IIT Madras

ONLINE DEGREE

Mathematics for Data Science 1
Week 05 - Tutorial 02

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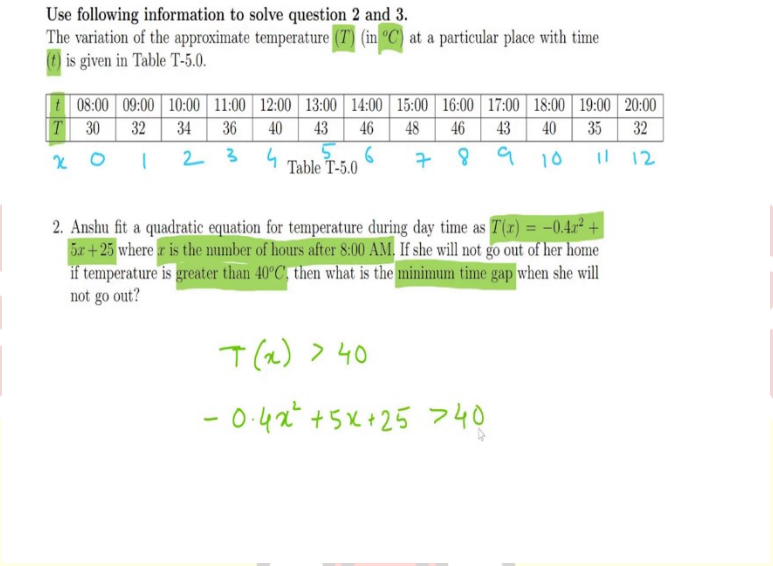
Use following information to solve question 2 and 3.
The variation of the approximate temperature (T) (in ^oC) at a particular place with time (t) is given in Table T-5.0.

t	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
T	30	32	34	36	40	43	46	48	46	43	40	35	32
x	0	1	2	3	4	5	6	7	8	9	10	11	12

Table T-5.0

2. Anshu fit a quadratic equation for temperature during day time as $T(x) = -0.4x^2 + 5x + 25$ where x is the number of hours after 8:00 AM. If she will not go out of her home if temperature is greater than 40^oC, then what is the minimum time gap when she will not go out?

$T(x) > 40$

$-0.4x^2 + 5x + 25 > 40$

We are supposed to use this information this particular table to solve question 2 and 3. We will do a question 2 now. And this table will give us the variation of approximate temperature T. So, this is a temperature T in ℃ at a particular place with time small t, so this is the time. So, the time and the respective temperatures are given in this table.

And Anshu fit a quadratic equation for temperature during day time as $T(x) = -0.4x^2 + 5x + 25$. Where x is the number of hours after 8 am. So, x begins from 0 for $x = 0$. If we wrote additionally here this is 0, this is 1, this is 2, this is 3, this is 4, 5, 6, 7, 8, 9, 10, 11 and 12. So, we have x going from 0 to 12. If she will not, so if Anshu will not go out of her home the temperature is greater than 40 degrees.

So, greater than 40 degrees and Anshu will not go out of the home. Then what is the minimum time gap when she will not go out? Which means what is the time when the temperature is greater than 40. And this is on the basis of this particular quadratic equations. So, we are essentially trying to solve this as $T(x) > 40$. So, that means $-0.4x^2 + 5x + 25 > 40$.

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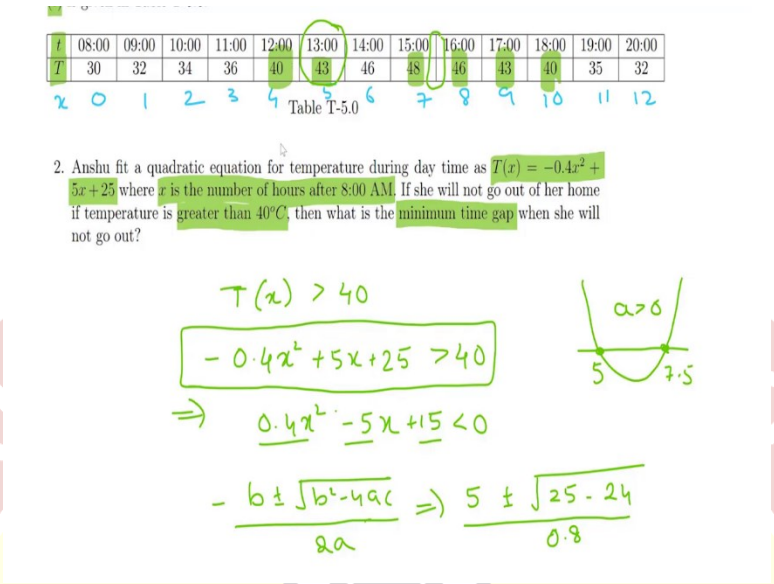

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Table T-5.0

2. Anshu fit a quadratic equation for temperature during day time as $T(x) = -0.4x^2 + 5x + 25$ where x is the number of hours after 8:00 AM. If she will not go out of her home if temperature is greater than 40°C, then what is the minimum time gap when she will not go out?

$T(x) > 40$

$-0.4x^2 + 5x + 25 > 40$

$\Rightarrow 0.4x^2 - 5x + 15 < 0$

$\frac{-b \pm \sqrt{b^2-4ac}}{2a} \Rightarrow \frac{5 \pm \sqrt{25-24}}{0.8}$

$a > 0$

5 7.5

And that would indicate that $0.4x^2 - 5x + 15 < 0$. So, if we took all the LHS to the RHS this is what you will get and this is an upward facing parabola. So, the parabola will be like this and we are looking for the portion where you have the value, the y value to less than 0. So, that would be happen between the roots for this we find out the roots using the formula $\frac{-b \pm \sqrt{b^2-4ac}}{2a}$.

And how did we know that this parabola is upward facing because a is greater than 0, a here is 0.4 b is -5 and c is 15. So, these roots will come out to be $5 \pm \sqrt{25 - 4 \times 0.4 \times 15}$ that is 16×0.4 that is 6 ×4 that is 24. So, divided by $2a$ is 0.8.

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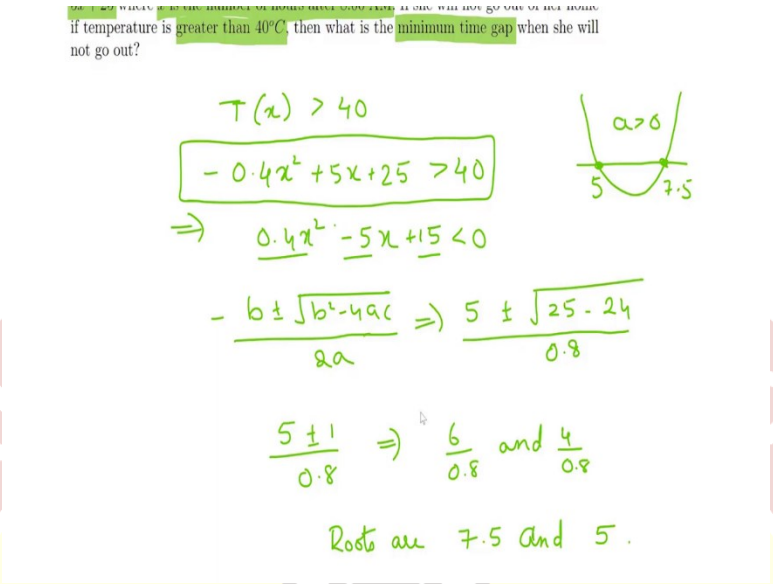

So, our roots are 5 plus or minus 1 divided 0.8 which is one is 6/ 0.8 and the other is 4/ 0.8. So, that gives us the roots as 7.5 and 5. So, these are the roots 5 and 7.5 and that means, this condition that is the temperature being greater than 40 is satisfied between 5 hours and 7.5 hours. That would be from here till somewhere in between here that is 15, 30. So, from 1 pm to 3:30 pm is the time suggested by the curve fit that Anshu has drawn but clearly this is wrong because it is already 43 here, and 48, here and 46, and 43, and 40, and 40 so it is a much larger duration where the temperature is greater than 40 degrees Celsius. So, this particular curve fit is pretty bad.