LESSON 01 EXERCISES

EXERCISE 1

Now in the main function of `exercise_1.cpp`:

Define a variable of type `int` called `weight` assume the unit is `[kg]`

Define a variable of type `double` called `height` assume the unit is `[m]`

Initialize to suitable values

Define a variable of type `double` called `bmi` and initialize it to `weight/height2`

Then write

```
bmi for weight:<weight> and height:<height> is <the result>
```

to the console output.

Vary the height and weight values set height=0 and observe

EXERCISE 2

In the file `exercise_2.cpp`, implement the following in the `main` function:

Define a variable `angle` of type `double` initialized to some value less than 2*pi

Define a variable `x` of type `double` initialized cos(angle)
Define a variable `y` of type `double` initialized sin(angle)

Define a variable `length` of type `double` initialized to the length of (x,y)

Write the length to the console

Vary angle and observe the length value. What is it you are calculating?

Hint: `Length` is defined as sqrt(x^2+y^2), include <`cmath`> to implement this

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EXERCISE 3

1) Use ChatGPT (or another generative AI) to find a formula that describes a throw of a mass with start speed v_0, and angle α and under the influence of the uniform gravitational field given by g=9,82 m/s^2

2) Use ChatGPT to make a graph using a start speed 5 m/s, an angle of 45 degrees and a mass of 100 kg

3) Use ChatGPT to make a graph using a start speed of 5 m/s, varying the angle from 5 to 80 degrees in steps of five and a mass og 100 kg

4) Describe to your fellow student what the parameters are – how many, what do each of the represent, what is the type of the value and what is the result (what does it represent and what type is it). **DO THIS BEFORE NEXT STEP** – the purpose is that you learn something NOT the answer in itself.

5) Use ChatGPT to do the same as in 4) and compare the descriptions

EXERCISE 3

6) I asked ChatGPT the following "create a prototype of a function in C++ for the projectile motion (vertical distance) at a given horizontal distance". It gave me the following:

```
double calculateVerticalDistance(double v0, double theta, double g, double x);
```

relate the parameters of the function to the description you made in step 4

7) Copy the prototype of the function into the file throw_parabola.h. Above the prototype, include a comment describing the parameters – one parameter per line

8) Using the formula found by ChatGPT in step 1, implement the function in the file throw_parabola.cpp . **DO NOT USE ChatGPT FOR THIS**.

9) Use ChatGPT to create a main function that tests the function with the following parameters: start speed 5 m/s, an angle of 45 degrees and a mass of 100 kg. Is the relult of your function as expected (what was expected?)

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EXERCISE 4

The following functions are to be implemented as **protypes** in `geometrics.h`-file
and as fully implemented functions in the `geometrics.cpp`-file

`double` `volume` (`double` `radius`), that calculates the volume of a sphere

`double` `area`(`double` `radius`), that calculates the surface area of a circle

`double` `geoRatio` (`double` `radius`), that calculates the area/volume of a sphere

Do the same for a rectangular box of a given `height` `width` and `length` (i.e. implement
as a prototype in `geometrics.h` and fully in `geometrics.cpp`
Test the functions in main in the file `exercise_4.cpp`.

Look up the formulas.

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EXERCISE 4

The number `geoRatio`, for a geometric body can be interpreted thermodynamically in the following way.

It calculates the surface area/volume

The amount of heat radiated from a homogeneous body is proportional to the surface area.

And the amount of heat stored in the body is proportional to the volume

So, the `geoRatio` says something about how fast the body cools (higher ->faster cooling)

Convince yourselves of the fact that a cube cools faster than a sphere

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