Al-Mustaqbal University / College of Engineering & Technology
Class: first
Subject: integral Mathematics/Code: UOMU024024
Lecturer: M.Sc. Alaa Khalid
Lecture name: method of integration
Lecture: 6
2nd term

Tabular Integration

Consider the integral of the form $\int f(x)g(x)dx$ in which $\int f(x)$ can be differential repeatedly to Zero and $g(x)$ can be integral repeatedly without difficulty Tabular integration save a great deal of work as natural method consider from integration

$f(x)$ and Its derivative		$g(x)$ and Its Integrals
$f(x)$		$g(x)$
$f'(x)$	+	$\int g(x)\,dx = g_1(x)$
$f''(x)$	-	$\int g_1(x)\,dx = g_2(x)$
$f'''(x)$	+	$\int g_2(x)\,dx = g_3(x)$
$\vdots$		$\vdots$
$f^{n-1}(x)$		
$f^{n}(x) = 0$		$g_{n-1}(x)\,dx = g_n(x)$

$$I = f(x)\,g_1(x) - f'(x)\,g_2(x) + f''(x)\,g_3(x) - \ldots\ldots\ldots \pm f^{n-1}(x)\,g_n(x)$$

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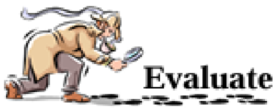

Evaluate $I = \int x^2 e^x dx$

Solution :-

$f(x)$ and Its derivative	Sign	$g(x)$ and Its Integrals
x^2	+	e^x
$2x$	-	$\int e^x dx = e^x$
2	+	$\int e^x dx = e^x$
0		$\int e^x dx = e^x$

$$I = \int x^2 e^x dx = x^2 e^x - 2xe^x + 2e^x + c$$

Evaluate $I = \int (x^3 - 2x^2 + 3x + 1)\sin(2x)\,dx$

Solution :-

$f(x)$ and Its derivative	Sign	$g(x)$ and Its Integrals
$x^3 - 2x^2 + 3x + 1$	+	$\sin(2x)$
$3x^2 - 4x + 3$	-	$\int \sin(2x)\,dx = -\frac{1}{2}\cos(2x)$
$6x - 4$	+	$\int -\frac{1}{2}\cos(2x)\,dx = -\frac{1}{4}\sin(2x)$
6	-	$\int -\frac{1}{4}\sin(2x)\,dx = \frac{1}{8}\cos(2x)$
0		$\int \frac{1}{8}\cos(2x) = \frac{1}{16}\sin(2x)$

$I = \ldots$

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$y = \int x^2\, e^{4x}\ dx$

f (x) D	g (x) I
x^2	e^{4x}
2 x	$\frac{1}{4}\, e^{4x}$
2	$\frac{1}{16}\, e^{4x}$
0	$\frac{1}{64}\, e^{4x}$

$$= \frac{1}{4}\, x^2\, e^{4x} - \frac{1}{8}\, x\, e^{4x} + \frac{1}{32}\, e^{4x} + c$$

Home Work:

Find $\int\ x^3 \sin x\ dx$?

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