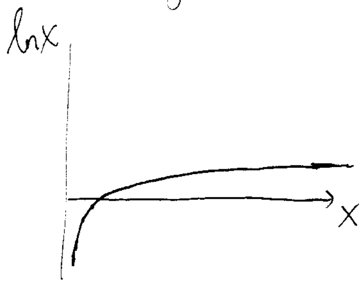
$$\frac{d}{dx} e^{kx} = k e^{kx} \Rightarrow \int e^{kx}\, dx = \frac{1}{k} e^{kx} + C \quad (k \neq 0)$$

$$\frac{d \ln x}{dx} = \frac{1}{x} \Rightarrow \int \frac{1}{x}\, dx = \ln|x| + C$$

If $a > 0$ $\quad \lim_{x \to \infty} \frac{\ln x}{x^a} = 0.$



$$\frac{d}{dx} \sin(kx) = k\cos(kx) \Rightarrow \int \overset{\cos}{\cancel{\sin}} kx\, dx = \frac{1}{k} \sin kx + C$$

$$\frac{d}{dx} \cos(kx) = -k\sin kx \Rightarrow \int \sin kx\, dx = \frac{-1}{k} \cos kx + C$$

$$\frac{d}{dx} \sin(\cos x) = \left[\frac{d}{d\cos x} \sin(\cos x)\right] \frac{d\cos x}{dx}$$

$$= \cos(\cos x)\left[-\sin x\right]$$

$$= -\cos(\cos x)\sin x$$

$$\int \sin(x^2)\, dx = ?$$

but $\int x \sin(x^2)\, dx = \frac{1}{2} \int \sin(x^2)\, dx^2$

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

$$= \frac{1}{2} \ln(x^2+1) + C$$

$$\int \tan x \, dx = \int \frac{\sin x}{\cos x} dx = -\int \frac{1}{\cos x} d\cos x = -\ln|\cos x| + c$$

Integration by part 部分積分.

$$\int \frac{d}{dx}\{u(x)v(x)\}dx = \int u'(x)v(x)dx + \int u(x)v'(x)\,dx.$$

$$\Rightarrow \underbrace{\int u'(x)v(x)dx = u(x)v(x) - \int u(x)v'(x)\,dx.}$$

ex: $\int xe^x dx = \cancel{x}xe^x - \int e^x dx = (x-1)e^x + c$

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

ex:

$$I = \int e^{2x}\sin x \, dx = \frac{1}{2}\int \sin x \, dx \, de^{2x}$$

$$= \frac{1}{2}\left\{\sin x \, e^{2x} - \int e^{2x}\cos x \, dx\right\}$$

$$= \frac{1}{2}\sin e^{2x} - \frac{1}{2^2}\int \cos x \, de^{2x}$$

$$= \frac{1}{2}\sin x \, e^{2x} - \frac{1}{4}\left\{\cos x \, e^{2x} + \underbrace{\int e^{2x}\sin x \, dx}_{I.}\right\}$$

$$\frac{5}{4}I = \frac{1}{2}\sin x \, e^{2x} - \frac{1}{4}\cos x \, e^{2x}$$

$$I = \frac{2}{5}\sin x \, e^{2x} - \frac{1}{5}\cos x \, e^{2x}$$

$$= \frac{1}{5}(2\sin x - \cos x)\, e^{2x}$$