

8.2: Integration by Parts

Integraton by Parts

Suppose u and v are differentiable functions. Then

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

A good mnemonic is ILATE.

Example. Evaluate $\int x e^{-\frac{x}{2}} dx$.

Integration by Parts for Definite Integrals

Let u and v be differentiable. Then

$$\int_a^b u(x)v'(x) dx = u(x)v(x) \Big|_a^b - \int_a^b v(x)u'(x) dx$$

Example. Find the area of the region between the x -axis and $f(x) = \frac{\ln(x)}{x^2}$ on $[1, e]$.

Example. Evaluate $\int x^2 \cos(2x) \, dx$.

Example. Evaluate $\int e^{-x} \sin(3x) dx$.

Example. Evaluate $\int e^{4x} \cos(3x) dx$.

Example. Derive the integral formula

$$\int \ln(x) \, dx = x \ln(x) - x + C$$

Example. Evaluate $\int 10 \cos(\sqrt{x}) \, dx$

Example. Evaluate $\int_1^e \ln(2x) \, dx$.