

Fall 2021

APPLIED PHYSICS - LAB

Lab-1

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-

Introduction:

“It’s a mistake to think that we (physicists) are in the business of finding how the universe works. We are actually in the business of finding good enough mathematical equations that fit our experiments.

-Niels Bohr

Let us make Mr. Bohr proud, we will use VPython as our mathematical simulation tool in this course. The theory section in our course Applied Physics provides us with all the mathematical equations that we can bring into 3D simulation and see how well this mathematical model fits with our experiments; everyday physics. This involves making objects, placing objects, moving objects under certain conditions, and calculating their properties. These labs will allow you to delve into the world of physics via your computational glasses.

VPython:

VPython is a “visual” extension of the Python programming language that allows users to produce 3D objects with animations. VPython works in a default three-dimensional environment that can be accessed by using conventional XYZ coordinates. This allows physics calculations to become more intuitive when vectors are involved.

There are different options available for you to perform these labs on VPython. You can download and install VPython in your own systems; this makes practice at home easy. You can also work on online platforms such as Google Colab, [Glowscript](#), and [Trinket](#). In these labs, you will use VPython on Trinket.

Log in to Trinket.io

Here are the instructions on how to get started:

1. Follow the link [Trinket.io](https://trinket.io) to access the website.
2. Log in using your @nu.edu.pk account.
3. In the New Trinket drop-down menu, select Glowscript
4. You will be provided with the option to select between Python and Blocks, select Python.

Now, you will find yourself in a blank file called `main.py` on the left and another blank section on the right. This is where you start programming!

Basic Operations:

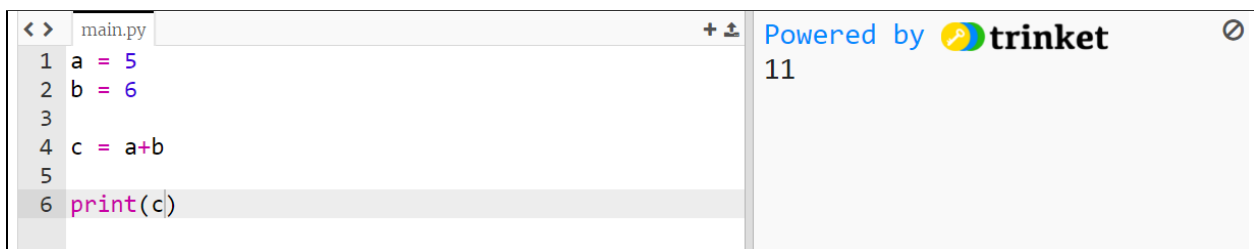
Let us get used to how to get outputs for basic mathematical operations in VPython.

Go ahead and type the following code in the `main.py` section on the left and click the Run button on the top bar. You will the answer appears on the right section.



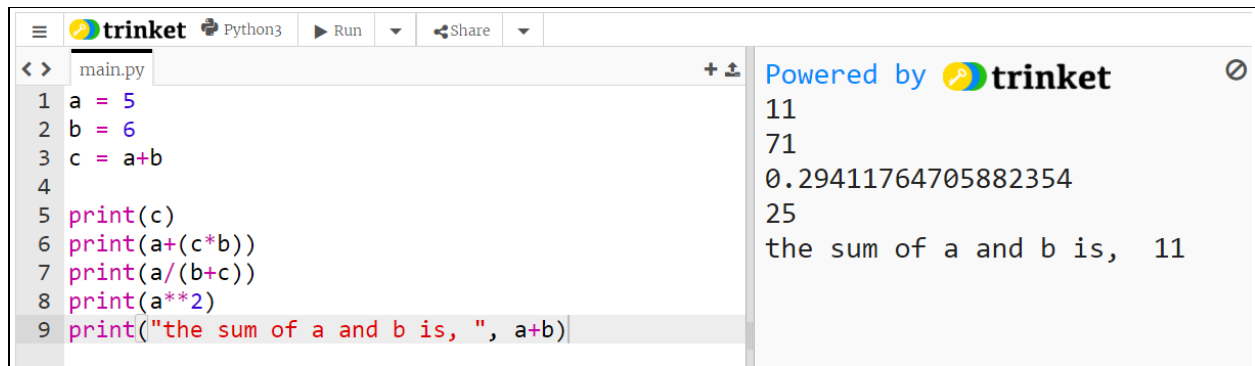
The screenshot shows the Trinket.io web interface. At the top, there's a navigation bar with the Trinket logo, 'Python3', a 'Run' button, and a 'Share' button. Below this, the left pane shows a file named 'main.py' with the code `1 print(2+3)`. The right pane, titled 'Powered by trinket', displays the output '5'.

In most cases, you'll need to assign the calculated values to a `variable`. A variable is just the same as mathematical variables (x, y etc.) In the following example, the variables `a` and `b` store the values that we assign, and `c` stores the value calculated by the program under your given operation.




The screenshot shows the Trinket.io web interface with a more complex example. The left pane shows the code: `1 a = 5`, `2 b = 6`, `3` (blank line), `4 c = a+b`, `5` (blank line), and `6 print(c)`. The right pane, titled 'Powered by trinket', displays the output '11'.

Now that the `a`, `b`, and `c` variables have values, you can calculate and print the other values directly as well. But remember, printing directly will not save this value.



```
1 a = 5
2 b = 6
3 c = a+b
4
5 print(c)
6 print(a+(c*b))
7 print(a/(b+c))
8 print(a**2)
9 print("the sum of a and b is, ", a+b)
```

Powered by  trinket

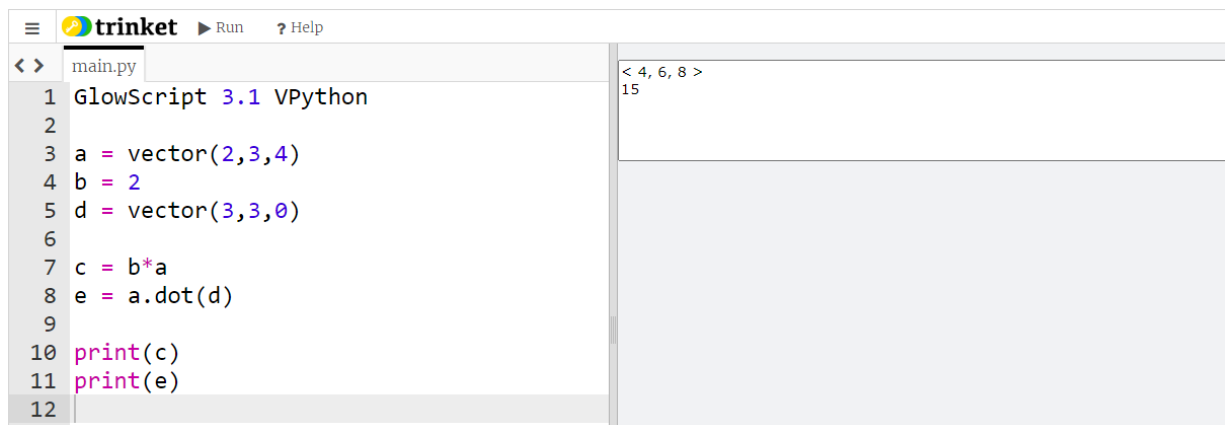
11
71
0.29411764705882354
25
the sum of a and b is, 11

Practice problems:

Will be uploaded on google classroom by tomorrow.

Vector Operations:

Vectors, in VPython, are defined by using the function `vector()` when assigning to any variable. The three values in the parenthesis are necessary to provide for the program to run. See the following example:



```
1 GlowScript 3.1 VPython
2
3 a = vector(2,3,4)
4 b = 2
5 d = vector(3,3,0)
6
7 c = b*a
8 e = a.dot(d)
9
10 print(c)
11 print(e)
12
```

< 4, 6, 8 >
15

Here is a [detailed manual](#) on how to use vector operations in VPython.

Practice problems:

Will be uploaded on google classroom by tomorrow.