Calculus II
Integrals with irreducible quadratic denomonimator

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Building blocks IIa and IIIa

Building block IIa: $\int \frac{x}{1+x^2}\mathrm{d}x$. Building block IIIa: $\int \frac{1}{1+x^2}\mathrm{d}x$.

Example (Block IIa)

$$\begin{aligned}\int \frac{x}{1+x^2}\mathrm{d}x &= \int \frac{1}{(1+x^2)}\frac{\mathrm{d}(x^2)}{2} \\ &= \int \frac{1}{1+x^2}\frac{\mathrm{d}(1+x^2)}{2} \qquad \Big| \text{ Set } u = 1+x^2 \\ &= \int \frac{1}{u}\frac{\mathrm{d}u}{2} \\ &= \frac{1}{2}\ln|u| + C = \frac{1}{2}\ln\left(1+x^2\right) + C \quad .\end{aligned}$$

Example (Block IIIa)

$$\int \frac{1}{1+x^2}\mathrm{d}x = \arctan x + C$$