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METHODS FOR SOLVING DEFINITE INTEGRALS

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Abstract: This article unclear integrals solution two main to the method , that is in pieces integration (partial integration) and variable exchange to the methods dedicated . This methods , unclear integrals in calculation complicated functions simplification and to calculate facilitate for wide is applied .The article firstly breaks down of integration main principles and his/her unclear integrals in solution how application seeing We will go out . This The method usually involves integrals simpler to expressions separation through the solution to find help gives .

Key words : Indefinite integral, piecewise integration , variable exchange , mathematics analysis , integrals solve , functions simplification , variable exchange

In our country, mathematics has been identified as one of the priority areas for the development of science in 2020. Over the past period, a number of systematic works have been carried out aimed at bringing mathematical science and education to a new qualitative stage.

Resolution of the President of the Republic of Uzbekistan dated May 7, 2020 No. PQ-4708 “On measures to improve the quality of education and develop scientific research in the field of mathematics”, dated July 9, 2020 “On state support for the further development of mathematical education and sciences, as well as the V.I. In connection with the rapid development of modern branches of mathematics, science and technology, the foundation of which was laid by our great ancestors such as Muhammad Al-Khwarizmi, Ahmad Al-Farghani, Abu Rayhon Beruni, Mirzo Ulugbek, and the resolutions of the State Duma No. PQ-4387 “On measures to radically improve the activities of the Romanovsky Institute of Mathematics”, the in-depth teaching of integrals, one of the main topics in higher education, is currently one of the important issues. This article serves to address the above-mentioned resolutions and the issues set before us.

Taking the above into account, we will study several methods for finding definite integrals of the following form.

If $\forall x \in [a,b]$ the equality holds $F(x)$for , $F'(x) = f(x)$the function is called the initial function of a $[a,b]$ continuous $f(x)$function on the interval.

Given function elementary function to find integration The function is called of integration one how many methods there is is , this in the article in pieces integration method and variables replacement method about stopped Let's go .

1. Integration by parts method . If u(x) and v(x) are differentiable functions if so , in pieces integration for $\int udv = uv - \int vdu$ Formula (1) is used. This method $\int P_n(x)sinx\alpha xdx$ is used to find integrals of the form , $\int P_n(x)cosx\alpha xdx, \int P_n(x)lnxdx$, $\int P_n(x)\alpha^x dx$, $\int P_n(x)arctgxdx$,

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$\int P_n(x)arcsinxdx$, $\int a^x sinxdx$, $\int arcsinxlog_a xdx, .(P_n(x) - n - darajali\ ko`phad)$

This method in use under the given integral f(x)dx expression he *dv in appearance choice must be , as a result of (1) – right on the side voodoo expression in integration initial integral to find relatively simple Let it be .

In general he and dv what to choose separately attention to give necessary.If given integral under expression plural and trigonometric or indicative functions from the multiplication consists of if , then she is function as polytheism to take to the goal appropriate will be .

If the integral is function logarithmic and reverse trigonometric of functions in the plural consists of if , then she is function as from differentiation then soda to look coming function if taken good result gives .

In pieces integration repetitive in use initially she is with how function what designated if we are then he /she with this function designation necessary , otherwise integral to zero without equal will be .

Example 1. $\int(3x+5)cos5xdx$Find the integral.

Solution : u=3x+5 and We get uv = cos5x . Then du=3dx, $\int cos5xdx = \frac{1}{5}sin5x$ Substituting this expression into formula (1), we obtain the following:

$$\int(3x+5)cos5xdx = \frac{1}{5}(3x+5)sin5x - \frac{3}{5}\int sin5xdx = \frac{3x+5}{5}sin5x - \frac{3}{25}cos5x + C$$

Example 2. $\int x(ln3x)^2 dx$Find the integral.

Solution :$\int x(ln3x)^2dx = \begin{bmatrix} u=(ln3x)^2 & dv = xdx \\ du = 2ln3x\frac{1}{x}dx & v=\frac{x^2}{2} \end{bmatrix} = \frac{x^2}{2}(ln3x)^2 =$

$\int \frac{2}{3x}ln3x\frac{x^2}{2}dx = \frac{x^2}{2}(ln3x)^2 - \int xln3xdx$(*)

Harvest made (*) PCB right by $\int xln3xdx$To find the integral, we again use the formula for integration by parts:

$$\int xln3xdx = \begin{bmatrix} u = ln3x & dv = xdx \\ du = \frac{1}{x}dx & v = \frac{x^2}{2} \end{bmatrix} = \frac{x^2}{2}ln3x - \int \frac{x^2}{2}ln3xdx == \frac{x^2}{2}ln3x - \frac{x^2}{4} + C$$

This is related to (*) given , given function integral

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$\int x(ln3x)^2 dx = \frac{x^2}{2}(ln3x)^2 - \frac{x^2}{2} ln3x + \frac{x^2}{4} + C = \frac{x^2}{2} ln3x(ln3x+1) + \frac{x^2}{4} + C$ we determine that.

2. Substitution of variables method . Hypothesis let's do it Let the substitution be performed $\int f(x)dx$ in the integral $x = \varphi(t)$. If $f(x)$ a continuous function with an inverse has a $\varphi(t)$ derivative $\varphi'(t)$, then

$$\int f(x)dx = \int f[\varphi(t)]\varphi'(t)dt + C \quad (2)$$

The formula is valid. will be . (2) to unclear in the integral variable replacement formula It is called .

Some in cases $t = \varphi(x)$ Getting a replacement will yield good results.

The variable replacement given internal simple to look if it brings it , application to the goal appropriate will be .

Uncertain in the integral variable replacement as a result found elementary in function new variable instead of initial variable through expression leaving given of the integral answer is defined . The function differential inside input , variable replacement method private is the case .

Example 3. $\int \frac{dx}{\sqrt{x}+1}$ Find the integral.

Solution : $x = t^2$ by equality variable we replace , then $dx = 2tdt$ and $\int \frac{dx}{\sqrt{x}+1} = \int \frac{2tdt}{t+1} = 2\left(\int dt - \int \frac{dt}{t+1}\right) = 2t - 2\int \frac{d(t+1)}{t+1} = [2t - 2ln|t+1| + C]_{t=\sqrt{x}} = 2(\sqrt{x} - ln|\sqrt{x}+1|) + C$

Example 4. $\int \sqrt{sin4x+3} cos4xdx$ Find the integral .

Solution : $t = sin4x + 3$ We substitute the variable through the equation, then

$$dt = 4cos4xdx <=> cos4xdx = \frac{1}{4}dt$$

$$\int \sqrt{sin4x+3} cos4xdx = \int \frac{1}{4} t^{\frac{1}{2}} dt = \frac{1}{4}\frac{t^{\frac{3}{2}}}{\frac{3}{2}} + C = \left[\frac{1}{6}\sqrt{t^3} + C\right]_{t=sin4x+3} = \frac{1}{6}\sqrt{(sin4x+3)^3} + C$$

Done replacement $t = sin4x + 3$ differential of a function under to enter equivalent .

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