NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Principle of Inclusion and Exclusion

Example 5 - Non multiples of 2 or 3

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How many integers from 1 to 100 are not multiples of 2 or 3? So let A be the set of integers which are multiples of 2, and let B be the set of integers which are multiples of 3,
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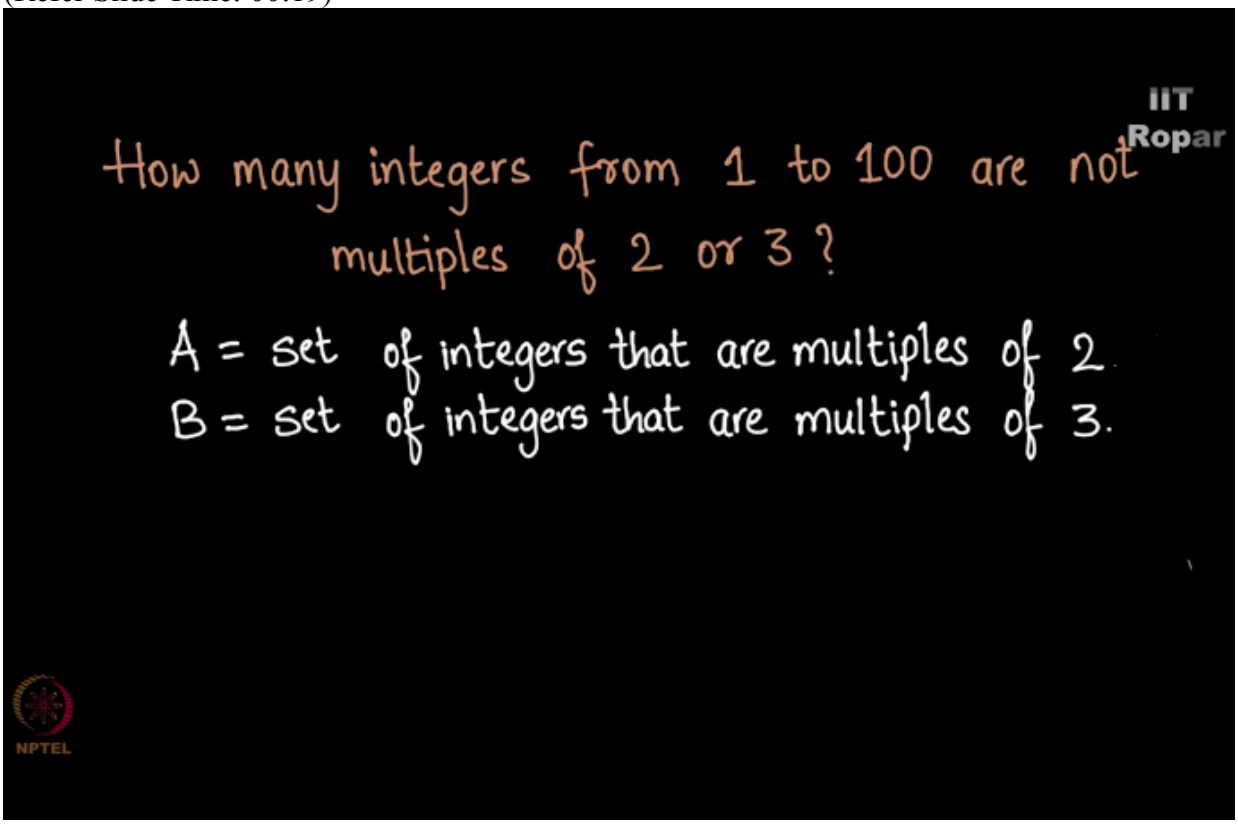

so now I have these 2 sets A and B, so what do we have to find out? We have to find out A bar intersection B bar, or if I say C1 is the condition where an integers satisfies C1 if it is a multiple of 2, and C2 is the condition where an integers satisfies C2 if it is a multiple of 3,
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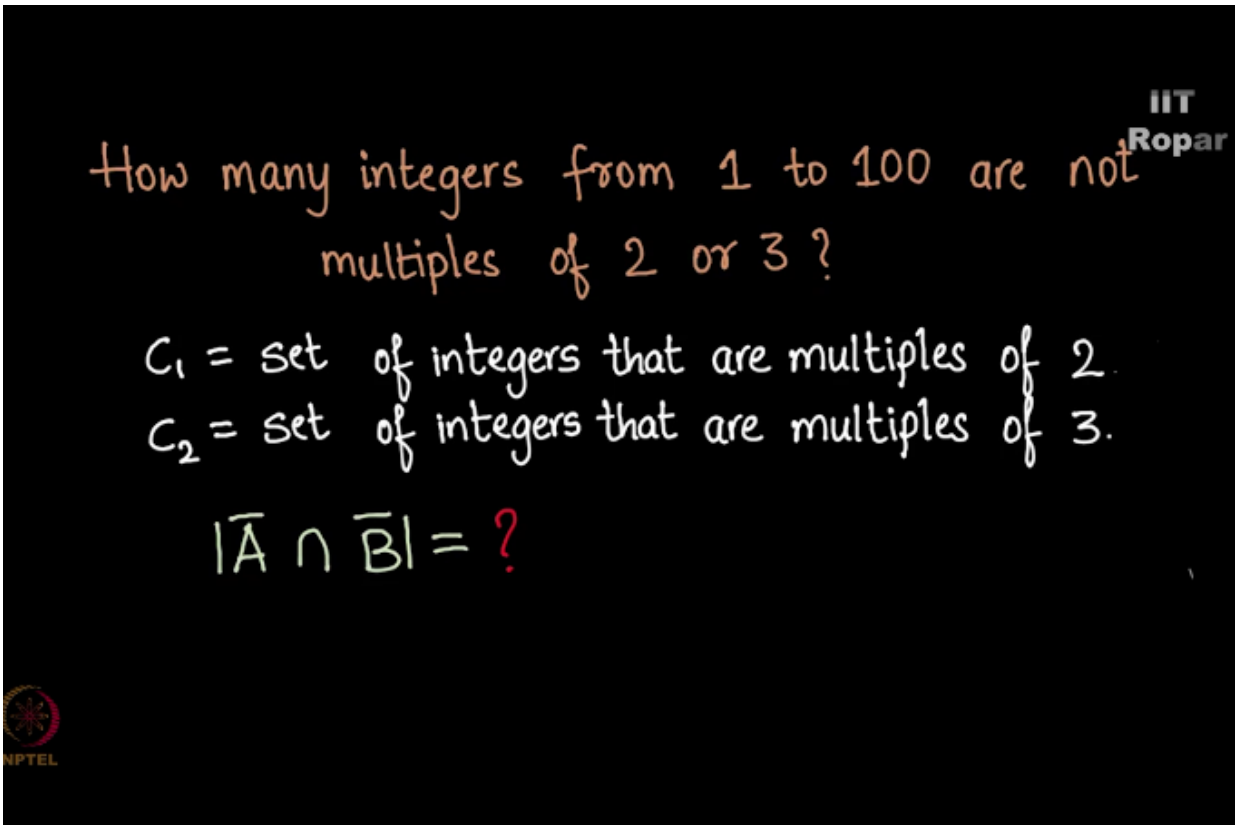

so you have to find out N(C1 bar, C2 bar), what is it going to be?

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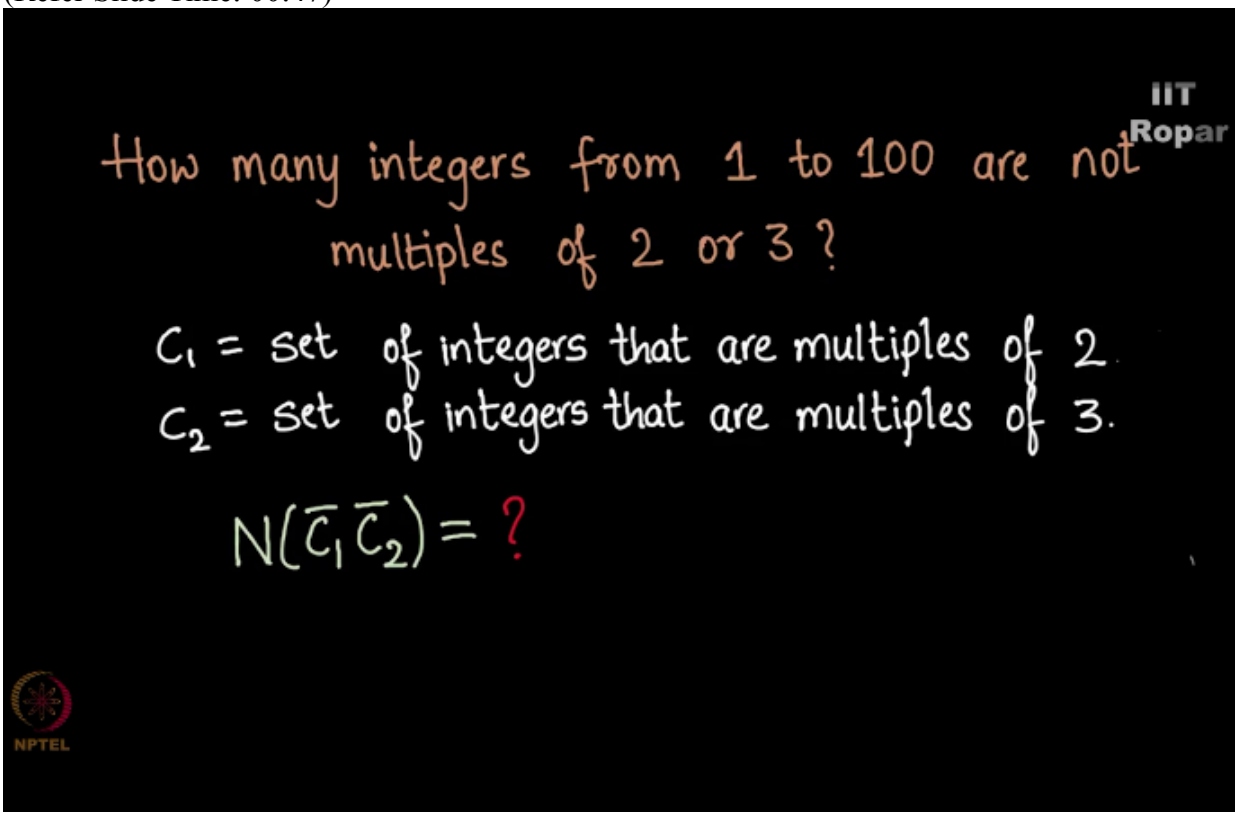

We know that N here is 100, that is integers from 1 to 100 so you have 100 of them here.

Now what is N(C1)? How many integers are multiples of 2? 2, 4, 6, 8, 10 so on, so you have 50 of them, N(C1) = 50, and how many are multiples of 3? 3, 6, 9, 12, 15 so on, so 33 of them are multiples of 3 here, how did we do that?
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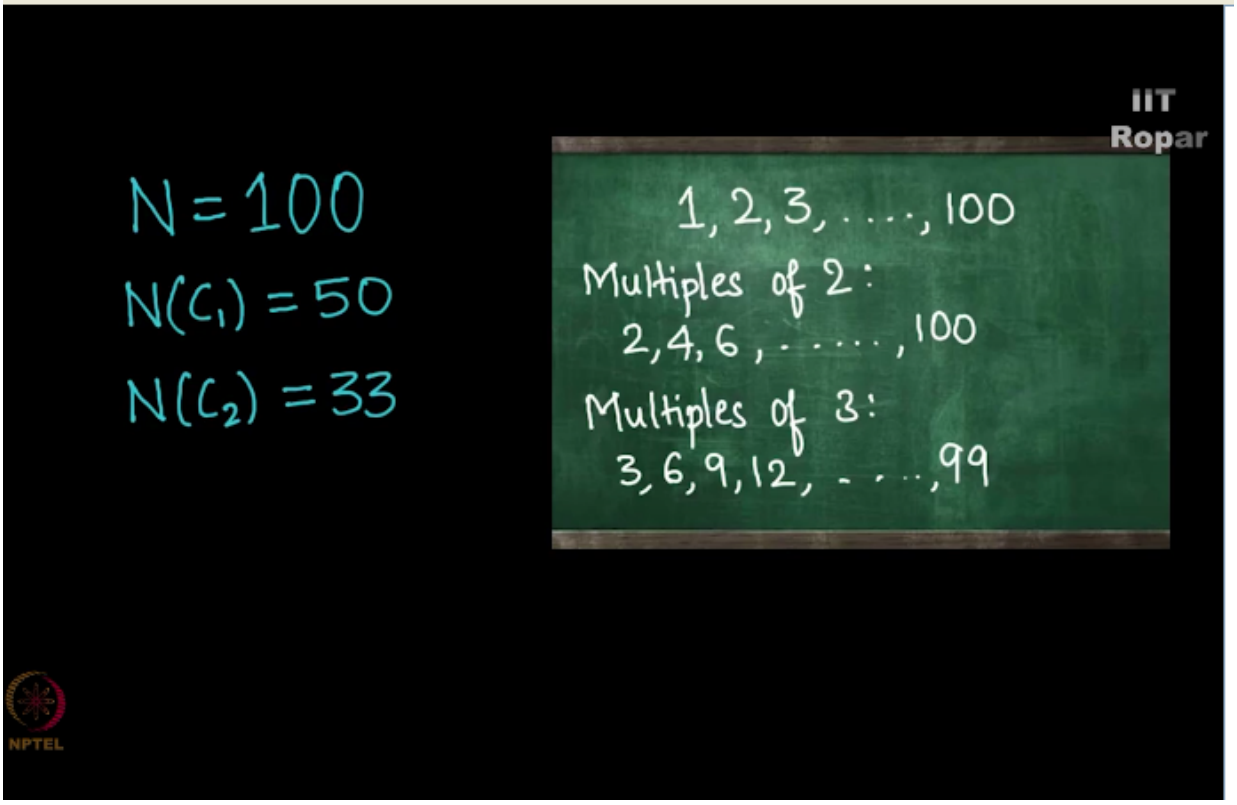

We did it like this 100/3 apply the lowest integer function or called as the floor function where you take the greatest integer which is less than or equal to that number, so here it happens to be 33.
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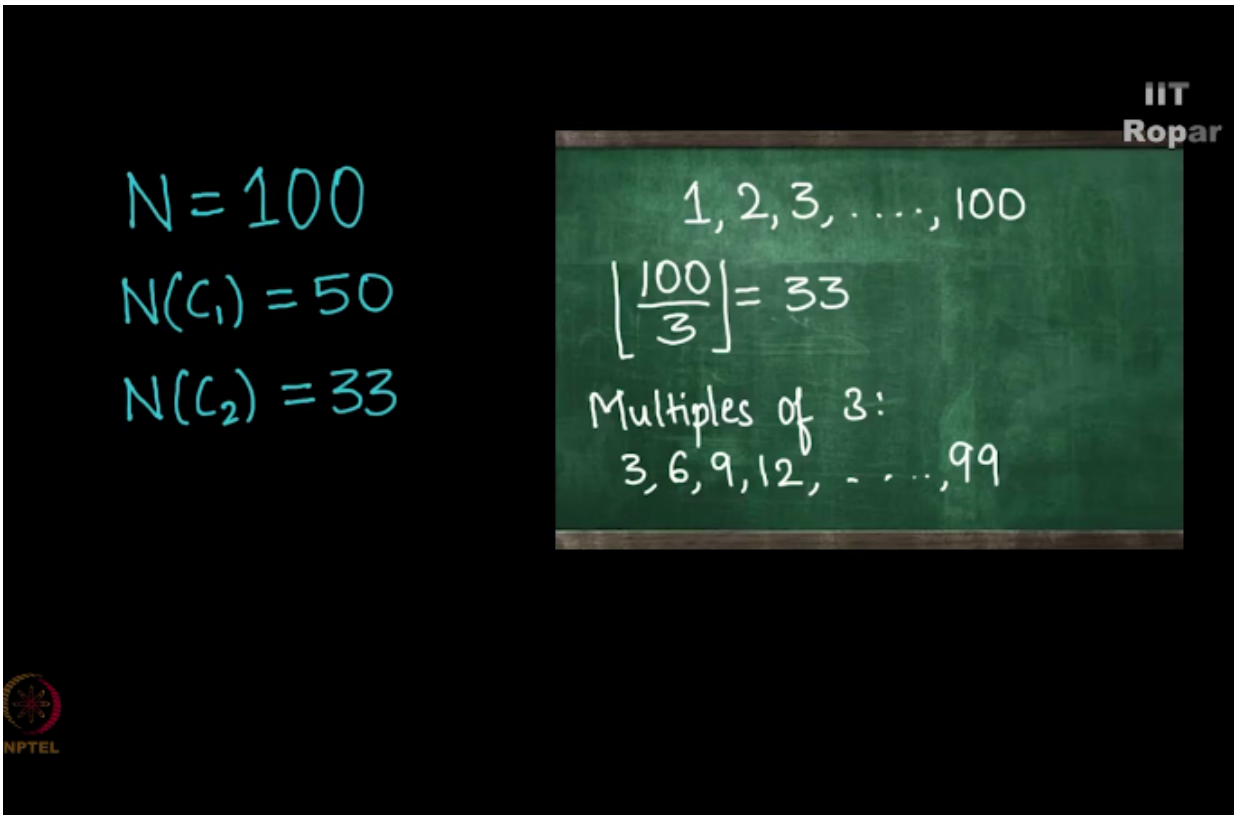

Now N(C1 bar, C2 bar) will be given by N-N(C1) + N(C2) – N(C1,C2), what is N(C1,C2) here?

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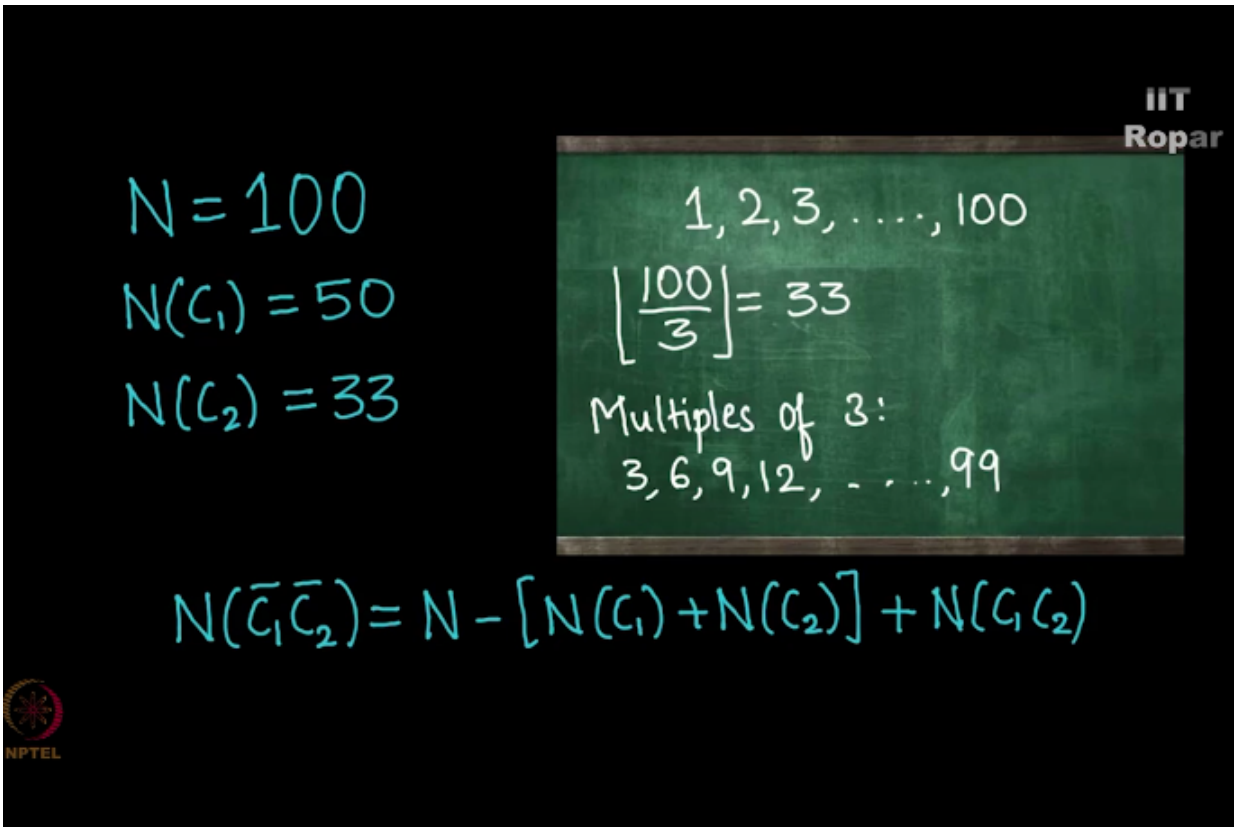

We have not found it out yet, N(C1,C2) happens to be those integers which are multiples of 2 and 3, so how do we do that? We take the LCM of 2 and 3 which happens to be 6, so those integers which are multiples of 6 will satisfy C1, C2, which means we have 16 integers which satisfy C1, C2, which means N(C1,C2) is 16.

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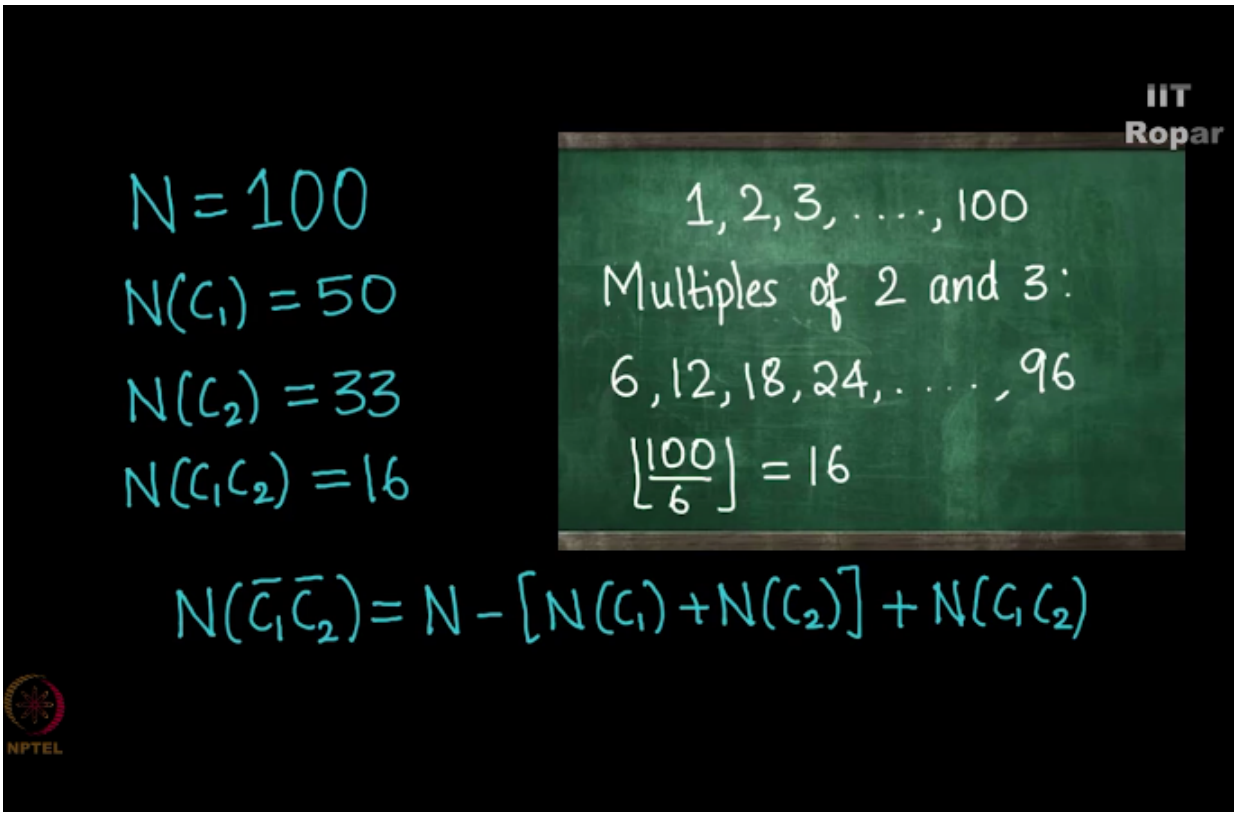

Now what is the answer then? So we have N bar or N(C1 bar,C2 bar) happens to be 100 – (50+33) + 16, which is 100 – 83 + 16, 100 – 83 is 17 + 16 and the answer is 33, so 33 integers are not multiples of 2 or 3 in the range 1 to 100.

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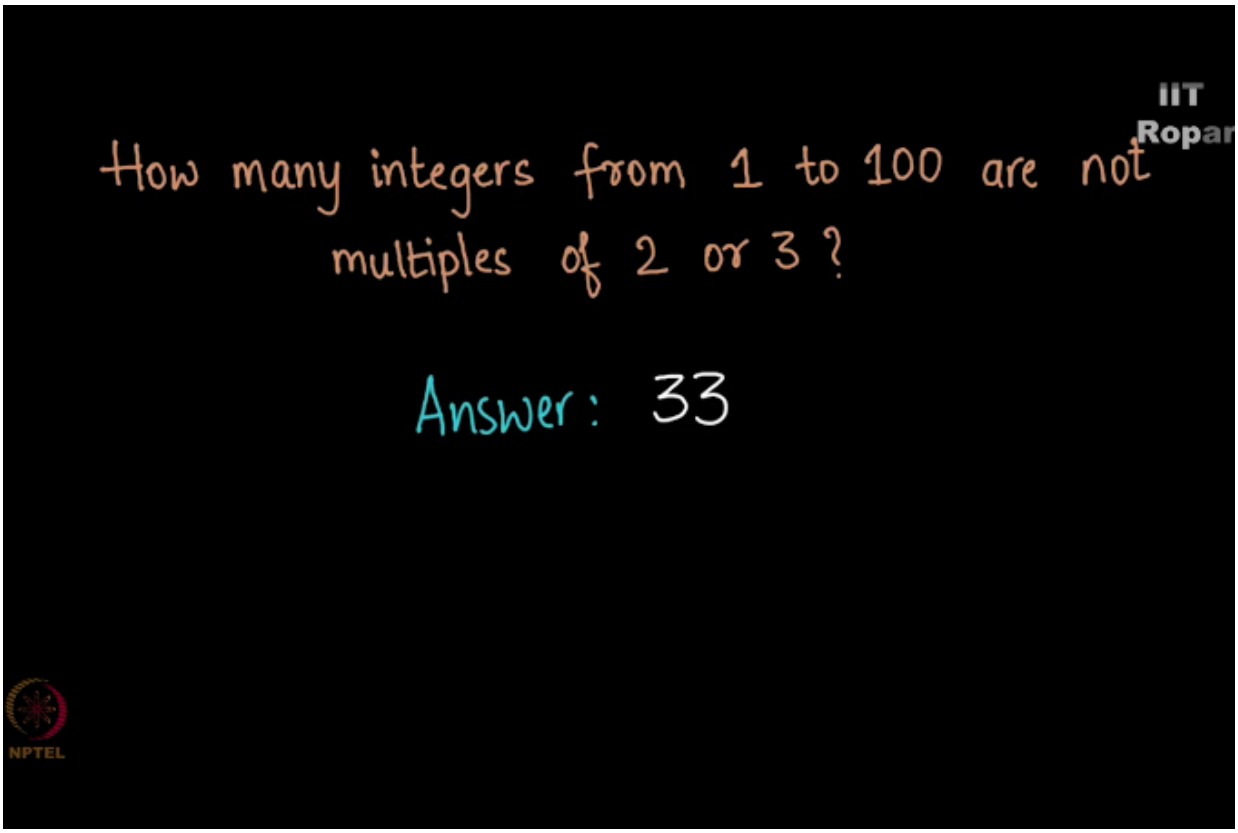

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