CONCOURS D'ENTREE EN 1ère ANNEE – SESSION AVRIL 2023

EPREUVE DE MATHEMATIQUES

Duration 3h00 - Coefficient 4

EXERCICE 1 : **3 Points**

In an assembly of 250 persons, there are 120 men with black trousers, 85 men with tie of which 50 are in black troussers. A person is chosen at random from the assembly for an interview.

1) What is the probability that he is in a black trouser? **0.5pt**

2) What is the probability that he is in a black trouser and has a tie? **0.5pt**

3) What is the probability that he is in black trousers or has a tie? **1pt**

4) What is the probability that he wears neither a black trouser nor a tie? **1pt**

EXERCICE 2 : **5 Points**

The municipal authority of a town in Cameroon envisage to construct low cost houses for municipal councilors. In order to fix the lodging price, the council accountant reveals the salaries X_i and rent proposition Y_i of a sample of eight agents. The results expressed in thousands of francs CFA are shown on the table below.

X_i	50	100	60	120	120	100	150	160
Y_i	15	20	15	30	25	25	40	35

The table above defines a statistical series with double character (X, Y)

Where X is the salary and Y the rent proposition.

1) a) Plot a scatter diagram representing the clouds of the series. **1pt**

b) Determine the coordinate of the mean of the series. **1pt**

2) a) Calculate the coefficient of linear correlation of the series. **1pt**

b) Can the salaries permit to explain the rent proposition? **0.5pt**

3) Use the least square method to determine the linear regression line of Y on X

1.5pt

EXERCICE 3 : **4 Points**

1) Write in a simpler form C= $\ln\frac{4}{9}+\frac{1}{2}\ln 36+\frac{2}{3}\ln\frac{27}{8}$. **0.5pt**

2) Express in the form X+Yi, the complex numbers: **1.5pt**

$$Z_1 = 4(-2+3i)+3(-5-8i) \quad and \quad Z_2 = \left(\frac{1+i}{2-i}\right)^2 + \frac{3+6i}{3-4i}$$

3) Solve the equation: $z^3+(1+i)z^2+(i-1)z-i=0$.

a) Given that one of the roots is purely imaginary. **0.5pt**

b) Determine real numbers a and b such that :

$$z^3+(1+i)z^2+(i-1)z-i=(z-ai)(z^2+bz+c).$$ **0.5pt**

c) Deduce all the roots of the equation. **1pt**

EXERCICE 4 : **8 Points**

Consider the function of real values f defined on IR by: $f(x) = \begin{cases} 2 - e^x & if \;\; x < 0 \\ 1 + \ln(1+x) & if \;\; x \geq 0 \end{cases}$

And (C_f) is the curve representing f in an orthonormal reference frame

1) Determine the domain of definition of f **0.5pt**

2) Study the continuity and the differentiability f at 0 **1pt**

3) Write the equation of the tangent to (C_f) at the point x=0 **0.5pt**

4) Calculate the limits of f at x=$-\infty$ $and\ at\ x = +\infty$ **0.5pt**

5) Study the infinite branches of the curve (C_f). **0.5pt**

6) Study the variations and draw a table of variation of f **1pt**

7) Sketch (C_f) after sketching the tangent to (C_f) at the point $x = 0$ **1.5pt**

8) Using integration by parts, evaluate $\int_0^1 \ln(1+x)\,dx$ **0.5pt**

9) Given that K is the area of the domain limited by (C_f), the $x - axis$ and the lines with equations $x = -ln2 \;\; and \;\; x = 1$

Write K in an integreable form and calculate K. **1pt**

10) Show that the restriction of $g\ of\ f$ in the interval $[0; +\infty[$ is a bijection of $[0; +\infty[\ in\ an\ interval\ J$ and determine J .
0.5pt

11) Show that the equation $g(x) = x$ has a unique solution

$\alpha\ in\ the\ interval\ 1 \leq \alpha \leq 3$ **0.5pt**

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