8.4 Indefinite Integrals (U-Sub)

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$\int f(x)\,dx$ — integral symbol → ; ← integrating with respect to x

Steps (u-substitution)

* if the function would require Chain Rule for its derivative, then it requires u-substitution for its antiderivative (integral)

① Choose u = quantity that is raised to a power (do not include the power)

② Calculate du (derivative of u)

③ Solve for dx

④ Substitute u and du into the problem

⑤ All x-variables must cancel out

⑥ Apply "Reverse Power Rule" to take the antiderivative (integral)

⑦ Switch back to x-variables

ex $\int 6x^2\sqrt{x^3+4}\,dx$

$\int 6x^2(x^3+4)^{1/2}\,dx$

① $u = x^3+4$

② $du = 3x^2\cdot dx$

③ $\frac{du}{3x^2} = \frac{3x^2}{3x^2}dx$

$\frac{du}{3x^2} = dx$

④ $\int 6x^2(x^3+4)^{1/2}\,dx$

⑤ $\int 6\cancel{x^2}(u)^{1/2}\frac{du}{3\cancel{x^2}}$

$\int 2u^{1/2}\,du$

⑥ $\frac{4}{3}u^{3/2}+C$

⑦ $\frac{4}{3}(x^3+4)^{3/2}+C$

ex $\int \frac{x+1}{(x^2+2x)^3}\,dx$

① $u = x^2+2x$

② $du = (2x+2)\,dx$

③ $\frac{du}{2x+2} = dx$

④ $\int \frac{\cancel{x+1}}{u^3}\frac{du}{2\cancel{(x+1)}}$

⑤ $\int \frac{1}{2u^3}\,du$

⑥ $\int \frac{1}{2}u^{-3}\,du = -\frac{1}{4}u^{-2}+C$

⑦ $-\frac{1}{4}(x^2+2x)^{-2}+C$

OR

$-\frac{1}{4(x^2+2x)^2}+C$