

Calculus Section 8.2 Integration by Parts II

-Use tabular method to perform integration by parts

Homework: page 521 #'s 29 or 30, 39, 41, 49, 53

In problems that require repeated application of the integration by parts method, a tabular method can help organize and speed up the pace of the problem.

Example) Use integration by parts

Find $\int x^2 \sin(4x) dx$

$u = x^2$ $v = -\frac{1}{4} \cos 4x$
 $du = 2x$ $dv = \sin 4x dx$

$$\int x^2 \sin 4x dx = -\frac{1}{4} x^2 \cos 4x + \int +\frac{1}{2} x \cos 4x dx$$

$u = \frac{1}{2} x$ $v = \frac{1}{4} \sin 4x$
 $du = \frac{1}{2} dx$ $dv = \cos 4x dx$

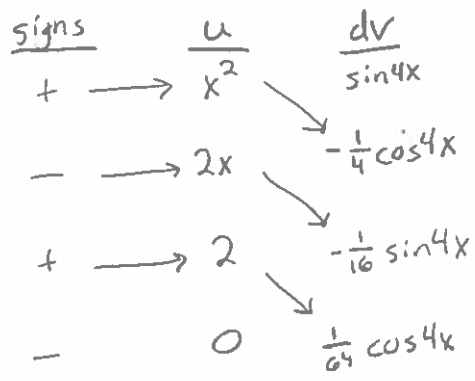
$$\int \frac{1}{2} x \cos 4x dx = \frac{1}{8} x \sin 4x - \int \frac{1}{8} \sin 4x dx$$

$$\int \frac{1}{2} x \cos 4x dx = \frac{1}{8} x \sin 4x + \frac{1}{32} \cos 4x$$

$$\int x^2 \sin 4x dx = -\frac{1}{4} x^2 \cos 4x + \frac{1}{8} x \sin 4x + \frac{1}{32} \cos 4x + C$$

Example) Use tabular method

Find $\int x^2 \sin(4x) dx$



$$\int x^2 \sin(4x) dx = -\frac{1}{4} x^2 \cos 4x + \frac{1}{8} x \sin 4x + \frac{1}{32} \cos 4x + C$$

Example) Definite Integral

Find $\int_0^1 (x^2 - 1)e^x dx$

signs	u	dv
+	$x^2 - 1$	e^x
-	$2x$	e^x
+	2	e^x
-	0	e^x

$$\left[(x^2 - 1)e^x - 2xe^x + 2e^x \right]_0^1$$

$$(0 - 2e + 2e) - (-1 - 0 + 2)$$

$$\boxed{-1}$$

Example) Non-terminating factors

Find $\int e^x \sin(x) dx$

$$u = \sin x$$

$$v = e^x$$

$$du = \cos x dx$$

$$dv = e^x dx$$

$$\int e^x \sin x dx = e^x \sin x - \int e^x \cos x dx$$

$$u = \cos x$$

$$v = e^x$$

$$du = -\sin x dx$$

$$dv = e^x dx$$

$$\int e^x \cos x dx = e^x \cos x + \int e^x \sin x dx$$

$$\int e^x \sin x dx = e^x \sin x - (e^x \cos x + \int e^x \sin x dx)$$

$$\int e^x \sin x dx = e^x \sin x - e^x \cos x - \int e^x \sin x dx$$
$$+ \int e^x \sin x dx$$

$$2 \int e^x \sin x dx = e^x \sin x - e^x \cos x$$

$$\int e^x \sin x dx = \frac{1}{2} e^x \sin x - \frac{1}{2} e^x \cos x + C$$