IIT Madras

ONLINE DEGREE

Mathematics for Data Science -2
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Tutorial 04
System of Linear Equations 4

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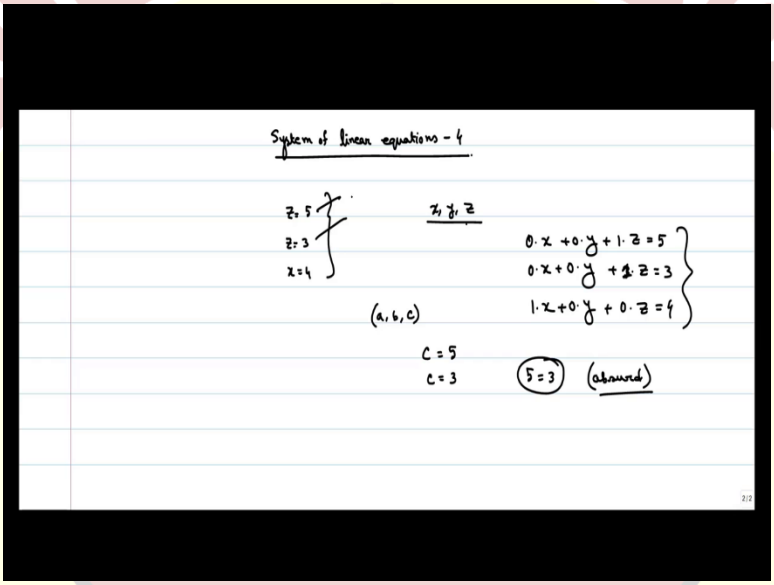

Hello. So let us observe the fourth example of System of Linear Equations. So here we have three equations, $z = 5, z = 3$ and $x = 4$. We are considering these three equation in three variable x, y and z. So these are three variables. So although there is no y variable in these three equation, but we can say that coefficient of y in these equations are 0.

So the first equation is basically $0 \times x + 0 \times y + 1 \times z = 5$. The second equation is $0 \times x + 0 \times y + 1 \times z = 3$. And for the last one, $1 \times x + 0 \times y + 0 \times z = 4$. So these are three equations in three variables x, y, z. And we are about to find is there any solution of these three linear equations.

So observe that if some point a, b, c is a solution of these three equations, then this a, b, c should satisfy all the three points. So this a, b, c should satisfy all the three equations. So if this point

satisfy the first equation, then we have $c = 5$ from the first one, and from the second one we have $c = 3$, again we have 5=3, which is absurd.

So there cannot exist any point a, b, c which satisfy all these three equation, because any point does not satisfy first two equation alone. So there is no chance of any point, existence of any point which satisfy all the three equations. So let us see this system of linear equation. What the geometric representation of it so that we can understand why this system of linear equation has no solution.

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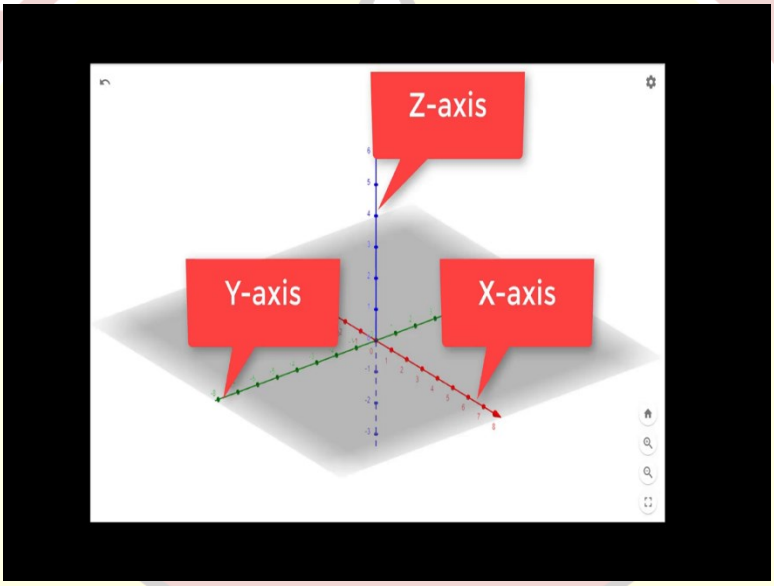

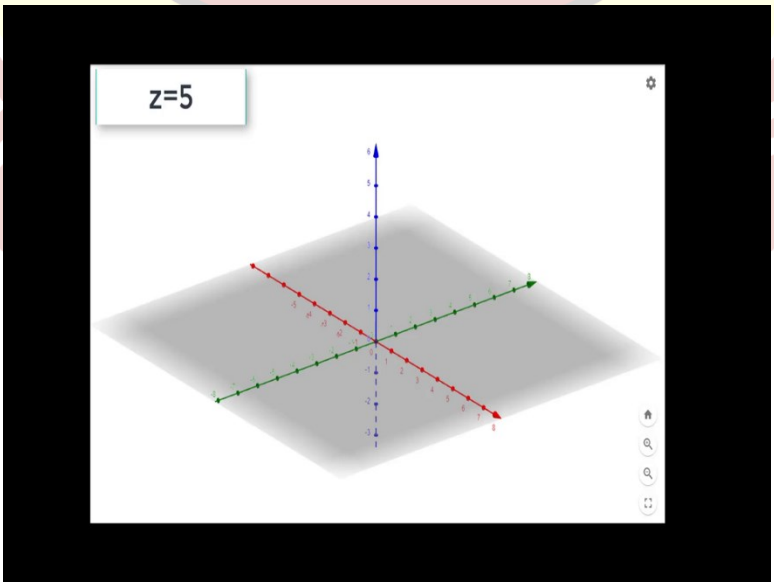

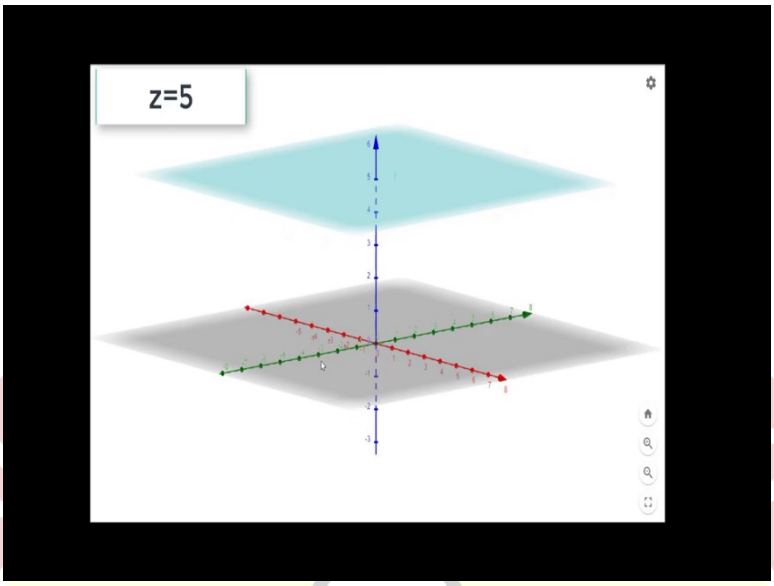

So again we are considering our red line to be x-axis, y line to be, green line to be y-axis and the blue to be z-axis which is perpendicular on both x and y-axis. So our first equation was $z = 5$. So this is $z = 5$. So $z = 5$ is a plane which is parallel to xy plane passing through the point (0,0,5), so its z intercept is (0,0,5) and it does not intersect at any point on x-axis or y-axis, because it is parallel to the plane xy. So this is our $z = 5$ plane.

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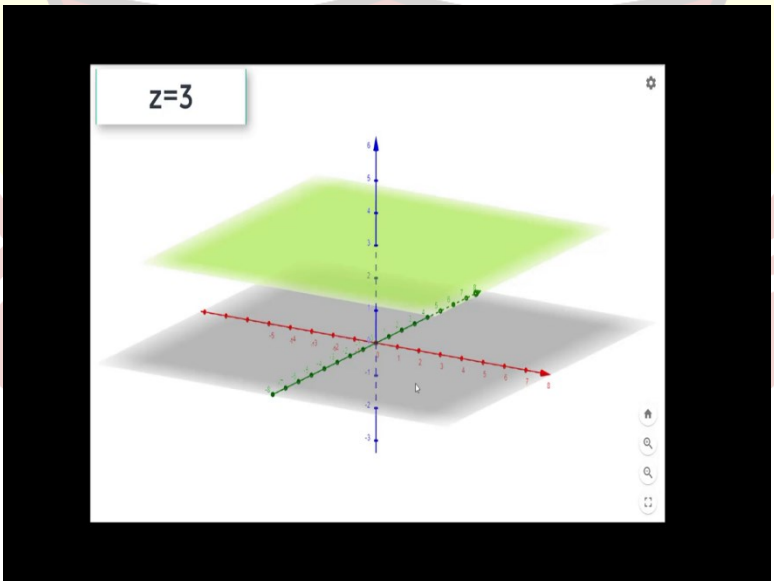

Now, similarly, z=3 is a plane, which is again parallel to xy plane and it is passing through the point (0,0,3), so its z intercept is (0,0,3). So this is our second plane.

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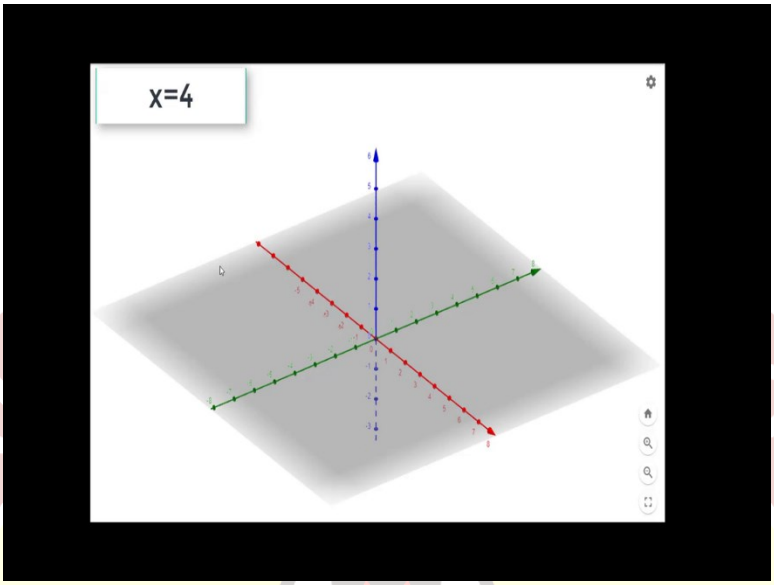

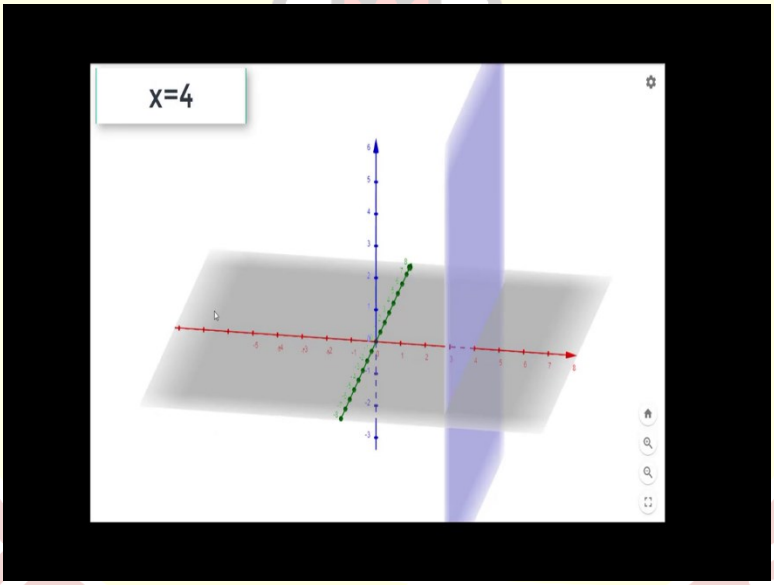

And now third equation was x=4. So x=4 will be parallel to yz plane, because there, this plane will not intercept at any point of y-axis and z-axis, but its intercept is (4,0,0). So it will cut the x-axis at (4,0,0) and this plane is parallel to yz plane.

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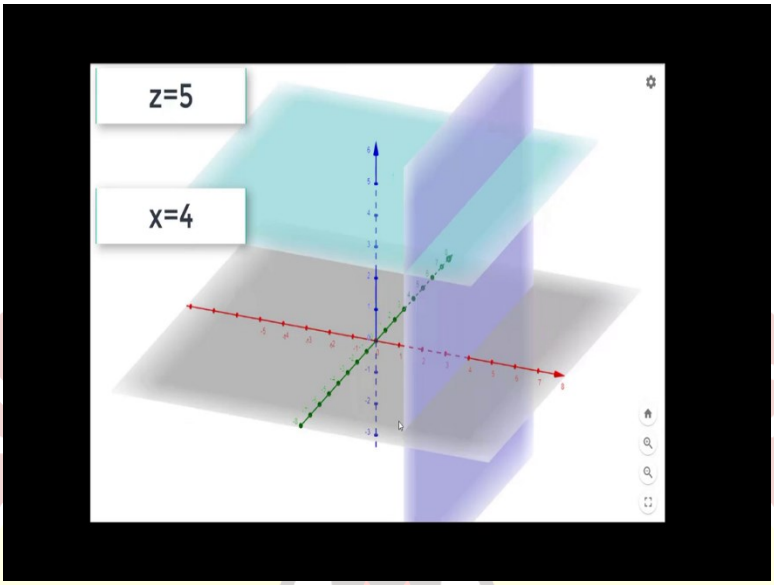

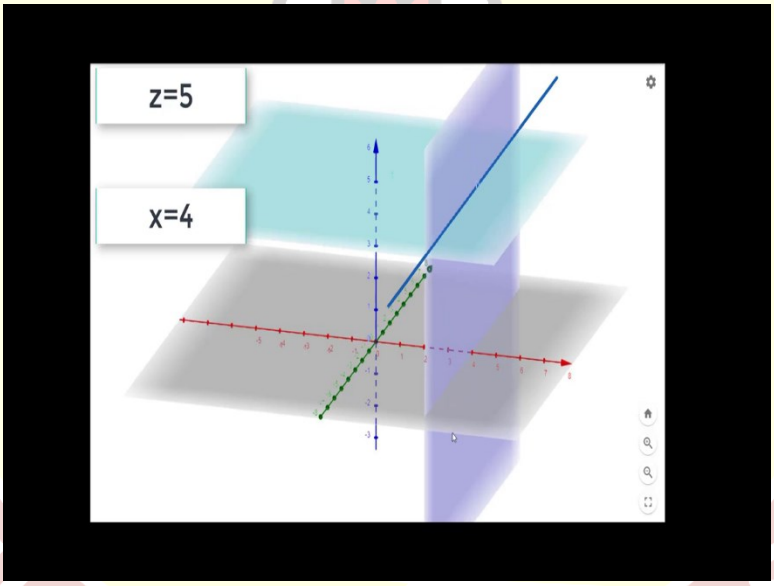

Now if we introduce back our first equation, the first plane z=5, then we can see that these two plane, the first and the third plane is intersecting at a straight line. So if we want to know the solution of first equation and third equation we will get, the solution will be this straight line. So there are infinitely many solution for the first and the third equation. So this is the straight line which denote the solution of this first and the third equation. So there are infinitely many solution.

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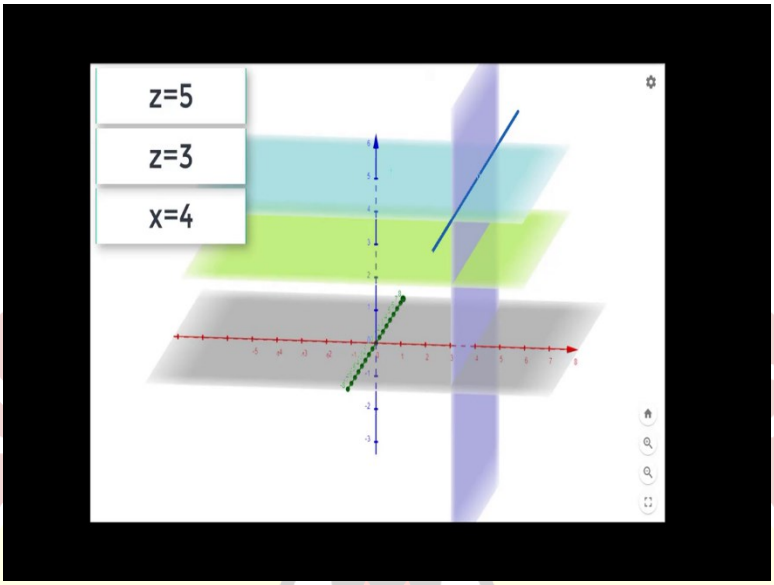

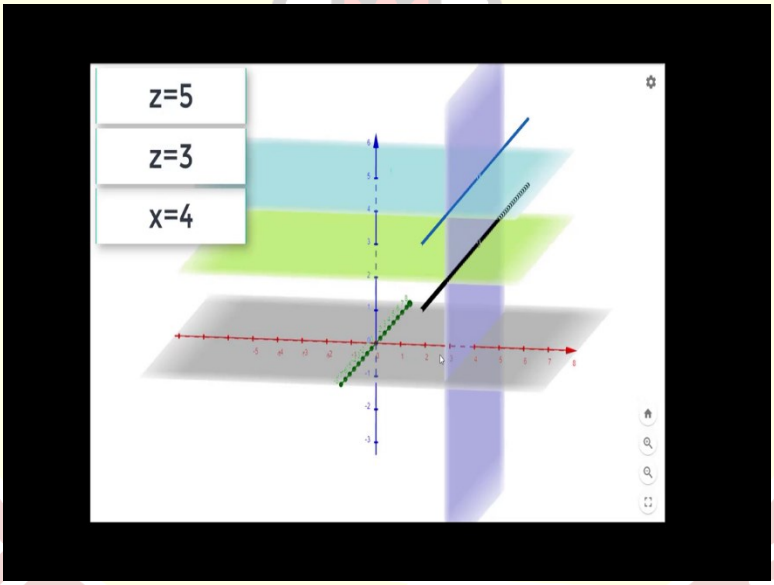

Now if we introduce back the second equation, we will see again it will intersect the third equation, the third plane at a straight line. So these are two straight line where in the first one the first and the third equation are intersecting, the first and the third plane are intersecting and in the second line the first, the second and the third plane are intersecting.

But these two straight line are not intersecting at any point, they are basically parallel to each other. So we can see that there are no point where these two straight lines are intersecting each other or there are no points where these three plane are intersecting each other. So there is no solution for this system of linear equation. Thank you.