

$$J_1 = \int_1^2 \frac{2}{x^2} dx = \left[\frac{-2}{x} \right]_1^2 = 1 \quad *$$

$$\begin{aligned} J_2 &= \int_{\frac{1}{2}}^1 \frac{-1}{x^3} dx \\ &= \left[-1 \cdot \frac{1}{-3+1} x^{-3+1} \right]_{\frac{1}{2}}^1 \\ &= \left[\frac{1}{2x^2} \right]_{\frac{1}{2}}^1 = -\frac{3}{2} \end{aligned} \quad *$$

$$\begin{aligned} J_3 &= \int_{\frac{1}{2}}^{\frac{1}{3}} \left(\frac{3}{x^4} - \frac{1}{x^5} \right) dx \\ &= \left[3 \cdot \frac{1}{-4+1} x^{-4+1} - \frac{1}{-5+1} x^{-5+1} \right]_{\frac{1}{2}}^{\frac{1}{3}} \\ &= \left[-\frac{1}{x^3} + \frac{1}{4x^4} \right]_{\frac{1}{2}}^{\frac{1}{3}} \\ &= -\frac{11}{4} \end{aligned} \quad *$$

$$\begin{aligned} J_4 &= \int_1^e \frac{1}{x} dx \\ &= [\ln |x|]_1^e = 1 \end{aligned} \quad *$$

$$\begin{aligned} J_5 &= \int_1^2 \frac{(x+1)^2}{x^4} dx \\ &= \int_1^2 \frac{x^2 + 2x + 1}{x^4} dx \\ &= \int_1^2 \left(\frac{1}{x^2} + \frac{2}{x^3} + \frac{1}{x^4} \right) dx \\ &= \left[-\frac{1}{x} - \frac{1}{x^2} - \frac{1}{3x^3} \right]_1^2 \\ &= \frac{37}{24} \end{aligned} \quad *$$

$$\begin{aligned} J_6 &= \int_1^2 \left(x^2 - \frac{1}{x^2} \right)^2 dx \\ &= \int_1^2 \left(x^4 - 2 + \frac{1}{x^4} \right) dx \\ &= \left[\frac{x^5}{5} - 2x - \frac{1}{3x^3} \right]_1^2 \\ &= \frac{31}{5} + \frac{7}{24} - 2 \end{aligned} \quad *$$

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