

Series of Exercises N°2

2025-2026

Exercise n°1. Determine the primitive of the following functions :

1. $f(x) = \frac{\sin x}{\cos^2 x}, \quad I =]-\frac{\pi}{2}, \frac{\pi}{2}[.$
2. $f(x) = xe^{-4x^2+9}, \quad I = \mathbb{R}.$
3. $f(x) = x^2 + \frac{3}{x^2}, \quad I = \mathbb{R}^*.$
4. $f(x) = \frac{t+1}{t^2+2t+5}, \quad I = \mathbb{R}.$

Exercise n°2. Calculate the following integrals :

1. $I_1 = \int_1^e \frac{\ln^2 x}{x} dx.$
2. $I_3 = \int_2^3 \frac{2x+3}{\sqrt{x^2+3x-4}} dx.$
3. $I_4 = \int_0^{\frac{\pi}{3}} (2 - \cos 3x) dx.$
4. $I_5 = \int_0^{\frac{\pi}{2}} \cos x \sin^3 x dx.$
5. $I_6 = \int_0^1 \left(\frac{1}{(x+1)^2} + \frac{1}{2x+1} \right) dx. \quad (\text{Leave to students}).$
6. $I_7 = \int_0^3 |x-1| dx.$

Exercise n°3. Let $I = \int_0^{\frac{\pi}{4}} \cos^2 x dx$ and $J = \int_0^{\frac{\pi}{4}} \sin^2 x dx.$

1. Calculate $I + J$ and $I - J.$
2. Deduce I and $J.$

Exercise n°4. Using integration by parts, calculate the following integrals :

1. $\int_e^{2e} z^2 \ln z dz.$
2. $\int_{-1}^0 (-2a + 1)e^{-a} da.$
3. $\int \arctan t \, dt.$

Exercise n°5. Calculate the following integrals using the indicate variable change :

1. $\int_1^3 \frac{dx}{\sqrt{x} + \sqrt{x^3}}, \quad x = t^2. \quad (\text{Leave to students}).$
2. $\int_0^1 \frac{e^{2x}}{e^x + 1} dx, \quad x = \ln t.$
3. $\int_0^\pi \frac{\sin t}{1 + \cos^2 t} dt, \quad x = \cos t.$
4. $\int \frac{1 - \sqrt{t}}{\sqrt{t}} dt, \quad x = \sqrt{t}.$

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