Useful Integrals

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

$$\int_0^\infty e^{-ax^2} dx = \frac{1}{2}\sqrt{\frac{\pi}{a}}$$

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

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

$$2\cdot\sqrt{\frac{a}{\pi}}\cdot\int_0^b e^{-ax^2} dx = erf\left(b\sqrt{a}\right)$$

$$2\cdot\sqrt{\frac{a}{\pi}}\cdot\int_b^\infty e^{-ax^2} dx = erfc\left(b\sqrt{a}\right)$$

$$Note: \quad erf(x) + erfc(x) = 1$$

$$\int \frac{dx}{(a+bx)(c+dx)} = \frac{1}{ad-bc}\ln\left(\frac{c+dx}{a+bx}\right)$$

$$\int \frac{dx}{z^n t^m} = \frac{1}{(n-1)\cdot\Delta}\cdot\frac{1}{t^{m-1}z^{n-1}} + \frac{(m+n-2)\cdot\beta}{(n-1)\cdot\Delta}\int\frac{dx}{z^{n-1}t^m}$$

$$= \frac{-1}{(m-1)\cdot\Delta}\cdot\frac{1}{t^{m-1}z^{n-1}} - \frac{(m+n-2)\cdot b}{(m-1)\cdot\Delta}\int\frac{dx}{z^n t^{m-1}}$$

$$where \quad z = a+bx,\ t = \alpha+\beta x \text{ and } \Delta = a\beta - \alpha b$$