



Multiplying & Dividing Rational Numbers

After watching this video lesson, you will know how to multiply and divide rational numbers. You will know when you need to flip your number and when you don't.

Rational Numbers

Sam works for this research company that gathers data for other companies for them to use. Part of Sam's job is to look at the numbers and then make certain calculations to give to the other companies so that they will better understand the information. The kinds of numbers that Sam sees for his job are called **rational numbers**. These are numbers that can be written as the fraction of two integers.

So, all simple fractions are rational numbers as are all integers because we can simply rewrite an integer as that number over 1. For example, $\frac{3}{8}$ is a rational number as is the number 25 because it can be rewritten as $\frac{25}{1}$. The proper form for any rational number is in fraction form. Unlike regular fractions where you want your bottom number to be larger than the top number, it is perfectly okay for the top number in a rational number to be larger than the bottom. So we can have rational numbers such as $\frac{8}{7}$ and even $\frac{50}{3}$.

Multiplying

One of the calculations that Sam needs to make with his rational numbers is that of multiplying them together. Looking down at his papers, Sam sees $\frac{2}{3} \times \frac{17}{3}$ as one of his problems. How will he solve this problem?

Sam remembers from a long time ago when he was in school that to multiply two rational numbers together, all he has to do is multiply the tops together and the bottoms together and he will get his answer. Sometimes, he'll need to simplify his answer, too.

So multiplying the tops of his problem, he gets:

$$2 \times 17 = 34$$

Multiplying the bottoms. He gets:

$$3 \times 3 = 9$$

Putting it together, he gets $34/9$ for his answer.

Can this be simplified? No. So $34/9$ is his answer. Sam can leave his answer in this form even though the top number is larger than the bottom number because he is working with rational numbers.

Dividing

The other type of calculation that Sam needs to make is that of dividing rational numbers. The next problem that Sam sees on his paper is this:

How does Sam solve this problem now? Sam remembers that to divide rational numbers, he can actually turn this problem into a multiplication problem by flipping the second rational number.

So $7/8$ becomes $8/7$ and the division symbol turns into a multiplication symbol.

$$\frac{5}{6} \div \frac{7}{8}$$

$$\frac{5}{6} \times \frac{8}{7}$$

Before Sam goes ahead with his multiplication, he sees that he can actually simplify his problem a little bit. This is just like any other multiplication problem now, so if Sam can simplify his problem before going ahead with the multiplication, it will be

easier for him to solve it.

Sam sees that he has an 8 on the top and a 6 on the bottom that he can simplify. Because this is a multiplication problem, Sam is able to take any number on the top and simplify it with any number on the bottom. It doesn't have to be in the same fraction. He can simplify these numbers by dividing both by 2. Remember that to simplify, you need to be able to divide both numbers by the same number. The 8 divided by 2 turns into a 4 and the 6 divided by a 2 turns into a 3.

So now the problem becomes

$$5/3 \times 4/7$$

And Sam can go ahead with the multiplication of the tops and bottoms together. He gets:

$$5 \cdot 4 = 20$$

$$3 \cdot 7 = 21$$

Combining these two numbers, Sam gets an answer of:

$$20/21$$

This answer is already as simplified as it can get, so 20/21 is the answer that Sam will be giving to his customer.

Examples

Sam has two more problems to go. See if you can help him with these next two problems.

$$11/12 \cdot 4/3$$

Looking at this multiplication problem, you see that you can either go ahead with the multiplication or simplify first. You can simplify the number 4 on top with the number 12 on the bottom. Both can be divided by 4. The 4 divided by 4 becomes 1 and the 12 divided by 4 becomes 3. The problem becomes:

$$11/3 \cdot 1/3$$

Multiplying the tops and bottoms now gives you 11/9. You can't simplify this further, so this is the answer.

This next problem is a division problem. You remember that you can turn this division problem into a multiplication problem by flipping the second rational number.

$$\frac{5}{6} \div \frac{13}{3}$$

$$\frac{5}{6} \cdot \frac{3}{13}$$

You see that you can simplify the 3 on the top with the 6 on the bottom. You can divide both numbers by 3. 3 divided by 3 is 1, and 6 divided by 3 is 2. The problem becomes:

$$5/2 \cdot 1/13$$

Performing the multiplication gives you 5/26. You can't simplify this any further, so you pass on this answer along with the answer from the other problem to Sam. Sam thanks you for helping his job go a bit faster today.

Lesson Summary

Let's review what we've learned. **Rational numbers** are numbers that can be written as the fraction of two integers. To multiply rational numbers together, you multiply the tops and bottoms separately to get your answer. If you can simplify your problem before you multiply, your problem will be easier to solve. To divide rational numbers, you turn the division problem into a multiplication problem by flipping the second rational number. Then you go ahead and multiply the tops and bottoms together to get your answer. If you can simplify your problem before multiplication, you can go ahead and do so to make your problem easier.

Learning Outcome

After you have finished reviewing this lesson, you should be able to solve a multiplication or division problem with rational numbers.