IIT Madras

ONLINE DEGREE

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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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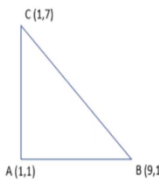
2. A farmer has a triangular field ABC as shown in figure below. If watering costs Rs. 10 per unit square, how much would he have to pay for whole field? If the fencing wire around the field costs Rs.5 per unit, how much would he have to pay for three rounds of fencing around his field?

In the second question, the reserved triangular field ABC, whose coordinates are given. And if watering costs rupees 10 per unit square, so they are giving the cost of watering the field, and it is so and so amount per unit square that is area, how much would you have to pay for the whole field? So, we would like to find out the area of the field. And then if the fencing wire around the field costs rupees 5 per unit, how much should he have to pay for 3 rounds of fencing around this field that is find the perimeter, so find the area and perimeter of this particular field.
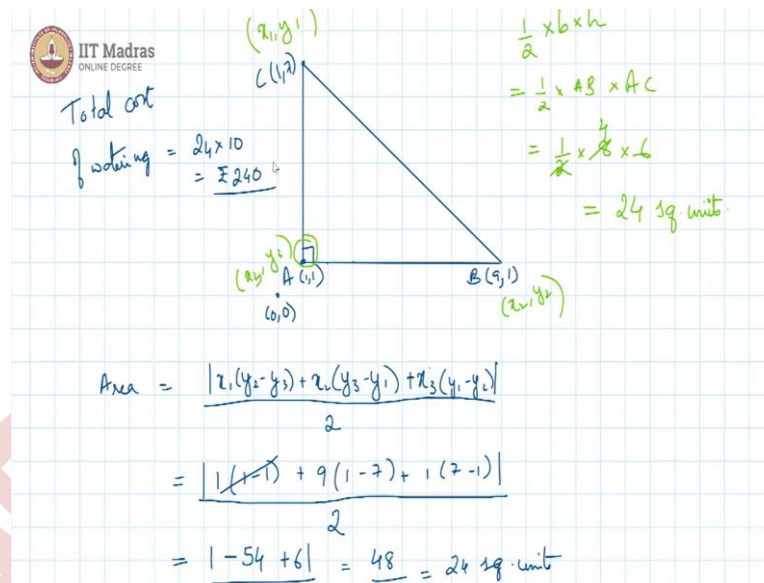
So, if we consider this to be our origin, the triangle is made up of these points, $(1, 1)$, this will be $(9, 1)$ and this is $(1, 7)$. So, this is our triangle, this is A, this is B, and this is C and you can see that AC is completely vertical, its x coordinate remains the same, it is 1, and AB is completely horizontal, its y coordinate remains the same, which is 1.

So, this is a right angled triangle. Now, we could use the area of triangle formula, the area will be $\frac{|x_1(y_2-y_3) + x_2(y_3-y_1) + x_3(y_1-y_2)|}{2}$, which in this case is going to be, you can take any of these points to be $x_1 \; y_1$ and the others to, the next one to be $x_2 \; y_2$ and x_1 to be $x_3 \; y_3$. The, how you choose $x_1 \; y_1$ $x_2 \; y_2$ and $x_3 \; y_3$ does not matter, the order is what is important. Applying this formula, we get our x_1, y_2, y_3 is 1.

So, $\frac{|1(1-1) + 9(1-7) + 1(7-1)|}{2} = \frac{|-48|}{2} = \frac{48}{2}$, and that is 24 square unit. However, the same problem could be approached in a slightly different way which is, if I observe that this is a right angle triangle, I could just do half into base into height. And here the base would be the length AB, that is half into AB for which the height would be the length AC.

And now since AB is horizontal, you can directly take the length to be $x_2 - x_3$ which is the difference in the x coordinates, so $\frac{1}{2} \times 8 \times 6$ we have 24 square unit. So, this worked out because our triangle is a right-angled triangle. So now the cost of watering is supposed to be the area into cost of watering per square unit which is 10 rupees, so total cost of watering is equal to 24 into 10 that is rupees 240.
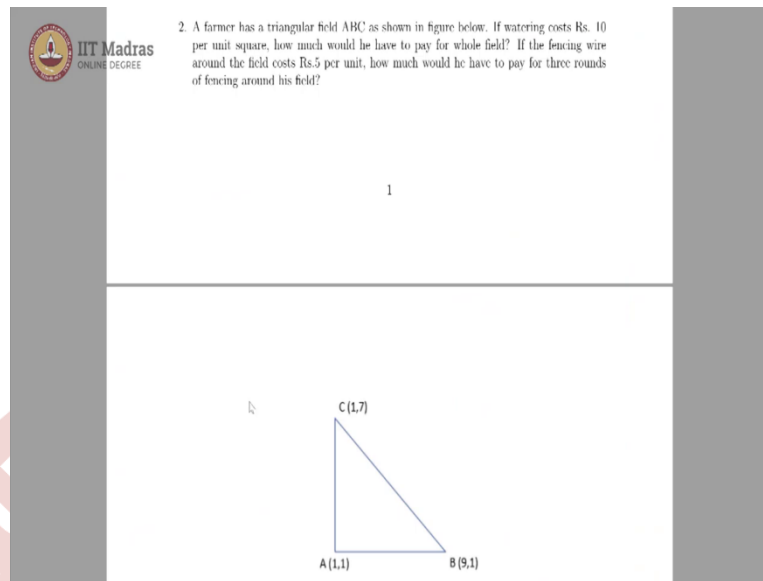
For the second part of the question, we require the perimeter of this triangle because fencing is done along the perimeter, and they have to do 3 rounds of fencing at the rate of rupees 5 per unit. So, we first find the perimeter.

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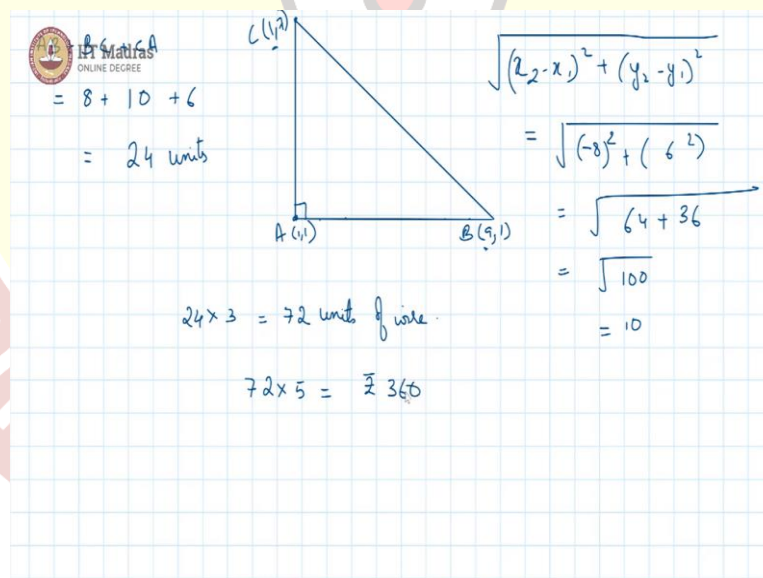
Perimeter would simply be AB plus BC plus CA, which is AB is clear it is 8 units, CA is also clear which is 6 units, BC needs to be figured out and BC we find out using the Euclidean distance, that is the $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ that is the square of the difference in x coordinates plus the square of the difference in y coordinates, the whole under root.

So, this gives us $\sqrt{(-8)^2 + 6^2} = \sqrt{64 + 36} = \sqrt{100} = 10$. So, we have 10. So, this quantity is 10 and thus our perimeter is also 24 units and we need wiring for fencing around 3 rounds. So, we will require 24 into 3 is equal to 72 unit of wire and then each unit has been fixed a price of 5 rupees. So, we have 72 into 5 is rupees 360 is the cost of fencing.