Some useful integrals for electrodynamics homework (cite by writing "(ieq#)")
All constants of integration are omitted but implied.

$$\int x^n \,\mathrm{d}x = \frac{x^{n+1}}{n+1}\,, \quad n \neq -1 \qquad \int \frac{\mathrm{d}x}{x} = \ln|x| \qquad \int \sin ax \,\mathrm{d}x = -\frac{\cos ax}{a} \qquad \int \cos ax \,\mathrm{d}x = \frac{\sin ax}{a}$$

$$\int \mathrm{e}^{ax} \,\mathrm{d}x = \frac{\mathrm{e}^{ax}}{a}$$

(1) $$\int \frac{\mathrm{d}x}{ax+b} = \frac{1}{a}\ln|ax+b|$$

(2) $$\int \frac{\mathrm{d}x}{(ax+b)^2} = \frac{-1}{a(ax+b)}$$

(3) $$\int (ax+b)^{m/2} = \frac{2(ax+b)^{(m+2)/2}}{a(m+2)}$$

(4) $$\int x(ax+b)^{m/2} = \frac{2(ax+b)^{(m+4)/2}}{a^2(m+4)} - \frac{2b(ax+b)^{(m+2)/2}}{a^2(m+2)}$$

(5) $$\int \frac{\mathrm{d}x}{\sqrt{x^2+a^2}} = \ln\left|x+\sqrt{x^2+a^2}\right|$$

(6) $$\int \frac{x\,\mathrm{d}x}{\sqrt{x^2+a^2}} = \sqrt{x^2+a^2}$$

(7) $$\int \sqrt{x^2+a^2}\,\mathrm{d}x = \frac{x\sqrt{x^2+a^2}}{2} + \frac{a^2}{2}\ln\left(x+\sqrt{x^2+a^2}\right)$$

(8) $$\int \frac{\mathrm{d}x}{(x^2+a^2)^{3/2}} = \frac{x}{a^2\sqrt{x^2+a^2}}$$

(9) $$\int \frac{x\,\mathrm{d}x}{(x^2+a^2)^{3/2}} = \frac{-1}{\sqrt{x^2+a^2}}$$

(10) $$\int x\sin ax \,\mathrm{d}x = \frac{\sin ax}{a^2} - \frac{x\cos ax}{a}$$

(11) $$\int x^2 \sin ax \,\mathrm{d}x = \frac{2x}{a^2}\sin ax + \left(\frac{2}{a^3} - \frac{x^2}{a}\right)\cos ax$$

(12) $$\int \sin^2 ax \,\mathrm{d}x = \frac{x}{2} - \frac{\sin 2ax}{4a}$$

(13) $$\int \sin^3 ax \,\mathrm{d}x = -\frac{\cos ax}{a} + \frac{\cos^3 ax}{3a}$$

(14) $$\int x\cos ax \,\mathrm{d}x = \frac{\cos ax}{a^2} + \frac{x\sin ax}{a}$$

(15) $$\int x^2 \cos ax \,\mathrm{d}x = \frac{2x}{a^2}\cos ax + \left(\frac{x^2}{a} - \frac{2}{a^3}\right)\sin ax$$

(16) $$\int \cos^2 ax \,\mathrm{d}x = \frac{x}{2} + \frac{\sin 2ax}{4a}$$

(17) $$\int \cos^3 ax \,\mathrm{d}x = \frac{\sin ax}{a} - \frac{\sin^3 ax}{3a}$$

(18) $$\int \sin ax\, \cos ax \,\mathrm{d}x = \frac{\sin^2 ax}{2a}$$

(19) $$\int \sin^2 ax\, \cos^2 ax \,\mathrm{d}x = \frac{x}{8} - \frac{\sin 4ax}{32a}$$

(20) $$\int \sin^n ax\, \cos ax\, \mathrm{d}x = \frac{\sin^{n+1} ax}{(n+1)a}, \quad n \neq -1$$

(21) $$\int \cos^n ax\, \sin ax\, \mathrm{d}x = -\frac{\cos^{n+1} ax}{(n+1)a}, \quad n \neq -1$$

(22) $$\int \frac{\sin ax\, \mathrm{d}x}{(p+q\cos ax)^n} = \frac{1}{aq(n-1)(p+q\cos ax)^{n-1}}$$

(23) $$\int x^n \ln x\, \mathrm{d}x = \frac{x^{n+1}}{n+1}\left(\ln x - \frac{1}{n+1}\right), \quad \text{if } n = -1, \text{ see (ieq24)}$$

(24) $$\int \frac{\ln x}{x}\, \mathrm{d}x = \frac{1}{2}(\ln x)^2$$

Definite Integrals

(25) $$\int_0^{\pi/2} \sin^2 x\, \mathrm{d}x = \int_0^{\pi/2} \cos^2 x\, \mathrm{d}x = \frac{\pi}{4}$$

(26) $$\int_0^{\infty} \mathrm{e}^{-ax^2}\, \mathrm{d}x = \frac{1}{2}\sqrt{\frac{\pi}{a}}$$

(27) $$\int_0^{\infty} x^n \mathrm{e}^{-ax}\, \mathrm{d}x = \frac{n!}{a^{n+1}}, \quad n = 0, 1, 2, \ldots$$

Fourier's trick integrals

(28) $$\int_0^a \sin(m\pi x/a)\, \sin(n\pi x/a)\, \mathrm{d}x = \begin{cases} 0 & \text{if } m \neq n, \\ a/2 & \text{if } m = n \end{cases}$$

(29) $$\int_0^a \cos(m\pi x/a)\, \cos(n\pi x/a)\, \mathrm{d}x = \begin{cases} 0 & \text{if } m \neq n, \\ a/2 & \text{if } m = n \end{cases}$$

(30) $$\int_{-1}^{1} P_\ell(x)\, P_m(x)\, \mathrm{d}x = \int_0^{\pi} P_\ell(\cos\theta)\, P_m(\cos\theta) \sin\theta\, \mathrm{d}\theta = \begin{cases} 0 & \text{if } \ell \neq m, \\ \dfrac{2}{2\ell+1} & \text{if } \ell = m \end{cases}$$

Legendre Polynomials

$P_0(x) = 1$
$P_1(x) = x$
$P_2(x) = \big(3x^2 - 1\big)/2$
$P_3(x) = \big(5x^3 - 3x\big)/2$
$P_4(x) = \big(35x^4 - 30x^2 + 3\big)/8$
$P_5(x) = \big(63x^5 - 70x^3 + 15x\big)/8$