Part 2 b)

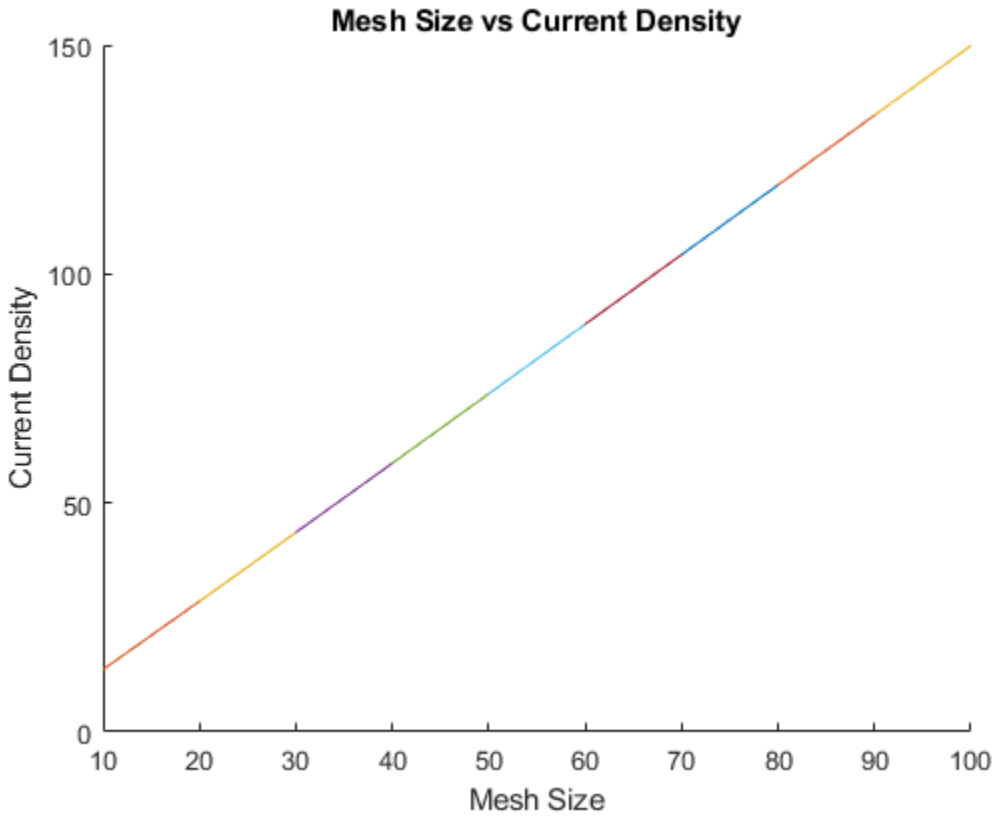
We want to increase the mesh sizes and see how the current changes with respect to it.

```
clear
clc
for mSize = 10:10:100

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

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

    sM = zeros (ny,mSize); % sigma matrix

    %the two contacts
    box = [mSize*2/5 mSize*3/5 ny*2/5 ny*3/5];

    for i = 1:mSize

        for j = 1:ny

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

            if i == 1
                G(n, :) = 0;
                G(n, n) = 1;
                B(n) = 1;

            elseif i == mSize
                G(n, :) = 0;
                G(n, n) = 1;
                B(n) = 0;

            elseif j == 1

                if i > box(1) && i < box(2)
                    G(n, n) = -3;
                    G(n, n+1) = 0.01;
                    G(n, n+ny) = 0.01;
                    G(n, n-ny) = 0.01;

                else

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

                end
```

```
            elseif j == ny

                if i > box(1) && i < box(2)

                    G(n, n) = -3;
                    G(n, n+1) = 0.01;
                    G(n, n+ny) = 0.01;
                    G(n, n-ny) = 0.01;

                else

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

                end

            else

                if i > box(1) && i < box(2) && (j < box(3)||j >
box(4))

                    G(n, n) = -4;
                    G(n, n+1) = 0.01;
                    G(n, n-1) = 0.01;
                    G(n, n+ny) = 0.01;
                    G(n, n-ny) = 0.01;

                else

                    G(n, n) = -4;
                    G(n, n+1) = 1;
                    G(n, n-1) = 1;
                    G(n, n+ny) = 1;
                    G(n, n-ny) = 1;

                end
            end
        end
    end

    for i = 1 : mSize

        for j = 1 : ny

            if i >= box(1) && i <= box(2)
                sM(j, i) = 0.01;

            else

                sM(j, i) = 1;
```

```
            end

            if i >= box(1) && i <= box(2) && j >= box(3) && j <=
box(4)

                sM(j, i) = 1;

            end
        end
    end


    V = G\B';

    m = zeros(ny,mSize,1);

    for i = 1:mSize

        for j = 1:ny

            n = j + (i-1)*ny;
            m(j,i) = V(n);

        end
    end

    [Ex,Ey] = gradient(m);

    Jx = sM .* Ex;
    Jy = sM .* Ey;

    J = sqrt(Jx.^2 + Jy.^2);

    figure(1)
    hold on

    if mSize == 10

        curr = sum(J, 2);
        currSum = sum(curr);
        currTemp = currSum;
        plot([mSize, mSize], [currTemp, currSum])

    end
    if mSize > 10

        currTemp = currSum;
        curr = sum(J, 2);
        currSum = sum(curr);
        plot([mSize-10, mSize], [currTemp, currSum])
        xlabel("Mesh Size")
        ylabel("Current Density")

    end
```

```
    title("Mesh Size vs Current Density")
end
```



Conclusion

From the plot, it is concluded that the mesh size is proportional to the current density

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