

Problem Definition

Problem 13. Find the indefinite integral and check your result by differentiation.

$$\int 5x^{-3} dx$$

Solution Step 1:

The power rule will allow us to compute this indefinite integral. The rule is

$$\int x^n dx = \frac{1}{n+1} x^{n+1} + C_1$$

where C_1 is the constant of integration that must be included.

For the present problem $n = -3$, so

$$\begin{aligned} \int 5x^{-3} dx &= 5 \int x^{-3} dx \\ &= 5 \left(\frac{1}{-2} x^{-2} + C_1 \right) \\ &= -\frac{5}{2} x^{-2} + C_2 \\ &= -\frac{5}{2x^2} + C_2 \end{aligned}$$

Solution Step 2:

To check the answer, all we need to do is differentiate the indefinite integral.

$$\begin{aligned} \frac{d}{dx} \left(-\frac{5}{2} x^{-2} + C_2 \right) &= -\frac{d}{dx} \left(\frac{5}{2} x^{-2} \right) + \frac{d}{dx} (C_2) \\ &= -\frac{5}{2} \frac{d}{dx} (x^{-2}) + 0 \\ &= -\frac{5}{2} (-2) x^{-3} \\ &= 5x^{-3} \end{aligned}$$