

Section 5.6: Integration by Parts

These notes reflect material from our text, *Calculus, Concepts and Contexts, Third Edition*, by James Stewart, published by Brooks/Cole, Pacific Grove, CA, 2005.

Key points from Stewart, Section 5.6: The technique of integration by parts.

Concepts

The **integration by parts** formula in its most succinct form is

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

It is obtained by integrating the formula for the derivative of a product,

$$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx},$$

and then using the Fundamental Theorem of Calculus.

The corresponding formula for definite integrals, in a more expansive notation, is

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

Examples

$\int x \sin x dx$, $\int xe^x dx$, $\int \ln x dx$, $\int \arctan x dx$, $\int e^x \sin x dx$, $\int \sin^2 x dx$

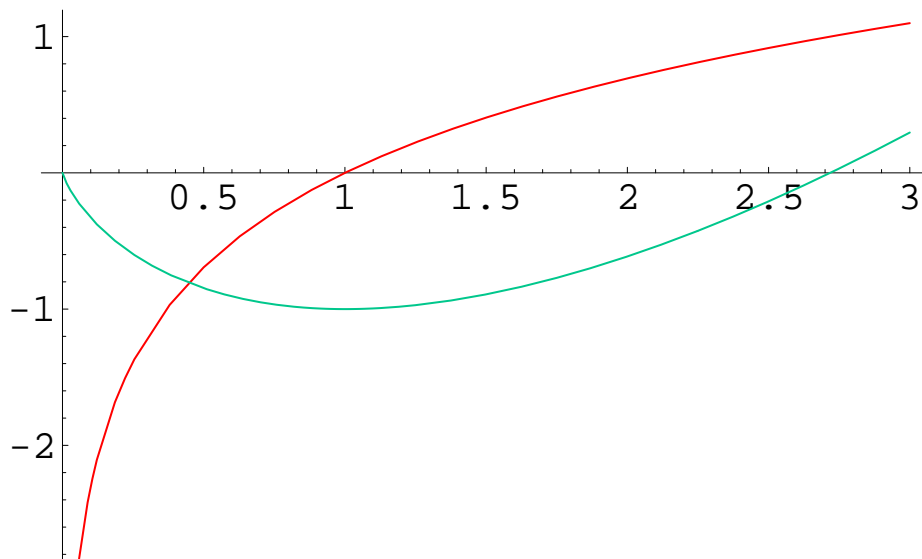


Fig. $\int \ln x dx = x \ln x - x$.

Exercises

Exercises for Section 5.6, pp 398–399: 3, 13, 16, 27 (integration by parts), 41 (particle), 42 (rocket)