# IIT Madras

ONLINE DEGREE

**Mathematics for Data Science 1**
**Week 06 - Tutorial 03**

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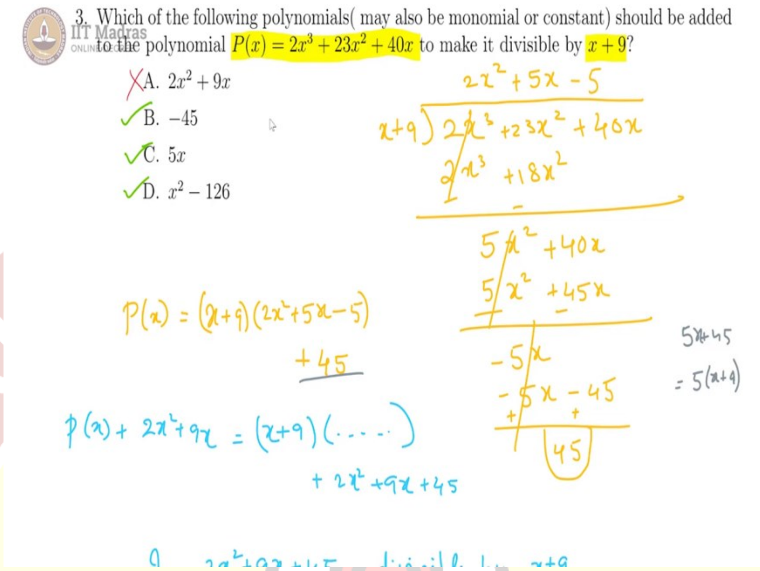


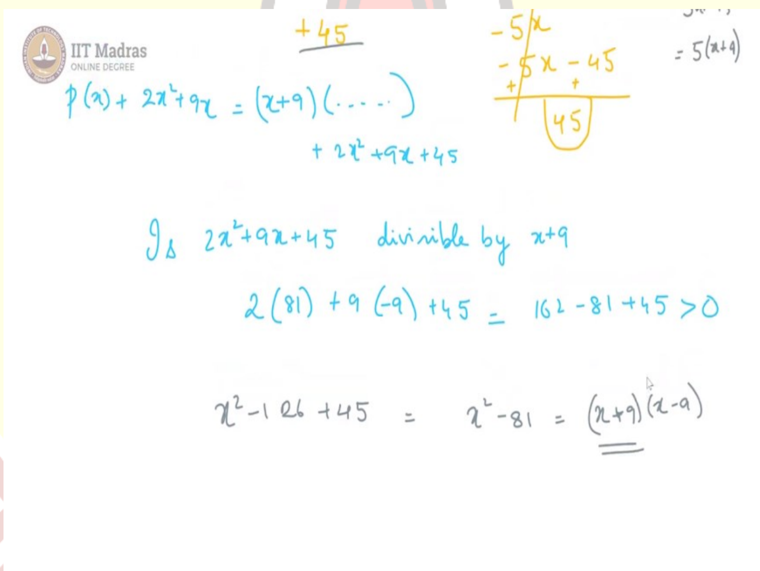


Now, we have this problem, which of the following polynomials should be added to the polynomial $p\ (x)$ to make it divisible by $x +\ 9$. So, we need to recognize that it is not necessary that there is only one polynomial that you add, because since it is only divisibility, we can add a number of polynomials to $p(x)$ and make it divisible by $x +\ 9$. So, we have to check for each of these cases.

So let us see, or what we can additionally do is, we can look at the remainder that we get by dividing $p(x)$ with this and then see what to do with that remainder. So, if we did the division, now, we have $2x^3 + 23x^2 + 40x$ and we are dividing it with $x + 9$. So, start with $2x^2$, so we get $2x^3 + 18x^2$. So, this cancels off, this gives us $5x^2 + 40x$.

So, we do $+5x$ additionally, then we get $5x^2 + 45x$, so negative and negative so we are left with $-5x$ and then that gives us a $-5$ additionally here, so we have $-5x - 45$, therefore these two go off and we are left with 45 as our remainder. So, $p(x)$ is essentially $(x + 9)$ into the quotient +45. So, if we subtracted 45 from $p( x)$, we will get divisibility by $(x + 9)$.

So, B is necessarily correct. Let us look at what happens if we added A, if we added A, $p(x) + 2x^2 + 9x$ is some multiple of some product of $(x + 9)$, and some quadratic plus $2x^2 + 9x + 45$. So, unless $2x^2 + 9x + 45$ is divisible by $(x + 9)$, $p(x)$ would not be divisible by $(x + 9)$.

So, what we should really be checking is $2x^2 + 9x + 45$. Is it divisible by $(x + 9)$? And the direct way to check it is to substitute $x = -9$, so you will get $2 \times 81 + 9 \times -9 + 45 = 162 - 81 + 45$, which is greater than 0, it is not equal to 0. So, no, A does not give us divisibility by $(x + 9)$.

What happens if we added $5x$, we get $5x + 45$. So, we have this 45 remainder, so we are getting $5x + 45$, which is equal to $5(x + 9)$, which is directly divisible by $(x + 9)$. So, this is correct too, c is also correct. And what happens if we added $x^2 - 126$ , then we would get $x^2 - 126$+45 as the additional part upside from $(x + 9)$ into that quadratic, so this is equal to $x^2 - 81$, which is equal to $(x + 9)(x - 9)$. So, $(x + 9)$ is dividing this particular polynomial. So, we can add $x^2 - 26x - 126$ also, and get divisibility by $(x + 9)$.