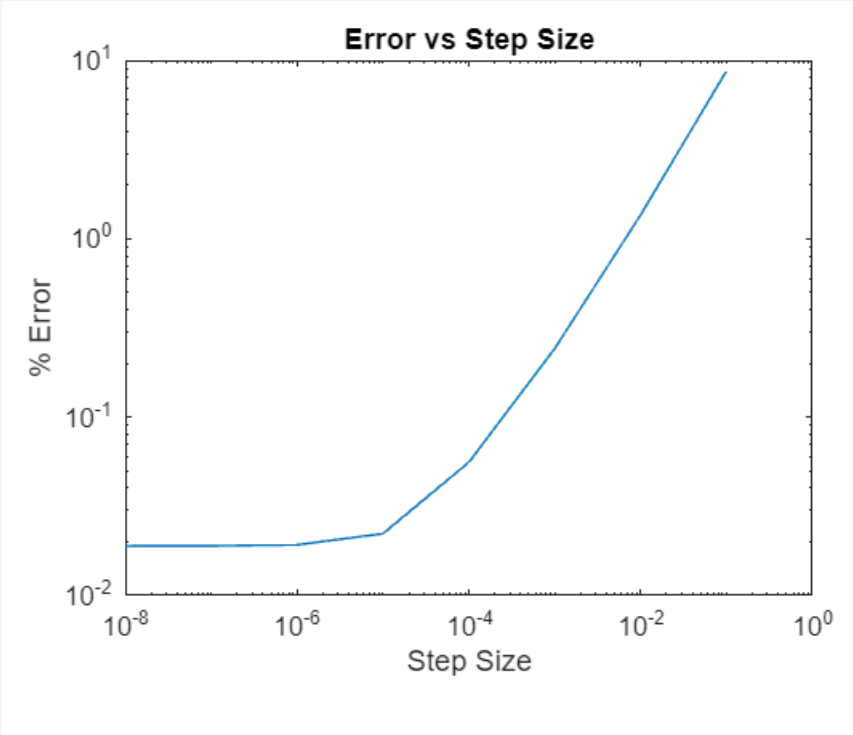
ING – 001

```
%Input givens
n = 8:-1:1;
h = 10.^-n;
%Input analytical soln
analytical = -0.134;
for i = 1:8
    happrox = 0:h(i):pi/6;
    y = -sin(happrox);
    approxsoln(i) = trapz(happrox,y);
end
%Calculate error
error = abs(((approxsoln - analytical)/analytical) *100);
%Plot needed loglog plot
loglog(h,error)
title('Error vs Step Size')
xlabel('Step Size')
ylabel('% Error')
```



Analysis:

The graph shows that error decreases with step size for numerical integration. However the degree to which the error decreases is less each time showing diminishing returns similar to numerical differentiation.

ING – 002

```
%Reset from ING 1
clc;
clear;
close all;
%Start ING 2
%Input givens
phi = 10^3;
g = 9.81;
z = 0:10:60;
D = 60;
w = [122,130,125,160,175,190,200];
%Do trap calculations for og table
ftotal1 = trapz(z,phi*g.*(D-z).*w);
top_of_function1 = trapz(z,z.*phi*g.*(D-z).*w);
d1 = top_of_function1/ftotal1;
%Set up variables for table 2
z = [0,10,20,50];
w = [122,130,135,190];
%do trap calculations for table 2
ftotal2 = trapz(z,phi*g.*(D-z).*w);
top_of_function2 = trapz(z,z.*phi*g.*(D-z).*w);
d2 = top_of_function2/ftotal2;
%Display each Ft and d
fprintf('Ft 1 = %g Ft 2 = %g',ftotal1,ftotal2)
fprintf('d 1 = %g d 2 = %g',d1,d2)
```

```
Ft 1 = 2.48782e+09 Ft 2 = 2.33576e+09
d 1 = 21.4511 d 2 = 17.7866
```

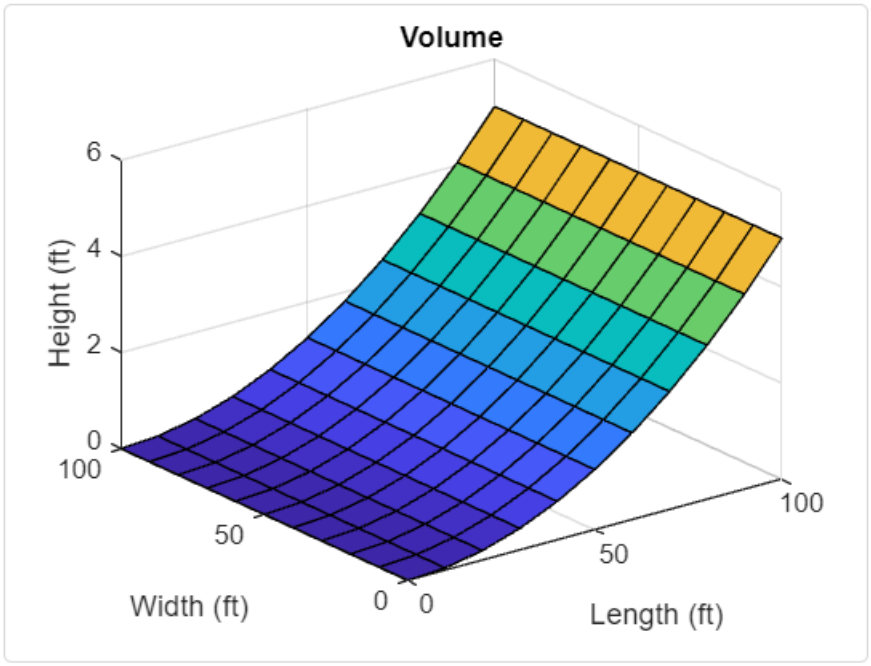
Analysis:

The values for the first go through have a greater force and lower line of action as they have a lower point in the water to measure from. The values from data set 2 do not go to the bottom of the dam and as such have a lower total force and higher line of action.

ING – 003

```
%Reset from ING 2
clc;
clear;
close all;
%Start ING 3
%load
load('construction.mat');
%Surf
surf(x,y,z)
xlabel('Length (ft)')
ylabel('Width (ft)')
```

```
zlabel('Height (ft)')
title('Volume')
%integrate for volume
vol = trapz(x,trapz(y,z));
%find number trucks needed
trucks = vol/400
```




```
trucks = 42
```