

Note on integration of a^x

We will compute the integral

$$\int a^x dx \tag{1}$$

We first notice that

$$a^x = e^{\ln a^x} = e^{x \ln a} \tag{2}$$

We have then

$$\begin{aligned} \int a^x dx &= \int e^{x \ln a} dx = \left| \begin{array}{l} u = \ln a^x = x \ln a \\ du = \ln a dx \end{array} \right| = \frac{1}{\ln a} \int e^u du = \\ &= \frac{e^u}{\ln a} + C = \frac{e^{x \ln a}}{\ln a} + C = \frac{e^{\ln a^x}}{\ln a} + C = \frac{a^x}{\ln a} + C \end{aligned} \tag{3}$$

The final result then is

$$\int a^x dx = \frac{a^x}{\ln a} + C \tag{4}$$

References

- [1] Swietoslaw Romanowski and Wlodzimierz Wrona (1967) *Matematyka wyzsza dla studiow technicznych* Warszawa, Panstwowe Wydawnictwo Naukowe

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