substitution

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Substitution is a method to simplify integration by changing variables. For an integral of the form:

$$\int f(g(x))g'(x)\,dx$$

you substitute $u = g(x)$, so $du = g'(x)dx$. This transforms the integral into:

$$\int f(g(x))g'(x)\,dx = \int f(u)\,du$$

In a sense, substitution undoes the chain rule:

- The chain rule multiplies by $g'(x)$ during differentiation
- Substitution compensates for $g'(x)$ during integration by replacing dx with $du = g'(x)dx$

substitution step by step