University of M'Sila,
Faculty of Mathematics and Computer Science / Department of Mathematics
Master of **Numerical and Mathematical Analysis S 2**
Distributions Analyse de Fourier II

Homework (Devoir maison) 2^{nd} semester $2025 - 2026$

** We use the notations of the lesson.
** We take into account of the presentation of the copy.

Exercise 1. (Lesson)
– Find the elementary solution of the waves equation in $\mathbb{R}^2$.
– In $\mathbb{R}^3$, prove the Laplacian formula in spherical coordinates.

Exercice 2. — Find the solution of the equation

$$u''_{xy} = u''_{y^2}$$

we can take $\xi = x$ et $\eta = x + y$.

Exercice 3. Calculate the Fourier transform of :
1. $f(x) = e^{-(2x-1)^2}$,
2. the Dirac distributions at $x = 0$ and $x = 1$,
3. the function $f(x) = x + (x+1)^2$,
4. the distribution xH.

Exercice 4. Integer the following system (use the polar coordinates $x + 1 = r\cos\theta$, $y = r\sin\theta$ with $r = r(t)$ and $\theta = \theta(t)$:

$$\frac{dx}{dt} = -x - 1 + \frac{2y}{x^2 + 2x + y^2 + 1}$$

$$\frac{dy}{dt} = -y - \frac{2x + 2}{x^2 + 2x + y^2 + 1} \ .$$

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