```
clear, clc
%AFM lab section 2.1 - plotting tip deflection vs laser deflection
tip_height = [5.3, 5.5, 5.7, 5.9, 6.1, 6.3, 6.5, 6.7, 6.9, 7.1]; %given cantilever tip heights
laser_height = [47.4, 50.5, 54, 56.4, 59, 61.6, 64.6, 67.3, 70.2, 73.1]; %given laser heights

tip_deflection = [0,.2,.4,.6,.8,1.0,1.2,1.4,1.6,1.8]; %measured data from 1
laser_deflection = [0,3.1,6.6,9,11.6,14.2,17.2,19.9,22.8,25.7]; %measured data from 1

scatter(tip_deflection, laser_deflection);
xlabel('Tip Deflection (cm)');
ylabel('Laser Deflection (cm)');
title('Tip Deflection vs. Laser Deflection');

%-------------------------------------------------------------------------
%AFM lab section 3.1 - plotting position vs. tip deflection in 3D

%equation of fit line: y = 14x + .39  where y is laser deflection
% -> x = (y - 0.39)/14  where x is tip deflection

x_pos = [0,1,2,3,4,5,6,7,8,9,10,11,12,13]; %x position relative to back left corner
y_pos = [0,1,2,3,4,5]; %y position relative to back left corner
laser_height_2 = [43.7 47.5 50 47.8 43.5 45.2 48.6 49 44.8 43.5 48 50 48.7 45.2;
43.5 48 50.5 49.5 45.5 48 50 50 47 46.8 49.8 51 49 44.5;
42.5 45 48 49 49.5 48.8 48 48 49 49.5 48.8 48.8 46.8 44;
41.5 42 44.4 48.5 50.7 49.7 45.3 46 49.5 50.5 48.5 45.5 43.5 43.1;
42.8 45.5 48.5 48.9 49.1 48.8 48.2 48.2 48.6 49.3 49.3 48.8 46 43.5;
43.5 48.5 50.6 49.2 45.5 47.2 50.2 49.8 46.5 46.5 49.6 51 48.5 44.5]; %laser height relative to position


laser_deflection_2 = laser_height_2 - 41.5; %laser deflection relative to height

tip_deflection_2 = (laser_deflection_2 - 0.39)/14; %tip deflection relative to laser deflection

surf(x_pos, y_pos, tip_deflection_2); %surface plot of x, y, z data

s = surf(x_pos, y_pos, tip_deflection_2);
s.EdgeColor = 'none'; %eliminating edges on surface plot

xlabel('X Coordinate (cm)'); %set x axis label
ylabel('Y Coordinate (cm)'); %set y axis label
zlabel('Tip Deflection'); %set z axis label
title('Position vs. Cantilever Tip Deflection'); %set title

%-------------------------------------------------------------------------
%AFM lab section 3.2 - prettying up figure from 3.1

set(gcf,'color','w'); %white background
axis equal; %equalizing axes
grid off; %turning grid off
colormap cool; %setting nice colormap
colorbar; %displaying numeric values of colors

view(-40,20); %setting view that allows for surface shape to be seen

set(gcf, 'Position',  [100, 100, 1000, 500]); %set wider figure window
f = gcf;
movegui(f,'center'); %position figure in center of any screen

%-------------------------------------------------------------------------
```

```
%AFM lab section 3.3 - finding and plotting Magnetic Force (3D)

L = 28.0*(10^(-2)); %length cantilever
t = 0.096*(10^(-2)); %thickness cantilever
w = 1.83*(10^(-2)); %weight cantilever
E = 200*(10^9); %Young's Modulus
I = (w*(t^3))/12; %cantilever cross-section's area moment of inertia

F = (E*I*tip_deflection_2*6)/((L^2)*(2*L)); %equation for tip deflection rewritten to find magnetic force

surf(x_pos, y_pos, F); %surface plot of x, y, z data

%s2 = surf(x_pos, y_pos, F);
%s2.EdgeColor = 'none'; %eliminating edges on surface plot

xlabel('X Coordinate (cm)'); %set x axis label
ylabel('Y Coordinate (cm)'); %set y axis label
zlabel('Magnetic Force'); %set z axis label
title('Position vs. Magnetic Force'); %set title

set(gcf,'color','w'); %white background
axis equal; %equalizing axes
grid off; %turning grid off
colormap cool; %setting nice colormap
colorbar; %displaying numeric values of colors

view(-20,40); %setting view that allows for surface shape to be seen

set(gcf, 'Position',  [100, 100, 750, 600]); %set wider figure window
f = gcf;
movegui(f,'center'); %position figure in center of any screen


%------------------------------------------------------------------------
%AFM lab section 3.4 - plotting Magnetic Force (2D)

pcolor(x_pos, y_pos, F); %surface plot of x, y, z data

s3 = pcolor(x_pos, y_pos, F);
s3.EdgeColor = 'none'; %eliminating edges on surface plot

xlabel('X Coordinate (cm)'); %set x axis label
ylabel('Y Coordinate (cm)'); %set y axis label
zlabel('Magnetic Force'); %set z axis label
title('Position vs. Magnetic Force'); %set title

set(gcf,'color','w'); %white background
axis equal; %equalizing axes
grid off; %turning grid off
colormap cool; %setting nice colormap
colorbar; %displaying numeric values of colors

view(-20,40); %setting view that allows for surface shape to be seen

set(gcf, 'Position',  [100, 100, 750, 600]); %set wider figure window
f = gcf;
movegui(f,'center'); %position figure in center of any screen
```