

## Finding a Common Denominator

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**Summary:** Learn how to find a common denominator between two fractions.

**Learning Objectives:** To define lowest common denominator. To find the common denominator when given two fractions.

This handout will teach you to find a common denominator among two fractions. The prerequisite knowledge assumed for this handout is that you must be able to work with basic fractions (know what a fraction is, how to write them, what they mean, what a numerator and denominator are, etc) and that you must be able to multiply and divide. Not even addition or subtraction is required to find a common denominator!



**A common denominator is a number which all denominators (of the fractions we're finding common denominators for) can divide into evenly.** For example, 12 is a common denominator of  $\frac{1}{4}$  and  $\frac{1}{6}$  because 6 and 4 both divide into 12 evenly. It's important that the numbers divide into 12 **evenly**—a common denominator must be a whole number.

It should be noted that an infinite number of common denominators exist for all sets of fractions (for instance, 24 is also a common denominator of  $\frac{1}{4}$  and  $\frac{1}{6}$  because both denominators will divide into 24). How, then, should we decide which one to use? We simply use the smallest one, or the **lowest common denominator**. In fact, throughout this handout, when you see the words "common denominator," just remember that, in fact, "**lowest common denominator**" is what we mean.

**Why might you need to find a common denominator?** Common reasons can be to add or subtract the two fractions, or to combine two fractions into one so that they can be simplified, but many reasons exist. The reasons for finding a common denominator are beyond the scope of this handout, but the important thing to know is that you don't find common denominators without good reason to. For the purposes of this handout, the reason will be "because that is what the instructions in the problem require." And this may also be the case with your homework, in fact!

There are three primary strategies for finding a common denominator: first, the lowest common denominator may be one of the denominators already. Second, you can find the multiples, or third, you can multiply the denominators. Let's explore each of those strategies individually.



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### Ask, do the denominators divide evenly into each other?

The common denominator may actually be one of the denominators of the fractions. If this is the case, then **the smaller denominator(s) will divide evenly into the largest denominator.**

For example, the common denominator of  $\frac{1}{2}$  and  $\frac{1}{4}$  is 4. You can tell that this is the case because 2 divides into 4 evenly ( $4/2=2$ ).

If the smallest denominator did not divide evenly into the largest, then you would have to use a different strategy. For example, the common denominator of  $\frac{1}{6}$  and  $\frac{1}{8}$  must use the next strategy (finding the multiples). This is because 6 won't divide into 8 evenly ( $8/6 = 1.3$  repeating, which is not a whole number).

### Find the Multiples of Each Denominator.

The second method works in all cases without variables. **To find the multiples, simply write multiples of each denominator in order. The first time they share a multiple, that multiple is your common denominator.**

For example, we can do this with  $\frac{1}{6}$  and  $\frac{1}{8}$ . Simply write down the 6 and the 8 in two columns, the 6 on the left column, and the 8 on the right column, and add 6 to the left column a few times, and add 8 to the right column a few times.

To use this method, enough numbers must be listed in the table for them to share a value in their respective columns.

1	6	8
2	12	16
3	18	24
4	24	32
5	30	40
6	36	48
7	42	56
8	48	64

From this table, we can see that 6 and 8 both share a 24 as their least common multiple. As such, this is the common denominator. Also notice the two highlighted numbers. 48 is also a common denominator of 6 and 8. However, it is not the *least* common denominator. The next method (multiplying the two denominators) discusses this more in detail.

### Multiply the Two Denominators

**Multiplying the two denominators will *always* give you a common denominator.**

In the previous example,  $8*6=48$  (notice the 48s are highlighted in the table with blue). As such, 48 is a common denominator of 8 and 6. However, as in this example, multiplying the two denominators will *not* always give you the *lowest* common denominator.

You can always try to divide this number in half (possibly several times) to try to get the lowest common denominator. However, there is no guarantee that you will get the lowest common denominator using this method. In the previous example, this works.  $6*8=48$ . Divide that by 2, and we get our lowest



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common denominator of 24. As stated previously, though, this will *not* always be the case. When it is not the case, you have two options.

**Option 1: Use the non-lowest common denominator.**

To use this option, you simply work the problem with the common denominator you found by multiplying the denominators and reduce the resultant fraction at the end of the problem. This typically results in larger numbers, sometimes to the point of needing a calculator.

**Option 2: Use a different method.**

If multiplying the denominators doesn't give you the lowest common denominator and a non-lowest common denominator simply will not do, then you'll need to use a different method, such as finding the multiples.

**Exercises**

Now, you try a few! Find the lowest common denominator in each of the following:

- 1)  $\frac{1}{4}$  and  $\frac{3}{8}$
- 2)  $\frac{1}{6}$  and  $\frac{2}{9}$
- 3)  $\frac{1}{4}$  and  $\frac{1}{6}$
- 4)  $\frac{1}{3}$  and  $\frac{4}{9}$
- 5)  $\frac{1}{6}$  and  $\frac{12}{18}$

**Multiple Fractions**

These same principles can be extended to three or more fractions. Doing this is a bit different for each of the three methods.

For the first method (where one of the denominators is the lowest common denominator), the method is the same except that the denominator must be the highest denominator of the fractions, and all of the other denominators must divide evenly into it.

For the finding the multiples method, simply make a column for each denominator and find a multiple that's common among all of the fractions.

For the multiplying the denominators method, two or more of the fractions multiplied together are potential candidates. However, make sure to check your answer either mentally or with the finding the multiples method before accepting it as the lowest common denominator.

Now, let's try some!

- 1)  $\frac{1}{4}$ ,  $\frac{1}{6}$  and  $\frac{1}{8}$
- 2)  $\frac{1}{6}$ ,  $\frac{1}{9}$  and  $\frac{1}{12}$
- 3)  $\frac{1}{4}$ ,  $\frac{1}{6}$  and  $\frac{1}{8}$
- 4)  $\frac{1}{3}$ ,  $\frac{1}{6}$  and  $\frac{1}{9}$
- 5)  $\frac{1}{6}$ ,  $\frac{1}{9}$  and  $\frac{1}{6}$



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## **Answer Key**

### Two Fractions

- 1) 42
- 2) 4
- 3) 56
- 4) 36
- 5) 104

### Multiple Fractions

- 1) 168
- 2) 90
- 3) 60
- 4) 840
- 5) 504



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