**[Assignment 1](https://mymasonportal.gmu.edu/webapps/assignment/uploadAssignment?content_id=_11468377_1&course_id=_407269_1&group_id=&mode=view)**

Solve problem 1.15 in the 5th textbook edition. In the 6th or 7th editions the problem 1.15 appears as 1.13. In addition to solving this problem as it is stated in the book, you also need to

1. Send me the plot V=V(t) and your code implementing Euler algorithm.
2. Explain what will happen with the droplet at t>10 min.
3. Obtain analytical solution and compare it with the numerical one.

Assignment (c) is optional, but I will give extra point if it is done correctly.

Instructions:

1. Click on the link "Assigments" above

2. Attach problem solution file(s)

3. Click "Submit"

1.13 Suppose that a spherical droplet of liquid evaporates at a rate that is proportional to its surface area. dVdt=−kAwhere V=volume (mm3), t=time (min), k=the evaporation rate(mm/min), and A=surface area (mm2). Use Euler’s method tocompute the volume of the droplet from t=0 to 10 min using astep size of 0.25 min. Assume that k=0.08 mm/min and that thedroplet initially has a radius of 2.5 mm. Assess the validity of your results by determining the radius of your final computed volume and verifying that it is consistent with the evaporation rate.

1. Send me the plot V=V(t) and your code implementing Euler algorithm.

*Code*

*Parameters:*

*k=0.08 mm/min*

*Variables*

*Voli and Volf (Volumes at Initial and Final moments)*

*input ri ri = 2.5mm (initial radius of drop)   
input ti,tf,dt ti = 0 min , tf = 10 min , dt = 0.25 min*

*(Times at initial, final moments and change in time)*

*Voli = \*\*ri3 (Initial volume calculation)*

*t=ti; v=vi*

*do (Calculation of Volume at each point)*

*if t <= tf then*

*Volf = Voli+(-k\*t) (New Volume = Old Volume + Slope x step)*

*print t,Volf (output of x and y coordinates)*

*t=t+dt (update the time)*

*endif;*

1. Explain what will happen with the droplet at t>10 min.

Soon after 10 min, the volume will be less than 0 and the drop will be no more.

The total error is greater than 1 when looking at the radius calculated from the Volume vs. the radius calculated using . See analytical solution

1. Obtain analytical solution and compare it with the numerical one.

Lets differentiate for

Simplify

Factorize

The Euler’s method uses a straight-line segment to approximate a continuously curving function. That causes a discrepancy when compared to the analytical solution.