IIT Madras

ONLINE DEGREE

Mathematics for Data Science -2
Professor Sarang S. Sane
Department of Mathematics,
Indian Institute of Technology Madras
Mr. Subhajit Chanda
Course Instructor,
Indian Institute of Technology Madras Online Degree Program
Tutorial 03
System of Linear Equations 3

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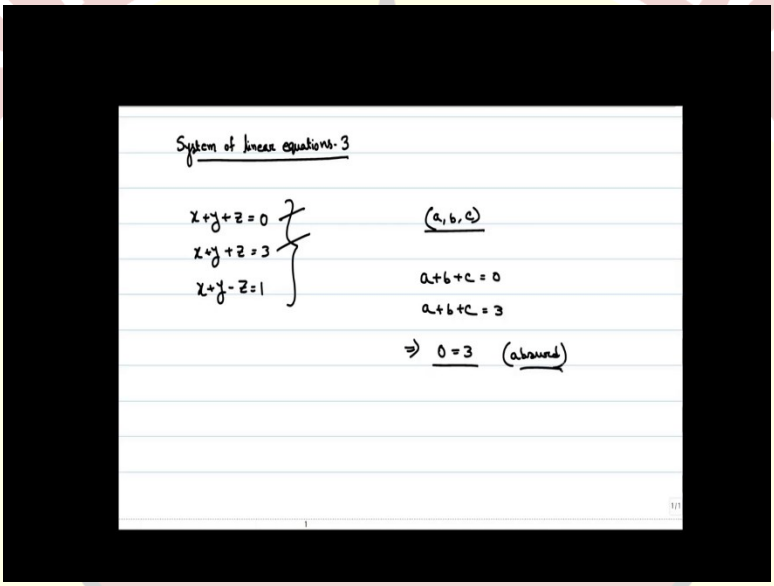

Hello. Now let us see the Third System of Linear Equations. So here we are considering a system to be like this, $x + y + z = 0$. This is our first equation. $x + y + z = 3$, this will be our second equation and $x + y - z = 1$, so this will be our third equation. So there are three equations with three variables.

Now if you observe the first two equations alone, suppose there is some point a, b, c with the solution of this system of linear equations, then this a, b, c should satisfy all the three equations. So if a, b, c satisfy the first equation then we get $a + b + c = 0$. And if satisfy the second equation then we get $a + b + c = 3$, which eventually will give us 0=3, but this is absurd.

So there cannot exist any point which is satisfying first equation alone. So there cannot exist any point, which satisfy all the three equations. So clearly we can say that this system of linear equation

have no solution. So let us see the geometrical representation of this so that we can understand what actually the geometry behind these three equations.

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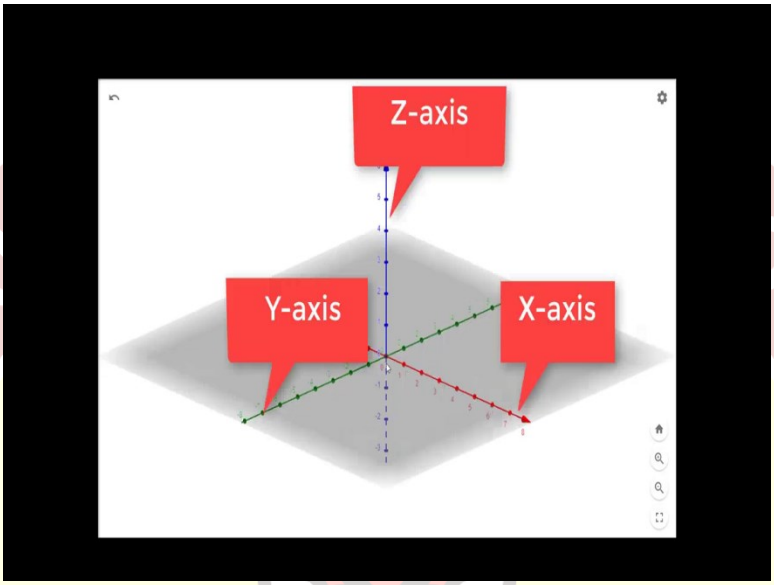

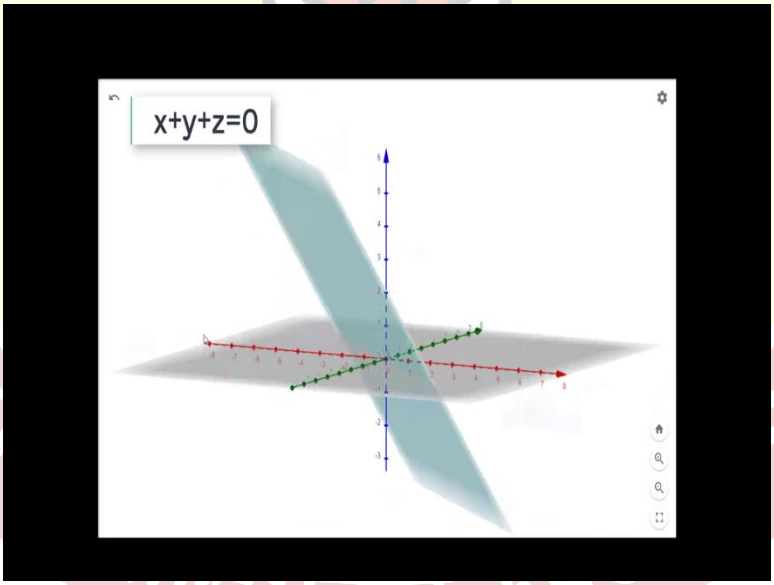

Now again we are using GeoGebra to see geometric representation of system of linear equation. So our first equation was $x + y + z = 0$. So here red line is our x-axis, the green line is our y-axis and the blue line which is perpendicular to both x and y-axis is our z-axis. So the plane $x + y + z = 0$ will look like this. Definitely it will pass through origin because (0,0,0) is satisfying this plane, this equation of the plane. So our plane will look like this.

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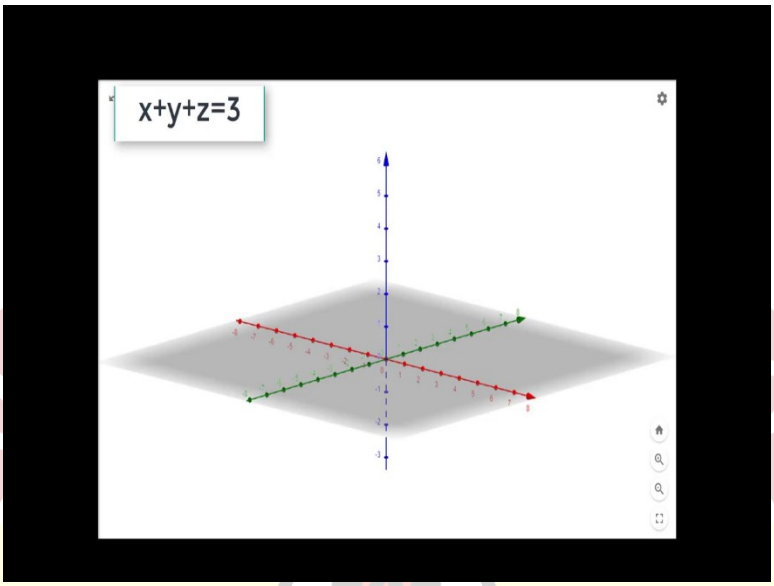

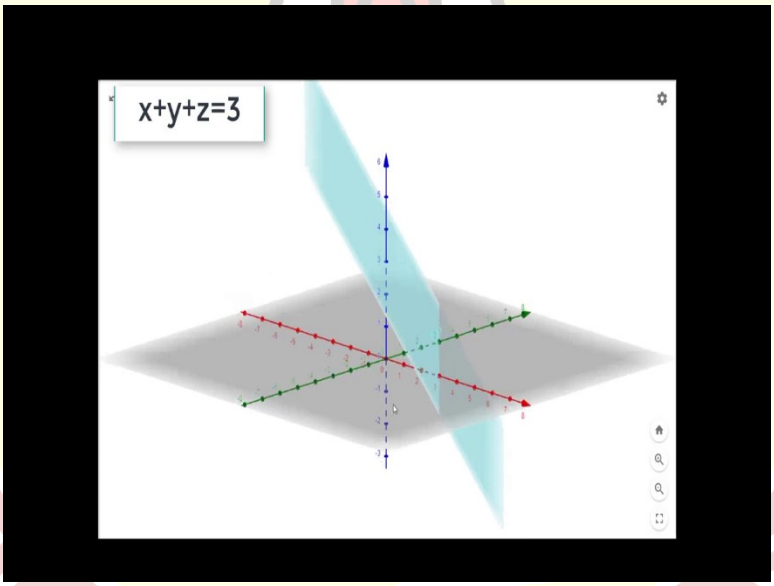

Now let us see the second equation. Second equation was $x + y + z = 3$. So this is how the plane look like. So from $x + y + z = 3$, you can see that the plane will pass from (3,0,0) as (3,0,0) satisfies this equation. Similarly, (0,3,0) will satisfy, it will intersect the y-axis at (0,3,0) and again it will intersect z-axis at (0,0,3). So all the x, y and z intercept will at a distance of 3 from the origin towards the positive direction. So this will be the plane, $x + y + z = 3$.

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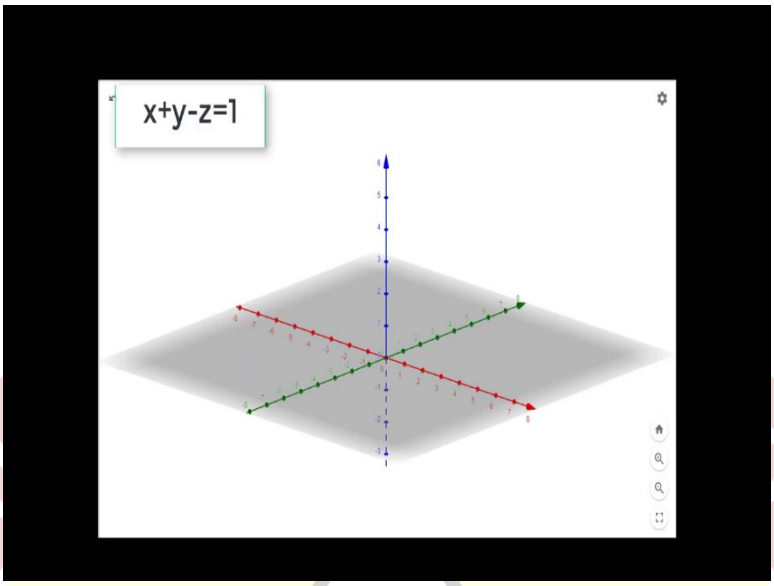

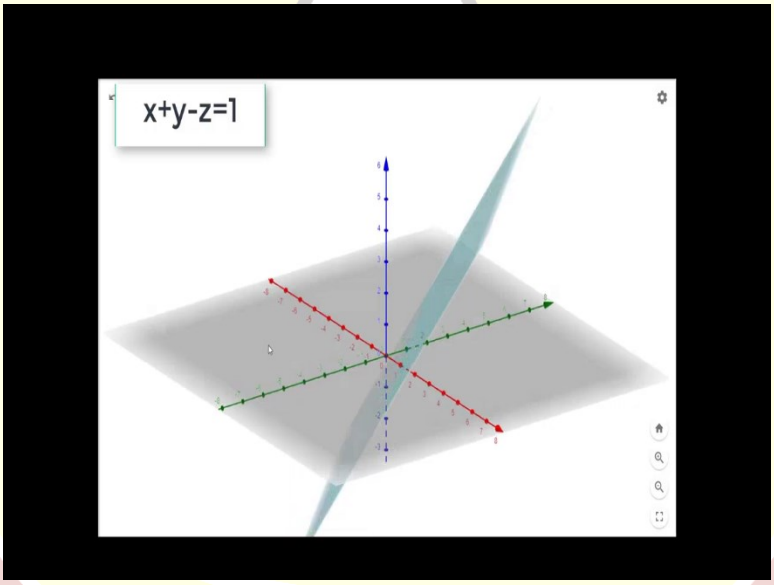

Now let us see the third equation. The third equation was $x + y - z = 1$. So this is how the plane will look like. So here the intercept, x intercept and y intercept are towards positive direction and z intercept is towards the negative direction. So the plane will pass through the points (1,0,0), (0,1,0) and (0,0,-1). So the plane will pass through these three points on the axis. So these are three planes which you have considered.

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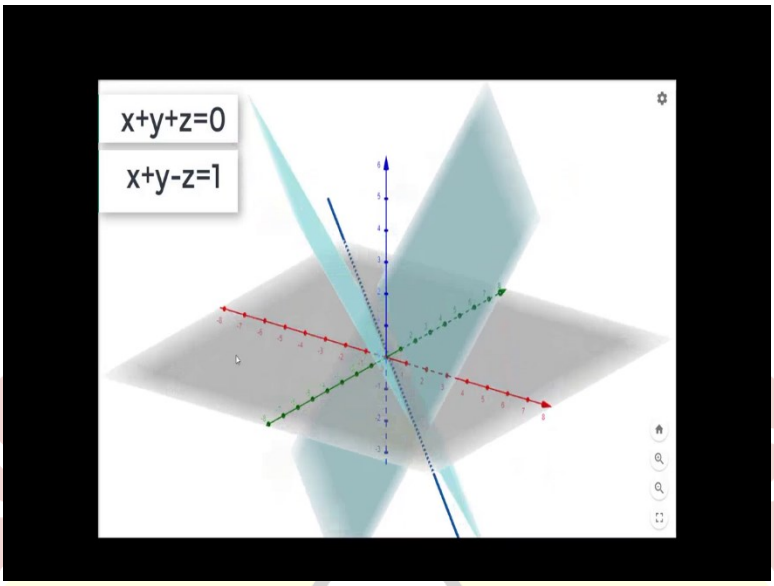

Now if we consider this plane equation three and the equation one, let get back our first plane, $x + y + z = 0$. So this is how it will look like. So these two plane will intersect in this straight line as you can see.

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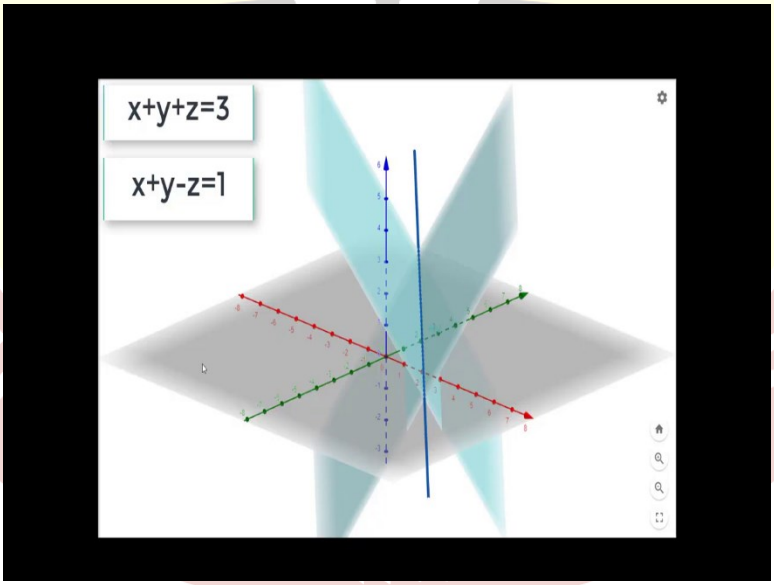

Now let us consider the second and third equation. So the second equation was $x + y + z = 3$ which was like this. Again, it will intersect at some straight line. So plane two and plane three will intersect in this straight line.

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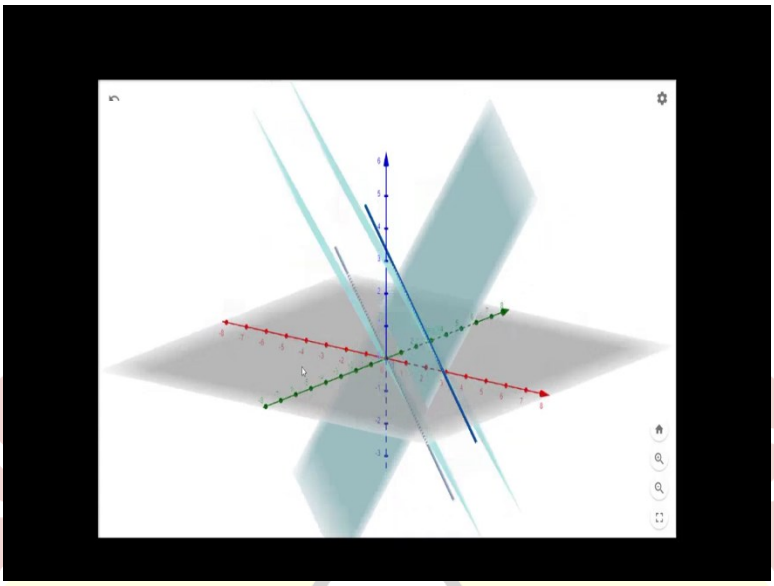

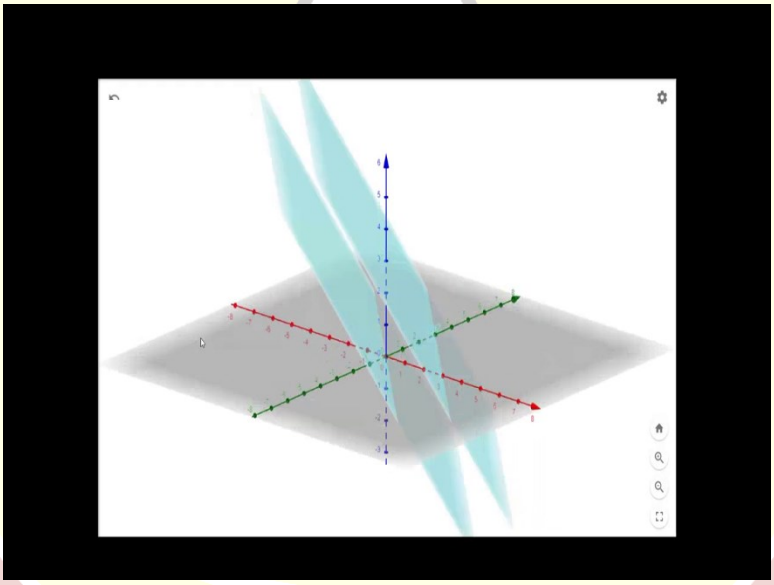

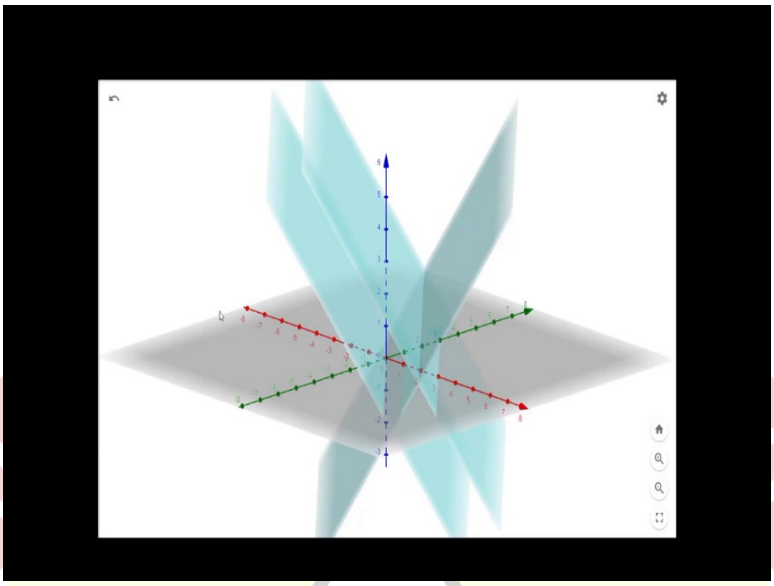

So now let us try to see where the three plane intersect that will be our solution. So if we get back our first equation, so we can see that the first and third equation will intersect in one straight line and the second and third equation intersecting at another straight line, but there are no common points where all these three planes are intersecting each other.

So clearly, our system of linear equation has no solution, as we have seen earlier in the calculation, because the first and second plane, so these are the first and second plane, these first and second plane are parallel to each other. They will not intersect at any point. So system of linear equation these three plane will not have any solution. Thank you.