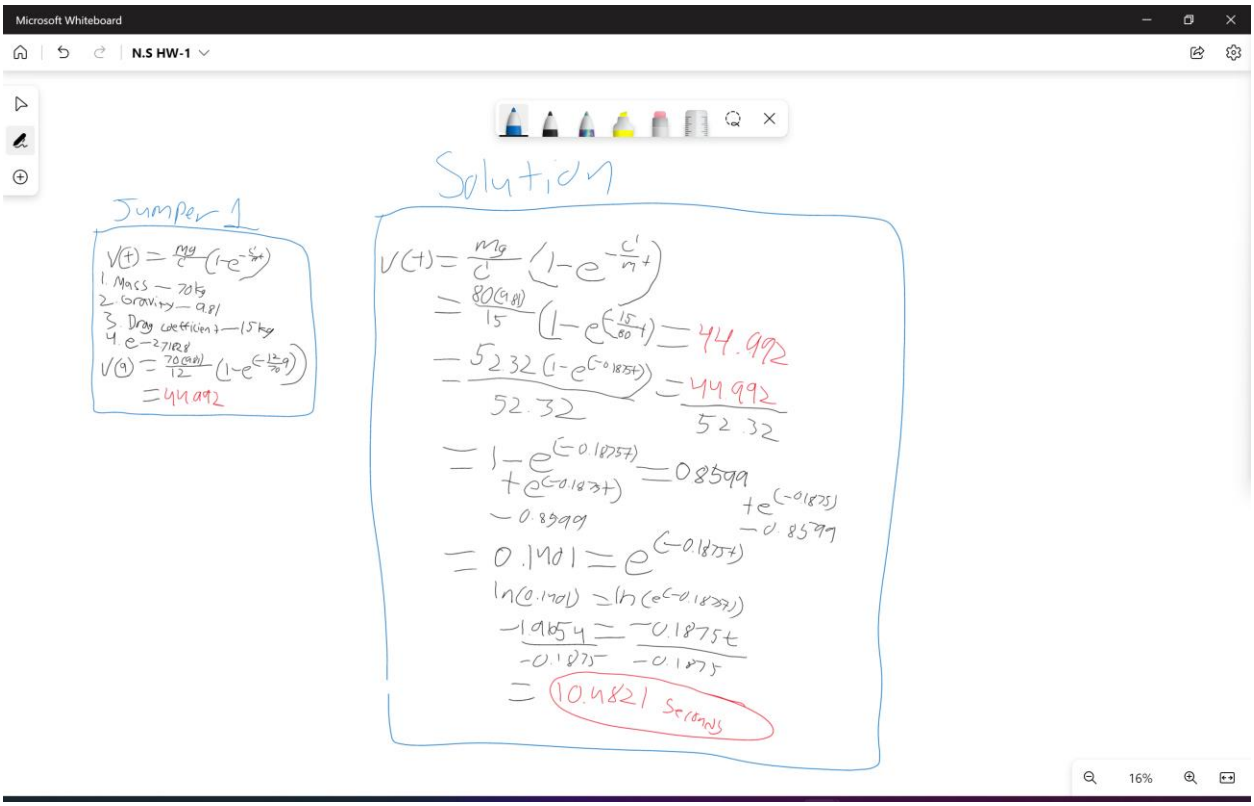
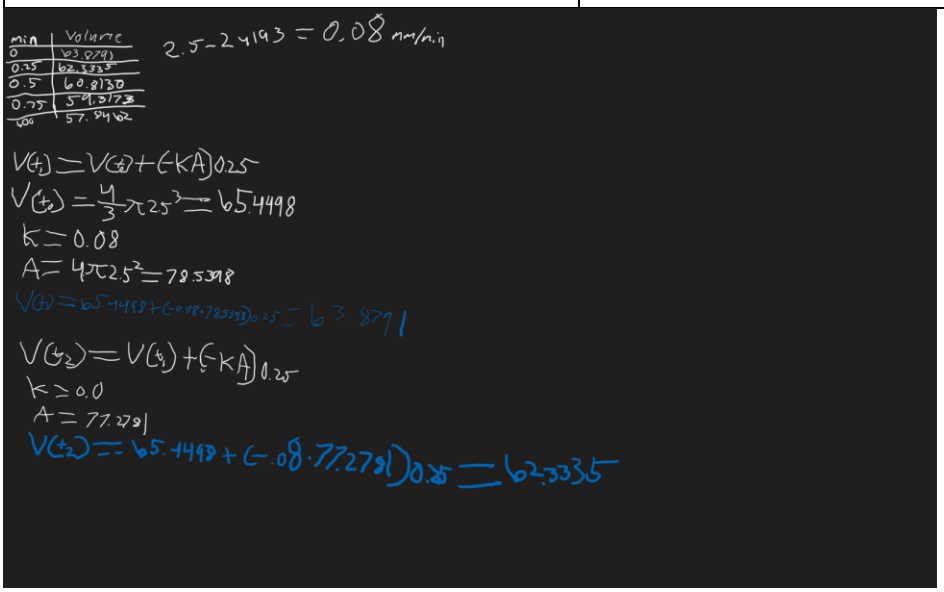
1. 10.4821 Seconds

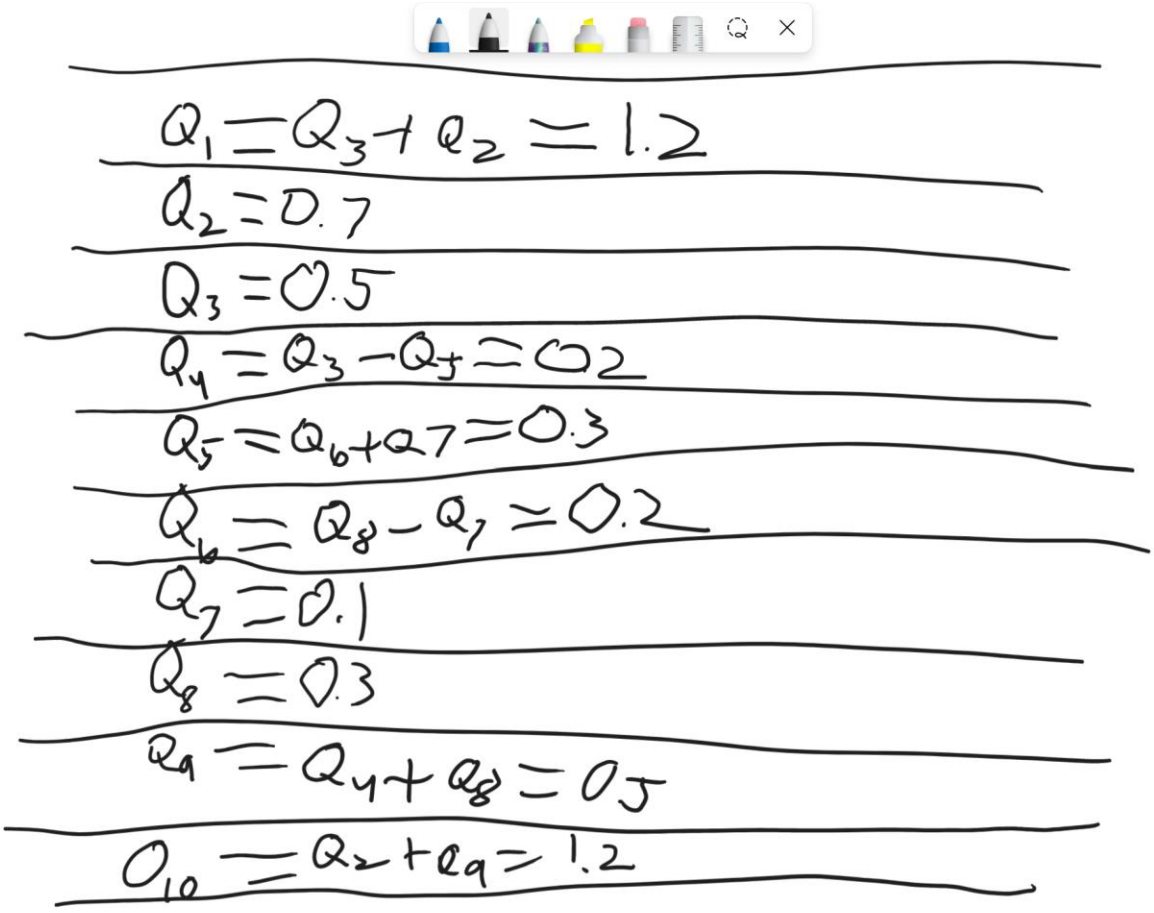


2.

Min	Volume
0	63.8791
0.25	62.3335
0.5	60.8130
0.75	59.3173
1.00	57.8462



3. Q1 = 1.2
   Q2 = 0.7
   Q3 = 0.5
   Q4 = 0.2
   Q5 = 0.3
   Q6 = 0.2
   Q7 = 0.1
   Q8 = 0.3
   Q9 = 0.5
   Q10 = 1.2



4.

Min	Temp
0	68.1000
2	66.2722
4	64.5139
6	62.8223
8	61.1951
10	59.6297
12	58.1237
14	56.6750

16	55.2814
18	53.9407
20	52.6509

problem_four.py > main

```python
def main():
    past_temp = 70
    current_temp = past_temp
    k = 0.019
    ambient_temperature = 20
    change_in_time = 2
    for i in range(0, 21, 2):
        derivative = -k * (current_temp - ambient_temperature)
        current_temp = past_temp + (derivative * change_in_time)
        print(current_temp)
        past_temp = current_temp

if __name__ == "__main__":
    main()
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL Python

```
PS D:\School\CS3320\HW\HW-1> & C:/Users/codyl/AppData/Local/Programs/Python/Python39/python.exe d:/School/CS3320/HW/HW-1/problem_four.py
Traceback (most recent call last):
  File "d:\School\CS3320\HW\HW-1\problem_four.py", line 13, in <module>
    main()
  File "d:\School\CS3320\HW\HW-1\problem_four.py", line 7, in main
    derivative = -k * (current_temp - ambient_temperature)
UnboundLocalError: local variable 'current_temp' referenced before assignment
PS D:\School\CS3320\HW\HW-1> & C:/Users/codyl/AppData/Local/Programs/Python/Python39/python.exe d:/School/CS3320/HW/HW-1/problem_four.py
68.1
66.2722
64.5138564
62.822329856799996
61.1950813222416
59.62966823199642
58.123740839180556
56.675038687291696
55.28138721717461
53.94069450292198
52.65094811181094
PS D:\School\CS3320\HW\HW-1>
```

5. $4/3r^3(p_s\text{-}pf) + p_f r h^2\text{-}p_f/3h^3$

Volume above water =

$$V_a = \int_0^h A(h)\,dh = \int_0^h \pi(r^2 - (r-h)^2)\,dh$$

$$V_a = \pi\int_0^h (2rh - h^2)\,dh = \pi\left(rh^2 - \frac{1}{3}h^3\right) = \frac{\pi h^2}{3}(3r - h)$$

Force balance $= p_s g\left(\frac{4}{3}\pi r^3\right) - p_f g\left(\frac{4}{3}\pi r^3 - \frac{\pi h^2}{3}(3r - h)\right)$