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Dividing Integers: Rules & Terminology

In this lesson, we will learn how to divide integers or signed numbers. Determining the correct sign of the answer is a very simple but important step in these calculations. We will also learn the role of zero in division of integers.

Mathematics Terminology

Before we get into dividing integers, there are a few rules and terms you should keep in mind. The first rule is that every number except zero is either negative or positive. If no sign is shown, then we know the number must be positive.

It will also be helpful to recall that the answer to a division problem is called a **quotient**. For example, in the problem 21 / 7 = 3, the number 3 is called the quotient.

Finally, the number in the top of a fraction is called the **numerator**, and the number in the bottom of a fraction is called the **denominator**. In the fraction 21/3, 21 is the numerator and 3 is the denominator.

Dividing Two Numbers with the Same Sign

We are now ready to consider our first problem with division of signed numbers. What is 15 / 3? Although this is arithmetic, it is also a signed number problem. Since no sign is shown for either number, this means both are positive. The answer is 5 or +5. This brings us to the first rule for dividing integers:

The quotient of two positive numbers is a positive number.

In signed numbers, we may also find that both numbers in a division problem are negative. What is - 15 / -3? The answer is also 5 or +5. You may wonder why. Here is one way to think about it. Every division problem can also be expressed as a multiplication problem. For example, 2 x 3 = 6 could be written as the division problem 6 / 3 = 2. The rule for multiplying signed numbers tells us that 5 x -3 = -15. One way to write this as a division problem is -15 / -3 = 5, which is the same as the example of -15 / -3.

This example demonstrates the second rule for dividing two numbers with the same sign:

The quotient of two negative numbers is a positive number.

Notice in both of these cases, the only difference from an arithmetic problem is that we had to consider the sign of the answer. This is true any time you divide signed numbers.

Finally, we can sum up the two rules for dividing numbers with the same sign with a single, simple rule:

The quotient of two numbers with the same sign is a positive number.

Dividing Two Numbers with Different Signs

A problem like -15 / 5 is an example of a division problem with different signs. The rule is very simple:

The quotient of two numbers with different signs is a negative number.

Using the above rule, we see that -15 / 5 = -3. What about 15 / -5? Even though the negative sign is in the denominator instead of the numerator, the numbers still have different signs. Using the same rule, 15 / -5 = -3. If you again wonder why, let's revisit the multiplication problem 5 x -3 = -15. Notice that 5 x -3 = -15 can also be written as the division problem -15 / 5 = -3. These examples show that when we calculate with signed numbers, we are still using the same rules we use in arithmetic.

Suppose we are given the problem -18 / -4. This quotient is not a whole number. Since the numbers are both negative, the sign of the quotient is positive. The answer is the fraction 9/2.

A slightly trickier problem is -18 / 4. We know from the rule that the answer is negative, but where should the negative sign go in the simplified fraction? Should the negative sign be in the numerator or denominator? The answer is it does not matter. If either the numerator or denominator is negative, then the fraction is negative. The correct answer could be given as -9/2 or 9/-2. In fact, there is actually a third way to express this fraction. The rule is as follows:

For numbers x and y, (-x / y) = (x / -y) = -(x / y)

This means that for the problem -18/4, a correct answer would be (- 9/2) or (9/-2) or -(9/2).

Zero in Division of Integers

Since zero has no sign, it has no effect on the sign of the quotient. However, there are important rules to remember whenever zero is in a fraction.

If the numerator is zero, the fraction is equal to zero.

This rule applies for any denominator except zero. If the denominator is zero, we apply the next rule.

*If the denominator is zero, the fraction is **undefined**.*

Some examples of these rules are as follows:

- 0 / 5 = 0
- 0 / -5 = 0
- -5 / 0 is undefined
- 2 / 0 is undefined

Sometimes students want to call 'undefined' the same as equal to zero, but this is not correct. 'Undefined' is a term that refers only to a fraction with a zero denominator.

Lesson Summary

There are simple but important rules to use when dividing signed numbers.

- If the signs of the numbers are the same, the quotient is positive.
- If the signs of the numbers are different, the quotient is negative.
- If the numerator is zero, the fraction is equal to zero.
- If the denominator is zero, the fraction is undefined.

Learning Outcomes

After you've reviewed this video lesson, you will be able to:

- Define quotient, numerator and denominator
- Explain the rules for dividing signed numbers
- Identify the two rules regarding zero in the division of integers