

7.1.1

2ndExample 1: Use integration by parts $\int x \ln(1+x) dx = \int (\omega-1) \ln \omega d\omega$

$$\text{Let } \omega = 1+x \\ d\omega = dx$$

$$I_1 = \int \omega \ln \omega d\omega$$

$$u = \ln \omega \quad dv = \omega d\omega$$

$$du = \frac{1}{\omega} d\omega \quad v = \frac{\omega^2}{2}$$

$$\Rightarrow I_1 = \frac{\omega^2}{2} \ln \omega - \int \frac{\omega^2}{2} \frac{1}{\omega} d\omega$$

$$I_2 = \int \ln \omega d\omega$$

$$u = \ln \omega \quad dv = d\omega$$

$$du = \frac{1}{\omega} d\omega \quad v = \omega$$

$$\Rightarrow I_2 = \omega \ln \omega - \int \frac{\omega}{\omega} d\omega$$

Example 2: Prove the reduction formula $\int x^n e^x dx = x^n e^x - n \int x^{n-1} e^x dx$

$$u = x^n \quad dv = e^x dx$$

$$du = n x^{n-1} dx; \quad v = e^x$$

$$\int x^n e^x dx = x^n e^x - \int e^x \cdot n x^{n-1} dx$$

$$= x^n e^x - n \int x^{n-1} e^x dx \quad \checkmark$$

1st