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. $\int \ln x \; dx$

2. $\int \arcsin x \; dx$

3. $\int x \cos(3x) \; dx$

4. $\int_0^1 t^2 e^t dt$

5. $\int \cos(\ln x)\ dx$

6. $\int e^x \cos x\ dx$

Example 2.

1. Prove the reduction formula

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

2. evaluate integral $\int \cos^4 x \, dx$

Example 3. 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 $x = 1$.