Representing Numbers as Points on a Number Line

Transcript

Instructor: Iain Pardoe

00:00:00:00 - 00:00:44:42
Instructor: Hello, and welcome to video number two in this series. In this video, I'm going to be reviewing the number line and thinking about numbers as points along a number line. That's going to help us with thinking about arithmetic properties that involve zero and negative numbers, inequalities and distances. Here we have a real number line with zero and then negative numbers over here. And positive numbers on the other side, and I can mark off integers, for example, minus three and plus three.

00:00:44:42 - 00:01:24:51
Instructor: I can mark off rational numbers, say like minus a half and one third, so let's mark off some other integers here too, so one and two. Then on the negative side, we got minus one here and minus two here. Then I can also put irrational numbers on here. For example, if I go to about here, that's where root two would be. Because it's 1.14 and a whole bunch of other decimals.

00:01:24:51 - 00:02:19:84
Instructor: Pi is 3.14 and then a bunch more decimals, that's going to be about here. In general, if I have a point, say, it's labeled A, then there is a real number associated with that point, lowercase A, and that represents the distance between the point A and zero, which is referred to as the origin. So if I have another point here, B, then lowercase B would be the distance between the point B and the origin. Now that we can think about numbers along a number line and we have positive numbers to the right of the origin and negative numbers to the left of the origin, it becomes easier to think about sign rules.

00:02:20:89 - 00:03:11:89
Instructor: So if I multiply two numbers together, A times B, then A could be negative or positive and B could be negative or positive. If I multiply two negative numbers together, then I get a positive number or if I multiply two positive numbers together, I get a positive number. Whereas if A is positive and B is negative, I'll get a negative result if A is negative

and B is positive, again, I'll get a negative result. And we have a similar situation with quotients. A divided by B, again, A can be negative or positive.

00:03:11:89 - 00:03:46:65
Instructor: B can be negative or positive. If I divide A by B and they're both negative or they're both positive, I get a positive result. If A is positive and B is negative, I get a negative quotient and if A is negative and B is positive, I get a negative quotient. Next, let's think about some properties of negative numbers. So if I have a number A and I multiply it by minus one, then I'll get the negative of that number A.

00:03:46:65 - 00:04:45:41
Instructor: For example, if I start with the number three and I multiply it by minus one, then I get minus three. If I start with a negative number minus A, and then I take the negative of that, then I get A back again. For example, if I start with minus three and I take the negative of that, then I'll get plus three. If I have a number A, and I multiply it by a number minus B, then that's going to be the same as if I have minus A times B. Either way, the answer will be equal to the negative of the product of A and B.

00:04:45:57 - 00:05:54:09
Instructor: But if I have minus A and I multiply it by minus B, then I end up with a positive result, which is going to be the product of A and B. For example, if I have A is three and B is four, and I want to multiply three times the negative of B, three times minus four, that would be the same as if I have the negative of A, which is minus three times the positive of B, which is four and either way it's -12. But if I have the negative of A, minus three and the negative of B and multiply those two numbers together, then I'll end up with a positive answer. I'll end up with plus 12. Next, let's think about some properties of zero.

00:05:54:09 - 00:07:01:46
Instructor: If I have a number A and I multiply it by zero, then I'll just get zero. Next, if I have two numbers multiplied together and the product is zero, then either A is zero or B is zero or they're both zero. This is called the zero factor theorem, and it looks fairly innocuous, but it comes up a lot when solving equations. Another property that comes up a lot when solving equations is I want to subtract B from A, A minus B, one way to do that calculation is to add the negative of B. We've turned a subtraction problem into an addition problem.

00:07:01:46 - 00:08:04:23
Instructor: Again, this looks a little bit innocuous too, but it does come up when we're trying to solve equations. Just as a quick example, if I had three minus four, one way to solve that is to take three and add minus four. Then we can think about it in terms of the number line. We're starting at three and then we're adding minus four, so we're ending up on the other side of the number line again, we're ending up at minus one. Or another quick example, if I want to subtract minus four from three, then one way to do that is to add the negative of minus four and the negative of minus four is plus four, that's going to be the same as adding three and four, and we'll end up with seven.

00:08:04:23 - 00:08:55:63
Instructor: Next, let's think about inequalities and we'll start with strict inequalities. A is greater than B if A minus B is positive, so again, linking back to the idea of the number line, and A is less than B. If A minus B is negative. For example, if I'm trying to compare three and four. I want to figure out whether we have a greater than sine here or a less sign.

00:08:55:63 - 00:09:30:05
Instructor: Again, it might be fairly obvious that we want to build a less than sign here, but let's apply the definition here. A minus B will be three minus four, that's minus one, it's negative, So A must be 3 must be less than four. What about three minus four. Do we have a less than sign here or a greater than sign here? Again, we'll apply the definition.

00:09:30:05 - 00:09:53:83
Instructor: We'll do three minus minus four. That's this example here. We got a positive result. A minus B is positive, so a must be greater than B, we must have a greater than sign here. It's quite easy when you're using inequalities to get things backwards.

00:09:53:83 - 00:10:50:25
Instructor: But if you think about it in these terms, think of these as definitions for these inequalities, then it's harder for you to go astray and get things backwards. These are strict inequalities. There's also non strict inequalities. So if we had a greater than or equal to B, that means either A is greater than B or A is equal to B and then similarly, a less than or equal to B, either A is less than B or A equals B. Finally, for this video, absolute values.

00:10:50:25 - 00:11:45:54
Instructor: The absolute value of a number A is defined as A if A is greater than zero or minus A, if A is less than zero. So for example, absolute value of three is three, absolute value of minus four is four. Absolute values are always positive. We could think of them as the magnitude of a number with no regard to the sign. Whether we're on the positive side of the number line or the negative side of the number line, the absolute value just tells you how far away from the origin you are.

00:11:45:70 - 00:12:28:13
Instructor: That leads us to thinking about distances. The distance between two points A and B, is the absolute value of the difference between A and B. And it doesn't matter which way round you do the subtraction. It's the same as the absolute value of B minus A. For example, we could have the distance between the numbers three and four.

00:12:28:37 - 00:13:20:87
Instructor: As a second example, we could have the distance between the numbers three and minus four. Just take a moment, pause the video and apply the definition of distances in terms of absolute values to calculate what these two distances are. So for the distance 3-4, we are applying the definition there, it's the absolute value of three minus four, the absolute value of minus one, so one, and then the distance between three and minus four. Applying the definition again, three minus minus four. I have three.

00:13:20:87 - 00:13:52:37
Instructor: We did this example up here, three minus minus four was seven. It's the absolute value of seven and that's seven. We can think about that in terms of the number line. The distance between 3 and 4 on the number line is going to be one and the distance between three and minus four, which will be over here is seven. That's all for this video.

00:13:52:37 - 00:14:02:31
Instructor: In the next video, I'm going to switch gears a little bit and start thinking about fractions and in particular, reducing fractions to their lowest terms.