

PROOF OF FORMULA 2.322.4

$$\int x^4 e^{ax} dx = e^{ax} \left(\frac{x^4}{a} - \frac{4x^3}{a^2} + \frac{12x^2}{a^3} - \frac{24x}{a^4} + \frac{24}{a^5} \right)$$

Formula 2.321.2 states that

$$\int x^n e^{ax} dx = e^{ax} \left(\sum_{k=0}^n \frac{(-1)^k k! \binom{n}{k}}{a^{k+1}} x^{n-k} \right).$$

The case $n = 4$ produces the requested evaluation.