TP 3 (part 2): C++ libraries

1. Libraries:

A library or software library is a set of functions and procedures, grouped and made available (in a file) so that they can be used directly without having to rewrite them. The functions and procedures are grouped by their belonging to the same conceptual domain (inputs/outputs, mathematics, graphics, sorting, etc.).

Among the standard C++ libraries we can cite: **iostream**,**string**, c**math**....

- To use a library, add the line at the start of the program:

  #include <library_name>

Example:

```
#include <iostream> // library for read/write instructions.
#include <string> // library for handling character strings.
#include <cmath> // library for math functions.
.
.
.
```

Noticed :

The #include <iostream> instruction is not sufficient to use the cin and cout functions; these functions are defined in the std namespace, so you must add the using namespace std instruction;

2. Operators (operations) in C++ language:

Operators are symbols used to perform operations on values. Among the C++ operators, We can cite : **( ) – ++ -- % / * - + .**

The following table gives the translation into C++ of the most frequent algorithmic operations.

Algorithmic language	C++ language
(A)	(A)
- A	- A
A ← A+1 (increment)	A++, ++AA
A ← A-1 (decrement)	A- - , - -A
A mod B (modulo)	A % B
A/B(A real or B real)	A/B
A/B(A and B integers)	A/B
A*B	A*B
A+B	A+B
A–B	A–B
A > B	A > B
A ≥ B	A >= B
A<B	A<B
A ≤ B	A <= B
A=B	A == B
A ≠ B	A != B
A and B (boolean operation)	A && B
A or B (boolean operation)	A || B
not(A) (boolean operation)	!A
A ← B (affectation)	A=B
A ← A + B	A += B
A ← A–B	A -= B
A ← A * B	A *= B
A ← A / B	A /= B
A ← A mod B	A %= B

3. Operator priorities:

The precedence of operators depends on the programming language used. Operators in the C++ language are ordered as follows:

Priority	Operators
1 (stronger)	()
2	! – ++ --
3	% / *
4	- +
5	> >= < <=
6	== !=
7	&&
8	||
9 (weaker)	= += -= *= /= %=

- An operand between two operators is associated with the operator which has the highest priority

Example:

A + B * C -------> (A + (B * C))

- An operand between two operators of the same priority is associated with the operator closest to ***LEFT*** except for the operands (! – ++ -- = += -= *= /= %=) where it is associated with the operator most at **RIGHT**.

Example:

A*B/C ↔ ((A*B)/C)
A %= B *= C ↔ (A %= (B *= C))

Noticed :

To avoid operator association errors, it is recommended to use **parentheses**.

4. Some mathematical functions

Math functions are defined in the c library **cmath**, so to use these functions you must first include the library at the start of the program as follows:

#include <cmath>

Among the functions contained in the <cmath> file, we can cite:

Mathematical functions	C++ language
Power: x^y	**pow(x,y)** x of type float or double
square root: √x	**sqrt(x)** x must be positive
sinus (x)	**sin(x)**
Cosinus (x)	**cos(x)**
tangent(s)	**tan(x)**
natural logarithm: log(x)	**log(x)**
logarithm to base 10: log10(x)	**log10(x)**
Exponential: ex	**exp(x)**
The absolute value: |x|	**abs(x)** applies to integers

Noticed :

Be careful with certain functions which only apply to a particular type, they can make implicit type conversions of their operands.

Example: abs(-3.25) gives 3

Practical work :

1) Write a C++ program that calculates the following functions (use comments to clarify your programs):

$$f(x) = \frac{2(X+1)^2 - x}{x+1}$$

$$g(x) = (\sin(x) + \sqrt{x})^4$$

- The execution of the program is as follows: