



Adding & Subtracting Rational Numbers

After watching this video lesson, you will be able to add and subtract rational numbers like a pro. Learn what is involved in adding and subtracting these types of numbers.

Rational Numbers

Samantha makes and sells pies from her bakery. She gets tons of orders every day. When she gets these orders, she has to know how much pie to slice up. She actually has to use what she learned in math in order to give people the right order. See, when she gets her orders, she actually has to add or subtract some rational numbers.

Rational numbers are the numbers that can be written as the fraction of two integers. For example, $\frac{1}{2}$ is a rational number and so is 4 because it can be rewritten as $\frac{4}{1}$. All of these numbers are made up of two integers: one in the numerator and the other in the denominator. Here are some examples of the types of orders that Samantha gets:

- Derrek wants $\frac{1}{8} + \frac{1}{4}$ of a pie
- Sue wants $\frac{3}{8} + \frac{1}{2}$ of a pie
- Jim wants $\frac{7}{8} - \frac{3}{8}$ of a pie
- Luke wants $\frac{3}{2} - \frac{1}{2}$ of a pie

So, Samantha's job requires her to add and subtract these rational numbers to figure out how much pie to cut for her customers. Let's see how Samantha handles each order.

Adding Rational Numbers

For her first two orders, Samantha needs to add her rational numbers together. To do this, Samantha first finds a common denominator. The common denominator is the least common multiple of the denominators. So, for her first order of $1/8 + 1/4$ of a pie, Samantha finds the least common multiple between 8 and 4. Looking at these two numbers and knowing the multiples of each, Samantha sees that 8 is the least common multiple because 4 can be multiplied by 2 to get 8.

Now that Samantha has found her common denominator, she now needs to change her rational numbers so that they both have the same denominator. The $1/8$ already has 8 as the denominator, so it doesn't have to change. The $1/4$ needs to be changed. To make this change, Samantha multiplies both the numerator and the denominator by the number that will turn the denominator into the common denominator. In this case, it is 2. So Samantha multiplies the numerator by 2 and the denominator by 2. She gets $2/8$ for her new number. Her addition problem now is $1/8 + 2/8$.

Now that the denominators are the same, Samantha can now go ahead and simply add the numerators together. Adding the numerators, she gets $1 + 2 = 3$. Her answer is the sum over the common denominator: $3/8$. Because this fraction is already as simplified as it can get, Samantha has found her answer. She needs to cut $3/8$ of a pie for this order.

Example

Let's look at Samantha's second order, the $3/8 + 1/2$. See if you can help Samantha out with this one.

What do you need to do first? Yes, find a common denominator. Your denominators are 8 and 2. What is the least common multiple between these two numbers? It is 8 because you can multiply the 2 by 4 to get 8.

Now what do you need to do? Change the rational numbers so that they both have the same common denominator. The $3/8$ already has the 8 as the denominator so it doesn't need to be changed. The $1/2$ needs to be changed. What do you need to multiply the denominator by to change it to the common denominator? 4. So you also need to multiply the numerator by this number. So you have $(1 * 4) / (2 * 4)$, which gives you $4/8$. Now you can go ahead and add $3/8 + 4/8$.

Do you remember what you should be adding once you have your common denominator? Yes, just the numerator part. So you add $3 + 4$. This gives you 7 so your answer is $7/8$. It is already simplified, so $7/8$ is your final answer. You tell Samantha that she needs to cut $7/8$ of a pie for this order.

Subtracting Rational Numbers

Samantha's third order requires her to subtract $7/8 - 3/8$. Let's see what she does. She begins like before by finding a common denominator and then changing her numbers so that they both have the same common denominator. Looking at her problem, though, she sees that for this order, both numbers already have the same common denominator. So, all she needs to do now is to subtract the numerators from each other. $7 - 3$ gives Samantha a 4. So her initial answer is $4/8$.

This is not Samantha's final answer, though, because she can simplify $4/8$ into a simpler rational number. How is this? Because looking at the numbers, Samantha sees that she can divide both numbers by 4. If you can divide both the numerator and the denominator by a common number, then you can simplify your answer further. So, dividing the numerator by 4 and the denominator by 4, Samantha gets $1/2$. She can't simplify this further, so this is her final answer. She needs $1/2$ of a pie for this order.

When we are just subtracting random rational numbers together, it is possible to get a negative answer. For example, if we were to subtract $3/8 - 7/8$, we would get $-4/8$. This simplifies to $-1/2$. Of course, for Samantha, this wouldn't make sense. She can't give someone minus half a pie. But for math problems, this is perfectly acceptable.

Final Example

Samantha's fourth order is also a subtraction problem: $3/2 - 1/2$. See if you can help Samantha one last time.

You look at this problem and you see that both numbers already share a common denominator. So you don't need to find a common denominator. You can go ahead and subtract the numerators from each other. You subtract $3 - 1$. It gives you 2. Your initial answer is $2/2$. Can you simplify this answer further?

Yes, you can since you can divide both the numerator and denominator by 2. Doing this gives you $1/1$, which simplifies to 1. You tell Samantha that for this fourth order, she doesn't need to cut at all; the customer simply wants 1 whole pie.

Lesson Summary

What did we learn? **Rational numbers** are the numbers that can be written as the fraction of two integers. To add or subtract these rational numbers, you first need to change your rational numbers so that they share a common denominator. Once you have a common denominator, you can then go ahead with the addition or subtraction of just the numerator part. Your answer, then, is the added or subtracted numerator part over the common denominator.

Learning Outcome

After you have finished, you should be able to add or subtract rational numbers by finding the common denominator.