

$$1. \int_1^4 (\int_0^2 (6x^2y - 2x)dy)dx$$

$$\begin{aligned} & \int_0^2 (6x^2y - 2x)dy = \\ & (3x^2y^2) \Big|_0^2 = \\ & 12x^2 \end{aligned}$$

$$\begin{aligned} & \int_1^4 (\int_0^2 (6x^2y - 2x)dy)dx = \\ & \int_1^4 12x^2dx = \\ & 4x^3 \Big|_1^4 = \\ & 192 - 4 = 188 \end{aligned}$$

$$2. \int_0^4 (\int_0^2 (y^3 e^{2x})dy)dx$$

$$\begin{aligned} & \int_0^2 (y^3 e^{2x})dy = \\ & \frac{y^4 e^{2x}}{4} \Big|_0^2 = \\ & \frac{16e^{2x}}{4} \end{aligned}$$

$$\begin{aligned} & \int_0^4 \frac{16e^{2x}}{4}dx = \\ & 4e^{2x} \Big|_0^4 = \\ & 8e^8 - 8 = 8(e^8 - 1) \end{aligned}$$

$$3. \int_{\frac{\pi}{2}}^{\frac{\pi}{6}} (\int_{-1}^5 \cos(y)dx)dy$$

$$\begin{aligned} & \int_{-1}^5 \cos(y)dy = \\ & x \cos(y) \Big|_{-1}^5 = \\ & 5 \cos(y) + \cos(y) = 6 \cos(y) \end{aligned}$$

$$\begin{aligned} & \int_{\frac{\pi}{2}}^{\frac{\pi}{6}} (6 \cos(y))dy = \\ & 6 \sin(y) \Big|_{\frac{\pi}{2}}^{\frac{\pi}{6}} = \\ & 6 \sin\left(\frac{\pi}{6}\right) \end{aligned}$$

$$4. \int_1^3 (\int_1^5 \frac{\ln(y)}{xy} dy)dx$$

$$\begin{aligned} & \int_1^5 \frac{\ln(y)}{xy} dy \\ & u = \ln(y) \\ & du = \frac{1}{y} dy \Rightarrow dy = du \cdot y \Rightarrow \\ & \int_1^5 \frac{u}{x} du = \\ & \frac{\ln(y)^2}{2x} \Big|_1^5 = \\ & \frac{\ln(5)^2}{2x} - \frac{\ln(2)^2}{2x} \end{aligned}$$

$$\begin{aligned} & \int_1^3 \left( \frac{\ln(5)^2}{2x} - \frac{\ln(2)^2}{2x} \right) dx = \\ & (\ln(5)^2 - \ln(2)^2) \int_1^3 \frac{1}{2x} dx = \\ & (\ln(5)^2 - \ln(2)^2) - x^{-1} \Big|_1^3 = \\ & (\ln(5)^2 - \ln(2)^2)(-3^{-1} + 1) \end{aligned}$$