IIT Madras

ONLINE DEGREE

Mathematics for Data Science 2

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Week-6 Tutorial 05

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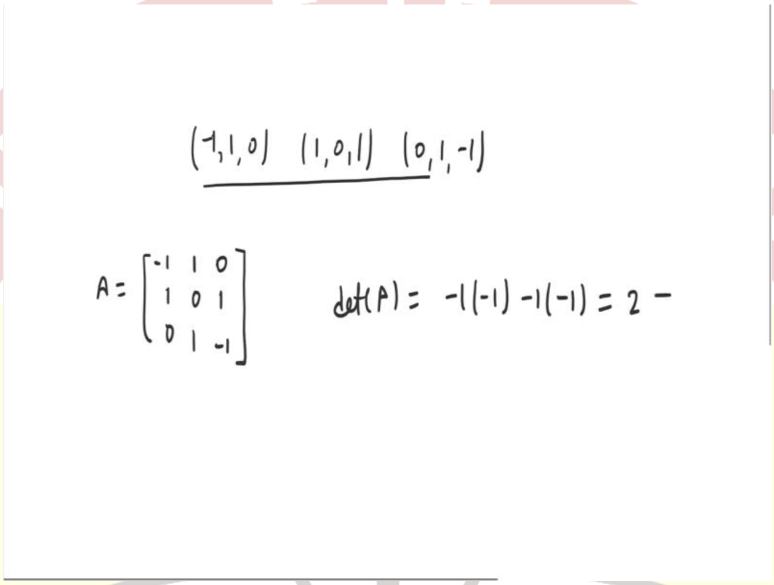

Hello friends. In this video we will talk about the linearly independent vectors. We know though, we know that $\mathbb{R}^3$ represent a vector space. So, let us take three vectors (-1, 1, 0), the second vector is (1, 0, 1) and third vector is (0, 1, -1). So, we know that how to check these three vectors are linearly independent. So, let us form a matrix using these vectors. So, let

$$A = \begin{bmatrix} -1 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & -1 \end{bmatrix}.$$

So, to check the linearly independence, we need to calculate the determinant, so determinant of this matrix A will be $\det(A) = -1(-1) - 1(-1) = 2 \neq 0$, that means these vectors are linearly independent.

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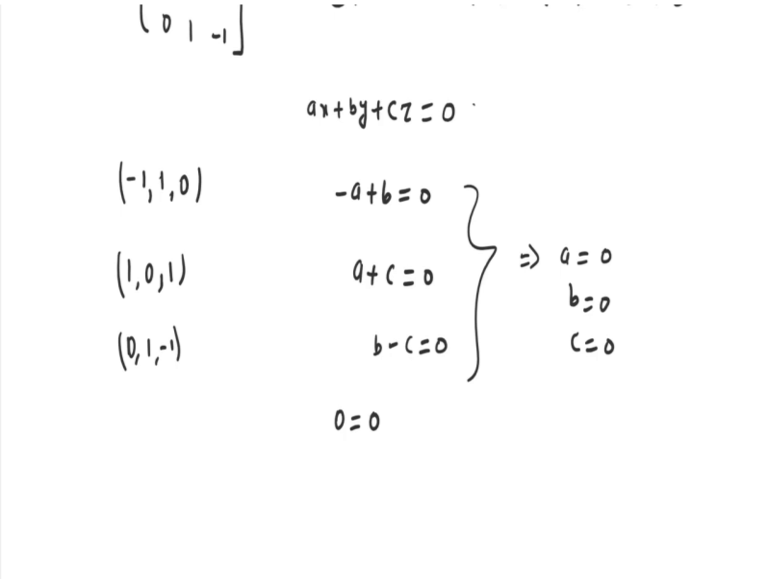

Now, let us see it geometrically. So, before to go to geometrically in GeoGebra, let us check is there a plane which passes through these three vectors. So, assume, let us assume a plane which is $ax + by + cz = 0$, which passes through these three vectors.

Now, this plane is passes through these three vectors that means, this vector (-1, 1, 0) will satisfy this equation that means we got the equation $-a + b = 0$. Similarly, for this second vector of (1, 0, 1) we got the equation $a + c = 0$ and for the third vector (1, 0, -1). If you will substitute these values you will get $b - c = 0$.

If we solve these three equations we will get $a = 0, b = 0, c = 0$ that means, if we substitute this value, we will get $0 = 0$ that means there is no plane which passes through these three vector. Similarly, we can prove that there is no line which passes through these three vectors.

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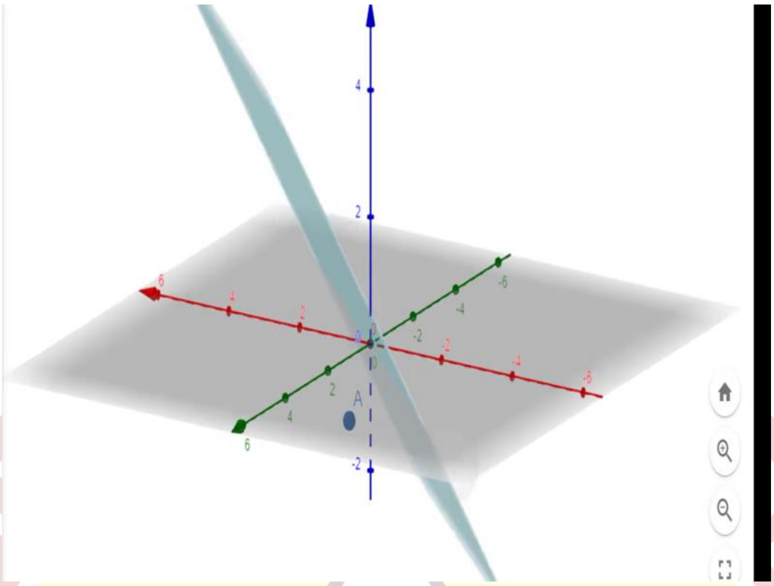

Now, let us come to in GeoGebra. So, assume there is a plane which passes through the vector minus (1, 1, 0) and vector (1, 0, 1). So, the plane is $x + y = z$, so which is this plane and now the third vector is (0, 1, -1). So, this is the vector A= (-0, 1, -1). So, we can see that this vector does not lie in the plane.

So, this is the mean that these three vectors are linearly independent also, in geometrically we can see. Similarly, we can find a plane using another two vector from these three vectors and we can see that the vector which is not lie, which is different from these two vector will does not lie in the plane. So, this, that is the mean these three vectors are linearly independent. These three vectors will never lie in a plane or in a line or in a plane. Thank you.