

INTEGRATION BY PARTS

$$\int u dv = uv - \int v du$$

GUIDELINES

1. Try letting dv be the most complicated portion of the integrand that fits a **basic integration rule**. Then u will be the remaining factor(s) of the integrand.
2. Try letting u be the portion of the integrand whose derivative is a function simpler than u . Then dv will be the remaining factor(s) of the integrand.

*Sometimes you need to use integration by parts more than once!

SUMMARY OF COMMON INTEGRALS USING INTEGRATION BY PARTS

1. For integrals of the form

$$\int x^n e^{ax} dx, \quad \int x^n \sin(ax) dx, \quad \text{or} \quad \int x^n \cos(ax) dx,$$

Let $u = x^n$ and let $dv = e^{ax} dx, \sin(ax), \cos(ax)$.

2. For integrals of the form

$$\int x^n \ln x dx, \quad \int x^n \arcsin(ax) dx, \quad \text{or} \quad \int x^n \arctan(ax) dx,$$

Let $u = \ln x, \arcsin(ax), \arctan(ax)$ and let $dv = x^n dx$.

3. For integrals of the form

$$\int e^{ax} \sin(bx) dx, \quad \text{or} \quad \int e^{ax} \cos(bx) dx,$$

Let $u = \sin(bx)$ or $\cos(bx)$ and let $dv = e^{ax} dx$.

1. Find the following integrals using the simplest method.

a. $\int \frac{\ln x}{x^2} dx$

b. $\int \frac{xe^{2x}}{(2x+1)^2} dx$

PROCEDURES FOR USING THE TABULAR METHOD

$$\int x^3 e^{-x} dx$$

ALTERNATE SIGNS	u and its derivatives	v' and its antiderivatives
+	x^3	$e^{-x} dx$
	0	

The solution is obtained by adding the signed products of the diagonal entries:

c. $\int x \operatorname{arc} \sec x dx$

d. $\int \theta \sec \theta \tan \theta d\theta$

e. $\int \frac{1}{t(\ln t)^3} dt$

f. $\int e^{-x} \cos x dx$