

$$\frac{d}{dx}(\tan^{-1}(x)) = \frac{1}{1+x^2} \quad \int \frac{1}{1+x^2} dx = \tan^{-1}(x) + c$$

$$\frac{d}{dx}(\sec^{-1}(x)) = \frac{1}{|x|\sqrt{x^2-1}} \quad \int \frac{1}{|x|\sqrt{x^2-1}} dx = \sec^{-1}(x) + c$$

$$\frac{d}{dx}(e^x) = e^x \quad \int e^x dx = e^x + c$$

recall $b^x = e^{x \ln(b)}$ $\int b^x dx = \int e^{x \ln(b)} dx = \frac{1}{\ln(b)} e^{x \ln(b)} + c$
(sub $u = x \ln(b)$)

Examples

$$\textcircled{1} \int \frac{1}{q^2+x^2} dx = \frac{1}{q} \int \frac{1}{1+x^2/q^2} dx = \frac{1}{q} \int \frac{1}{1+(x/q)^2} dx, \text{ sub } u = x/q$$

$$\textcircled{2} \int \frac{1}{\sqrt{1-4x^2}} dx = \int \frac{1}{\sqrt{1-(2x)^2}} dx \quad \text{sub } u = 2x, \dots$$

$$\textcircled{3} \int x(x+1)^4 dx \quad \textcircled{4} \int \sqrt{4x-1} dx \quad \textcircled{5} \int \sin^2 x \cos x dx$$

$$\textcircled{6} \int x \cos(x^2) dx \quad \textcircled{7} \int x \sqrt{x^2-1} dx \quad \textcircled{8} \int \frac{1}{x \ln(x)} dx$$

$$\textcircled{9} \int \frac{e^{2x} + e^{4x}}{e^x} dx \quad \textcircled{10} \int 2^x dx \quad \textcircled{11} \int x e^{x^2} dx$$