

Instructions: You must show all work to receive full credit for the problems below. You may check your work with a calculator, but answers without work will receive minimal credit. Use exact answers unless the problem starts with decimals or you are specifically asked to round.

1. Integrate.

a. $\int \frac{(\ln x)^7}{x} dx$

$$\begin{aligned} u &= \ln x \\ du &= \frac{1}{x} \end{aligned} \quad \int u^7 du = \frac{1}{8} u^8 + C$$

$$= \frac{1}{8} (\ln x)^8 + C$$

b. $\int t^2 e^{-t^3} dt$

$$\begin{aligned} u &= -t^3 \\ du &= -3t^2 \\ -\frac{1}{3} du &= t^2 \end{aligned} \quad \int -\frac{1}{3} e^u du = -\frac{1}{3} e^u + C$$

$$= \frac{1}{3} e^{-t^3} + C$$

c. $\int x e^{-2x} dx$

$$\begin{aligned} u &= x & dv &= e^{-2x} dx \\ du &= dx & v &= -\frac{1}{2} e^{-2x} \end{aligned}$$

$$\begin{aligned} -\frac{1}{2} x e^{-2x} - \int -\frac{1}{2} e^{-2x} dx &= -\frac{1}{2} x e^{-2x} + \frac{1}{2} \left(-\frac{1}{2} e^{-2x} \right) + C \\ &= -\frac{1}{2} x e^{-2x} - \frac{1}{4} e^{-2x} + C \end{aligned}$$

d. $\int x^2 \ln 5x dx$

$$\begin{aligned} u &= \ln 5x & dv &= x^2 dx \\ du &= \frac{5}{x} dx & v &= \frac{1}{3} x^3 \end{aligned}$$

$$\begin{aligned} \frac{1}{3} x^3 \ln 5x - \int \frac{5}{3} \cdot \frac{1}{x} \cdot x^3 dx &= \frac{1}{3} x^3 \ln 5x - \frac{5}{3} \int x^2 dx = \\ \frac{1}{3} x^3 \ln 5x - \frac{5}{9} x^3 + C \end{aligned}$$