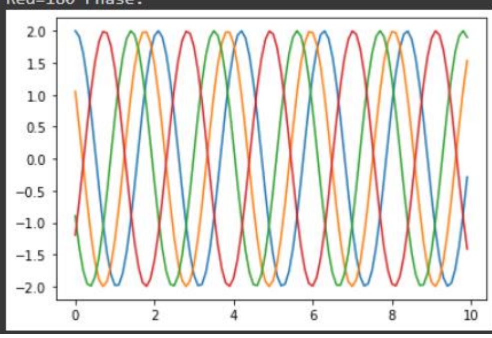
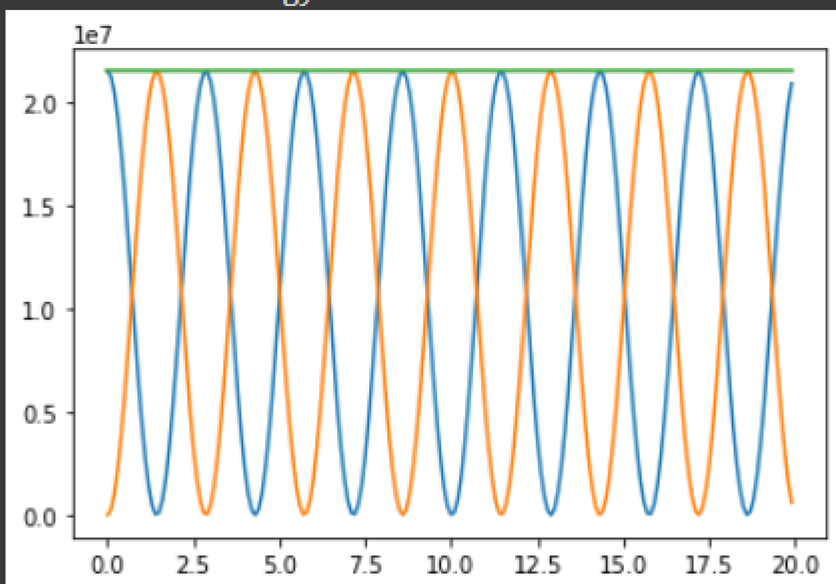
```
import matplotlib.pyplot as plt
import numpy as np
xm=2
w=3
phase=0
t=np.arange(0,10,0.1)
x1=Xm*(np.cos((w*t)+phase))
plt.plot(t,x1)
phase=45
x2=Xm*(np.cos((w*t)+phase))
plt.plot(t,x2)
phase=90
x3=Xm*(np.cos((w*t)+phase))
plt.plot(t,x3)
phase=180
x4=Xm*(np.cos((w*t)+phase))
plt.plot(t,x4)
print("Blue=0 phase.\nOrange=45 phase.\nGreen=90 Phase.\nRed=180 Phase.")
```

```
Blue=0 phase.
Orange=45 phase.
Green=90 Phase.
Red=180 Phase.
```



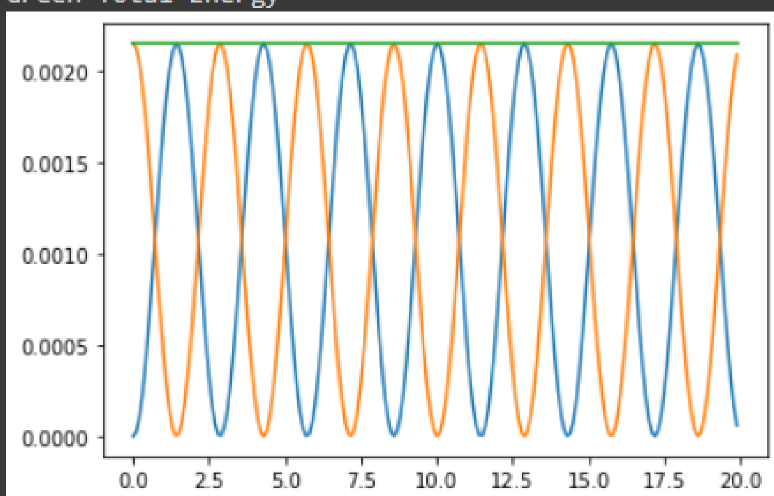
```python
mass=2.72E5
freq = 10
t=np.arange(0,20,0.1)
xm=(0.2)**2
w=2*np.pi*freq
k=(w**2)*mass
PE=0.5*k*xm*(np.cos(np.deg2rad((w*t)+0))**2)
plt.plot(t,PE)
KE=0.5*k*xm*(np.sin(np.deg2rad((w*t)+0))**2)
plt.plot(t,KE)
TOT=PE+KE
plt.plot(t,TOT)
print("Blue=Potential.\nOrange=Kinetic.\nGreen=Total Energy")
```

```
Blue=Potential.
Orange=Kinetic.
Green=Total Energy
```



```python
mass=2.72E-5
freq = 10
xm=(0.2)**2
t=np.arange(0,20,0.1)
w=2*np.pi*freq
k=(w**2)*mass
PE=0.5*k*xm*(np.cos(np.deg2rad((w*t)+90))**2)
plt.plot(t,PE)
KE=0.5*k*xm*(np.sin(np.deg2rad((w*t)+90))**2)
plt.plot(t,KE)
TOT=PE+KE
plt.plot(t,TOT)
print("Blue=Potential.\nOrange=Kinetic.\nGreen=Total Energy")
```

```
Blue=Potential.
Orange=Kinetic.
Green=Total Energy
```



```
ts=int(input("Input the start time "))
te=int(input("Input the end time "))
dc=float(input("Input the damping constant"))
mass=float(input("Input mass"))
w=float(input("Input the angular frequency"))
phase=float(input("Input the phase"))
xm=2
t=np.arange(ts,te,0.1)
x= xm*(np.exp((-dc*t)/(2*mass)))*(np.cos((w*t)+phase))
plt.plot(t,x)
check =0
for i in range(10):
  if(x[i]>x[i+1]):
    check=check+1
if(check>=2):
  print("Damped Oscillation")
else:
  print("Undamped Oscillation")
```

```
Input the start time 30
Input the end time 50
Input the damping constant6.5
Input mass4.5
Input the angular frequency5.5
Input the phase45
Damped Oscillation
```