List of Common Integrals

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CM3110 Transport Processes I
CM4650 Polymer Rheology

$$\int du = u + C$$

$$\int u\ du = \frac{u^2}{2} + C$$

$$\int u^n\, du = \frac{u^{n+1}}{n+1} + C$$

$$\int \frac{1}{u}\, du = \ln|u| + C$$

$$\int \frac{1}{u^2} du = -\frac{1}{u} + C$$

$$\int e^u\ du = e^u + C$$

$$\int \ln u\ du = u \ln u - u + C$$

$$\int a^u du = \left(\frac{1}{\ln a}\right) a^u + C$$

$$\int \sin u\ du = -\cos u + C$$

$$\int \cos u\ du = \sin u + C$$

$$\int u\, e^u\, du = e^u(u-1) + C$$

$$\int u^2 e^u\, du = e^x(x^2 - 2x + 2) + C$$

$$\int e^u \sin u\ du = \frac{e^u(\sin u - \cos u)}{2} + C$$

$$\int e^u \cos u\ du = \frac{e^u(\sin u + \cos u)}{2} + C$$

$$\int e^{au} \sin bu = \frac{e^{au}}{(a^2+b^2)}(a \sin bu - b \cos bu) + C$$

$$\int e^{au} \cos bu = \frac{e^{au}}{(a^2+b^2)}(b \sin bu + a \cos bu) + C$$

Integration by parts:

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

Note: Many more integrals can be solved with these formulas by using *substitution*. For example, evaluate I:

$$I \equiv \int (1-2x)^2 dx$$

Let $u = (1-2x)$; then

$$\frac{du}{dx} = -2, \qquad du = -2\, dx$$

Substituting into the integral, we obtain

$$I = -\frac{1}{2}\int u^2 du = \left(-\frac{1}{2}\right)\frac{u^3}{3} + C$$

Substituting back (eliminating u) gives the answer:

$$I = -\frac{1}{6}(1-2x)^3 + C$$

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