Finally, if the numerator and denominator of our fraction are the same then it is equal to 1, and we generally write it as such (for example \( \frac{4}{4} = 1 \)). Furthermore, if the denominator of our fraction is 1 then the fraction is in fact equal to a whole number (for example \( \frac{5}{1} = 5 \)).
Finally, if the numerator and denominator are the same then our fraction is equal to 1, and we generally write it as such. For example, four quarters is simply equal to one. Furthermore, if the denominator of our fraction is 1 then the fraction is in fact equal to a whole number (for example $5/1 = 5$).

**Simplifying Fractions**

One of the things you may need to do with fractions is to simplify them. As a basic example of simplifying a fraction, consider this pizza:

![Pizza](image)

You could say that there is $4/8$ of a pizza left, but would you? Most likely you would say that there is $1/2$ of a pizza left, and in doing so you would have simplified the fraction.

It is best to always write fractions in their simplest form, which you can do by following these steps:

1. Determine the highest common factor of the numerator and denominator (i.e. the largest number that divides into both a whole number of times). If you can't find the highest common factor then at least determine a factor (i.e. a number that divides into both a whole number of times); it just means you will need to repeat these steps.

   For example, when simplifying $8/12$ consider that the factors of 8 are 1, 2, 4 and 8 and the factors of 12 are 1, 2, 3, 4, 6 and 12. Hence the highest common factor is 4.

2. Divide both the numerator and the denominator by this highest common factor or factor to obtain a new numerator and denominator. If the latter, repeat as necessary until there are no more factors.

   For example, when simplifying $8/12$ consider that $8 \div 4 = 2$ and $12 \div 4 = 3$, so $8/12$ simplifies to $2/3$.

One of the things you may need to do with fractions is to simplify them. As a basic example of simplifying a fraction, consider the pizza shown.

There were originally 8 pieces of pizza, and now there are only 4 left. So you could say that there is four eighths of a pizza left. But would you? Most likely, you would say that there is half of a pizza left, and in doing so you would have simplified the fraction- probably without even realising it.

It is best to always write fractions in their simplest form; that is, with the smallest possible numbers for the numerator and denominator. You can do this by following two steps.
The first step is to determine the highest common factor of the numerator and denominator (that is, the largest number that divides into both a whole number of times), by writing out lists of factors for both numbers if necessary. If you can’t find the highest common factor then at least determine a factor (that is, a number that divides into both a whole number of times); it just means you will need to repeat these steps. For example, when simplifying eight twelfths consider that the factors of 8 are 1, 2, 4 and 8 and the factors of 12 are 1, 2, 3, 4, 6 and 12. Hence the highest common factor is 4.

The second step is to divide both the numerator and the denominator by this highest common factor to obtain a new numerator and denominator. If dividing by a factor other than the highest common factor, repeat as necessary until there are no more factors. For example, when simplifying eight twelfths consider that 8 divided by 4 is equal to 2 and 12 divided by 4 is equal to 3, so eight twelfths simplifies to two thirds.

Examples: Simplifying Fractions

1. What is 75/100 in simplest form?
   Factors of 75 are 1, 3, 5, 15, 25 and 75, and factors of 100 are 1, 2, 4, 5, 10, 20, 25, 50 and 100
   So highest common factor is 25
   Dividing numerator and denominator by 25 gives ¾

2. What is 9/12 in simplest form?
   Factors of 9 are 1, 3, and 9, and factors of 12 are 1, 2, 3, 4, 6 and 12
   So highest common factor is 3
   Dividing numerator and denominator by 3 gives ¾

3. A survey is conducted with 12 people, 10 of whom are female. What fraction of participants are female (simplify)?
   Factors of 10 are 1, 2, 5 and 10, and factors of 12 are 1, 2, 3, 4, 6 and 12
   So highest common factor is 2
   Dividing numerator and denominator by 2 gives 5/6

Let’s work through some more examples involving simplifying fractions.

Example one requires us to simplify 75 over 100. To do this we write out lists of factors if necessary, in order to determine that the highest common factor of 75 and 100 is 25. We then divide 75 by 25 to give 3, and 100 by 25 to give 4. Hence the simplified form of the fraction is three over four, or three quarters. Note that you could have also calculated this by dividing through by a factor of 5 and then 5 again.

Example two requires us to simplify nine twelfths. To do this we write out lists of factors if necessary, in order to determine that the highest common factor of 9 and 12 is 3. We then divide 9 by 3 to give 3, and 12 by 3 to give 4. Hence the simplified form of this fraction is also three quarters.
Example three requires us to simplify ten twelfths. To do this we write out lists of factors if necessary, in order to determine that the highest common factor of 10 and 12 is 2. We then divide 10 by 2 to give 5, and 12 by 2 to give 6. Hence the simplified form of this fraction is five sixths.

Activity 1: Practice Questions

Click on the Activity 1 link in the right-hand part of this screen.

Now have a go at simplifying fractions on your own by working through some practice questions.

Converting Mixed Numbers to Improper Fractions

When performing calculations involving fractions you may be required to convert from mixed numbers to improper fractions. To do this follow these steps:

1. Multiply the whole number part of the mixed number by the denominator of the fractional part
   For example, when converting 7 2/3 to an improper fraction multiply 7 by 3 to give 21

2. Add this answer to the numerator. This gives the numerator of the improper fraction, and the denominator is just the denominator of the fractional part of the mixed number
   For example, when converting 7 2/3 to an improper fraction add 21 to 2 to give a numerator of 23, and hence an improper fraction of 23/3.
When performing calculations involving fractions, such as multiplication and division, you may be required to convert from mixed numbers to improper fractions. You can do this by following two steps.

The first step is to multiply the whole number part of the mixed number by the denominator of the fractional part. For example, when converting 7 and two thirds to an improper fraction you should multiply the whole number 7 by 3 to give 21.

The second step is to add this answer to the numerator to obtain the numerator of the improper fraction, while the denominator of the improper fraction is just the denominator of the fractional part of the mixed number. For example, when converting 7 and two thirds to an improper fraction add 21 to 2 to give a numerator of 23, and hence an improper fraction of 23 over 3.

Converting Improper Fractions to Mixed Numbers

When a solution to a problem turns out to be an improper fraction, typically it should be converted to a mixed number. This can be done by following these steps:

1. Divide the numerator of the improper fraction by the denominator

   For example, when converting 14/4 to a mixed number or whole number divide 14 by 4 to give 3.5

2. If this result is a whole number then your improper fraction is equivalent to a whole number. If this result is a decimal number then your improper fraction is equivalent to a mixed number, and the whole number part of this mixed number is just the whole number part of the decimal result. Furthermore, the denominator of the fractional part of the mixed number is just the denominator of the original improper fraction. To determine the numerator, just multiply the whole number part of the decimal result by the denominator of the original improper fraction, and subtract this result from the numerator.

   For example, when converting 14/4 to a mixed number division gives the decimal number of 3.5. Hence 3 is the whole number part of our mixed number, the denominator of the fractional part is 4 and the numerator is 14 – 3 x 4 = 2, giving a mixed number of 3 2/4

3. Simplify the fractional part of the mixed number if required

   For example, when converting 14/4 to a mixed number performing steps 1 and 2 above gives 3 2/4, which can then be simplified to 3 1/2.
When a solution to a problem, such as addition of fractions, turns out to be an improper fraction typically it should be converted to a mixed number. You can do this by following three steps. 

The first step is to divide the numerator of the improper fraction by the denominator. For example, when converting 14 over 4 to a mixed number or whole number divide 14 by 4 to give 3.5.

If this result is a whole number then your improper fraction is equivalent to a whole number. If this result is a decimal number then your improper fraction is equivalent to a mixed number, and the whole number part of this mixed number is just the whole number part of the decimal result. Furthermore, the denominator of the fractional part of the mixed number is just the denominator of the original improper fraction. To determine the numerator, just multiply the whole number part of the decimal result by the denominator of the original improper fraction, and subtract this result from the numerator. For example, when converting 14 over 4 to a mixed number division gives the decimal number of 3.5. Hence 3 is the whole number part of our mixed number, the denominator of the fractional part is 4 and the numerator is 14 subtract 3 multiplied by 4, which gives a result of 2. Therefore the mixed number result is 3 and two fourths.

The third and final step, if required, is to simplify the fractional part of the mixed number. For example, when converting 14 over 4 to a mixed number performing steps 1 and 2 above gives 3 and two fourths, which can then be simplified to 3 and a half.

**Examples: Converting between Improper Fractions and Mixed Numbers**

1. Convert 4 ½ to an improper fraction
   
   \[ 4 \times 2 = 8 \]
   
   \[ 8 + 1 = 9 \]
   
   Therefore improper fraction equivalent is 9/2

2. Convert 16/6 to a mixed number
   
   \[ 16 \div 6 = 2.67, \text{ so whole number part of mixed number is } 2 \]
   
   Denominator of fractional part of mixed number is 6
   
   Numerator of fractional part of mixed number is \[ 16 - 2 \times 6 = 4 \]
   
   So mixed number equivalent is 2 4/6
   
   Which simplifies to 2 2/3.

Let's work through some more examples involving converting between improper fractions and mixed numbers.

Example one requires us to convert 4 and a half to an improper fraction. To do this we multiply the whole number part of the mixed number, which is 4 in this case, by the denominator of the fractional part, which in this case is 2, to give 8. We then add the numerator of the fractional part of the mixed number, which in this case is 1, to this to give a total of 9. Hence the improper fraction equivalent of 4 and a half is 9 over 2.
Example two requires us to convert 16 over 6 to a mixed number. To do this we divide 16 by 6 to give a result of 2.67, which tells us that the whole number part of our mixed number is equal to 2. Now the denominator of the fractional part of our mixed number is simply the same as the denominator of our improper fraction, which is 6, so it just remains to determine the numerator. We do this by multiplying the whole number part of our decimal number, 2, by the denominator of the original improper fraction, 6, and subtracting this result from the numerator of 16. Hence we end up with a numerator of 4, and therefore the mixed number equivalent of 16 over 6 is 2 and four sixths, which we can simplify to 2 and two thirds.

Activity 2: Practice Questions

Click on the Activity 2 link in the right-hand part of this screen.

Now have a go at converting between improper fractions and mixed numbers on your own by working through some practice questions.

Multiplying Fractions

Another thing you may need to do with fractions is multiply them together. To do this simply multiply the two numerators together to make the new numerator, and the two denominators together to make the new denominator, then simplify if necessary.

For example: \( \frac{1}{3} \times \frac{2}{7} = \frac{1 \times 2}{3 \times 7} \)
\[ = \frac{2}{21} \]

To multiply a fraction by a whole number, you simply multiply the numerator by the whole number and leave the denominator as is (as the whole number is equivalent to a fraction with a denominator of 1).

For example:
\[ \frac{2}{7} \times 3 = \frac{2 \times 3}{7} \]
\[ = \frac{6}{7} \]

Note that multiplying by a fraction is the same as finding that fraction ‘of’ the number- i.e. we can say that 2/7 of 3 is 6/7, based on our multiplication above.

Also, note that when multiplying with mixed numbers you should convert to improper fractions first before proceeding as above.
Another thing you may need to do with fractions is multiply them together. To do this simply multiply the two numerators together to make the new numerator, and the two denominators together to make the new denominator, then simplify if necessary. For example to calculate one third multiplied by two sevenths, multiply the one and the two together to make the new numerator, and the three and the seven together to make the new denominator. This gives a result of two over twenty one.

To multiply a fraction by a whole number, you simply multiply the numerator by the whole number and leave the denominator as is- because as mentioned previously, the whole number is equivalent to a fraction with a denominator of 1. For example to calculate two sevenths multiplied by 3, multiply the two and the three together to make the new numerator, and leave the denominator as seven. This gives a result of six sevenths.

Note that multiplying by a fraction is the same as finding that fraction ‘of’ the number- i.e. we can say that 2/7 of 3 is 6/7, based on our multiplication above.

Also note that when division involves mixed numbers, you should convert any mixed numbers to improper fractions first (as described previously) before proceeding as above.

Examples: Multiplying Fractions

1. What is 3/7 x 1/4?
   
   \[
   \frac{3}{7} \times \frac{1}{4} = \frac{3 \times 1}{7 \times 4} = \frac{3}{28}
   \]

2. What is 3/4 x 2/5?
   
   \[
   \frac{3}{4} \times \frac{2}{5} = \frac{3 \times 2}{4 \times 5} = \frac{6}{20} = \frac{3}{10}
   \]

3. A survey is conducted regarding whether people have pets, and if so what kind they have. If 2/3 of the people surveyed have a pet, and 4/7 of those who have a pet have a dog, then what fraction of all the survey participants have a dog?
   
   \[
   \frac{2}{3} \times \frac{4}{7} = \frac{2 \times 4}{3 \times 7} = \frac{8}{21}
   \]

Let’s work through some more examples involving multiplying fractions.

Example one requires us to multiply three sevenths by one quarter. To do this we multiply the three by the one to make the new numerator, and the seven by the four to make the new denominator. Hence the solution is three over twenty-eight.
Example two requires us to multiply three quarters by two fifths. To do this we multiply the three by the two to make the new numerator, and the four by the five to make the new denominator. Finally, we simply this fraction by dividing both the numerator and denominator by the highest common factor of two, to give a solution of three tenths.

Example two requires us to multiply two thirds by four sevenths. To do this we multiply the two by the four to make the new numerator, and the three by the seven to make the new denominator. Hence the solution is eight over twenty one.

Activity 3: Practice Questions

Click on the Activity 3 link in the right-hand part of this screen.

Now have a go at multiplying fractions on your own by working through some practice questions.

Dividing Fractions

You may also need to perform division with fractions. To understand how to do this, recall that dividing by a whole number is the same as multiplying by a fraction with a numerator equal to 1 and denominator equal to the whole number (i.e. the reciprocal of the number).

For example: \( \frac{3}{5} \div 6 = \frac{3}{5} \times \frac{1}{6} \)

\[ = \frac{(3 \times 1)}{(5 \times 6)} \]

\[ = \frac{3}{30} \]

\[ = \frac{1}{10} \]

Similarly, dividing by a fraction with a certain numerator and denominator is the same as multiplying by a fraction with the numerator and denominator switched around (i.e. the reciprocal of the fraction).

For example: \( \frac{3}{5} \div \frac{2}{3} = \frac{3}{5} \times \frac{3}{2} \)

\[ = \frac{(3 \times 3)}{(5 \times 2)} \]

\[ = \frac{9}{10} \]

Note that when dividing with mixed numbers, you should convert to improper fractions first before proceeding as above.
You may also need to perform division with fractions. To understand how to do this, recall that dividing by a whole number is the same as multiplying by a fraction with a numerator equal to 1 and denominator equal to the whole number (this is referred to as the reciprocal of the number).

For example, three fifths divided by six is equivalent to three fifths multiplied by one sixth, which can be evaluated by multiplying the 3 and 1 together to determine the numerator, and the 5 and 6 together to determine the denominator. This gives a numerator of 3 and a denominator of 30, which should then be simplified by dividing both the numerator and the denominator through by 3 to give a result of 1/10.

Similarly, dividing by a fraction with a certain numerator and denominator is the same as multiplying by a fraction with the numerator and denominator switched around (again this is referred to as the reciprocal, this time of the fraction).

For example, three fifths divided by two thirds is equivalent to three fifths multiplied by three over two, which can be evaluated by multiplying the 3 and 3 together to determine the numerator, and the 5 and 2 together to determine the denominator. This gives a numerator of 9 and a denominator of 10, and hence the final answer is nine tenths.

Note that when division involves mixed numbers, you should convert any mixed numbers to improper fractions first (as described previously) before proceeding as above.

**Examples: Dividing Fractions**

1. What is 6 ÷ 2/3?
   
   \[ \frac{6}{2/3} = 6 \times \frac{3}{2} = \frac{18}{2} = 9 \]

2. What is 5 ÷ 7/12?
   
   \[ \frac{5}{7/12} = 5 \times \frac{12}{7} = \frac{60}{7} = 8 \frac{4}{7} \]

3. What is 3/5 ÷ 4/7?
   
   \[ \frac{3}{5} \div \frac{4}{7} = \frac{3}{5} \times \frac{7}{4} = \frac{21}{20} = 1 \frac{1}{20} \]

Let’s work through some more examples involving dividing fractions.

Example one requires us to divide 6 by two thirds. To do this we swap the numerator and denominator of our fraction around, to give 3 over 2, and multiply this by 6 instead. Performing multiplication as we have done previously gives a result of 18/2, which we can then simplify to 9.
Example two requires us to divide 5 by seven twelfths. To do this we swap the numerator and denominator of our fraction around, to give 12 over 7, and multiply this by 5 instead. Performing multiplication as we have done previously gives a result of 60/7, which we can then convert to the mixed number 8 and four sevenths, again using the method described previously.

Example three requires us to divide three fifths by four sevenths. To do this we swap the numerator and denominator of our second fraction around, to give 7 over 4, and multiply this by three fifths instead. Performing multiplication as we have done previously gives a result of 21/20 which we can then convert to the mixed number 1 and one twentieth, again using the method described previously.

Activity 4: Practice Questions

Click on the Activity 4 link in the right-hand part of this screen.

Now have a go at dividing fractions on your own by working through some practice questions.

Equivalent Fractions

Two or more fractions are said to be equivalent if they are equal in value. For example, ½ and 2/4 are equivalent fractions:

Sometimes you may wish to determine an equivalent fraction when you are given the required new numerator or denominator- for example, if you wanted to convert an assignment mark of 63/90 to a mark out of 30. You can do this by following these steps:

1. If you are trying to find a denominator, then divide the numerator of your ‘incomplete’ fraction by the numerator of your ‘complete’ fraction. Alternatively, if you are trying to find a numerator then divide the denominator of your ‘incomplete’ fraction by the denominator of your ‘complete’ fraction.

For example, if you want to convert 4/10 to a fraction with a numerator of 52 then divide 52 by 4 to get 13.
2. If you are trying to find a denominator, then multiply the denominator of your ‘complete’ fraction by the value obtained previously. Alternatively, if you are trying to find a numerator then multiply the numerator of your ‘complete’ fraction by the value obtained previously.

For example, if you want to convert 4/10 to a fraction with a numerator of 52 then multiply the original denominator of 10 by 13 to get a new denominator, 130. Hence 4/10 as a fraction with a numerator of 52 is 52/130.

Two or more fractions are said to be equivalent if they are equal in value. For example, one half and two fourths are equivalent fractions. Another equivalent fraction for one half is four eighths, as demonstrated in our previous pizza example.

Sometimes you may wish to determine an equivalent fraction when you are given the required new numerator or denominator- for example, if you wanted to convert an assignment mark of 63 out of 90 to a mark out of 30 (that is, to a fraction with unknown numerator, and denominator of 30). You can do this by following two steps.

If you are trying to find a denominator, then the first step is to divide the numerator of your ‘incomplete’ fraction by the numerator of your ‘complete’ fraction. Alternatively, if you are trying to find a numerator then the first step is to divide the denominator of your ‘incomplete’ fraction by the denominator of your ‘complete fraction.

For example, if you want to convert four tenths to a fraction with a numerator of 52 then divide 52 by 4 to get 13.

If you are trying to find a denominator, then the second step is to multiply the denominator of your ‘complete’ fraction by the value obtained previously. Alternatively, if you are trying to find a numerator then the second step is to multiply the numerator of your ‘complete’ fraction by the value obtained previously.

For example, if you want to convert four tenths to a fraction with a numerator of 52 then multiply the original denominator of 10 by 13 to get a new denominator, 130. Hence four tenths as a fraction with a numerator of 52 is 52 over 130.

Examples: Equivalent Fractions

   Dividing 16 by 4 gives 4
   Multiplying 3 by 4 gives 12, so equivalent fraction is 12/16

2. Convert 1/5 to a fraction with a numerator of 3.
   Dividing 3 by 1 gives 3
   Multiplying 5 by 3 gives 15, so equivalent fraction is 3/15

3. If a student scores 18/40 on a test, but it only counts for 20 marks of her final grade, determine how many of the 20 marks she has earned.
   Dividing 20 by 40 gives 0.5
Multiplying 18 by 0.5 gives 9, so equivalent fraction is 9/20

Let’s work through some more examples involving finding equivalent fractions.

Example one requires us to convert three quarters to a fraction with a denominator of 16. To do this we divide 16 by 4 to give 4, and then multiply this by our original numerator of 3 to give a new numerator of 12 and hence an equivalent fraction of 12 over 16.

Example two requires us to convert one fifth to a fraction with a numerator of 3. To do this we divide 3 by 1 to give 3, and then multiply this by our original denominator of 5 to give a new denominator of 15 and hence an equivalent fraction of 3 over 15.

Example three requires us to convert 18 over 40 to a fraction with a denominator of 20. To do this we divide 20 by 40 to give 0.5, and then multiply this by our original numerator of 18 to give a new numerator of 9 and hence an equivalent fraction of 9 over 20.

Activity 5: Practice Questions

Click on the Activity 5 link in the right-hand part of this screen.

Now have a go at finding equivalent fractions on your own by working through some practice questions.

Adding or Subtracting Fractions with Like Denominators

When it comes to adding or subtracting fractions, there are two different types of problems we need to consider. The first is when the fractions have like denominators (i.e. the same denominators); when this is the case, adding or subtracting them is straightforward. You just add or subtract the numerators of the fractions, and keep the denominator of your answer the same as the original fractions.

For example: \(\frac{1}{5} + \frac{2}{5} = \frac{(1 + 2)}{5}\)

\[= \frac{3}{5}\]
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\[ \frac{3}{7} + \frac{2}{7} - \frac{1}{7} = \frac{3 + 2 - 1}{7} = \frac{4}{7} \]

Note that when adding or subtracting mixed numbers, you should add the whole number part of the mixed numbers together before adding the fractional parts together, and then simplifying if necessary.

When it comes to adding or subtracting fractions, there are two different types of problems we need to consider. The first is when the fractions have like denominators, that is, the same denominators. When this is the case adding or subtracting them is straightforward. You just add or subtract the numerators of the fractions, and keep the denominator of your answer the same as the original fractions.

For example when adding one fifth and two fifths, add one and two together to make three, which therefore gives an answer of three fifths.

Similarly, when adding three sevenths and two sevenths and subtracting one seventh, add three and two and subtract one to make four, which therefore gives an answer of four sevenths.

Note that when adding or subtracting mixed numbers, you should add the whole number part of the mixed numbers together before adding the fractional parts together, and then simplifying if necessary.

Adding or Subtracting Fractions with Unlike Denominators

Adding or subtracting fractions with unlike, or different, denominators requires a bit more work, as you need to convert the fractions to equivalent fractions with the same denominators first before you can add or subtract them. You can do this by following these steps:

1. Determine what the lowest common denominator of all the fractions in the problem is (i.e. the lowest number that all the denominators can divide into a whole number of times). If you can’t find the lowest common denominator you can always just use the product of the denominators, which is always a common denominator but may not be the lowest.

For example, if you want to evaluate \( \frac{1}{3} + \frac{1}{2} \) consider that the first two multiples of 3 are 3 and 6, while the first three multiples of 2 are 2, 4 and 6. Hence the lowest common
2. Convert each fraction in the problem to an equivalent fraction with a denominator as specified.

For example, if you want to evaluate $1/3 + 1/2$ then you need to convert both $1/3$ and $1/2$ to equivalent fractions with denominators of 6, which gives $2/6$ and $3/6$ respectively.

3. Once your fractions all have the same denominator, you can add or subtract them as usual. For example, if you want to evaluate $1/3 + 1/2$ then adding $2/6$ and $3/6$ gives $5/6$.

4. Simplify your result if necessary.

Adding or subtracting fractions with unlike, or different, denominators requires a bit more work, as you need to convert the fractions to equivalent fractions with the same denominators first before you can add or subtract them. You can do this by following four steps.

The first step is to determine what the lowest common denominator of all the fractions in the problem is (that is, the lowest number that all the denominators can divide into a whole number of times), by writing out lists of multiples for all the denominators if necessary. If you can’t find the lowest common denominator you can always just use the product of the denominators, which is always a common denominator but may not be the lowest. If it isn’t, it just means you will definitely need to simplify your fraction at the end of working. For example, if you want to evaluate one third plus one half consider that the first two multiples of 3 are 3 and 6, while the first three multiples of 2 are 2, 4 and 6. Hence the lowest common denominator of 3 and 2 is 6, which also happens to be the product of 3 and 2 in this case.

The second step requires you to convert each fraction in the problem to an equivalent fraction with a denominator as specified, using the method described previously for equivalent fractions. For example, if you want to evaluate one third plus one half then you need to convert both fractions to equivalent fractions with denominators of 6, which gives two sixths and three sixths respectively.

The third step requires you to add or subtract these new fractions with the same denominator, as described previously. For example, if you want to evaluate one third plus one half then you need to add two sixths and three sixths to give five sixths.

Examples: Adding or Subtracting Fractions

1. $3/8 + 4/8$
   $= (3 + 4)/8$
   $= 7/8$

2. $1/6 + 1/3$
   Lowest common denominator of two fractions is 6
   Equivalent fractions are $1/6$ and $2/6$ respectively
   $1/6 + 2/6 = (1 + 2)/6$
   $= 3/6$
   $= 1/2$
3. $\frac{1}{2} - \frac{4}{9} + \frac{5}{6}$
   
   Lowest common denominator of three fractions is 18.
   Equivalent fractions are $\frac{9}{18}$, $\frac{8}{18}$ and $\frac{15}{18}$ respectively.
   
   $\frac{9}{18} - \frac{8}{18} + \frac{15}{18} = \frac{(9 - 8 + 15)}{18}$
   
   $= \frac{16}{18}$
   
   $= \frac{8}{9}$

Let’s work through some more examples involving adding or subtracting fractions.

Example one requires us to add three eighths and four eighths, which simply requires adding the numerators of three and four together, to give a solution of seven eighths.

Example two requires us to add one sixth and one third, which first requires us to determine the lowest common denominator of the two fractions. In this case, since 3 divides into 6 a whole number of times the lowest common denominator is 6 itself. Therefore we only need to convert our second fraction to an equivalent fraction with a denominator of 6, which we do by doubling both the numerator and denominator to give two sixths. We can then add this to one sixth by adding the numerators of one and two together, to give a total of three sixths. Finally, we can simplify this fraction to give a solution of one half.

Example three requires us to subtract four ninths from one half and then to add five sixths, which first requires us to determine the lowest common denominator of the three fractions. In this case, the lowest common denominator is 18, which can be determined by writing out lists of early multiples of the three denominators if necessary. Therefore we need to convert each fraction to an equivalent fraction with a denominator of 18, which in the case of the first fraction gives 9 over 18, in the case of the second fraction gives 8 over 18, and in the case of the third gives 15 over 18. We can then evaluate the problem by subtracting 8 from 9 and adding 15, to give 16 over 18. Finally, we can simplify this fraction to give a solution of eight ninths.

Activity 6: Practice Questions

Click on the Activity 6 link in the right-hand part of this screen.

Now have a go at adding and subtracting fractions on your own by working through some practice questions.
Converting Decimal Numbers to Fractions

Sometimes you may wish to convert between fractions and decimal numbers. You can convert a decimal number to a fraction or mixed number by following these steps:

1. If your decimal number has a whole number part, then you are converting to a mixed number so write this down as the whole number part.

   For example, to convert 35.049 to a mixed number write down 35 as the whole number part.

2. Write down the fractional part of your decimal number as the numerator of your fraction.

   For example, to convert 35.049 to a mixed number write down 35 and numerator of 49.

3. Count how many digits there are after the decimal point in your decimal number, and then put a 1 followed by that many zeroes as the denominator of your fraction.

   For example, to convert 35.049 to a mixed number write down 35 and 49 over 1000.

4. If necessary, simplify the fractional part of your mixed number.

Converting Fractions to Decimal Numbers

You can convert a fraction or mixed number to a decimal number by following these steps:

1. If you are converting from a mixed number, write down the whole number part of the mixed number and insert a decimal point after it.
For example, to convert $1 \frac{2}{3}$ to a decimal number write down 1.

2. Divide the numerator of your fraction by the denominator. If your number was a mixed number, put whatever is after the decimal point in the result after your decimal point. Otherwise, just write down the result.

For example, to convert $1 \frac{2}{3}$ to a decimal number write down $1.666\ldots$

3. If necessary, round your decimal number as appropriate.

For example, converting $1 \frac{2}{3}$ to a decimal number rounded to two decimal places gives 1.67

You can convert a fraction or mixed number to a decimal number by following three steps.

The first step applies only if you are converting from a mixed number. If this is the case, you should write down the whole number part of the mixed number and insert a decimal point after it. For example, to convert 1 and two thirds to a decimal number you would write down 1.

The second step requires you to divide the numerator of your fraction by the denominator. If your number was a mixed number, put whatever is after the decimal point in the result after your decimal point. Otherwise, just write down the result. For example, to convert 1 and two thirds to a decimal number write down $1.66\text{ recurring}$.

The third and final step requires you to round your decimal number as appropriate. For example, to convert 1 and two thirds to a decimal number rounded to two decimal places gives 1.67.

**Examples: Converting between Fractions and Decimal Numbers**

1. Rewrite $0.35$ as a fraction in simplest form
   
   $= \frac{35}{100}$
   
   $= \frac{7}{20}$

2. Rewrite $52.27$ as a mixed number in simplest form
   
   $= 52 \frac{27}{100}$

3. Convert $2 \frac{3}{8}$ to a decimal number
   
   $= 2.375$

Let’s work through some more examples involving converting between fractions and decimal numbers.

Example one requires us to convert $0.35$ to a fraction in simplest form. Do this by writing 35 as the numerator of the fraction, with a denominator of 100. Then simplify this fraction by dividing through both the numerator and the denominator by 5 to give seven over twenty.
Example two requires us to convert 52.27 to a fraction in simplest form. Do this by writing 52 as the whole number part of the mixed number, with a fractional part of 27 over 100.

Example three requires us to convert 2 3/8 to a decimal number. Do this by dividing 3 by 8 to give 0.375, and hence a decimal equivalent of 2.375.

Activity 7: Practice Questions

Click on the Activity 7 link in the right-hand part of this screen.

Now have a go at converting between fractions and decimal numbers on your own by working through some practice questions.

End of Topic

Congratulations, you have completed this topic.

You should now have a better understanding of Fractions.