

welcome students in previous class we saw how to find out certain integrals which were involving polynomial expressions we looked for the integrals at the later half of the class of the kind $\frac{p x + q}{a x^2 + b x + c}$ $\frac{p x + q}{\sqrt{a x^2 + b x + c}}$ and as a particular case one over $\sqrt{a x^2 + b x + c}$ and one over square root of $\sqrt{a x^2 + b x + c}$ all these integrals we converted into certain known forms and we try to evaluate them using those known forms before moving further i will pick couple of more examples one example related to this particular form ah to further understand or for how to apply the methods which we learnt so will pick one quick example here we need to integrate $\frac{2x - 1}{\sqrt{4x^2 - x^2}}$ or square root of $\sqrt{4x^2 - x^2}$ so if you compare it with the form $\frac{p x + q}{\sqrt{x^2 + b x + c}}$ notice that here a is negative minus one so as in previous class i told you in order to evaluate this what we do is that we write the numerator in terms of a specific combination of the derivative of the denominator plus a constant so you will write $2x - 1 = a(2x - 1) + b$ equals to a times d by dx of the denominator function except the square root so here it is $4x^2 - x^2$ squared plus b so that will get a times four minus two x plus b now both sides are polynomial therefore we can compare the coefficients so first compare the coefficient of x so you get two equals to minus of two a implying that a is equals to minus one and then four a plus b equals to minus one implying that b equals to three so once we got the values of a and b we replace this $2x - 1$ by this expression in the integral let us say this integral is i so the integral i now after replacing this term can be represented as $\int \frac{a(2x - 1) + b}{\sqrt{4x^2 - x^2}} dx$ which is $\int \frac{4x - 2x + 3}{\sqrt{4x^2 - x^2}} dx$ sorry instead of a i have to put it minus one minus one times four minus two x and plus b the value of b is three divided by square root of $\sqrt{4x^2 - x^2}$ dx this this is minus one times four minus two x i can write it as $\int \frac{4x - 2x + 3}{\sqrt{4x^2 - x^2}} dx$ plus the next term is three integral $\frac{dx}{\sqrt{4x^2 - x^2}}$ my four x minus x is squared square root of four x minus x squared ah look at these two parts here so in earlier case when the square root was not there we substituted sorry $\sqrt{4x^2 - x^2}$ four x minus x squared

so in earlier case when when
 this square root was not there we substituted this term
 so that it became one by t
 so we we shall do
 the same process and let us see what it evolves to
 so four x minus x is square equals to t
 so that four minus two x d x equals to d t in the first integral it turns out
 to be minus
 of integral d t over square root of t plus three times the second integral in
 order to
 evaluate this what we do is that it is of the form x square plus b x plus c
 so we will try this
 is this is of the first form which we discussed ah in the previous class this
 is of the form
 one by square root of x square plus b x plus c
 so you will try to make a perfect square out of
 it
 so you can easily see that that i can write four x minus x square as
 minus of x square minus four x which i can further write as four
 minus x square minus four x plus four which will make it four minus
 x minus two whole square
 so the term four x minus x
 square now converts into the form four minus x minus two whole square this d t
 by root t can be easily evaluated it is
 basically t raise to power minus half
 so which will give you t raise to power half divided
 by half plus this integral if i put x minus two equals to u then d x is equals
 to d u so
 that this integral will be converted into form of d u over square root of four
 minus u square which
 if you remember the formula this is of the form a square minus ah u square
 so ultimately this
 turns out to be minus of two square root of t plus three a square minus u
 square
 so this will be sine inverse u by a c u by two plus constant finally
 substituting the values of t and u we will get minus of two square root of t
 and t is
 nothing but four x minus x squared plus three sine inverse u is nothing but x
 minus two
 divided by two plus a constant of integration
 so we note that the integration of two x
 minus one divided by root of four x minus x square gives us this integral
 value what is more
 important here is to understand how we proceeded by converting into two
 separate integrals for
 both of which we knew how to evaluate this the idea that we proceeded here for
 this
 particular problem writing the numerator as a combination of derivative of the
 denominator
 this can even be further used for the cases where the denominator which is the
 quantity
 term is having a degree other than half for example
 so far we have considered these two
 cases where the denominator a x square plus b x plus c is having a degree one

here or

the entire term was having degree half square root means having a degree half so if

other than that if it is some other term also say for example ah it is a x square plus b x

plus c raised to power sum three four or some other number then also you can use the same idea

writing $p x + q$ as a combination of ah this denominator derivative of the denominator plus

some constant and then you can proceed ah further will pick another quick simple example

so let us find out the integral of x^2 over square root of $x^6 + a^6$ where a is

some constant which is given to be positive and we have to find out this integral look at

this integral carefully

so we have to find out well i hope you have quickly noticed

that this integral can be represented as $x^2 dx$ over square root of $x^6 + a^6$ squared plus a raised to the power six and if i take the derivative of x^3 i will

get ah x^2 which is part of the integrand

so taking x^3 is equals to a new variable t

rise of $x^2 dx$ turns out to be equals to dt and therefore this integral will be converted

into form of one by three dt over square root of $t^2 + a^2$ since i want

to use my formula

which i already know of the form ah $x^2 + a^2$ kind of formula therefore this a raise

to power six i should write as a cube squared

so this becomes very easily the known form of

integral dt over $t^2 + a^2$ if i consider this a cube to be some new number a

then this is $t^2 + a^2$

so for that integral of $t^2 + a^2$

we know it is nothing but logarithmic of $t + \sqrt{t^2 + a^2}$ plus a square that means a cube squared plus constant which finally gives us one

by

three log of what is the t its $x^3 + x^3 + a^3$ plus constant

so noticing a small thing here that a six can

be written as a cube raised to the bar two we can simply solve this example so

so far we have seen that certain integrals which were written in certain algebraic form can be evaluated using these techniques which we have developed

further ah now we shall look at another method which is known as method by partial fraction

so if we are given the integrand this is of the form $p(x) / q(x) dx$

so we are going

to look for the integrals of this kind

so our integrand is of the form $p(x) / q(x)$ such that $q(x)$ is not equal to zero that means it is a

rational function of p and q where p and q are polynomials in the variable x
 so in order to use method of partial fractions we shall assume certain
 specific forms on these p and q the degree of a polynomial is defined as the
 highest degree term present for the variable
 for example $x^2 + 3x + 4$ if I define it as a $p(x)$ then this is
 said to
 be of degree two or a quadratic polynomial similarly if I define an expression
 in cube
 then that will be defined as cubic I hope you all are aware of that
 so if degree of the polynomial $p(x)$ is less than degree of the polynomial $q(x)$
 then the rational function p/q we call it as proper and if it is not so if
 the degree is bigger than or equals
 to degree of q then we call it improper
 so for a proper rational function
 the degree of $p(x)$ should be less than degree of $q(x)$ ah one important fact
 one can note that even if it is improper say for example degree of $p(x)$ is
 larger than
 that of $q(x)$ we can use ah large division and then we can further write it as a
 as a ah polynomial
 plus another rational functions which will be a propagational function I will
 show you with
 the help of an example how it can be done
 so in for method of partial fractions what we assume is that the
 denominator polynomial $q(x)$ can be factorized into either linear or quadratic
 polynomials that means we can factorize this
 $q(x)$ in terms of linear factors or if not then at least in quadratic
 polynomials
 one such examples we have already seen in in previous class was when we were
 evaluating
 the integral of $\frac{dx}{x^2 - a^2}$
 so here you if you look at it carefully the
 integrand is of the form $\frac{p}{q}$ where p is equals to one and q is equals to $x^2 - a^2$
 square minus
 a square also q can be written as $(x - a)(x + a)$ and therefore q can
 be factorized
 in terms of two linear polynomials making q
 so depending on the specific forms of p and q we can assume specific partial
 fractions
 so forms of the rational function and the
 partial fraction we should choose for that
 so if the form is linear in the numerator and
 the denominator which is quadratic can be written as factor of ah two
 different linear factors a not equaling to b sometimes if we put this $q(x)$ to be
 equals to 0
 this a and b are also called roots
 so in that sense we can say that that the denominator
 function has two distinct roots a and b in that case we choose partial
 fraction
 as $\frac{A}{x - a} + \frac{B}{x - b}$ similarly if the case is of repeated
 root numerator function is of the form $p(x)$ and denominator is
 repeated that means $(x - a)^2$ in that case the partial fraction is
 chosen as $\frac{A}{x - a} + \frac{B}{(x - a)^2}$
 upon $x - a$ plus B upon $(x - a)^2$
 so these are the two cases for

the for the for the case when numerator is linear and denominator is quadratic

if the denominator is a cubic function then suppose that there are three distinct roots a numerator is a quadratic polynomial then the partial fraction corresponding can be given as

so a is not equaling to b none of the a b c are equal a naught equals to b and b not equals to c and a not equals to c

so fourth case again since its a cubic polynomial in the denominator therefore there is a possibility of two repeated roots

so $p x^2 + q x + r$ over $(x - a)^2$ into $x - a$ plus b for the repeated root case $x - a$ whole square

so this is similar to the previous case when we had a repeated root case here

plus c upon $x - a$ and fifth case when numerator is quadratic $p x^2 + q x$

plus r and denominator is of the form $x^2 + a x + b$ into $a x^2 + b x + c$ that means it

cannot be factorized into the linear factors in third case the choice is a upon $x - a$ so

that linear factor separate plus corresponding to this quadratic factor which cannot

be further factorizing to linear factor the choice for partial fraction will be $b x + c$ by $a x^2 + b x + c$ let me call it as a one

so that there is no confusion a one the two terms are different a and a one

so it has a distinct root here and these

these are the coefficients of the polynomial

so these are five specific cases corresponding

to which partial fractions are are ah written and in a similar process in the similar way we

can define further partial fractions for other expressions as well

so if roots are distinct then

we write them separately if roots are repeated then the term is written once again with

the quadratic term as well and similarly ah if there is a quadratic term which cannot be

further factorized then corresponding to that the term is written as a multiple of the variable

x plus constant

so this forms one has to keep in mind

so let us choose the example of

one integral which we have already done is $\frac{d x}{x^2 - a^2}$

so we

already know the value of this integral as $\frac{1}{2a} \log \left| \frac{x - a}{x + a} \right|$

plus constant

so what if we we we solve it using partial fractions we can see that that that

the denominator function here can be factorized into $(x - a)(x + a)$ so

the entire factor can be written as equals to the partial fraction of this rational function is noted down as $\frac{a}{x-a} + \frac{b}{x+a}$ so the form of the integrand if it is of this form $\frac{p}{x-a} + \frac{q}{x+a}$ they should be written as $\frac{a}{x-a} + \frac{b}{x+a}$ so here the integrand is of the form $\frac{1}{x^2 - a^2}$ which I have written in this form so this should be written as $\frac{a}{x-a} + \frac{b}{x+a}$ so computing this we can find that taking $x-a$ as LCM here on the right hand side so what you get on the right hand side is $a + b$ and on the left hand side you will get one because $x-a$ is cancelled throughout so you compare the coefficients again being the polynomial you compare the coefficients of both the sides so what you should get is $a + b = 0$ the coefficient of x on the right hand side and there is nothing on the left hand side therefore $a + b = 0$ and here $a = -b$ so a can be taken as common equals to one so from this expression we can figure out that $a = -b$ and if I substitute $a = -b$ here what I get is that $2a = 1$ which will give me $a = \frac{1}{2}$ to $a = \frac{1}{2}$ since $a = -b$ therefore $b = -\frac{1}{2}$ and therefore this expression the integrand is written to be equals to $\frac{1}{2} \left(\frac{1}{x-a} - \frac{1}{x+a} \right)$ so minus I can take one by two as common one over $x+a$ so if you remember you found the same thing when we used when we derived this formula in our previous class now you can easily write this one by two a this is logarithmic of $|x-a|$ minus logarithmic of $|x+a|$ plus a constant c so $\log \frac{m}{n} = \log m - \log n$ and therefore the formula the same formula we will reach to so we will give you another example here suppose that we want to integrate the function $\frac{dx}{x^4 + 1}$ so this does not fall into any of the form which we have discussed so far so but if we do some change in the integrand we can see that we can actually find out the integral using partial fractions so for that what we have to do here is that we try to figure out what if we substitute some number so that you know your substitution as it used to work that you get a factor of the integrand in that derivative so here it is x^2 raised to

power 4 here which is x^3 so none of them are working but if you multiply it by x^3 in both numerator and denominator what I will get is x^4 x^4 plus one well now if I substitute x^4 and I see that x^3 $d x$ that is appearing there

so a factor of the integrand is appearing in the numerator so that substitution I will make x^4 is equal to t which will make $x^3 d x$ is equal to $d t$ so that $x^3 d x$ is equal to $d t$ by four

so this calculation leads to one by four of $d t$ over t into t plus one this integrand now is of the form the form which we are looking at

so quadratic in denominator

and constant in the numerator therefore I can make partial fraction out of it one

by t into t plus one I can write it as a by t plus b by t plus one

so now I just

need to compute the values of a and b again using the comparison a time t plus one plus b time d

so it will lead to a is equal to

one and b is equal to minus one

so that this integrand can be written as one by four integral $d t$ over t t plus one

this number can be replaced by this number a

so one by t b is minus one

therefore one by t plus one $d t$ which one can see very easily

is one by four one by t $d t$ is \log of $\text{mod } t$ minus this is \log of

$\text{mod } t$ plus one plus constant so substituting the value for t which is x^4 raise to power 4 we get final answer as $\frac{1}{4} \ln|x^4 + 1| + C$ and also using the formula

simultaneously \log

of m minus \log of n is equal to \log of m by n as x^4 raised divided by $x^4 + 1$ mod plus constant C

so this is what

you get

so as I mentioned the case for the rational functions which are of the form $\frac{p(x)}{q(x)}$ such that $q(x)$ is not zero ah it may be possible sometime the degree of $p(x)$

is more than degree of $q(x)$ or equals to the degree of $q(x)$ in those cases what we do is that we first do the long division

so that we get a polynomial and then a proper rational function and then

on the iteration function we apply partial fractions

so let us look at one example which will help you to understand the problem so the example is $\frac{x^4 + 1}{x^2 + 1}$ $\frac{x^4 + 1}{x^2 + 1}$ we

need to evaluate this integral if you look at this integrand it looks like x^4 times x^2 x^4 raise to power four

so it's a four degree polynomial in the numerator four degree polynomial denominator but if we also look at it carefully we can see

that the quadratic terms they are only appearing in both the numerator and denominator

there is no linear term or there is no cubic term

so no no other term is appearing there apart from this quadratics therefore ah what we can find out the solution of this problem we can simplify this expression by substituting it as a new variable $x^2 = y$

so we are not making it as a real substitution in the integral rather we are just making this substitution in integrand so the integrand becomes this integrand becomes $y + 1$ $y + 2$ over $y + 3$ into $y + 4$ which makes if i if i look at the product $y^2 + 3y + 2$ divided by $y^2 + 7y + 12$

so both the numerator and denominator they are having the same degree term and therefore we have to go for the wrong division so let us divide $y^2 + 7y + 12$ by $y^2 + 3y + 2$

so the coefficient is same here therefore it can go one time so i will get here $y^2 + 7y + 12$ subtracting we get these signs as minus so what is left here is that this y^2 get cancelled $3y - 7y$ will give you minus of $4y$ and $2 - 12$ is minus of ten so the remainder here is minus four $y - 10$

so this expression of integrand this expression of integrand can be written as $1 + \frac{-4y - 10}{y^2 + 7y + 12}$ this is what the integrand is so we will write it now the integrand this fashion or we can further write it as one minus instead of one plus one minus four $y + 10$ by $y^2 + 7y + 12$

so this factor can further be written as i mean $y + 3$ into $y + 4$ and this is for the integrand so our actual integral i which is $x^2 + 1$ $x^2 + 2$ divided by $x^2 + 3x + 4$ $d x$ in this we only changed x by y x^2 by y^2 you see here we just change x^2 by y^2 therefore let us go back in order to write that integral so in this integrand replace y by x^2

so this will be equals to $1 - \frac{4x^2 + 10}{x^2 + 3x + 4}$ $d x$

so now this entire exercise of solving this expression converts into another problem which is having one as a polynomial and then another expression so what we will do here is that further is that that we know how to handle this expression now because this integral we can handle using partial fraction so in order to solve this we will go through partial fractions and i will show you how to find out the partial fraction for $\frac{4y + 10}{y^2 + 7y + 12}$

so the partial fraction for this will be written as $\frac{a}{y + 3} + \frac{b}{y + 4}$ which you can

easily after solving you can find out that in this case a turns out to be two and b turns out to be six so take the multiplication do that and then you can write this calculation so you find out that a is equals to minus two and b is equals to six and hence this integral will be equals to integral one dx minus this factor replacing y by x square is same as this factor so will be a which is minus 2 so minus of let us put a curly bracket here minus two upon y plus three so y replaced by x square x square plus three integral $d x$ plus b so plus 6 by y plus 4 x square plus four integral $d x$ and then curly bracket closed so what we have done so far is that that this expression has been converted into using some new replacement y or converted into this expression and corresponding to this we have used the partial fractions and now we have written this expression in terms of those partial fractions so ultimately the integral which finally equals to this integral leads to i will rewrite it equals to integral one $d x$ integral one $d x$ which is nothing but x plus two times one over x square plus three minus six times integral one over x square plus four $d x$ so this expression can be easily evaluated as x minus two times x square plus a square the formula this will give you one by a tan inverse x by a plus six times this will also give you one by a tan inverse x by a plus constant so after simplification this goes to two three six so this will be a form of solution which you can get so sometimes it helps if instead of looking at the problem exactly the way it has been written from a different perspective by replacing or changing some variable it may become far more easier to solve using the methods or the techniques which we know in the next we will look for another example of another kind so this example deals with the problem of linear factor in the numerator and the denominator is a cubic polynomial having two as a as a root and then x square plus one as a factor so suppose that we have to find out this integral so as integrand one can see that this is of the form linear divided by cubic where ah the cubic is having one linear factor another quadratic factor we again go back to the form of the partial fractions where it was ah it was mentioned that in case if the quantity factor cannot be further factorized then that case we have to write it as the linear

factor plus b x plus c times quadratic factor
 so this case can be compared that p equals to zero
 q and r both are one because this is one and one q and r are one and similarly
 we can compare
 other coefficients to write this
 so the integrand written as partial fractions will be written as a upon x
 minus two
 plus b x plus c upon x square plus one
 so simplifying this we get left
 hand side as a linear polynomial right hand side we get a x square plus one
 plus
 b x plus c times x minus two
 so you can see there a x square and here you will get b x square
 so a
 plus b since on the left hand side there is no x square therefore a plus b
 equals to zero
 once you compare the coefficient of x what you will get from here is that that
 minus
 two b plus c
 so minus two b plus c the coefficient of x here is one and then further if
 you compare
 the constant coefficients it gives you a minus c minus two c a
 minus two c on the left
 hand side equals to one a on the left hand side
 so we get these three equations three
 unknown three equations
 so you can solve them clearly a is equals to minus b therefore either
 you substitute b is equals to minus a or a is equals to minus b and then you
 solve these two
 equations in either in a and c or b and c so it should not be very difficult
 for you to solve
 and figure out that a is nothing but three by five b is nothing but minus of
 three by five
 and c is nothing but minus of one by five
 so the integrand can be represented in this
 factor form and therefore the integral i shall be represented as as this
 factor is equals to a
 where a is equals to this number b and c are these numbers
 so we will replace this integrand with
 this factor by replacing values of a and b also a is three by five
 so it is three
 by five of one over x minus 2 here plus b is minus 3 by 5
 so minus 3 by 5 times x
 plus c c sorry c is minus 1 by 5 minus one by five divided by x square plus
 one x square plus one d x
 so this entire integral now turns out into
 this form the first factor integrating is very easy in order to integrate the
 second factor
 what we do is that we break it into two parts
 so the integral we shall write as
 following three by five integral of x minus two minus i can take one by five as
 common integral of three x over x square
 plus one and then minus d x of course one by five one over x square plus one d
 x

so this is what we will get minus
 three by five minus one by five
 so the integral turns out to be three
 by five log of mod of x minus two linear term minus three by five this x
 square plus one if i replace it
 by a number t then i will get two x $d x$ is equals to $d t$ therefore x $d x$ will
 be d
 t by two
 so i can immediately write it as one half of logarithmic of mod of x square
 plus one
 so one now you can evaluate it simply minus one by five
 so here it is $d x$ over
 x square plus one which i can immediately write using the formula tan inverse
 x and
 plus finally a constant of integration simplifying it a bit here
 you can get the final answer
 so the cases where the function cannot be factorized further for example here
 x square plus one cannot be factorized further we can use this technique and
 find out the
 integrals using some other known formulas this topic of partial fraction
 this can further be practiced and when you solve problems you will realize
 that how
 to compute the values of a b 's and these unknown constants and once you are
 able to factorize
 them in terms of linear or quadratic factors the the the formula which we
 have
 already developed they become very handy
 so evaluating those integrals
 which are of the form p by q where those p by q can further be ah written in
 terms of partial fractions it becomes very easily next we shall look for
 another kind of
 method which is known as integration by parts this method is important ah when
 we
 have to solve the integrals which involve certain products
 so far we are seeing
 that that integrands are becoming complicated ah when they involve certain
 products sometimes it
 becomes easier if we are able to break them into products and find out the
 integrals of those
 so further we shall look another method for evaluating ah the integrals where
 the integrand
 is given as the product of certain functions sometimes it becomes easier if we
 know the
 integral of ah the parts or if we can convert them into certain form where we
 can ah evaluate
 the integrals of the parts then this particular method becomes very useful
 so we shall look look
 at the method known as integration by parts the method is motivated by the
 fact that in case of
 differentiation we know that the differential of two functions u and v if we
 take the
 differential of their product it turns out to be where u and v are obviously
 assumed to be function of x if we integrate this throughout
 so we know

we can operate this an integral operation we get $u v$ equals to integral of $u \frac{d}{dx} v$ over dx plus integral of $\frac{d}{dx} u$ over dx times v over dx now if i write this expression by taking this $u \frac{d}{dx} v$ over dx on the left hand side and write it as $u v$ then becomes minus of $\frac{d}{dx} u$ over dx times v over dx now make certain assumptions here assume that u is a function of x $f(x)$ and v is a function of x such that $\frac{d}{dx} v$ over dx is equals to $g(x)$ you will notice why we are doing this so that it what it will come here is that $f(x) \frac{d}{dx} v$ over dx is dx so $f(x) \times g(x) dx$ then this expression will take the form as integral of $f(x) g(x) dx$ equals to $u v$ so u is $f(x) \frac{d}{dx} v$ over dx is equals to $g(x)$ therefore v will be integral of $g(x) dx$ minus integral $\frac{d}{dx} u$ over dx since u is equals to $f(x)$ therefore $\frac{d}{dx} u$ over dx will be $f'(x)$ times v v is again integral $g(x) dx$ put a close bracket and then entire integral so integral of this entire thing so what we we notice from here is that if we take this differentiation of the product of two functions we use that formula what where we ultimately you reach to using these two functional identification we reach to this formula integration of functions $f(x) g(x) dx$ is equals to $f(x)$ integration $g(x) dx$ minus integration $f'(x)$ into integration of $g(x) dx$ and then the integration of the whole so this becomes the formula for integration by parts or formula for integration of product of two functions how shall we understand it so integration of the product so we will call one of the function as first function and other function as second function so the integrand is written the product of two functions first into second then integral equals to we are calling $f(x)$ as first function we normally memorize or remember it in this form multiplied by $g(x) dx$ integral that means integral of second function minus integral $f'(x)$ that is differentiation of first function multiplied by integral of second function so the integration of the product turns out to be first function integral of the second function minus integral differentiation of the first function into integral of second function let us look at one quick example which will help us to understand this formula very simple example to evaluate $x e^x$ raise to power $x dx$ so in order to evaluate this we can choose a function as first function so suppose that we choose this as first function and this as second function then what does formula say first function \times integration of the second e^x raised to power x minus differentiation of the first x prime so dx prime is one multiplied

by integration of the second integration of the second is e
 raised to power x integral of whole and therefore this gives you x
 e raised to the power x minus exponential integral is again e raised to power
 x and plus finally a constant of integration sorry
 so this is the integral in this
 case using this formula of integration by parts what is important or you may
 note here is
 that whenever we are integrating first during use use of the formula we are
 not using constant
 let me put it here for you and see what happens
 so suppose that that during the process of
 integration if we have used the constants then the integral of $x e$ raised to
 power x d
 x would have taken the form of first function this is first function this is
 second function
 into integration of the second
 so instead of writing e raised to power x i should have
 written here e raise to power x plus c minus integration differentiation of
 the first
 function it will be one again integration of the second i should have written
 e
 raised to the power x plus c then d x
 so ultimately what i will get here is
 that $x e$ raised to power x plus c x minus integral of this term now is e
 raised to power x
 because of this factor c is a constant
 so integral will get me $c x$ plus another constant c one this
 $c x$ cancels with this $c x$
 so ultimately i get $x e$ raised to power x minus e raised to the
 power x plus and constant c one you know that up to constant these are fine
 so these two
 integrals are same
 so it is redundant to write the constant during the process of integration
 and we can leave them
 so we do not bother when we are writing the integral of the second
 function and at that time we leave those constant it is very important to choose
 here or make
 the choice of the function that which function should be chosen as first
 function and which
 function should be chosen as second function if you look at the formula for the
 product
 this formula becomes very handy if we have a proper choice of the
 functions if you notice carefully in the in the formula what is happening
 here
 is that that the product function is going to have the integral of the second
 function and
 the differentiation of the first function
 so if we have a function which reduces when we take the
 derivative say for example a polynomial function you know that if you
 differentiate polynomial
 function ah its degree reduces then we may choose that polynomial function as
 a first
 function and other function as second function but that cannot be considered
 as rule ah

it depends on what is our second function because if we have a second function as a function which will be giving or or the function for which we do not know the integral then it will be difficult for us to evaluate that integral so we shall look for the choice of these functions that which function we should choose as first function which function we should choose as second function also how we should make use of this particular formula in our next class thanks you

Prutor@MITK