

$$\int \frac{1}{ax^2 + bx + c} dx = \begin{cases} \frac{2}{\sqrt{4ac - b^2}} \arctan \frac{2ax + b}{\sqrt{4ac - b^2}} & \text{for } 4ac - b^2 > 0 \\ \frac{2}{\sqrt{b^2 - 4ac}} \ln \left| \frac{2ax + b - \sqrt{b^2 - 4ac}}{2ax + b + \sqrt{b^2 - 4ac}} \right| & \text{for } 4ac - b^2 < 0 \\ -\frac{2}{2ax + b} & \text{for } 4ac - b^2 = 0 \end{cases}$$

$$\int \frac{x}{ax^2 + bx + c} dx = \frac{1}{2a} \ln |ax^2 + bx + c| - \frac{b}{2a} \int \frac{dx}{ax^2 + bx + c}$$

$$\int \frac{mx + n}{ax^2 + bx + c} dx = \begin{cases} \frac{m}{2a} \ln |ax^2 + bx + c| + \frac{2an - bm}{a\sqrt{4ac - b^2}} \arctan \frac{2ax + b}{\sqrt{4ac - b^2}} & \text{for } 4ac - b^2 > 0 \\ \frac{m}{2a} \ln |ax^2 + bx + c| + \frac{2an - bm}{a\sqrt{b^2 - 4ac}} \operatorname{arctanh} \frac{2ax + b}{\sqrt{b^2 - 4ac}} & \text{for } 4ac - b^2 < 0 \\ \frac{m}{2a} \ln |ax^2 + bx + c| - \frac{2an - bm}{a(2ax + b)} & \text{for } 4ac - b^2 = 0 \end{cases}$$

$$\int \frac{1}{(ax^2 + bx + c)^n} dx = \frac{2ax + b}{(n-1)(4ac - b^2)(ax^2 + bx + c)^{n-1}} + \frac{(2n-3)2a}{(n-1)(4ac - b^2)} \int \frac{1}{(ax^2 + bx + c)^{n-1}} dx$$

$$\int \frac{1}{x(ax^2 + bx + c)} dx = \frac{1}{2c} \ln \left| \frac{x^2}{ax^2 + bx + c} \right| + \frac{1}{2c} \int \frac{1}{ax^2 + bx + c} dx$$

3. Integrals of Exponential Functions

$$\int x e^{cx} dx = \frac{e^{cx}}{c^2} (cx - 1)$$

$$\int x^2 e^{cx} dx = e^{cx} \left(\frac{x^2}{c} - \frac{2x}{c^2} + \frac{2}{c^3} \right)$$

$$\int x^n e^{cx} dx = \frac{1}{c} x^n e^{cx} - \frac{n}{c} \int x^{n-1} e^{cx} dx$$

$$\int \frac{e^{cx}}{x} dx = \ln |x| + \sum_{i=1}^{\infty} \frac{(cx)^i}{i \cdot i!}$$

$$\int e^{cx} \ln x dx = \frac{1}{c} e^{cx} \ln |x| + E_i(cx)$$

$$\int e^{cx} \sin bxdx = \frac{e^{cx}}{c^2 + b^2} (c \sin bx - b \cos bx)$$

$$\int e^{cx} \cos bxdx = \frac{e^{cx}}{c^2 + b^2} (c \cos bx + b \sin bx)$$

$$\int e^{cx} \sin^n x dx = \frac{e^{cx} \sin^{n-1} x}{c^2 + n^2} (c \sin x - n \cos bx) + \frac{n(n-1)}{c^2 + n^2} \int e^{cx} \sin^{n-2} dx$$

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