Lesson 2 Exercises – Part I

1. Write a program in C++ that outputs the volume of a cone with base radius of 14.5 and height of 26.79. You should use this formula:

$$\frac{\pi \times radius^2 \times height}{3}$$

Remember that the (approximate) value of π is 3.141592.

2. Modify the previous program using three variables, all of them of type `double`: `radius`, `height` and `volume`. `radius` and `height` will be initialized to 14.5 and 26.79, respectively. `volume` will obtain the result from applying the formula.

3. Write a program in C++ that reads a (real) number from the keyboard meaning a measure in degrees Fahrenheit and converts it to Celsius, displaying the result on the screen.

    ºC = 5 / 9 x (ºF - 32)

4. Write a program in C++ that reads an elapsed `time` in seconds from the keyboard and displays the equivalent `hours`, `minutes` and `seconds` on the screen.

5. Write a program in C++ that starts by declaring the following variables (initial values between parenthesis):

    ✓ Integer variable called `x` (12)

    ✓ Real variable called `sigma` (2.1836)

    ✓ Integer variable called `y` (3)

    ✓ Real variable called `lambda` (1.11695)

    ✓ Real variable called `alfa` (328.67)

    ✓ Real variable called `f`

    The program will display the value (`f`) resulting from the following formula:

$$f = 3 \times \left(\frac{x + sigma \times y}{x^2 - y^2} \right) - lambda \times \left(alfa - 13.7 \right)$$

6. Write the following expression in C++ (use strictly necessary parentheses):

$$\frac{4}{3(r + 34)} - 9(a + bc) + \frac{3 + d(2 + a)}{a + bd}$$

7. Write a program in C++ that calculates the final grade of this subject, from the partial grades obtained on the final exam, the project, and the additional activities. It will ask the user for each partial grade and will show the final grade obtained. It will not consider minimum requirements in some partial grades (project passed, at least 5 on the final exam).

8. Write a program in C++ that calculates an employee's paycheck based on the following data: basic salary, position complement, academic complement, overtime worked, number of children, and number of elderly dependents.

   The total amount of the paycheck is equal to the employee's gross salary minus taxes.
   The gross salary is equal to the basic salary plus the complements plus the corresponding amount for the overtime (23 $ per hour). Taxes (IRPF) are a percentage of the gross salary: with no children or elderly dependents, 24% is applied. For each child 2 points are subtracted from that percentage, and 1 point for each elderly dependent.

   The program will ask the user for the data needed and will write a detailed paycheck with a format similar to this one:

   ```
   Basic Salary: 1237.56 $
   Position Complement: 146.95 $
   Academic Complement: 97 $
   Overtime: 7
   Children: 2
   Elderly Dependents: 1
   Paycheck.-
   Gross Salary: 1642.51 $
   IRPF Percentage: 19%
   IRPF Deduction: 312.08 $
   Net Salary: 1330.43 $
   ```

   Use descriptive identifiers for variables and include comments describing the operations.

9. Given these declarations:

   ```
   int a = 1;
   ```

   ```
   double d = 1.0;
   ```

   What is the result of each of these expressions (the assigned value)?

   ```
   a = 46 % 9 + 4 * 4 - 2;
   a = 45 + 43 % 5 * (23 * 3 % 2);
   a = 45 + 45 * 50 % a--;
   d = 1.5 * 3 + (++d);
   d = 1.5 * 3 + d++;
   a %= 3 / a + 3;
   ```

10. A triangle's area can be calculated with the *Sine Law*: Knowing two sides of a triangle, `side1` y `side2`, and the angle α between them, that law states that

Area = ½ x side1 x side2 x sine α

Write a program in C++ that calculates a triangle's area with that formula. The program will ask the user for two sides and the angle between them (in degrees). Be aware that the `sin()` function expects the angle will be provided in radians. Angle in radians = Angle in degrees x π / 180.

11. Write a program in C++ that asks the user for the values of two real variables x and y, and then displays the result of applying them in this formula:

$$f(x, y) = \sqrt{1.531^{(x+y)} + \frac{\left|e^x - e^y\right| \times (\sin(x) - \tan(y))}{\log_{10}(y) \times 3.141592^x}}$$

Declare constants for fixed values.

12. Write a program in C++ that asks the user for a mortgage's data (capital lent, annual interest rate and years of amortization) and then displays the monthly payment and total amount paid once the amortization ends, distinguishing between interest and capital amounts.

The formula for obtaining monthly payment is:

$$payment = \frac{capital \times rate}{100 \times (1 - (1 + \frac{rate}{100})^{-term})}$$

Where *rate* is the monthly interest rate and *term* is provided in months.