Standard Integration formulas

(1) $\displaystyle\int x^k\,dx = \frac{1}{k+1}x^{k+1}\ (k \neq -1);$

(2) $\displaystyle\int \frac{1}{x}\,dx = \ln|x|;$

(3) $\displaystyle\int e^{ax}\,dx = \frac{1}{a}e^{ax};$

(4) $\displaystyle\int \sin x\,dx = -\cos x$

(5) $\displaystyle\int \cos x\,dx = \sin x;$

(6) $\displaystyle\int \sec x\,dx = \ln|\sec x + \tan x|;$

(7) $\displaystyle\int \frac{1}{a^2+x^2}\,dx = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right);$

(8) $\displaystyle\int \frac{x}{a^2+x^2}\,dx = \frac{1}{2}\ln(a^2+x^2);$

(9) $\displaystyle\int \frac{1}{a^2-x^2}dx = \frac{1}{2a}\ln\left|\frac{a+x}{a-x}\right|;$

(10) $\displaystyle\int \frac{1}{\sqrt{x^2+a^2}}\,dx = \ln\left|x+\sqrt{x^2+a^2}\right|;$

(11) $\displaystyle\int \frac{1}{\sqrt{x^2-a^2}}\,dx = \ln\left|x+\sqrt{x^2-a^2}\right|;$

(12) $\displaystyle\int \frac{1}{\sqrt{a^2-x^2}}\,dx = \sin^{-1}\left(\frac{x}{a}\right);$

(13) $\displaystyle\int \sqrt{x^2+a^2}\,dx = \frac{1}{2}x\sqrt{x^2+a^2} + \frac{1}{2}a^2\ln\left|x+\sqrt{x^2+a^2}\right|;$

(14) $\displaystyle\int \sqrt{x^2-a^2}\,dx = \frac{1}{2}x\sqrt{x^2-a^2} - \frac{1}{2}a^2\ln\left|x+\sqrt{x^2-a^2}\right|;$

(15) $\displaystyle\int \sqrt{a^2-x^2}\,dx = \frac{1}{2}x\sqrt{a^2-x^2} + \frac{1}{2}a^2\sin^{-1}\left(\frac{x}{a}\right);$

(16) $\displaystyle\int \ln x\,dx = x\ln x - x;$

(17) $\displaystyle\int e^{ax}\cos bx\,dx = e^{ax}\left[\frac{a\cos bx + b\sin bx}{a^2+b^2}\right];$

(18) $\displaystyle\int e^{ax}\sin bx\,dx = e^{ax}\left[\frac{a\sin bx - b\cos bx}{a^2+b^2}\right].$

Some reduction formulas

(1) $\displaystyle\int \sin^n x\,dx = -\frac{\cos x\,\sin^{n-1} x}{n} + \frac{n-1}{n}\int \sin^{n-2} x\,dx;$

(2) $\displaystyle\int \cos^n x\,dx = \frac{\sin x\,\cos^{n-1} x}{n} + \frac{n-1}{n}\int \cos^{n-2} x\,dx;$

(3) $\displaystyle\int \tan^n x\,dx = \frac{\tan^{n-1} x}{n-1} - \int \tan^{n-2} x\,dx,\ (n>1);$

(4) $\displaystyle\int \sec^n x\,dx = \frac{\sec^{n-2} x\,\tan x}{n-1} + \frac{n-2}{n-1}\int \sec^{n-2} x\,dx,\ (n>1);$

(5) $\displaystyle\int e^{ax}x^n\,dx = \frac{e^{ax}x^n}{a} - \frac{n}{a}\int e^{ax}x^{n-1}\,dx;$

(6) $\displaystyle\int \frac{a^2}{(x^2+a^2)^n}dx = \frac{1}{(2n-2)}\frac{x}{(x^2+a^2)^{n-1}} + \frac{2n-3}{(2n-2)}\int \frac{1}{(x^2+a^2)^{n-1}}dx,\ (n>1).$

Some trigonometric identities

(1) $\sin(x \pm y) = \sin x\cos y \pm \cos x \sin y;$

(2) $\cos(x \pm y) = \cos x\cos y \mp \sin x \sin y;$

(3) $\displaystyle\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \tan y};$

(4) $\displaystyle\sin x\cos y = \frac{1}{2}\left[\sin(x+y) + \sin(x-y)\right];$

(5) $\displaystyle\cos x\cos y = \frac{1}{2}\left[\cos(x+y) + \cos(x-y)\right];$

(6) $\displaystyle\sin x\sin y = \frac{1}{2}\left[\cos(x-y) - \cos(x+y)\right].$

Area, Arc Length, Volume

1. Area between two curves: $\displaystyle\int_a^b |f(x) - g(x)|dx$
2. Arc length: $\displaystyle\int_a^b \sqrt{1+[f'(x)]^2}dx$
3. Volume, revolution about the x-axis: $\displaystyle\pi\int_a^b [R(x)^2 - r(x)^2]dx,$

   revolution about the y-axis: $\displaystyle 2\pi\int_a^b x|f(x) - g(x)|dx$
4. Surface area, revolution about the x-axis: $\displaystyle 2\pi\int_a^b f(x)\sqrt{1+[f'(x)]^2}dx$