

CSE 218, January 2021 Term Online on Interpolation Foundation vs Empire

The foundation ship Hardin-3 aims to defeat the empire ship Cleon-II. In order to defeat Cleon-II it needs to shoot a laser beam and for that purpose, its **executed force** in a specific time should cross a threshold value. Now, being a gravitic ship, both of its **mass (m)** and **velocity (v)** depend on time (t). The **mass.txt** and **velocity.txt** file contains the specific mass(metric ton=1000kg) and velocity(m/sec) of the ship in specific times (sec).

As an engineer, you have several tasks.

- (1) Find the mass (in metric ton unit) and velocity (in m/sec unit) of Hardin-3 in **t= 25 sec** using fourth order polynomials of Newton's divided difference method.(You can not use any Python scientific library to directly calculate the interpolated value). Also, find the absolute approximate relative error. Finally, plot two separate graphs for showing the mass, velocity as a function of time respectively and indicate the interpolated values in the graph. **[5+5+2+3]**

- (2) Find the total applied force (in kN unit) of Hardin-3 at **t=25 sec**. Note that $\sum F = dp/dt$, $p = mv$. **[5]**
(You can use the Python SimPy library to calculate the differentiation function. Sample code is attached)

```
from sympy import *
x = Symbol('x')
f = (x-4)*(x+8)
f_prime = f.diff(x)
print(f)
print(f_prime)
f_prime = lambdify(x, f_prime)
print(f_prime(2))
```