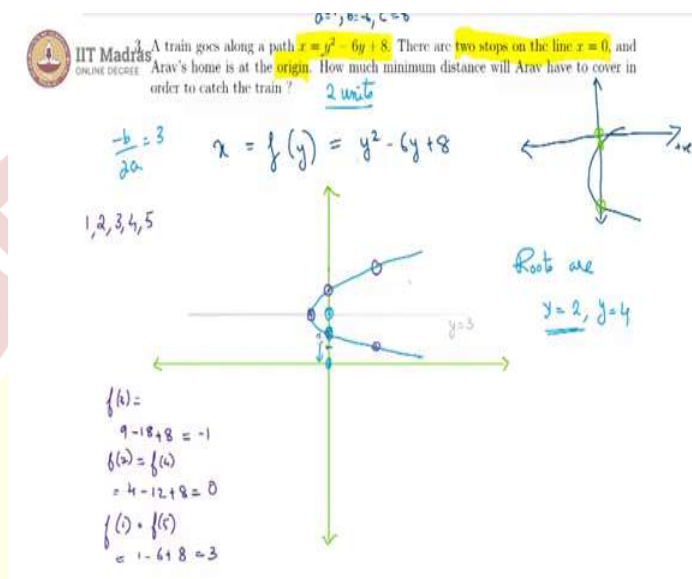# IIT Madras
ONLINE DEGREE

Mathematics for Data Science 1
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Week - 04
Tutorial - 03

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In question 3, there is a path $x = y^2 - 6y + 8$. So, if we observe here, we are basically saying x is a function of y. And that function is quadratic, we have $y^2 - 6y + 8$. So, we are now switching the axis and so our parabola is expected to look something like this, or like this, because this is the X-axis and this is the Y-axis. Now, we see that the coefficient of y square, which is a is 1, and b is -6, the coefficient of y and lastly, the constant term c is 8.

Since, a is greater than 0, we expect that this is an upturned parabola. In the case of upturn in X, what we mean is it is towards the positive X-axis. So, our parabola is expected to be something like this. Of course, it could be moving about, we do not know where exactly it cuts the axis or where the point is. And for that, we will have to go further. They are saying this 2 stops on the line $x = 0$ that is on Y-axis and of course, these will be this point and this point, basically, if we looked at it in terms of our standard $y = f(x)$ these are what are the roots of our equation.

And Arav's home is at the origin, Arav lives at the origin so this is where Arav is. How much minimum distance will Arav have to cover in order to catch the train? So, the question is simple, you have two routes for your $x = f(y)$, and these routes will be on the Y-axis now, because

we have switched the axis and which route is closer to Arav's home that is which route is closer to the origin. So, let us try to find out now, let us try to plot this particular graph and let us see where the tool train stops are. From the equation, we know that the vertex will be $\frac{-b}{2a}$, which is again $\frac{-(-6)}{2}$, that is 3.

So, here we are basically saying $y = 3$ is the vertex. So, this is 1, this is 2, then this is our $y = 3$ and thus, the vertex will be along the line, $y = 3$, the axis of symmetry is $y = 3$. So, this is our axis of symmetry, $y = 3$. And for plotting the graph, we are now going to look at various points, which will be 3 and 1 to the other side of 3, 2 and 1 to this side of 3, 4 and then 5, and then 1, this should give us a reasonable idea of what the graph looks like.

So, $f(3)$ at the vertex, what is the x-coordinate that would be $f(3) = 9 - 18 + 8 = -1$, so $x = -1$, which is going to be somewhere around here, this is our vertex. And $f(2)$ will be equal to $f(4)$ because of symmetry. So, if I just substitute 2, I will get $4 - 12 + 8 = 0$, ok, that is good so we now have roots, we know that on 2 this point, and at 4 our curve is going to intersect the Y-axis.

So, if you want, we can further look at what is $f(1)$ which is also equal to $f(5)$, that is going to give us $1 - 6 + 8 = 3$, so we got to be somewhere over here, for these two points we are going to get somewhere here and thus our quadratic parabola looks like this. And we know for a fact that the routes are $y = 2$ and $y = 4$. Clearly $y = 2$ is closer to the origin. So, the minimum distance that Arav will have to cover is 2 units that is from the origin to this particular point, and this is the distance he will have to cover.