IIT Madras

ONLINE DEGREE

Mathematics for Data Science 1
Indian Institute of Technology, Madras
Week 02
Tutorial 01

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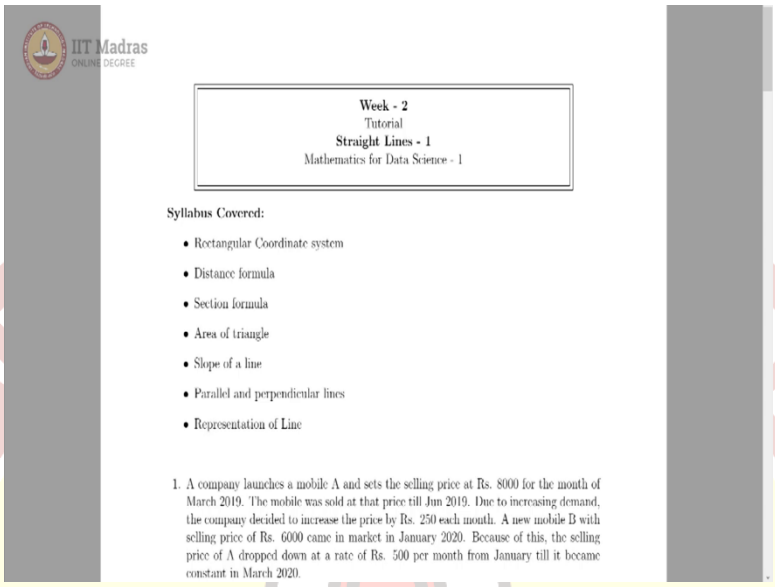

(())(0:18) In this tutorial we are going to look at the problems which are related to contents of week 2, that is to do with straight lines and all these topics here.

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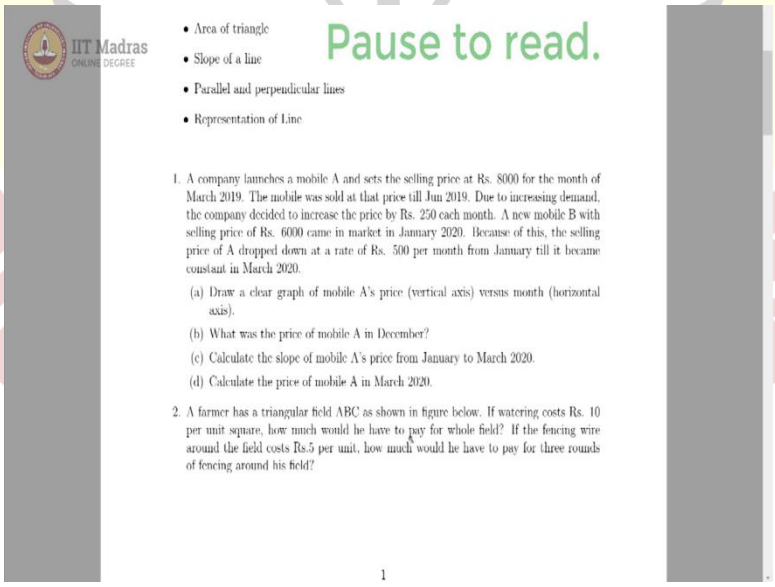

- Area of triangle
- Slope of a line
- Parallel and perpendicular lines
- Representation of Line

1. A company launches a mobile A and sets the selling price at Rs. 8000 for the month of March 2019. The mobile was sold at that price till Jun 2019. Due to increasing demand, the company decided to increase the price by Rs. 250 each month. A new mobile B with selling price of Rs. 6000 came in market in January 2020. Because of this, the selling price of A dropped down at a rate of Rs. 500 per month from January till it became constant in March 2020.
   (a) Draw a clear graph of mobile A's price (vertical axis) versus month (horizontal axis).
   (b) What was the price of mobile A in December?
   (c) Calculate the slope of mobile A's price from January to March 2020.
   (d) Calculate the price of mobile A in March 2020.
2. A farmer has a triangular field ABC as shown in figure below. If watering costs Rs. 10 per unit square, how much would he have to pay for whole field? If the fencing wire around the field costs Rs.5 per unit, how much would he have to pay for three rounds of fencing around his field?

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So, we will start with our first question. The data provided here is, there is a company which is selling mobile phones and it all begins in March 2019. In March 2019, the selling price was 8000 and it was sold at 8000 rupees, mobile A was sold at 8000 rupees from March until June. After that, due to increasing demand, the company decided to increase the price by 250 each month, so they are selling better.

So, they have decided to increase their price by 250 rupees every month. This went on until a new mobile B was launched at a lesser price, competition at a lesser price was launched in January. So, because of this the selling price of A dropped at a rate of 500 per month, from January till March 2020, so 2 months it had decreased. We are expected to demonstrate a clear graph of this. For that let us look at this graph.

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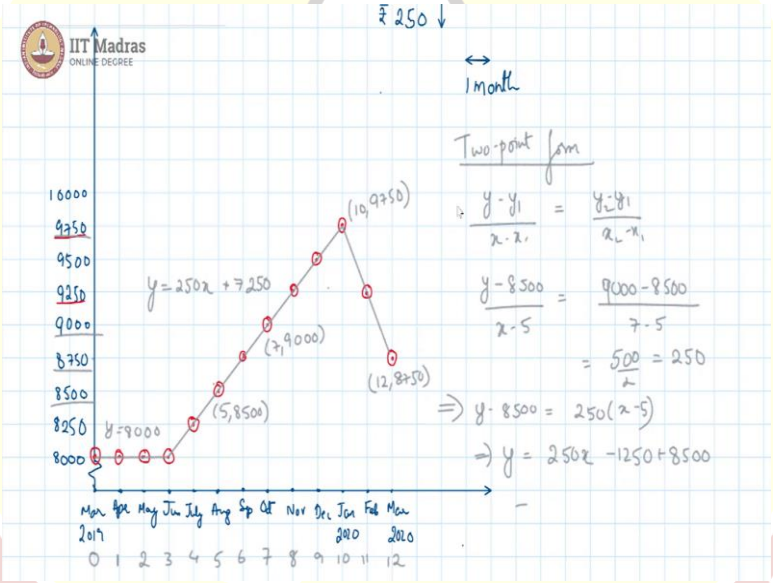

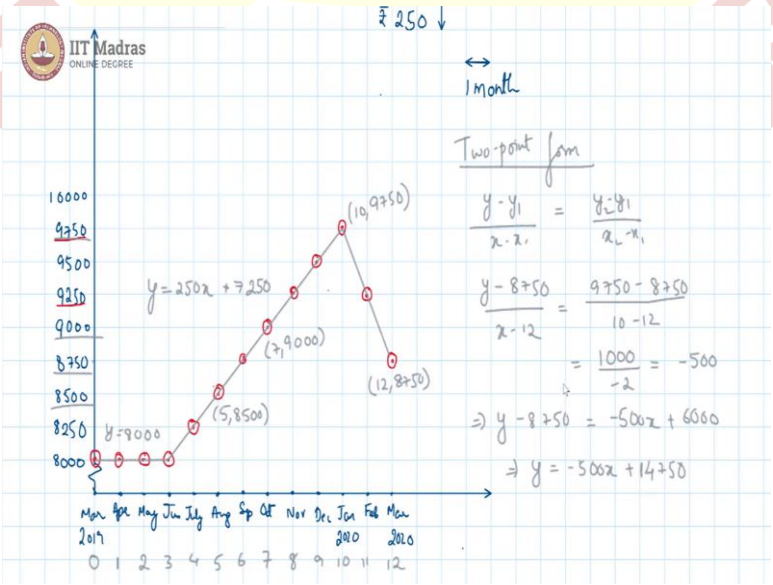

What we need to realize about situations like this is, the x and y axis do not necessarily represent the same units. So, we have along the x axis 1 unit is 1 month, however along the y axis 1 unit is, let us take about 250 rupees. So, 1 month and 250 rupees are not the same thing, so please remember this in situations like this. Now, because we are beginning from March let us take the starting month to be March, then this is April, May, and so on.

So, our entire problem deals with this 1 year span from March 2019 to March 2020, so this will be along our x axis. And now along the y axis, if we took each unit to be 250, then this is 250 and this is 500 and so on, the 8000 will be beyond our screen. So, to better represent our situation, we are going to introduce a zigzag here to indicate that a lot of values have been compressed into this little space. So, we are going to start from 8000 and this is going to be 8250, 8500, so on. And now we begin to mark out the points that we have, we know that in month of March the price was 8000, so this is the point for the month of March.

And then in April, May, and June the price stayed constant so it is been like this. And this portion can be represented using a horizontal line and this line is y is equal to 8000. Beyond that, the price had been increasing by 250 every month so in July we will be here, August here, September here, this will be October, this will be November, this is December, and this is January.

So, this segment can be indicated by this line, in order to find out the equation of this line we use the 2 point form, so we first write 2 points on this line segment. You could choose this one which is August, and for that let us number our months now, so March will be 0, April is 1, May is 2, June is 3, this is 4 and this is 5. So, our price point here it is $(5, 8500)$.

I am ready to take another month, so let us take October, this is the seventh month from March 2019, so this point becomes $(7, 9000)$. Using these 2 points, we can find the equation of the line by employing the 2 point form of the line equation, $\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$, where x_1, y_1 and x_2, y_2 are two points on the line segment. So, here we can see it as $\frac{y-8500}{x-5} = \frac{9000-8500}{7-5}$. So, this would be equal to $\frac{500}{2} = 250$.

So that implies $y - 8500 = 250(x - 5)$, which finally gives us the line equation to be $y = 250x - 1250 + 8500$ plus this line is y $= 250x + 7250$. Moving on, the next 2 months, the price dropped by 500 each month. So, here we are at 9750, then for February we should be at

9250, so this will be our point for February and then the next month again 500 drop we will reach here, which is 8750. And this line segment also corresponds to a straight line, which also we can find using the 2 point form.

So, this point here is, let us number the months completely, this is 8, this is 9, this is 10, this is 11, this is 12. So, this point here, which is January is the tenth month, and the y axis gives us 9750 whereas this point here, this is the twelvth month, and it corresponds to 8750. And again, we would like to know the line equation for this and we use the 2 point form again.

So, this is $\frac{y-8750}{x-12} = \frac{9750-8750}{10-12}$ that gives us $\frac{1000}{-2} = -500$. Plus we have $y - 8750 = -500x + 6000$. That gives us $y = -500x + 14750$, so this is our new length. And this is a clear graph of the situation and the given question.

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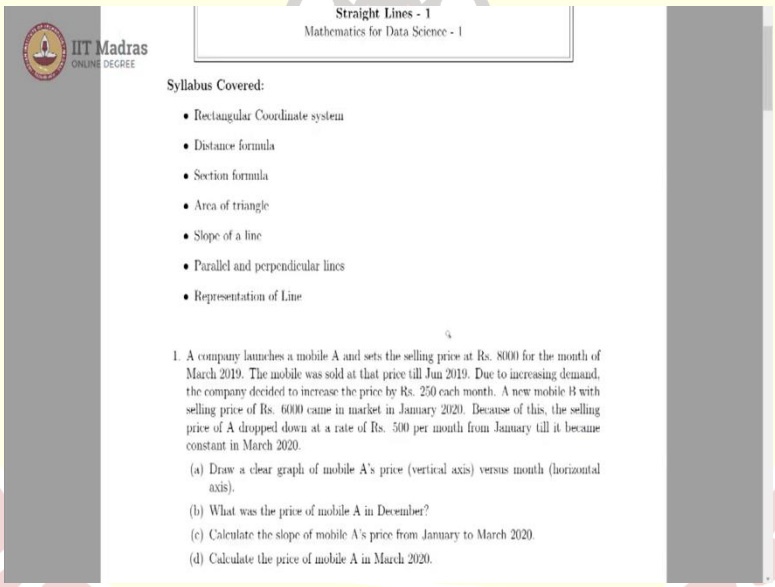

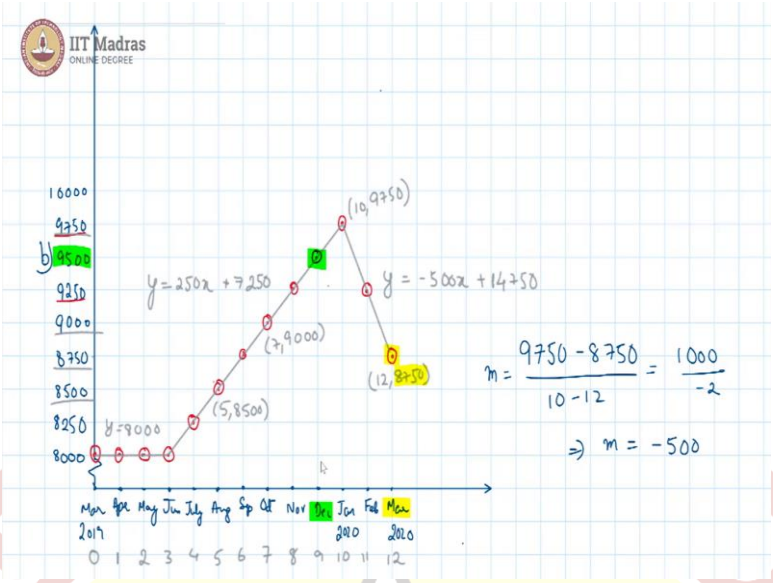

For the part B of this question, it is asked, what is the price of mobile A in December. So, this is the December month, which would be this point here which has a price of 9500, so this is our answer for B. And then in C it has asked, calculate the slope of mobile A's price from January to March 2020, so we want the slope of this segment here and this slope we had already calculated, it was $m = \frac{9750-8750}{10-12} = \frac{1000}{-2} = -500$.

And because of the negative slope you can see that it is a decreasing function, which is what is happening, the price had fallen at 500 per month. Lastly, we have being asked, what is the price of mobile A in March 2020, so this is March 2020, this is a point and we have already found the price which is 8750 that is our part.