$$\int x\, e^{ax}\, dx = \frac{e^{ax}}{a^2}\,(ax-1) + C$$

$$\int x^n\, e^{ax}\, dx = \frac{1}{a}\, x^n\, e^{ax} - \frac{n}{a}\int x^{n-1}\, e^{ax}\, dx$$

$$\int_0^\infty x^n\, e^{-ax}\, dx = \frac{n!}{a^{n+1}}\ \text{(a>0, n is a positive integer)}$$

$$\int_0^\infty e^{-ax^2}\, dx = \sqrt{\frac{\pi}{4\,a}}$$

$$\int_0^\infty x^{2\,n}\, e^{-ax^2}\, dx = \frac{1*3*5\cdot\cdots\cdot(2\,n-1)}{2^{n+1}\,a^n}\sqrt{\frac{\pi}{a}}$$

$$\int_0^\infty x^{2\,n+1}\, e^{-ax^2}\, dx = \frac{n!}{2\,a^{n+1}}$$

$$\int_{-\infty}^\infty e^{\left(\frac{-x^2}{a^2}\right)}\, dx = a\sqrt{\pi} = \sqrt{\pi a^2}$$

$$\int_{-\infty}^\infty e^{\left(\frac{-x^2}{2\,a^2}\right)}\, dx = \sqrt{2\,\pi a^2}$$

$$\int_{-\infty}^\infty -x^2\, e^{-ax^2}\, dx = -\frac{1}{2}\sqrt{\frac{\pi}{a^3}}$$

$$\int_{-\infty}^\infty x^2\, e^{\left(\frac{-x^2}{a^2}\right)}\, dx = \frac{1}{2}\, a^3\sqrt{\pi} = \frac{1}{2}\left(a^2\right)^{\frac{3}{2}}\sqrt{\pi}$$

$$\int_{-\infty}^\infty x^4\, e^{\left(\frac{-x^2}{a^2}\right)}\, dx = \frac{3}{4}\, a^5\sqrt{\pi} = \frac{3}{4}\left(a^2\right)^{\frac{5}{2}}\sqrt{\pi}$$

$$\int_{-\infty}^\infty x^n\, e^{\left(\frac{-x^2}{a^2}\right)}\, dx = 0,\quad n = \text{odd}$$

$$\int_{-\infty}^\infty x^n\, e^{\left(\frac{-x^2}{a^2}\right)}\, dx = \frac{n-1}{n}\, a^{\frac{n+1}{2}}\sqrt{\pi},\quad n = \text{even}$$

$$\sin A \cos B = \frac{1}{2} \sin 2A$$

$$\cos\theta = \frac{e^{i\theta} + e^{-i\theta}}{2} \quad \sin\theta = \frac{e^{i\theta} - e^{-i\theta}}{2i} \quad e^{\pm i\theta} = \cos\theta \pm i\sin\theta$$

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + ... \quad \text{for all } x$$

$$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} + \frac{x^6}{6!} + ...$$

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ...$$

$$\frac{1}{1-x} = 1 + x + x^2 + ... \quad x^2 < 1$$

$$(1 \pm x)^n = 1 \pm nx + \frac{n(n-1)}{2!} x^2 \pm \frac{n(n-1)(n-2)}{3!} x^3 + ... \quad x^2 < 1$$

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)(x-a)^2}{2!} + \frac{f'''(a)(x-a)^3}{3!} + ...$$

$$x = r\sin\theta\cos\phi \,;\; y = r^2 \sin\theta\sin\phi \,;\; z = r\cos\theta$$

$$dx\,dy\,dz = dV = r^2 \sin\theta\, dr\, d\theta\, d\phi$$

$$\int dx\,dy\,dz = \int_0^\infty r^2\, dr \int_0^\pi \sin\theta\, d\theta \int_0^{2\pi} d\theta$$

$$\int_0^\infty r^2\, dr \int_0^\pi \sin\theta\, d\theta \int_0^{2\pi} d\theta = 2 * 2\pi \int_0^\infty r^2\, dr = 4\pi \int_0^r r^2\, dr$$