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First year in Computer Science — 2025-2026

Exercise Series N°01.
Algebra 1

Note : Questions marked with $(*)$ are left for students.

Exercise 01 :
Among the following statements, determine which are **True** propositions, **False** propositions, or **not proposition** at all.

1. $x^2 \geq 0$.
2. For all $x \in \mathbb{R}$, $x^2+1=0$ has no solution.
3. There is no real number x satisfies that $x^2=-1$.
4. Let $x \in \mathbb{R}$, $x^2 = 9$ then $x = 3$ or $x = -3$.
5. There is an even prime number.
6. The interval $[0, 1]$ of real numbers has a finite number of elements.
7. Every triangle has three vertices (angles) and three edges.
8. In a right triangle, the square of the hypotenuse equals the sum of the squares of the other two sides.
9. Every quadrilateral has exactly one right angle ($90°$).
10. Every rectangle is a square.
11. Every square is a rectangle.
12. The number π is an irrational number.
13. The circumference of every circle is 2π.
14. I'm reading, therefore I am in the classroom.
15. All that he is saying is not true.
16. Solve the problem.
17. All students of the University of M'sila passed the Baccalaureate Exam.
18. What is your name ?
19. Mathematics is beautiful.
20. I wish you all success in your studies.

Exercise 02 :
Let p, q, r be propositions.

i. Establish the truth table of the following assertions.

   1. $\bar{p} \wedge \bar{q}$.
   2. $\bar{p} \vee \bar{q}$.$(*)$
   3. $\overline{p \wedge q}$.
   4. $\overline{p \vee q}$.

ii. What can we conclude from both (1 and 4), and (2 and 3) ?

iii. Using truth table prove that :

   1. $(p \wedge (q \vee r)) \Leftrightarrow ((p \wedge q) \vee (p \wedge r))$.

2. $((p \vee q) \vee r) \Leftrightarrow (p \vee (q \vee r)).(*)$
3. $(p \Rightarrow q) \Leftrightarrow (\bar{p} \vee q)$

Exercise 03 :

- Express the following expression using quantifiers and give its negation :

  a) For all real number x, the function f is positive.
  b) For all real number x, the function f is increasing.
  c) For all real number x, the function f is constant. $(*)$
  d) The sum of two even integer numbers x and y is even.
  e) The function f is zero at some real numbers.
  f) The function f vanishes at a unique real number a.

Exercise 04 :
Consider the following propositions :

1. $\forall \alpha \in \mathbb{R}, \forall \beta \in \mathbb{R}, \alpha + \beta > 0.$
2. $\exists \alpha \in \mathbb{R}, \forall \beta \in \mathbb{R}, \alpha + \beta > 0.$
3. $\forall \alpha \in \mathbb{R}, \forall \beta \in \mathbb{R}, \alpha^2 + \beta^2 \geq 0.$
4. $\forall \alpha \in \mathbb{R}, |\alpha| \geq 0.$
5. $\exists \alpha \in \mathbb{R}, \forall \beta \in \mathbb{R}, \beta^2 > \alpha.(*)$

   Are these propositions true or false ? Provide their negations.

Exercise 05 :
Among the following propositions, determine which are true or false and justify your answer.

1. $\exists x \in [-1, 1],\ x^2 - \frac{1}{4} = 0$
2. The product of two odd integer numbers x and y is odd.
3. All prime numbers are odd.
4. For all real numbers x, $x^2 > x.(*)$
5. $\forall a, b \in \mathbb{R}^+$, if $\frac{b+1}{a} = \frac{a+1}{b} \Rightarrow a = b$
6. $\forall n \in \mathbb{N}^*,\ 1 + 3 + 5 + \ldots + (2n-1) = \sum_{i=1}^{n}(2i-1) = n^2$