

Quick Hit 5.3 (1)

1. Compute the following integrals

$$(a) \int \frac{x^2 - 1}{x} dx = \int \frac{x^2}{x} - \frac{1}{x} dx = \int x - \frac{1}{x} dx = \frac{x^2}{2} + \ln(|x|) + C$$

$$(b) \int \frac{x}{x^2 - 1} dx = \int \frac{1}{u} \frac{du}{2} = \frac{1}{2} \ln(|u|) + C$$
$$u = x^2 - 1$$
$$du = 2x dx$$
$$\frac{du}{2} = x dx$$
$$= \frac{1}{2} \ln(|x^2 - 1|) + C$$

2. Find the general solution to the differential equation

$$x^2 \frac{dy}{dx} = y$$

$$\int \frac{dy}{y} = \int \frac{dx}{x^2} \rightarrow \ln(|y|) = -x^{-1} + C$$

$$\rightarrow |y| = e^{-x^{-1} + C} = ke^{-x^{-1}}$$