

Practical Work 2 - Variables, Data Types and Operations

Exercise 1 - Variables and expressions

Using variables and `math` module, calculate the following functions:

Start with $a = 3, b = 5, c = 1, \alpha = \pi, \beta = \frac{\pi}{2}$ and calculate:

$$eq_1 = \frac{a}{15-b}$$

$$eq_2 = \frac{a+20}{b}$$

$$\Delta = b^2 - 4ac$$

$$X_1 = \frac{-b+\sqrt{\Delta}}{2a}$$

$$eq_3 = e^{\alpha} + \sin\beta$$

$$eq_4 = \frac{a}{5-b}$$

Example of using `math` module:

```
>>> import math
>>> math.sqrt(25)
5.0
```

Exercise 2 — Identifying data types

Create the following variables:

```
nbr_of_parts = 15
temperature = 23.5
material = "Steel"
machine_on = True
```

For each variable, identify its Python type, then use `type()` to verify your answers.

Exercise 3 - Type conversion

Predict the result and the type of each expression before executing it and use `type()` to check your answers.

```
int("150")
int(3.72)
float("150")
float(150)
str(150)
float(150)+ int("150")
str(150) + str(10)
```

Exercise 4 - Formatted output

Open the Python shell and try:

```
>>> distance, time = 125, 7
>>> speed = distance / time
>>> print(speed)
>>> print("Average Speed = ", speed)
>>> print(f"{speed:.2f}")
>>> print(f"Average Speed = {speed:.2f}")
>>> print(f"Average Speed = {speed:.2f} m/s")
```

Exercise 5 - Rectangle calculator

Create a Python program that calculates the area and perimeter of a rectangle with:

```
length = 10.5
width = 3.0
```

Then display:

```
Rectangle
-----
Length = 12.50 m
Width = 4.00 m
Area = 50.00 m²
Perimeter = 33.00 m
```

Your program must:

- use variables;
- perform the calculations using expressions;
- store the results in variables;
- use f-strings to display two decimal places;

Exercise 6 - Advanced rectangle calculator

Repeat Exercise 5 using the `input()` function.

Exercise 7 (optional) - Simple engineering calculation

A moving object with mass m , travels a distance d in time t .

Using the input and the output functions, write a Python program that calculates:

1. The average speed: $v = \frac{d}{t}$
2. The acceleration, assuming the object starts from rest: $a = \frac{v}{t}$
3. The force: $F = ma$

The program should display a clear report such as:

```
Engineering Calculation
-----
Distance = ... m
Time = ... s
Mass = ... kg
Speed = ...
Acceleration = ...
Force = ... N
```

Requirements

The program should:

- use variables for all input values;
- use the `input()` function to read the input values
- use f-strings for the output;
- display numerical results with two decimal places;
- include appropriate units;
- use meaningful variable names.
- Use useful comments

Exercise 8 (optional) - Surface of a cylinder

1. Write a script to calculate the surface of a cylinder given by: $S = 2\pi r^2 + 2\pi rh$
where r and h are the radius and the height of the cylinder respectively.
2. Include in your script valuable comments