Inverse Trig Functions

$$\int \frac{1}{\sqrt{a^2-u^2}}\,du = \sin^{-1}\left(\frac{u}{a}\right)+c \qquad \int \sin^{-1}u\,du = u\sin^{-1}u+\sqrt{1-u^2}+c$$

$$\int \frac{1}{a^2+u^2}\,du = \frac{1}{a}\tan^{-1}\left(\frac{u}{a}\right)+c \qquad \int \tan^{-1}u\,du = u\tan^{-1}u-\frac{1}{2}\ln\left(1+u^2\right)+c$$

$$\int \frac{1}{u\sqrt{u^2-a^2}}\,du = \frac{1}{a}\sec^{-1}\left(\frac{u}{a}\right)+c \qquad \int \cos^{-1}u\,du = u\cos^{-1}u-\sqrt{1-u^2}+c$$

Hyperbolic Trig Functions

$$\int \sinh u\,du = \cosh u + c \qquad \int \operatorname{sech} u \tanh u\,du = -\operatorname{sech} u + c \qquad \int \operatorname{sech}^2 u\,du = \tanh u + c$$

$$\int \cosh u\,du = \sinh u + c \qquad \int \operatorname{csch} u \coth u\,du = -\operatorname{csch} u + c \qquad \int \operatorname{csch}^2 u\,du = -\coth u + c$$

$$\int \tanh u\,du = \ln\left(\cosh u\right) + c \qquad \int \operatorname{sech} u\,du = \tan^{-1}\left|\sinh u\right| + c$$

Miscellaneous

$$\int \frac{1}{a^2-u^2}\,du = \frac{1}{2a}\ln\left|\frac{u+a}{u-a}\right|+c \qquad \int \frac{1}{u^2-a^2}\,du = \frac{1}{2a}\ln\left|\frac{u-a}{u+a}\right|+c$$

$$\int \sqrt{a^2+u^2}\,du = \frac{u}{2}\sqrt{a^2+u^2}+\frac{a^2}{2}\ln\left|u+\sqrt{a^2+u^2}\right|+c$$

$$\int \sqrt{u^2-a^2}\,du = \frac{u}{2}\sqrt{u^2-a^2}-\frac{a^2}{2}\ln\left|u+\sqrt{u^2-a^2}\right|+c$$

$$\int \sqrt{a^2-u^2}\,du = \frac{u}{2}\sqrt{a^2-u^2}+\frac{a^2}{2}\sin^{-1}\left(\frac{u}{a}\right)+c$$

$$\int \sqrt{2au-u^2}\,du = \frac{u-a}{2}\sqrt{2au-u^2}+\frac{a^2}{2}\cos^{-1}\left(\frac{a-u}{a}\right)+c$$

Standard Integration Techniques

Note that all but the first one of these tend to be taught in a Calculus II class.

u Substitution

Given $\int_a^b f\left(g\left(x\right)\right)g'\left(x\right)dx$ then the substitution $u=g\left(x\right)$ will convert this into the integral, $\int_a^b f\left(g\left(x\right)\right)g'\left(x\right)dx = \int_{g(a)}^{g(b)} f\left(u\right)\,du$.

Integration by Parts

The standard formulas for integration by parts are,

$$\int u\,dv = uv - \int v\,du \qquad \int_a^b u\,dv = uv\Big|_a^b - \int_a^b v\,du$$

Choose u and dv and then compute du by differentiating u and compute v by using the fact that $v=\int dv$.

