## Lab 2.9.4 Evaluating different kinds of means

### Objectives

Improve the student's skills in:

- using the **for** loop;
- translating iterative mathematical formulas into C++ code.

### Scenario

Nobody wants to be "a mean man", but paradoxically, "means" play a very important role in the modern world. We can say that many people love "means": politicians love "means" (when they want to prove or disprove something), financiers love "means" too (when they want to show that their profits are not as big as you may suspect) and, most of all, statisticians love "means" more than anything else.

Although an old joke claims that one statistician drowned in a lake whose mean depth didn't exceed 1 ft (ca. 30 cm), we think that it's worth a try if you can evaluate some of the most commonly used variants of means.

Let's take four of them into consideration:

- arithmetic mean:

$$\frac{a_1 + a_2 + ... + a_n}{n}$$

- harmonic mean:

$$\frac{n}{\dfrac{1}{a_1} + \dfrac{1}{a_2} + ... + \dfrac{1}{a_n}}$$

- geometric mean:

$$\sqrt[n]{a_1 \cdot a_2 \cdot ... \cdot a_n}$$

- root mean square:

$$\sqrt{\frac{a_1^2 + a_2^2 + ... + a_n^2}{n}}$$

Look at the code below and complete it with a part that evaluates every mean mentioned. Compare your results with the ones we've provided.

Note the additional **#include** directive – it's intended to include headers of the mathematical functions needed to finish your work. We believe that two of them are essential:

- **double pow(double x, double y)** to evaluate x to the power of y;
- **double sqrt(double x)** to evaluate the square root of x.

Hint:

$$\sqrt[n]{x} = x^{\frac{1}{n}}$$

```cpp
#include <iostream>
#include <cmath>

using namespace std;

int main(void) {

 double vector[] = { 1., 2., 3., 4., 5. };
 int n = sizeof(vector) / sizeof(vector[0]);
 double ArithmeticMean;
 double HarmonicMean;
 double GeometricMean;
 double RootMeanSquare;

 // Insert your code here

 cout << "Arithmetic Mean = " << ArithmeticMean << endl;
 cout << "Harmonic Mean   = " << HarmonicMean   << endl;
 cout << "Geometric Mean  = " << GeometricMean  << endl;
 cout << "RootMean Square = " << RootMeanSquare << endl;

 cout << endl;
 return 0;
}
```

## Example output

```
Arithmetic Mean = 3
Harmonic Mean   = 2.18978
Geometric Mean  = 2.60517
RootMean Square = 3.31662
```