

Hi everyone, welcome to Vector Math 2 in which we will further review some vector math.

So, we've discussed that the variables we're going to work with in fluid mechanics can be divided into scalars and vectors, and many mathematical operations that involve vectors proceed differently from how we would treat scalars. So, let's say that I have a fluid flow and I have an acceleration, which could potentially have X, Y, and Z components. And so, I would write my acceleration vector with its magnitude in x, my i unit vector, my magnitude of acceleration in y multiplied by my j unit vector, plus my acceleration in z multiplied by my k unit vector. And so, let's say that my particular acceleration had a magnitude where a x was equal to 2, the magnitude of acceleration in y is equal to 0, and magnitude of acceleration in z is equal to 4. So if I want to draw what that looks like on my coordinate axes I would have you know, my acceleration along my X-axis and then a larger component of acceleration along my Z-axis something like this, and then the two of them together would be my acceleration vector. And so, let's say that I want to know the magnitude of acceleration, a . If these were scalars then I could just add 2 plus 0 plus 4 equals magnitude of 6. But these are vectors, and I have these i, j, k components and so I need to add the vector components using vector math. So my acceleration magnitude is going to be defined as the square of my X magnitude plus the square of my magnitude of the Y component of acceleration plus the square of the magnitude of the Z component, and this entire quantity is going to be raised to the one half power like that. So, I'll substitute in my magnitude of acceleration in X plus my zero magnitude acceleration in y plus my magnitude of acceleration in z, and so I've got a magnitude of acceleration that is 2 times the square root of 5 when I add as vectors.

So now I know the magnitude of acceleration, but I don't know its direction so this time I'm going to draw my components in X like this, here's my X component of acceleration, and then I'm going to draw my Z component over here like this, and then here is my acceleration vector. And so, the angle that my acceleration vector makes with respect to the horizontal I'm going to give this the angle θ . And so if I want to find the specific direction of acceleration the tangent of that angle θ that uh my acceleration vector makes with the horizontal is going to be equal to my Z divided by my X component like that, and so my angle θ is going to be my inverse tangent of my a_z over a_x . So, if you'll remember my Z-component of acceleration was 4, X-component was 2 so I have an angle θ that has a value of about 63.43 degrees. So now I can specify my magnitude of acceleration. It was 2 times the square root of 5 and I can specify its direction as 63 degrees with respect to the horizontal.

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Congratulations for making it to the end of the video. Please reward yourself with a moment of Zen. I study fluid mechanics because I love water and aquatic ecosystems. So, whatever your passion is, I hope that it motivates you to continue your study of fluid mechanics. Thank you.