Name:

Maths

Question N.1:

Finite summations: let n be an integer, $\Sigma_{k=0,n}2^k =$?

Question N.2:

Prove $\Sigma_{k=1,n}(k^2(k+1) - k(k-1)^2) = n^2(n+1)$

Question N.3:

Identities:
$a^n - b^n =$?
$(a+b)^n =$?

Question N.4:

What are the values of $\Sigma_{k>0}\frac{1}{2^k}$ and $\Sigma_{k>0}\frac{1}{k}$?

Question N.5:

Classify asymptotically the functions (variable n integer).
$log(n)$, 2^n, $\sqrt{n}$, n^n, $log(log(n))$, n^3

Question N.6:

Consider $T = 1 + 2 + 4 + ...$
Compute $2T = 2 + 4 + 8 + ... = T - 1$, thus $T = -1$.
What's wrong here?
Give an interpretation of the sum: 1-1+1-1+1 ...

Question N.7:

What is an irrational number?

Question N.8:

Recall the definition of a *function* $F : S \to T$.
What is a injective function?

Question N.9:

Give the definition of the derivative of the continuous function f defined on all the real points.
Describe briefly its geometric interpretation.

Question N.10:

What are the derivative of each function: $x^2 + 2x$, $\sqrt{x}$, $log(x)$, $\frac{1}{x}$

Question N.11:

Recall the interpretation of the integral of a function.
Examples for $(x+1)^2$ on $[0..1]$ and $1/x^c$ on $)0, \infty($ for $c > 0$

Question N.12:

Consider a –continuous– function f(x). Give a definition and an example for the following asymptotic notations: $O(f(x))$, $\Omega(f(x))$, $\Theta(f(x))$.

Question N.13:

$$A = \begin{pmatrix} 2 & 0 & 1 \\ 3 & 3 & 1 \\ 0 & 5 & 2 \end{pmatrix}$$

Compute the determinant of A and compute A^2.

Question N.14:

Write the number 2021 in base 2 (binary) and in base 16.

Question N.15:

Describe the main composant of the Algebra of Propositional Logic

Question N.16:

Truth tables.
Build the table for the main operations of propositional logic.
Check the contraposition operation using truth tables.

Question N.17:

Define the notion of *equivalence relation.*

Question N.18:

Do you know the notion of *algebraic closure*?

Question N.19:

Prove that the following relation between pairs of integers (n_i, m_i): $(n_1, m_1)\rho(n_2, m_2)$ iff $n_1 + m_2 = n_2 + m_1$ is an equivalence relation.
Give an interpretation of the equivalent class that contains $(n = 1, m = 0)$.

Question N.20:

What is an order relation?

Question N.21:

Give the formal definition of the intersection and union of two sets S and T.

Question N.22:

Give the formal definition of the set difference of S and T.

Question N.23:

Define the cross product (or cartesian product) of two sets S and T.

Question N.24:

Express $\log_a(x)$ with logarithms in base b.

Question N.25:

Give another expression for $n^{\log_a(b)}$.