IIT Madras

ONLINE DEGREE

Mathematics for Data Science -2

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Tutorial 02

System of Linear Equations: Geometric Visualization

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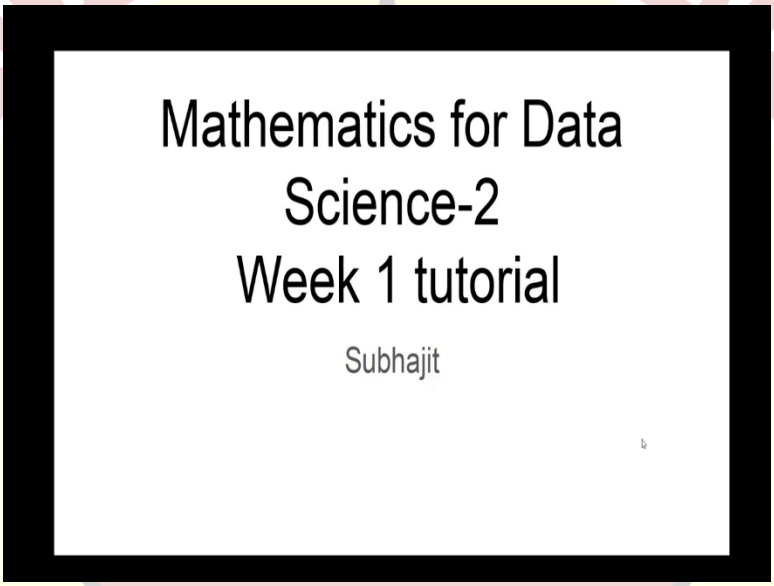

Hi, all. Welcome to the Mathematics for Data Science 2 Week 1 Tutorial.

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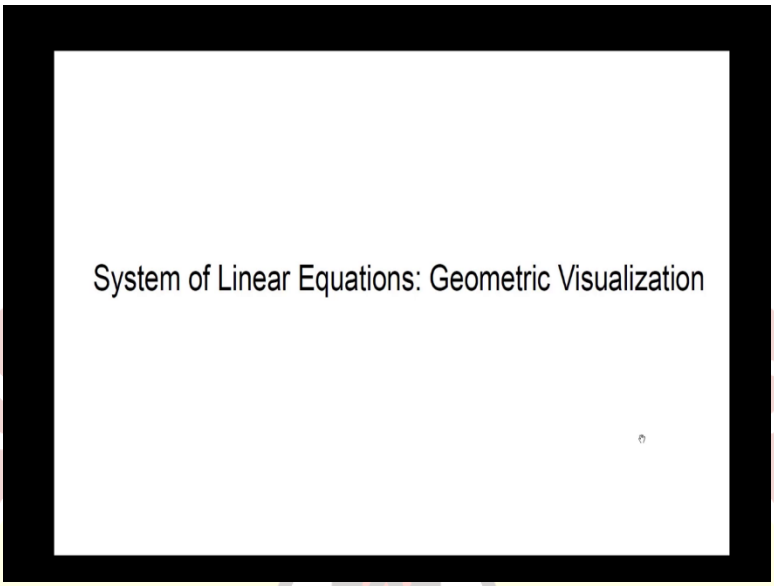

So this is our second example of System of Linear Equations: Geometric Visualization. So here again we will consider a system of linear equation and geometrically we will try to see whether it has unique solution, infinitely many solutions or no solution. So let us see the system of linear equations.

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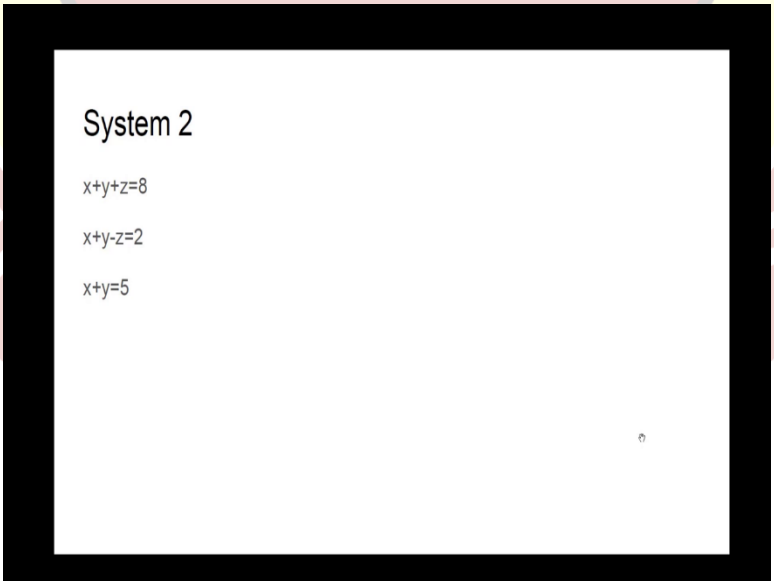

So this is our system of linear equation, where the first equation is $x + y + z = 8$. The second equation is $x + y - z = 2$. And the third equation is $x + y = 5$. So let us see how it looks geometrically.

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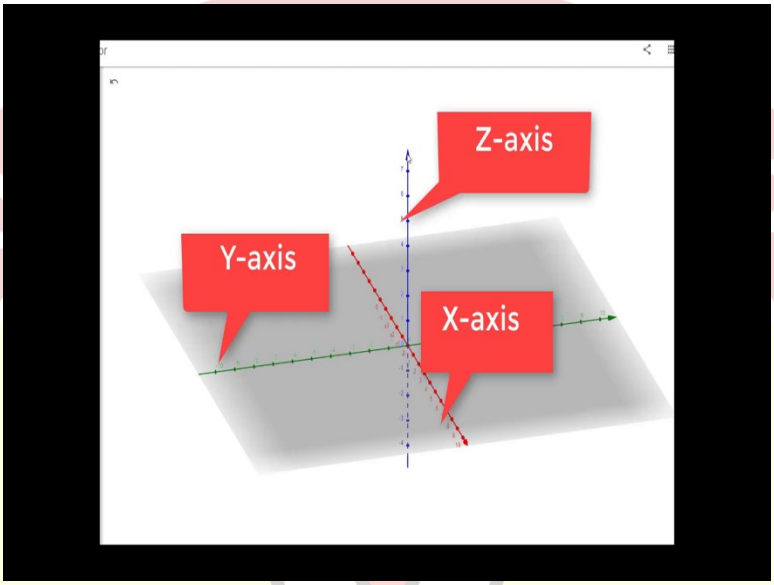

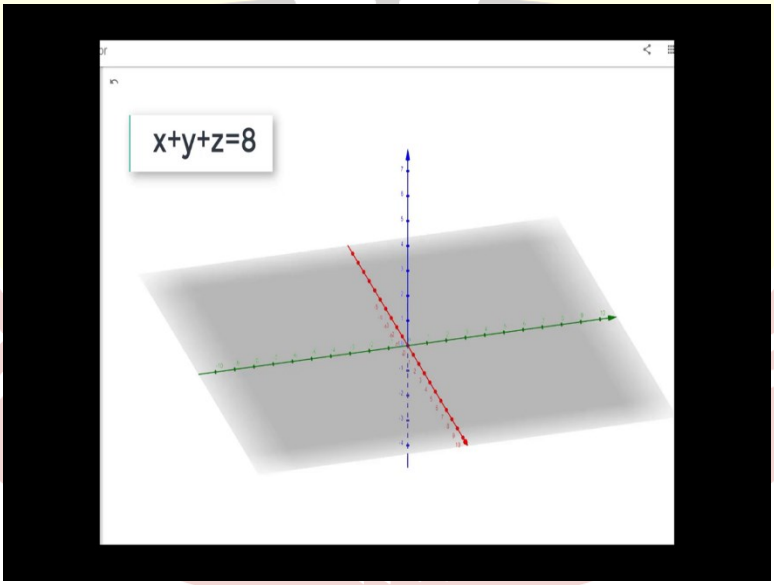

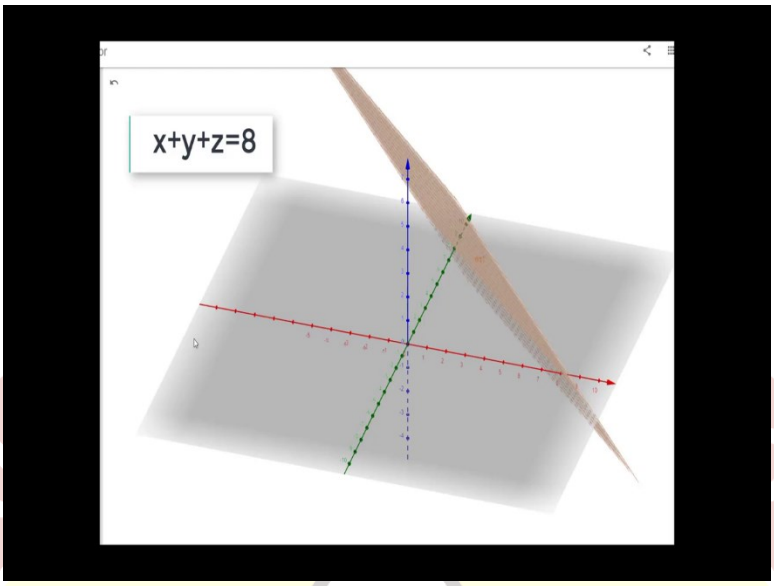

So, again, we are considering this GeoGebra software and this red line is our x-axis, this green line is our y-axis and this blue line is our z-axis. So let us consider the first equation, which is $x + y + z = 8$. So this is the plane, $x + y + z = 8$. So you can see that this plane passing through the point 8,0,0 on x-axis.

0,8,0 on y-axis and it will also pass through the point 0,0,8 on z-axis. So it will intersect all the three axis. So this is our first plane.

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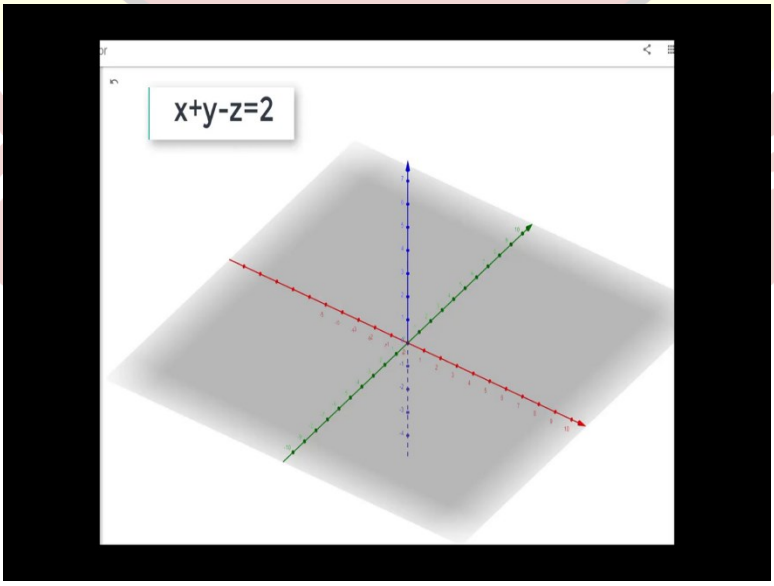

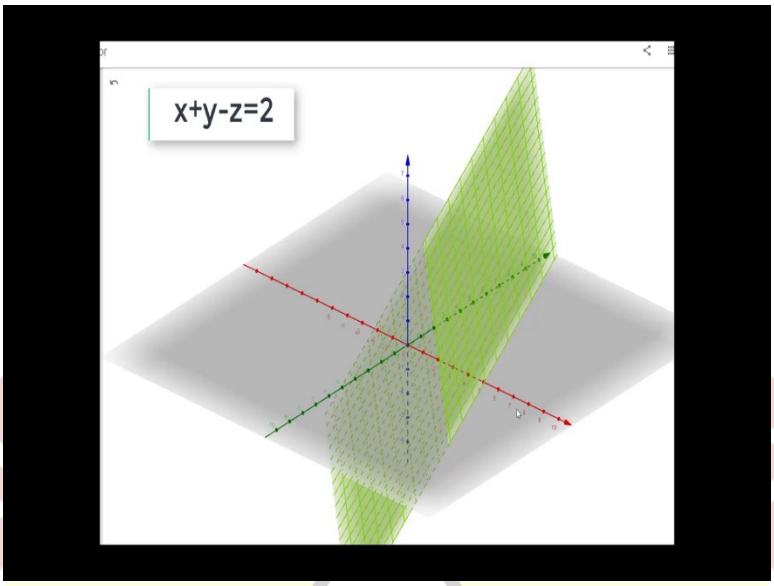

Now, let us consider the second plane, which is $x + y - z = 2$. So you can see that this is our plane. So it will pass through the point (2,0,0) on x-axis, (0,2,0) on y-axis and (0,0,-2) on z-axis. So it will intersect these three points as you can see from the figure. So it will intersect z-axis on the negative direction. So hope you can visualize this plane from this diagram.

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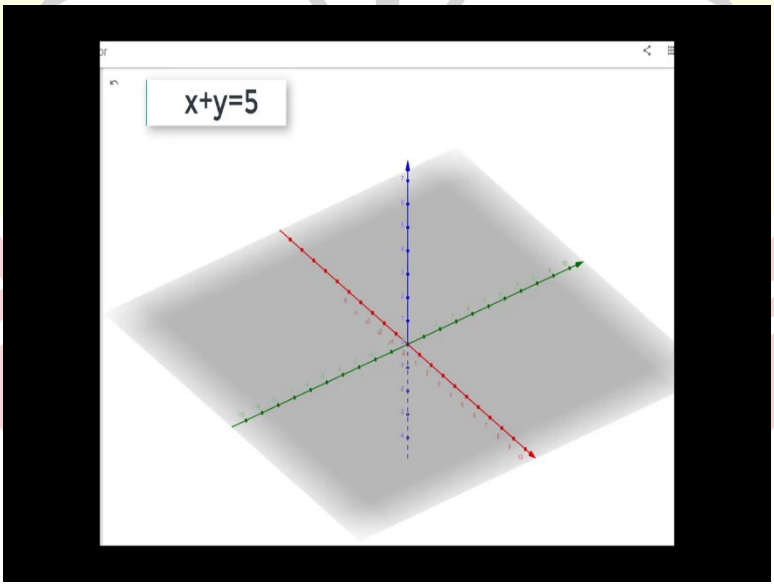

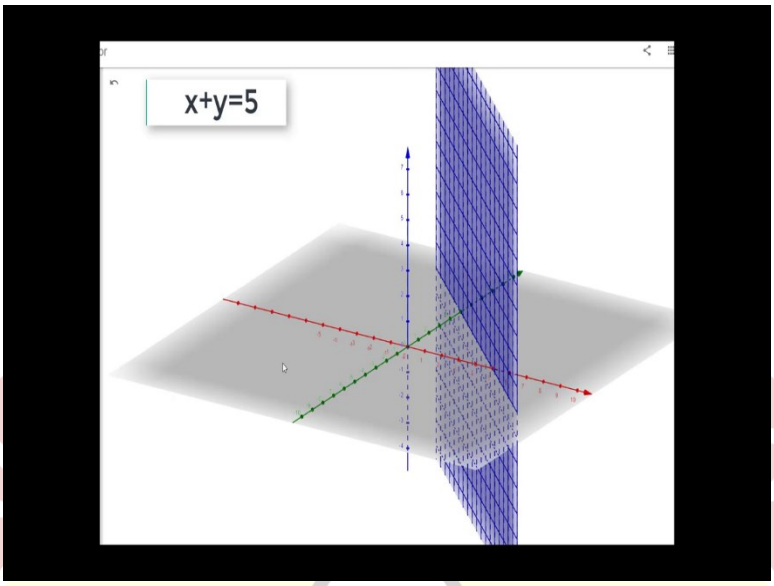

Now we consider the third plane, which is $x + y = 5$. So this is the plane. So this is basically parallel to z-axis. It will not intersect z-axis as this equation does not involve any z. So it will intersect the x-axis at the point (5,0,0) and it will intersect the y-axis at the point (0,5,0). So this is our third plane.

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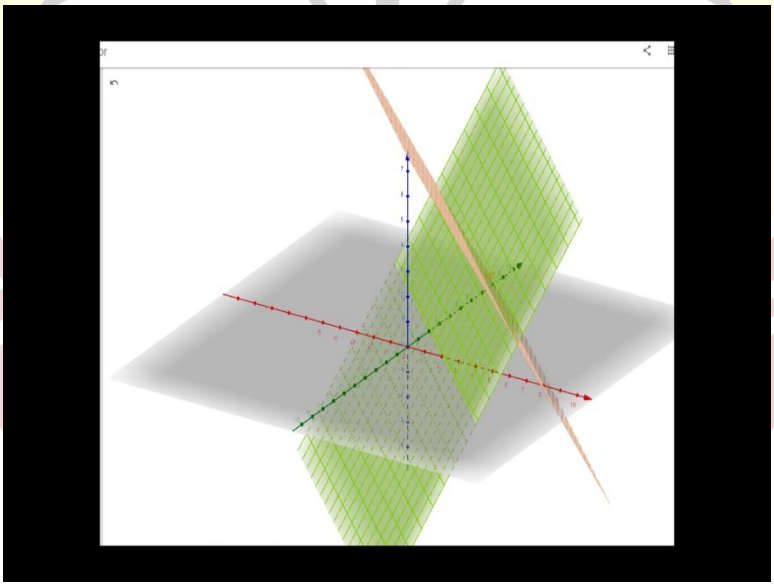

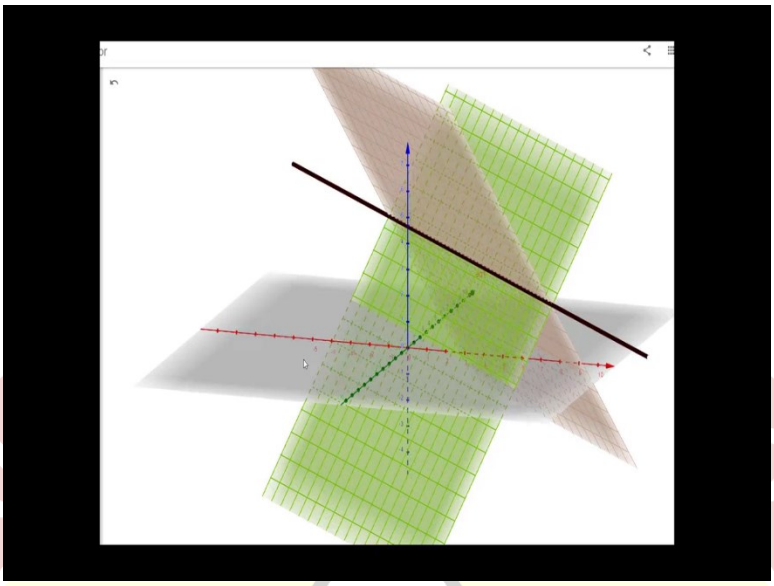

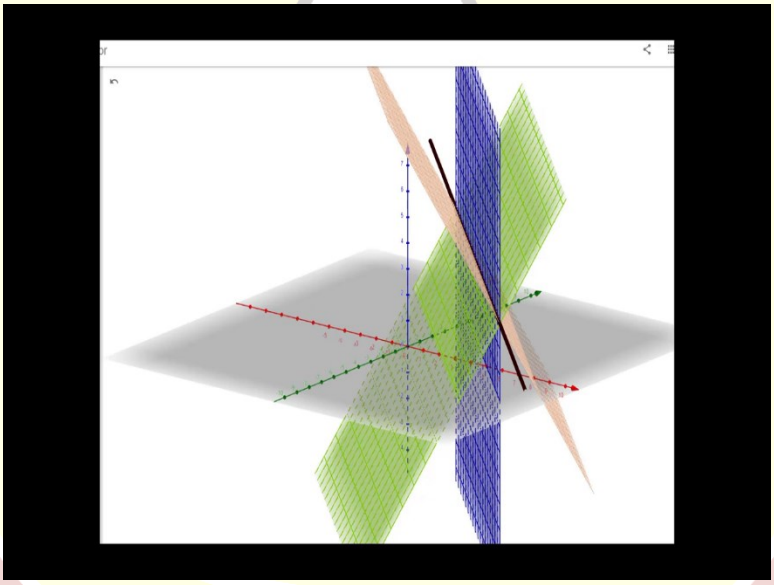

So let us go back to the first two equation and we can see that these two equation will intersect at a line. So this is the line where these two plane intersects. So this is the line. So geometrically we can visualize what is the line on this 3D plane where these two planes are intersecting. Now we introduce the third plane and see what is the solution.

So this is our third plane and we can see that third plane is also passing through this line as you can see from this geometric diagram. So this line is basically the intersection of these three planes. And there are infinitely many points on this line, so these three equation have infinitely many solution. Thank you.