IIT Madras

ONLINE DEGREE

Mathematics for Data Science 1
Week 03 – Tutorial 06

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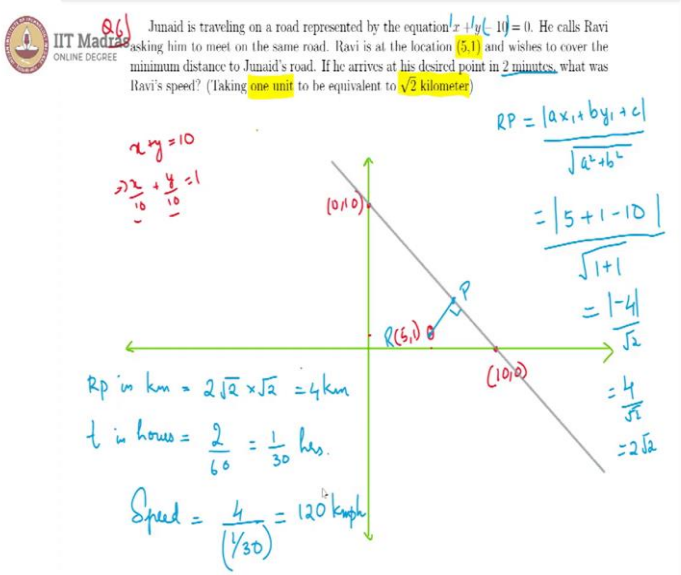

Sixth question. We have Junaid who is traveling on a road represented by the equation x+y-10=0. So, in the graph if we plot that, we can see that x+y=10, which gives us $\frac{x}{10} + \frac{y}{10} = 1$, which means the x intercept and y intercept are both equal to 10. So, if this is 10 and this is also 10, so this would be (10,0). Whereas this is (0,10) and the line that passes through them is the road that Junaid is traveling on.

So, this is the line that Junaid is traveling on and he calls Ravi, asking him to meet on the same road. But Ravi is at this point. So, that would be 5, it would be somewhere here halfway and 1 would be somewhere here. So, this is 1 and this would become our location of Ravi, that is (5,1) and Ravi wishes to cover the minimum distance to Junaid's road. So, we know that minimum distance is achieved when you go perpendicular that is normal to the other line.

So, we can see that Ravi goes along this path and intersects, that path intersects somewhere over there, let us call this point P and he arrives at this point P in 2 minutes and we are being asked, what is Ravi's speed? So, we need to first find out, assuming Ravi's original location (5,1) is R, if we find out what RP is, then we should be able to find out the speed. So, RP is basically the shortest distance of R from this particular line. So, we can calculate it from that formula, which is $\frac{|ax_1+by_1+c|}{\sqrt{a^2+b^2}}$.

And now, here a is 1, b is also 1, c is -10. So, we have this is equal to $\frac{|5+1-10|}{\sqrt{1+1}}$, because a is 1 and b is 1, the squares are also 1. So, we get $\frac{|-4|}{\sqrt{2}} = \frac{4}{\sqrt{2}}$, which is then equal to $2\sqrt{2}$ units and now it is given that 1 unit is equivalent to $\sqrt{2}$ kilometres.

So, that means the distance in kilometre RP in km is equal to $2\sqrt{2} \times \sqrt{2}$, that is 4 km and Ravi has taken 2 minutes. If we write it in hours, t in hours is then $\frac{2}{60}$ that is $\frac{1}{30}$hours. So, the speed would be distance by time, which is $\frac{4}{\frac{1}{30}}$ which gives us 120 kmph, kilometre per hour. This is the speed that Ravi travels at.