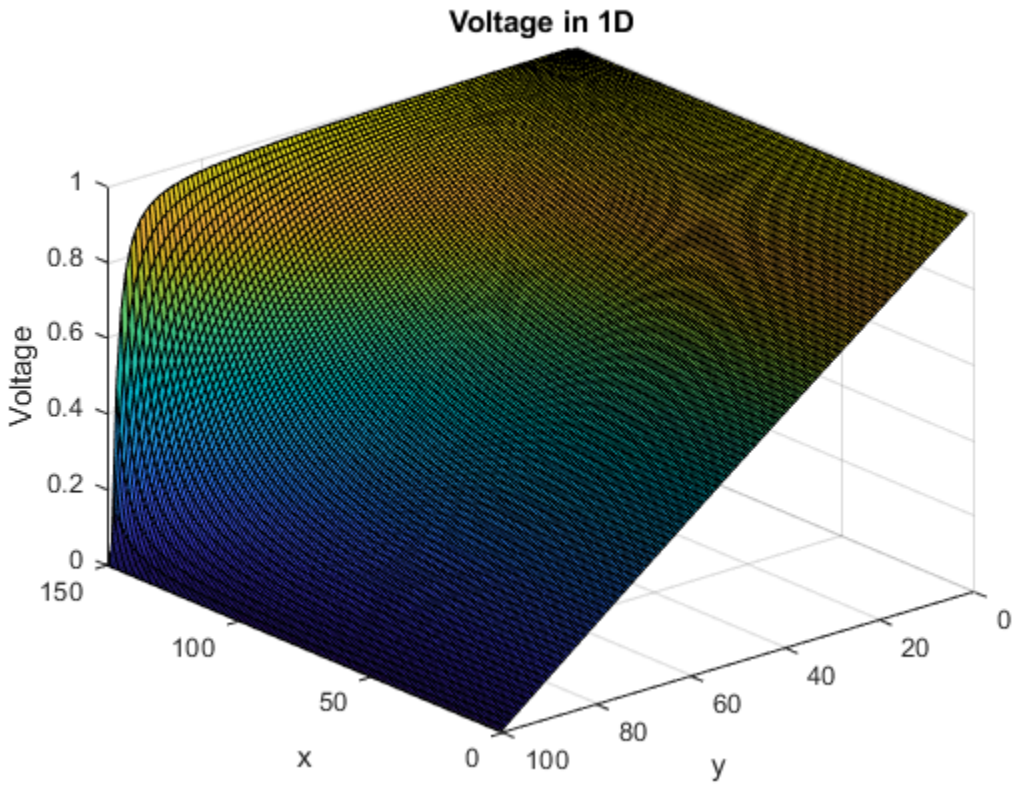
Finite Difference Method

Question 1

This code solves laplaces equation using the finite difference method.

```
nx = 100;
ny = 1.5 * nx; %Since we want the region to be a rectangle and ratio
 is 3/2

G = sparse(nx*ny, nx*ny); %the equations
B = zeros(1,nx*ny);

for i= 1:nx
    for j= 1:ny
        n = j + (i-1) * ny;

        if i == 1
            G(n,:) = 0;
            G(n,n) = 1;
            B(n) = 1;
        elseif i==nx
            G(n,:) = 0;
            G(n,n) = 1;
            %B(n) = 0;
        elseif j==1 %top
            G(n,:) = 0;
            G(n,n) = -3;
            G(n,n+1) = 1;
            G(n, n + ny) = 1;
            G (n,n-ny) = 1;

        elseif j==ny %bottom

            G(n,n)= -3;
            G(n,n-1) =1;
            G(n,n+ny) = 1;
            G(n-ny) = 1;

        else
            G(n,n) = -4; %middle value
            G(n,n-1) = 1; %left side
            G(n,n+1) = 1; %right side
            G(n,n-ny) = 1 ;%first value
            G(n,n+ny) = 1 ; %last value
        end


    end

end
```

```
V = G\B';

m = zeros(nx,ny,1);


for i = 1:nx
    for j=1:ny
        n = j + (i-1)* ny ;
        m(i,j) = V(n);
    end
end

figure(1);
surf(m);
title("Voltage in 1D");
xlabel("x");
ylabel("y");
zlabel("Voltage");
view(-130,30);
```



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