المدة: ساعة وربع الساعة
(٧٥ دقيقة)

مسابقة في مادة الرياضيات

الاسم:
الرقم:

ملاحظة: - يسمح باستعمال آلة حاسبة غير قابلة للبرمجة او اختزان المعلومات او رسم البيانات.
- يستطيع المرشّح الإجابة بالترتيب الذي يناسبه (دون الالتزام بترتيب المسائل الواردة في المسابقة).

I- (5 points)

The table below represents the weekly number of working hours (x_i) and the monthly salary in dollars (y_i) of five employees in a company.

Weekly number of working hours (x_i)	35	40	45	50	55
Monthly salary in dollars (y_i)	300	500	800	1000	1200

The plane is referred to an orthogonal system.

1) Calculate the coordinates $\bar{x}$ and $\bar{y}$ of G, the center of gravity of the statistical data (x_i, y_i).
2) Determine the coefficient of correlation r and interpret its result.
3) Write an equation of the regression line $(D_{y/x})$ of y in terms of x.
4) Estimate the monthly salary of an employee who works 42 hours per week.
5) If an employee aims to receive a salary that is at least 600 dollars per month, estimate the minimum number of weekly working hours required.
6) An employee usually works 45 hours per week.
In a certain month and due to health problems, he worked 35 hours per week.
Calculate the percentage decrease in his salary.

II- (6 points)

In the table below, only one among the proposed answers to each question is correct.
Write the number of each question and give, **with justification**, the answer that corresponds to it.

Nº	**Questions**	**Proposed Answers**		
		A	**B**	**C**
1	For all real numbers $a > 0$, $\ln(ae^2) - \ln\left(\frac{1}{a}\right) =$	2	$2 + 2\ln a$	$2 + \ln a$
2	The domain of definition of the function f given by $f(x) = \frac{1}{\ln(2x)}$ is	$\left]0, \frac{e}{2}\right[\cup \left]\frac{e}{2}, +\infty\right[$	$]0, +\infty[$	$\left]0, \frac{1}{2}\right[\cup \left]\frac{1}{2}, +\infty\right[$
3	The number of solutions, in $\mathbb{R}$, of the equation $(e^{-2x} - 1)(\ln x - 1) = 0$ is	0	1	2
4	The derivative of the function defined over $]-\infty, +\infty[$ as $f(x) = \ln(2e^x + 1) - x$ is	$\frac{-2e^x}{2e^x + 1}$	$\frac{2e^x}{2e^x + 1}$	$\frac{-1}{2e^x + 1}$
5	The set of solutions, in $\mathbb{R}$, of the inequality $\ln(x - 1) < 3$ is	$]1, 1 + e^3[$	$]1, +\infty[$	$]-\infty, 1 + e^3[$
6	$\lim\limits_{x \to +\infty} \frac{e^x + x}{\ln(2x)} =$	0	$+\infty$	1

III- (9 points)

The plane is referred to an orthonormal system $(O;\vec{i},\vec{j})$.

Consider the function f defined over $]-\infty,+\infty[$ as $f(x)=(-3-x)e^{-x}+3$, and denote by (C) its representative curve.

Let (d) be the line with equation $y=3$.

1) Determine $\lim\limits_{x\to-\infty} f(x)$ and calculate f(–3.2).

2) **a)** Show that (d) is an asymptote to (C) at $+\infty$.

b) Study, according to the values of x, the relative positions of (C) and (d).

3) **a)** Show that $f'(x)=(2+x)e^{-x}$.

b) Solve the inequality $f'(x)\geq 0$.

c) Set up the table of variations of f.

4) Determine an equation of (T), the tangent to (C) at the origin O.

5) The curve (C) intersects the x-axis at two points with abscissas 0 and α where $-2.9<\alpha<-2.8$.

Draw (d) and (C).

6) Let h be the function given by $h(x)=\ln\big(f(\alpha x)\big)$.

Determine the domain of definition of h.