

7.1 Integration by Parts

1. Diff by parts (the “reverse of product rule” for indefinite integrals we have:

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

or simplified:

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

2. Diff by parts for definite integrals:

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

3. Why?

The Product Rule states that if f and g are differentiable functions, then

$$\frac{d}{dx} [f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$$

In the notation for indefinite integrals this equation becomes

$$\int [f(x)g'(x) + g(x)f'(x)] dx = f(x)g(x)$$

or

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

We can rearrange this equation as

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