# NUR solution template

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**Abstract**

In this document an example solution template is given for the exercises in the course Numerical recipes for astrophysics.

## 1 Sine exercise

In this section we look at question 1 subquestion a, we want to add this extra explanation bla bla, and also note bla bla.

Out script is given by:

```python
#!/usr/bin/env python3
import numpy as np
import matplotlib.pyplot as plt

# allocate x array
x = np.linspace(0,2*np.pi)

# define and allocate y array
y = np.sin(x)
y2 = np.cos(x)

plt.plot(x,y,label='Sine')
plt.plot(x,y2,label='Cosine')
plt.legend()
plt.xlabel('x variable')
plt.ylabel('y variable')
plt.savefig('./plots/sineplot.png')
plt.close()
```

sine.py

Our script produces the following results, see Fig. 1, compare with literature in Fig. 2.

## 2 Hello world exercise

```python
#!/usr/bin/env python3

# print what we want to print
print("Hello world!")
print("This is an example for output")
print("That is piped to an output file")
print("And afterwards displayed in your pdf")
```

helloworld.py

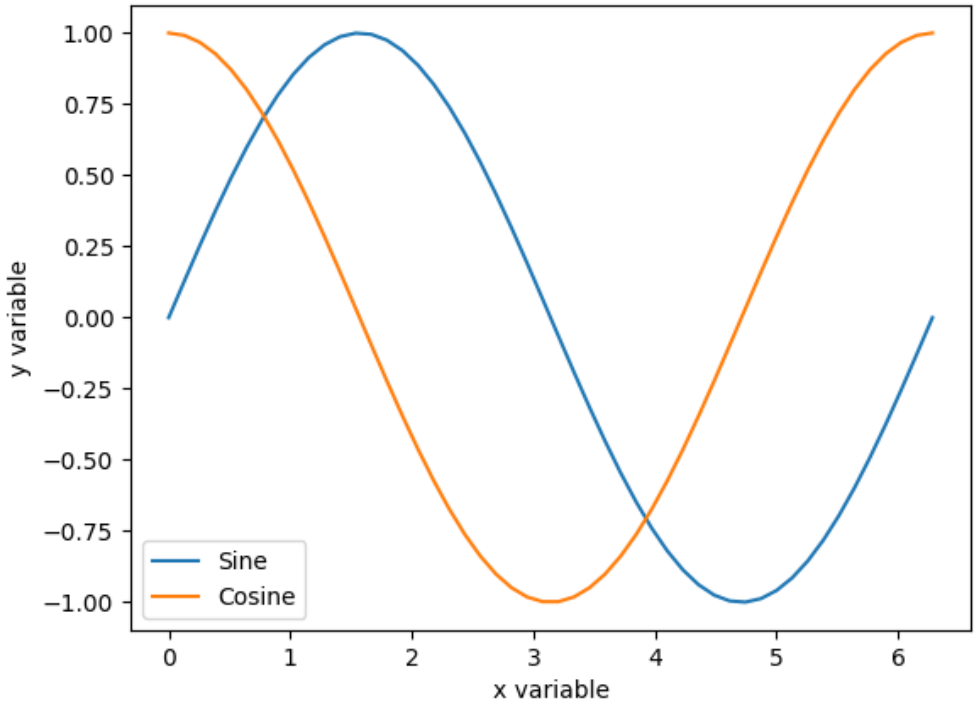


Figure 1: The result of our program, as can be seen the sine and cosine are behaving exactly as expected, there for we can conclude ....

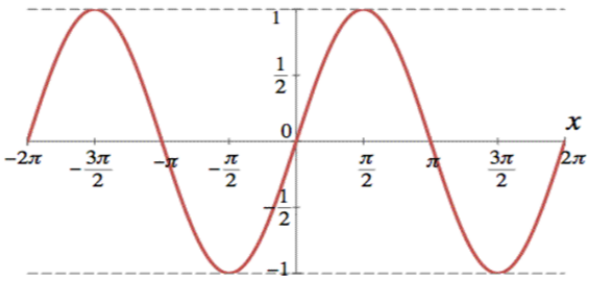


Figure 2: Literature result, say something...

## 3 cosine question

The file of this exercise is:

```
#!/usr/bin/env python
import numpy as np

# program to check values at specific variables of cosine
x = np.array([0,np.pi/2, np.pi])
y = np.cos(x)

# Save a text file
np.savetxt('cosoutput.txt',np.transpose([x,y]))
```

cos.py

The result of the script is given by:

```
0.00000000000000000e+00  1.00000000000000000e+00
1.57079632679489658e+00  6.12323399573676603e-17
3.14159265358979316e+00  -1.00000000000000000e+00
```

cosoutput.txt

# 4 Sine movie exercise

For exercise we needed to make a movie, bla bla. Done with:

```
#!/usr/bin/env python3
import numpy as np
import matplotlib.pyplot as plt
from tqdm import tqdm

x = np.linspace(0,2*np.pi,100)

for i in tqdm(range(0,300)):
    y = np.sin(x+np.pi*i/300.)
    plt.plot(x,y)
    plt.xlabel('x axis')
    plt.ylabel('y axis')
    plt.savefig('./plots/snap%04d.png'%i)
    plt.close()
```

sinemovie.py

For the movie see the main directory the file `sinemovie.mp4`.

# 5 Exercise that fails

I tried several things, bla bla, code doesn't seem to work

```
#!/usr/bin/env python3
import numpy as np

print("fail"
```

failex.py