

Examples

(5)

$$\textcircled{1} \int \underbrace{x}_u \underbrace{e^x}_{v'} dx \quad \left. \begin{array}{l} u=x \\ v'=e^x \end{array} \right\} \begin{array}{l} u'=1 \\ v=e^x \end{array} \quad \left. \begin{array}{l} \text{Q: spoke we chose these the} \\ \text{other way round?} \end{array} \right\}$$

$$= uv - \int u'v dx$$

$$xe^x - \int 1 \cdot e^x dx = xe^x - e^x + c \quad \text{check!}$$

observation: $\int_a^b uv' dx = [uv]_a^b - \int_a^b u'v dx$

$$\textcircled{2} \int_1^2 \ln(x) dx = \int_1^2 \underbrace{1}_{v'} \cdot \underbrace{\ln(x)}_u dx \quad \begin{array}{l} u = \ln(x) \\ v' = 1 \end{array} \quad \begin{array}{l} u' = \frac{1}{x} \\ v = x \end{array}$$

$$= \left[x \ln x \right]_1^2 - \int_1^2 x \cdot \frac{1}{x} dx$$

$$= 2 \ln(2) - [x]_1^2 = 2 \ln(2) - 1$$

$$\textcircled{3} \int \underbrace{x^2}_u \underbrace{\cos(x)}_{v'} dx = \underbrace{x^2}_u \sin(x) - \int \underbrace{2x}_u \underbrace{\sin(x)}_{v'} dx$$

$$= x^2 \sin x - 2x(-\cos x) + \int 2(-\cos x) dx$$

$$= x^2 \sin x + 2x \cos x - 2 \sin x + c \quad \text{check!}$$

$$\textcircled{4} \int \underbrace{e^x}_u \underbrace{\sin(x)}_{v'} dx = e^x(-\cos x) - \int \underbrace{e^x}_u \underbrace{(-\cos x)}_{v'} dx$$

$$= -e^x \cos x + e^x \sin x - \int e^x \sin x dx$$