

Chapter 8. Techniques of integration
Section 8.1 Integration by parts

The formula for integration by parts for indefinite integrals is

$$\int f(x)g'(x)dx = f(x)g(x) - \int f'(x)g(x)dx$$

The formula for integration by parts for definite integrals is

$$\int_a^b f(x)g'(x)dx = f(x)g(x)]_a^b - \int_a^b f'(x)g(x)dx$$

Example 1. Find the integral.

1. $\int x \cos 3x \, dx$

2. $\int \ln x \, dx$

3. $\int_0^1 (t^2 + 2t + 3)e^t \, dt$

4. $\int \sin^{-1} x \, dx$

5. $\int e^x \cos x \, dx$

Example 2. Use the methods of cylindrical shells to find the volume of a solid generated by rotating the region bounded by $y = e^{-x}$, $y = 0$, $x = -1$, $x = 0$ about $x = 1$.