

# Mohamed Khider University of Biskra

Faculty of Exact Sciences  
Department of SM  
University Year 2025/2026

Module: Series and Diff. Eq  
Level: 2<sup>nd</sup> Year LMD  
Specialty: Physics

## Dirigated Work N°1

(SINGLE INTEGRALS)

**Exercise 1** Calculate the following integrals (Using a primitive):

$$\int x^2 - 5x + \frac{4}{x^2} dx, \quad \int \frac{2x}{x^2+1} dx, \quad \int \frac{2x+\sqrt{x}}{x} dx, \quad \int_0^1 x^2 e^{x^3} dx,$$
$$\int_5^2 4x^3(x^4 - \frac{1}{2})dx, \quad \int \frac{x^3}{(x^4+6)^2} dx$$

**Exercise 2** Calculate the following integrals (Using integration by parts):

$$\int x^2 e^x dx, \quad \int_1^2 \ln x dx, \quad \int x \ln(x+1) dx, \quad \int_0^1 x e^{-x} dx,$$
$$\int \ln^2 x dx$$

**Exercise 3** Calculate the following integrals (Using variable change):

$$\int \frac{dx}{(2x+1)^2}, \quad \int_0^1 \frac{dx}{e^x+1}, \quad \int_2^3 \frac{dx}{\sqrt{x+1}}, \quad \int \frac{\ln x}{x} dx,$$
$$\int \frac{1}{x \ln x} dx, \quad \int x e^{-x^2} dx,$$

**Exercise 4** Let  $f$  be the function defined by:  $f(x) = \frac{x^3 - 3x}{(x-1)^2}$ .

1. Determine the domain of definition  $D_f$ .
2. Prove the existence of three real numbers  $a, b, c$  such that:

$$f(x) = ax + b + \frac{c}{(x-1)^2}$$

3. Deduce the primitives of  $f$ .

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Charged of courses

Dr. OUAAR, F

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## Dirigated Work N°2

(DOUBLE AND TRIPLE INTEGRALS)

**Exercise 5** Calculate the following integrals:

$$\int_3^4 \int_1^2 \frac{dxdy}{(x+y)^2}, \quad \int_1^2 \int_x^{x\sqrt{3}} xydxdy, \quad \int_0^{2\pi} \int_{2\sin\theta}^2 r dr d\theta, \quad \int_0^1 \int_{y-1}^{2y} xydxdy.$$

**Exercise 6** Define the integration limits for  $\iint_D f(x, y)dxdy$ ,  $D$  being delimited by:

a)  $x = 2, x = 3, y = -1, y = 5$       b)  $y = 0, y = 1 - x^2$   
c)  $x^2 + y^2 = 4$                               d)  $y = \frac{2}{1+x^2}, y = x^2$

**Exercise 7** Calculate the following integrals:

a)  $\iint_D |x+y| dxdy$ ,      où  $D = \{(x, y) \in \mathbb{R}^2 / |x| < 1, |y| < 1\}$ .  
b)  $\iint_D \frac{1}{1+x^2+y^2} dxdy$ ,      où  $D = \{(x, y) \in \mathbb{R}^2 / x^2 + y^2 < 1\}$ .  
c)  $\iint_D \frac{xy}{x^2+y^2} dxdy$ ,      où  $D = \{(x, y) \in \mathbb{R}^2 / x > 0, y > 0, x+y < 1\}$ .  
d)  $\iint_D \sqrt{x^2+y^2} dxdy$ ,      où  $D = \{(x, y) \in \mathbb{R}^2 / 0 < y < x < 1\}$ .

**Exercise 8** Calculate the area of the figure bounded by the curves:

a)  $D = \{(x, y) \in \mathbb{R}^2 / y^2 = 2x, y = x\}$   
b)  $D = \{(x, y) \in \mathbb{R}^2 / y = \sin x, y = \cos x, x = 0\}$   
c)  $D = \{(x, y) \in \mathbb{R}^2 / y^2 = 4x, x + y = 3, y \geq 0\}$   
d)  $D = \{(x, y) \in \mathbb{R}^2 / y^2 = 4x + 4, y^2 = -4x + 4\}$

**Exercise 9** Calculate the volume bounded by the surfaces:

a)  $V = \left\{ (x, y, z) \in \mathbb{R}^3 / \frac{x^2}{9} + \frac{y^2}{16} + \frac{z^2}{25} = 1 \right\}$   
b)  $V = \{(x, y, z) \in \mathbb{R}^3 / x^2 + z^2 = R^2, y^2 + z^2 = R^2\}$

**Exercise 10** Calculate the following integrals:

$$\iiint_V z dx dy dz \quad \text{où } V = \{(x, y, z) \in \mathbb{R}^3 / x \geq 0, y \geq 0, z \geq 0, z \leq 1 - y^2 \text{ et } x + y \leq 1\}$$

$$\iiint_V xyz dx dy dz \quad \text{où } V = \{(x, y, z) \in \mathbb{R}^3 / 0 < z < 1, x^2 + y^2 < z^2\}$$

*Charged of courses*

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