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```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
% CODE CHALLENGE 5 - Template Script
%
% The purpose of this challenge is to predict whether or not the
 Boulder
% Reservior will have to close due to a major leak.
%
% To complete the challenge, execute the following steps:
% Part 1:
% 1) Read in the data file
% 2) Set values to any constants
% 3) Perform a trapazoid integration on the data w/r.t. x
% 4) Perform a simpson's 1/3 integration on the data w/r.t. x
% 5) Display which volume measurement is more accurate and why
%
% Part 2:
% 1) Define which delta t will be used in the Euler integration
% 2) Set values to any constants and initial conditions
% 3) Propagate h with t using Euler integration
% 4) Repeat steps 1-4 with different delta t values
% 5) Display which delta t gives a more accurate result and why.
%
%
% NOTE: DO NOT change any variable names already present in the code.
%
% Upload your team's script to Gradescope to complete the challenge.
%
% NAME YOUR FILE AS Challenge5_Sec{section number}_Group{group
 breakout #}.m
% ***Section numbers are 1 or 2***
% EX File Name: Challenge5_Sec1_Group15.m
%
%
% 1) Suphakan Sukwong
% 2) John Glezen
% 3) Reid Godbey
% 4) Tristan Workman
% 5) Brendan Sheets
```

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%%%%%%%%%%%%
```

Housekeeping

don't "clear variables", it makes things easier to grade

```
close all;    % Close all open figure windows
clc;          % Clear the command window
```

Part 1

Set up

```
data = readtable("depth_data.csv") % read in .csv
x = data.x; % [ft]
d = data.d; % [ft]
L = 4836; % length of reservior [ft]
```

```
data =

  31×2 table

      x          d
    ______    _______

         0          0
    223.82      5.126
    447.64     9.6481
    671.46     13.478
    895.29     16.552
    1119.1     18.844
    1342.9     20.369
    1566.8     21.183
    1790.6     21.381
    2014.4     21.089
    2238.2      20.45
      2462     19.614
    2685.9      18.72
    2909.7     17.886
    3133.5     17.196
    3357.3     16.696
    3581.1     16.387
      3805     16.233
    4028.8     16.162
    4252.6      16.08
    4476.4     15.883
    4700.3      15.47
    4924.1     14.759
    5147.9     13.696
```

```
    5371.7        12.267
    5595.5        10.497
    5819.4        8.4562
    6043.2        6.2481
      6267        4.0047
    6490.8        1.8727
    6714.6    2.5539e-06
```

Trapazoid - Calculate Volume

```
n = length(x) - 1;
dx = 223.8215;
Area = 0;
for i=1:n % summation for repeating values
    Area = Area + (dx * d(i));
end
Area = Area + (dx./2)*(d(1)+d(n+1))
comparison = trapz(x,d) % checking accuracy
Vol_trap = Area * L; % [ft^3]
```

```
Area =

   9.5403e+04
```

```
comparison =

   9.5403e+04
```

Simpson 1/3 - Calculate Volume

```
sum1 = 0;
for i=2:(n/2) % first summation for odd repeating values
    sum1 = sum1 + d(2*i-1);
end
sum2 = 0;
for i=1:(n/2) % second summation for even repeating values
    sum2 = sum2 + d(2*i);
end
Area_S = dx/3 * (d(1) + d(n+1) + (2 * sum1) + (4 * sum2)) % area
V_simp = Area_S * L % [ft^3]
```

```
Area_S =

   9.5536e+04
```

```
V_simp =
```

```
    4.6201e+08
```

The simpsons rule calculation is much more accurate.

Part 2

Set up

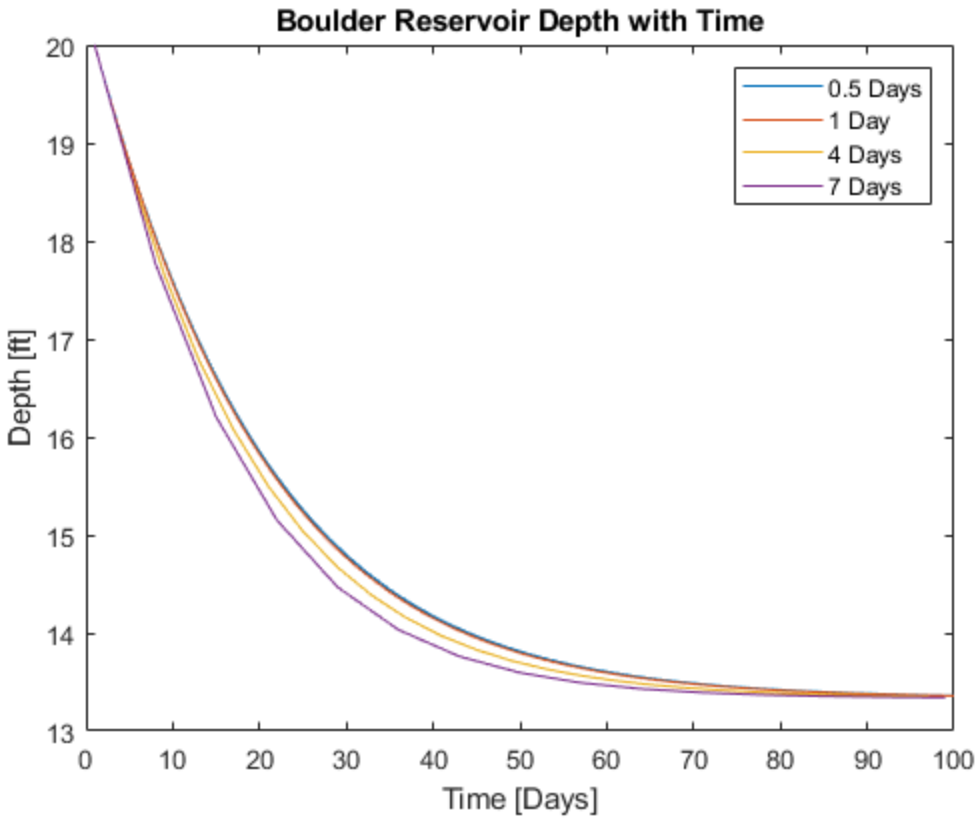
```
del_t = [0.5 1 4 7]; % various delta t values to test [days]
% time vector with the 4 provided delta t's
figure(1) % create figure

h0 = 20; % initial depth
alpha = 1.5 * 10^6; % relating volume out per day to depth [ft^2/day]
dV_in = 2 * 10^7; % volume in rate per day

for j = 1:4 % for plotting the 4 delta t's
    t = 1:del_t(j):100; % allocate time vector [days]
    h = zeros(length(t),1); % allocate depth vector [ft]
    h(1)= h0; % set initial value in h vector
    for i = 1:(length(t)-1) % Euler method
        dhdt = get_dhdt(h(i),L,alpha,dV_in); % get dh/dt at this depth
        h(i+1) = h(i) + dhdt*del_t(j); %compute next depth value
    end
    plot(t,h)
    hold on
end
legend("0.5 Days","1 Day","4 Days","7 Days")
title("Boulder Reservoir Depth with Time")
xlabel("Time [Days]")
ylabel("Depth [ft]")

% plot results

% labels for plot
```



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