OPT MATLAB LAB 2

Prelab

```
x=linspace(0,10);
>> yx = .008*x.^5-.224*x.^4+2.344*x.^3-11.152*x.^2+22.848*x-13.824;
>> y2x = .75*x.^2-7.5*x+12;
>> y3x=.08*x.^3-1.2*x.^2+5.68*x-8.4;
>> x2=linspace(-2pi,2pi);
 x2=linspace(-2pi,2pi);
      ↑
```

Invalid expression. Check for missing multiplication operator, missing or unbalanced delimiters, or other syntax error. To construct matrices, use brackets instead of parentheses.

Did you mean:

```
>> x2=linspace(-2*pi,2*pi);
>> yx2=sin(x);
>> xc=linspace(g-4*q,g+4*q);
Unrecognized function or variable 'g'.

>> g=3;
>> q=2;
>> xc=linspace(g-4*q,g+4*q);
>> (1/q*sqrt(2*pi))*e.^(-1*(((xc-q).^2)./(2*q.^2))):
 (1/q*sqrt(2*pi))*e.^(-1*(((xc-q).^2)./(2*q.^2))):
                    ↑
```

Error: Invalid expression. Check for missing or extra characters.

```
>> (1/q*sqrt(2*pi))*e.^(-1*(((xc-q).^2)./(2*q.^2))):
 (1/q*sqrt(2*pi))*e.^(-1*(((xc-q).^2)./(2*q.^2))):
                    ↑
```

Error: Invalid expression. Check for missing or extra characters.

```
>> (1/q*sqrt(2*pi))*e.^(-1*(((xc-q).^2)./(2*q.^2)));
```

Unrecognized function or variable 'e'.

```
>> e=2.718;
>> (1/q*sqrt(2*pi))*e.^(-1*(((xc-q).^2)./(2*q.^2)));
>>
```

3. you need a key, axis labels, title, and integer labels

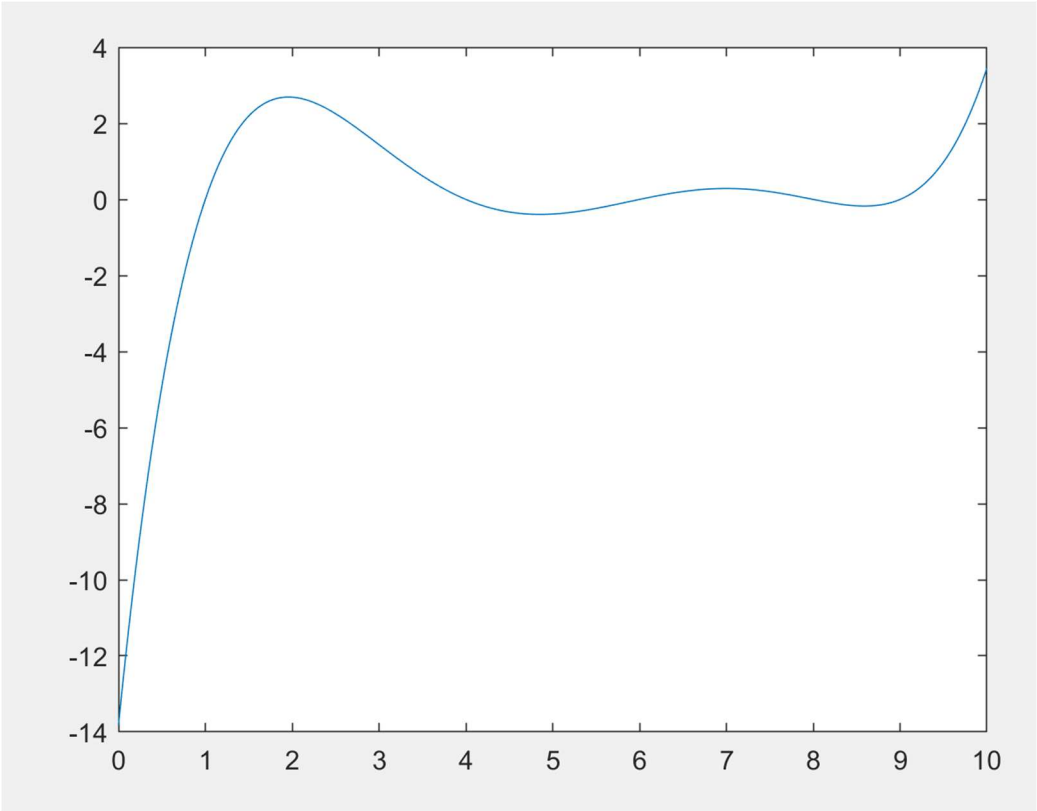
4. 20min

Part 1

```
plot(x,yx)
>> x=linspace(0,10);
>> yx = .008*x.^5-.224*x.^4+2.344*x.^3-11.152*x.^2+22.848*x-13.824;
>> plot(x,yx)
```

Part 2

```
%Ezra Alcon-Kirshman, OPT 211 lab 2, plot simple polynomial functions
x=linspace(0, 10, 1000);
y4 = .008*x.^5-.224*x.^4+2.344*x.^3-11.152*x.^2+22.848*x-13.824;
y1 = x;
y2 = .75*x.^2-7.5*x+12;
y3=.08*x.^3-1.2*x.^2+5.68*x-8.4;
figure(1)
plot(x,y1)
plot(x,y2)
plot(x,y3)
plot(x,y4)
```


4
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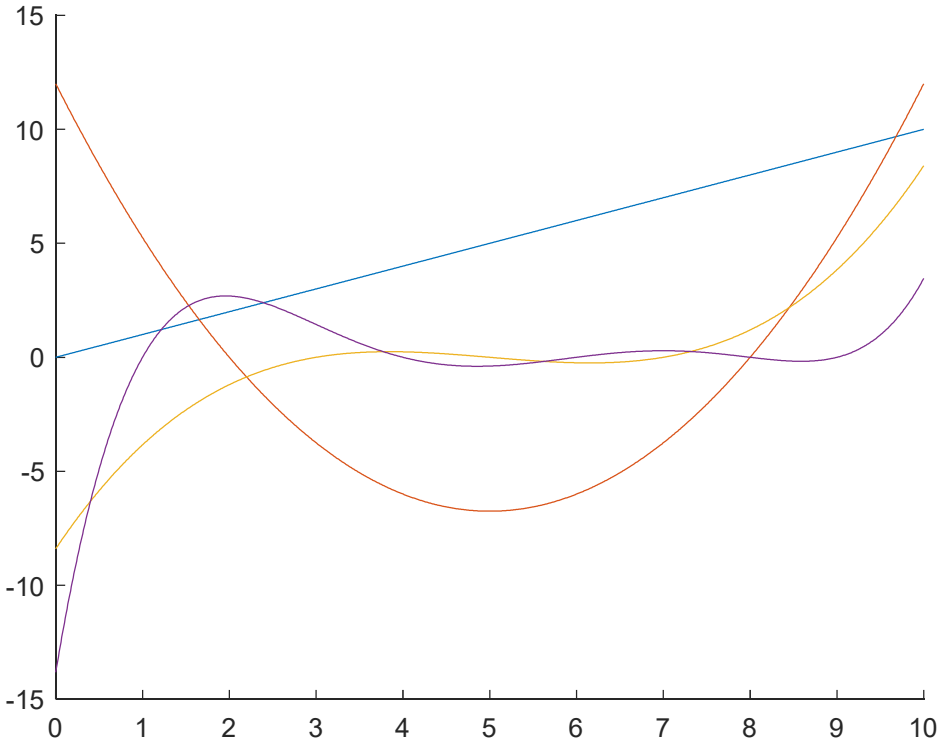
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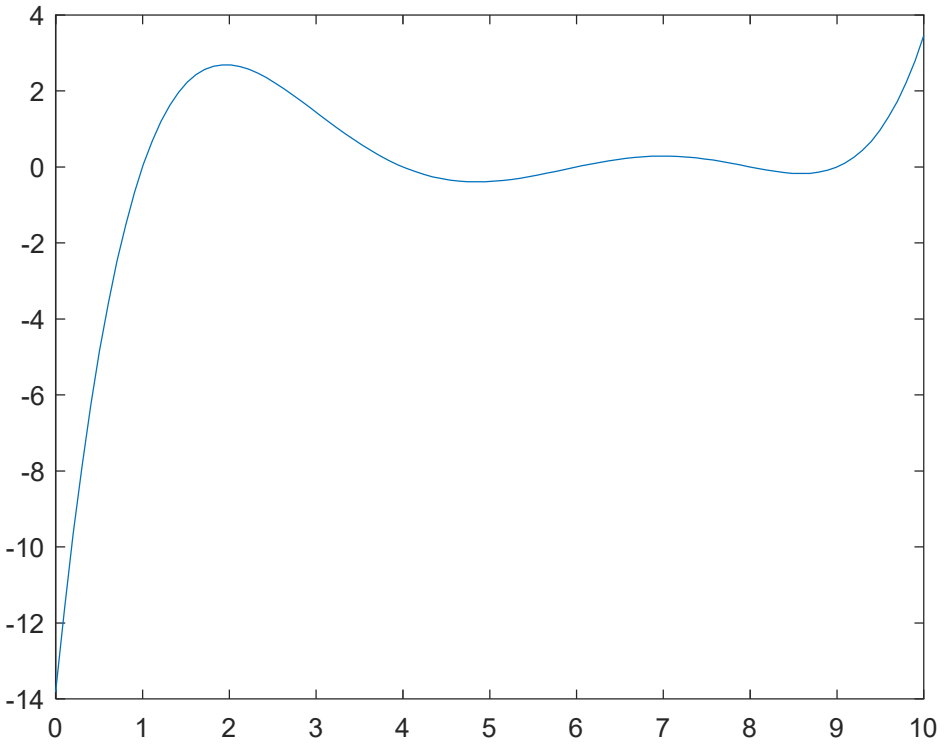
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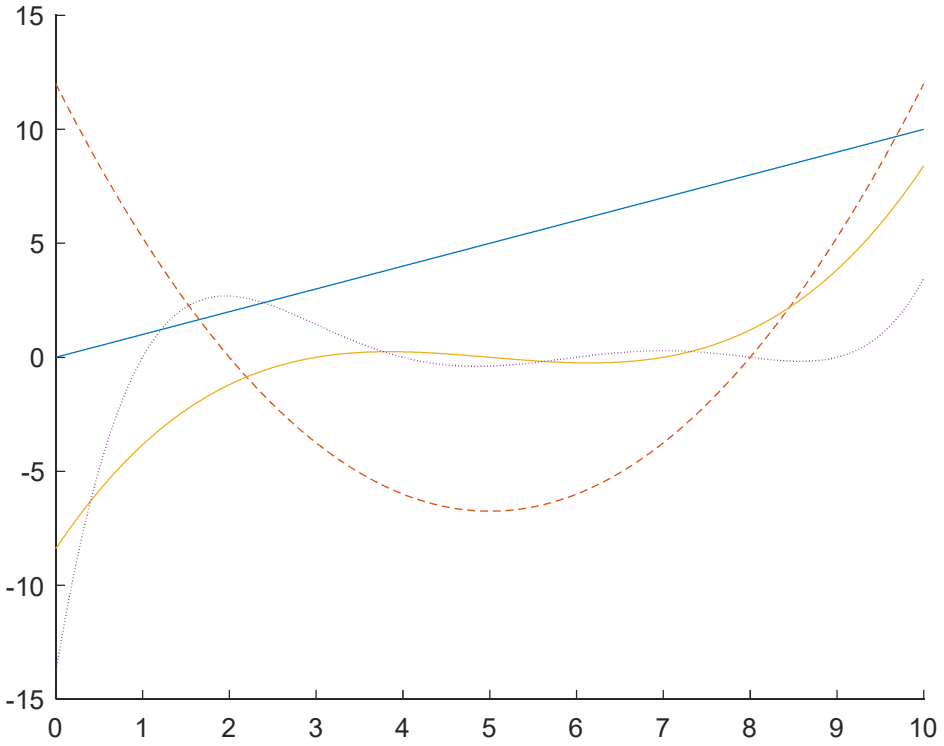
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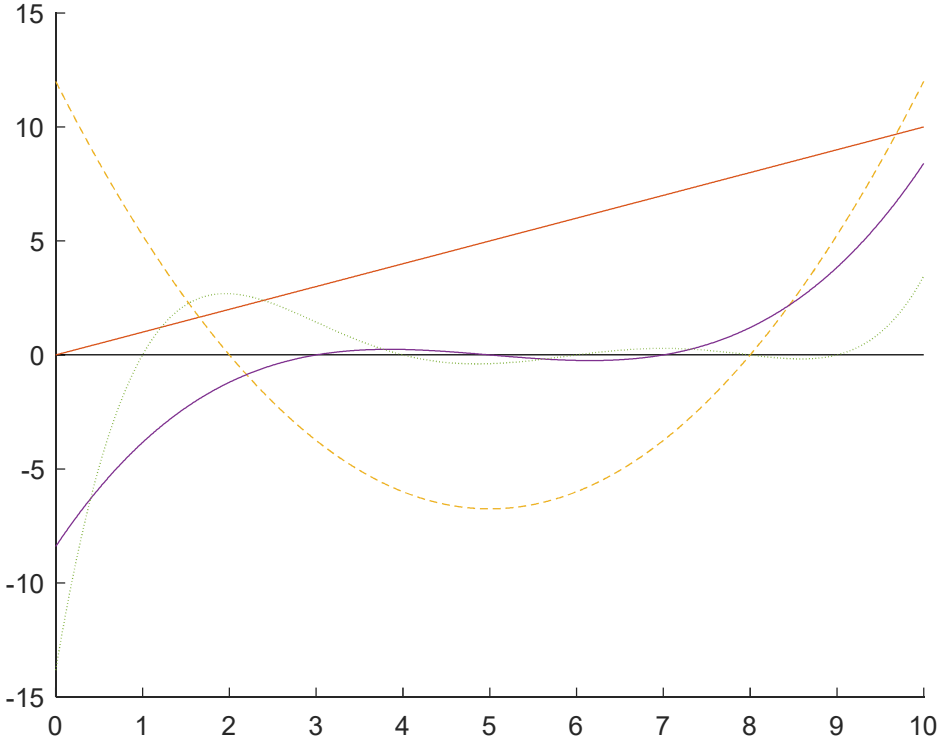
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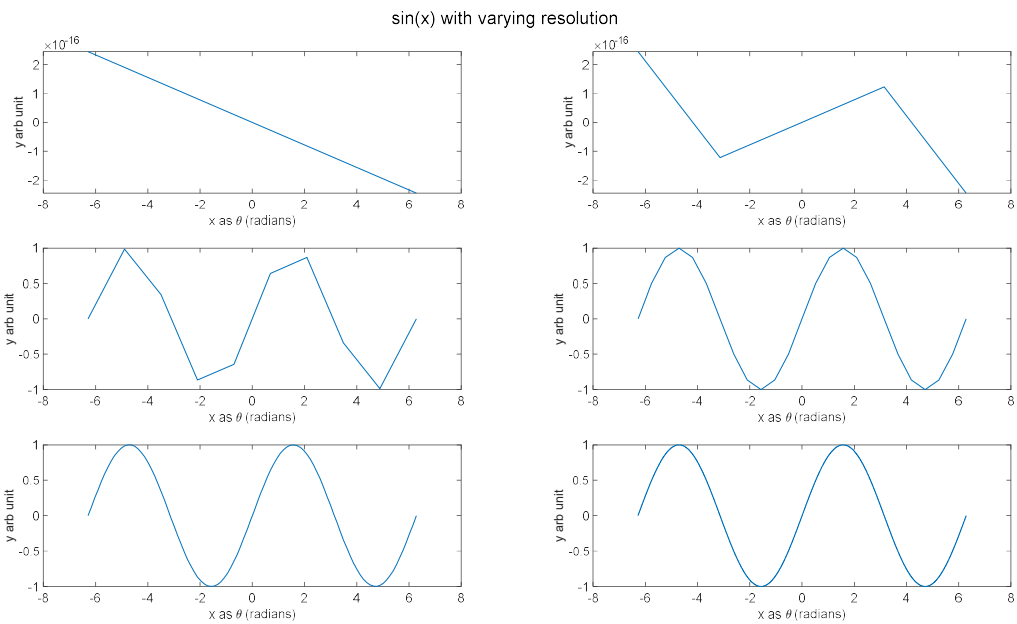
Part 3

Part 4




```
%Ezra Alcon-Kirshman, OPT 211 lab 2, subplot in radians from -2pi to 2pi
x1 = linspace(-2*pi,2*pi,3);
x2 = linspace(-2*pi,2*pi,5);
x3 = linspace(-2*pi,2*pi,10);
x4 = linspace(-2*pi,2*pi,25);
x5 = linspace(-2*pi,2*pi,100);
x6 = linspace(-2*pi,2*pi,10000);
figure
subplot(3,2,1) %plots a figure in space 1 of 6 of a 3 row 2 colum set
plot(x1,sin(x1)) %plots sin(x1)
subplot(3,2,2)% plots a figure in space 2 of 6 of a 3 row 2 colum set
plot(x2,sin(x2))%plots sin(x2)
subplot(3,2,3)%plots a figure in space 3 of 6 of a 3 row 2 colum set
plot(x3,sin(x3))%plots sin(x3)
subplot(3,2,4)%plots a figure in space 4 of 6 of a 3 row 2 colum set
plot(x4,sin(x4))%plots sin(x4)
subplot(3,2,5)%plots a figure in space 5 of 6 of a 3 row 2 colum set
plot(x5,sin(x5))%plots sin(x5)
subplot(3,2,6)%plots a figure in space 6 of 6 of a 3 row 2 colum set
plot(x6,sin(x6))%plots sin(x6)
sgtitle('sin(x) with varying resolution') %creates a main title over subplots
```

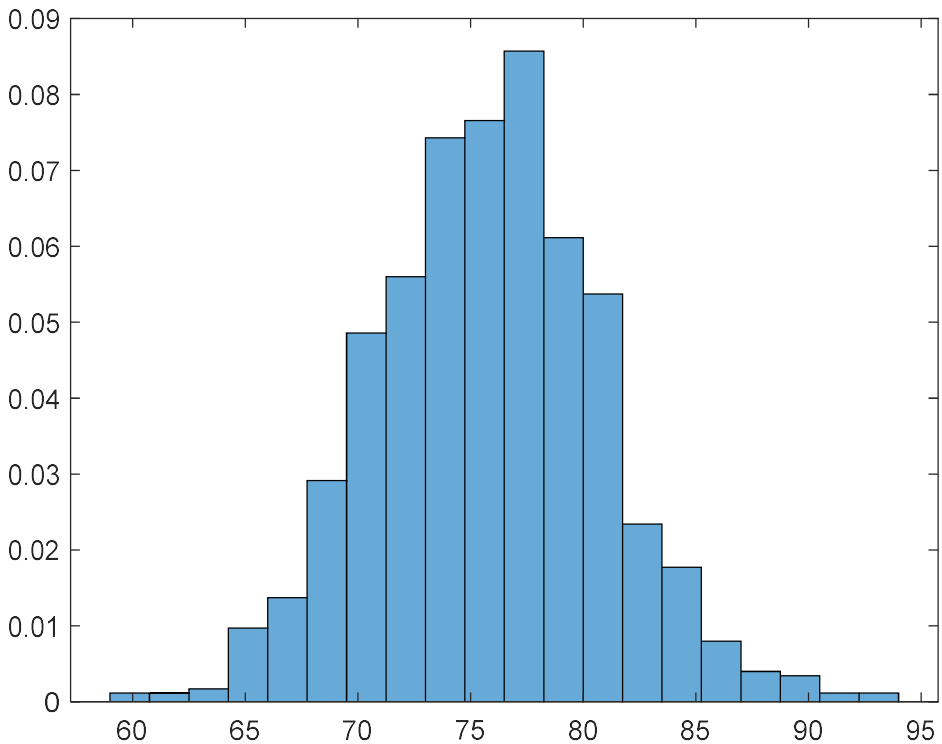
Part 5

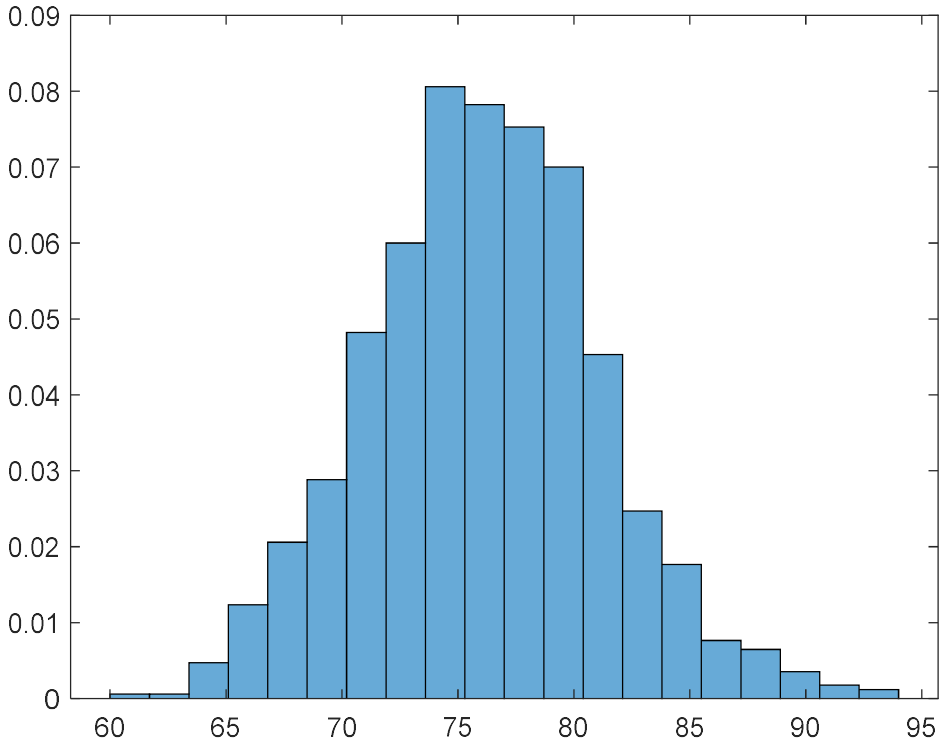
```
function guassDistribution(m,s,np,b)

%Ezra Alcon-Kirshman, OPT 211 lab 2, gaussian distribution practice

x = s*randn(1,np)+m; % Generate normal (Gaussian) distribution in a discrete,
1D array


figure
histogram(x,b,'Normalization','pdf') %plot discrete normal distribution
```

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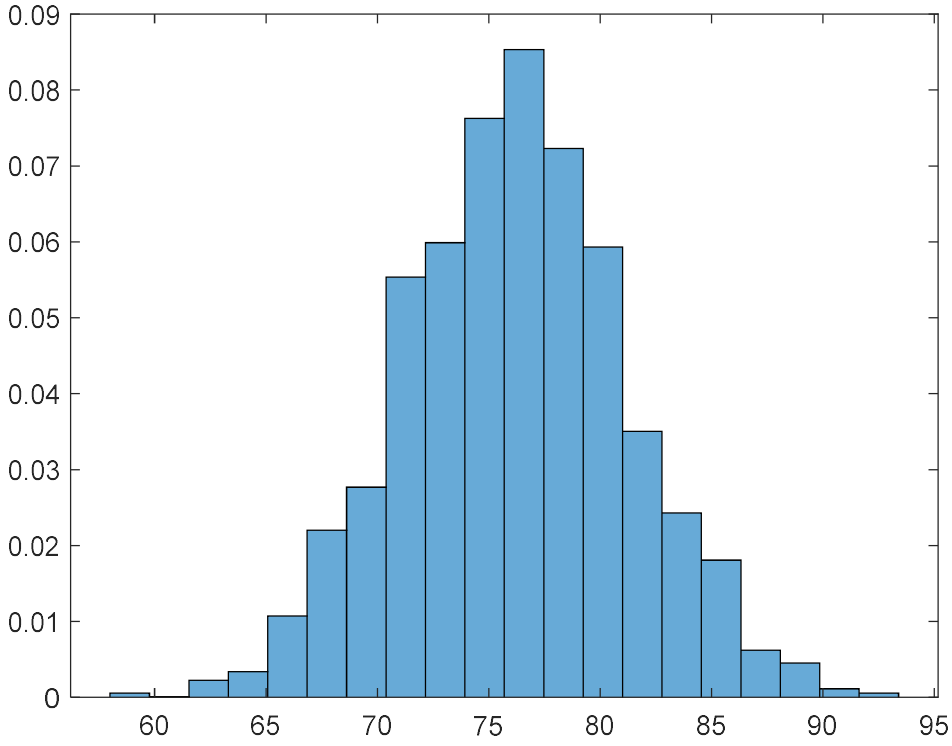
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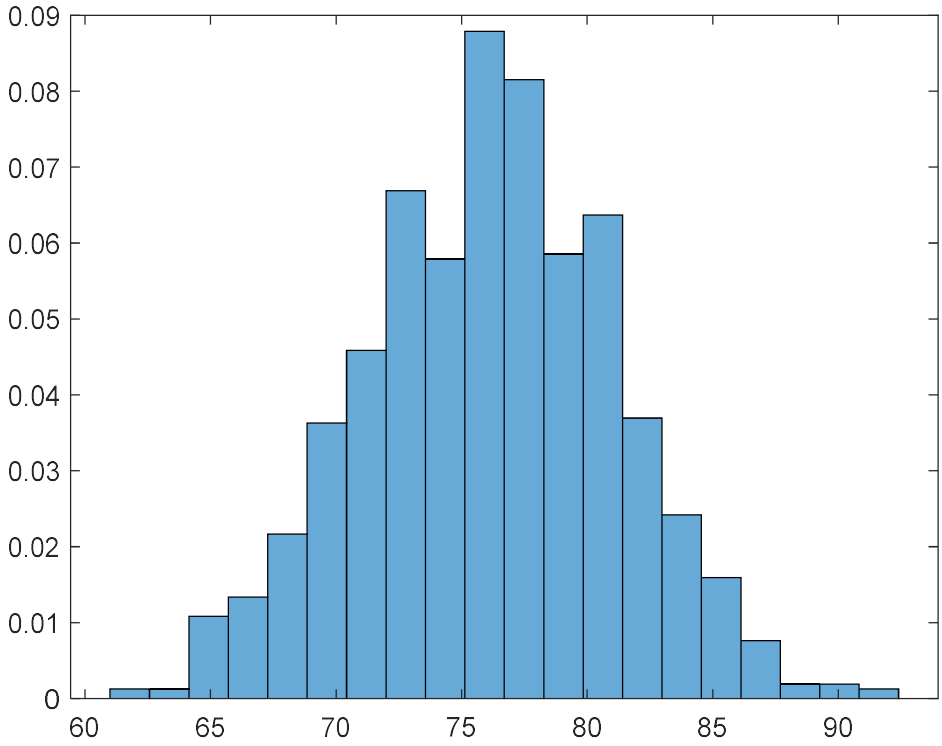
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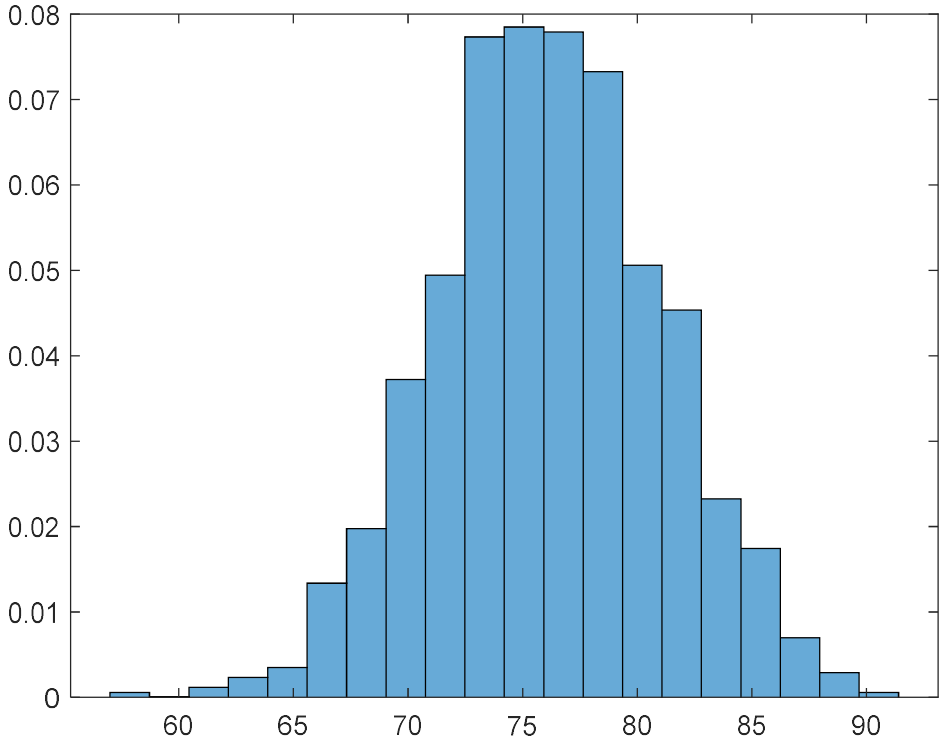
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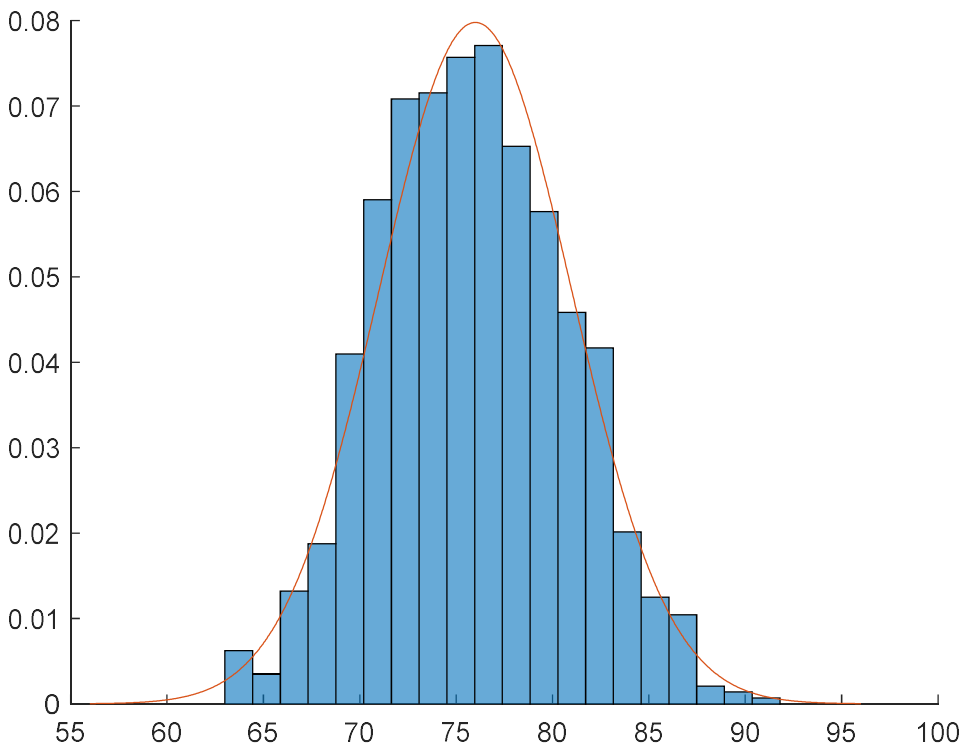
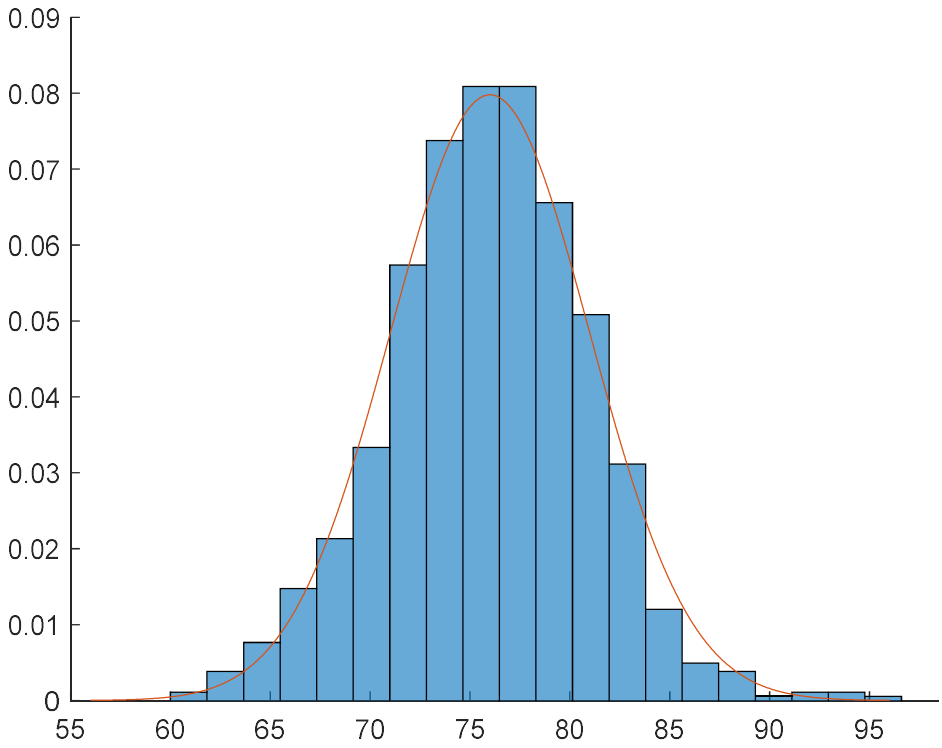
```
function guassDistribution(m,s,np,b)

%Ezra Alcon-Kirshman, OPT 211 lab 2, gaussian distribution practice

x = s*randn(1,np)+m; % Generate normal (Gaussian) distribution in a discrete,
1D array

y = linspace(m-4.*s,m+4.*s,1000);

figure
hold on
histogram(x,b,'Normalization','pdf') %plot discrete normal distribution
plot(y,(1 ./ (s * sqrt(2 * pi))) * exp(-((y - m).^2) / (2 * s^2))) %plots y
in guassian function
hold off
```

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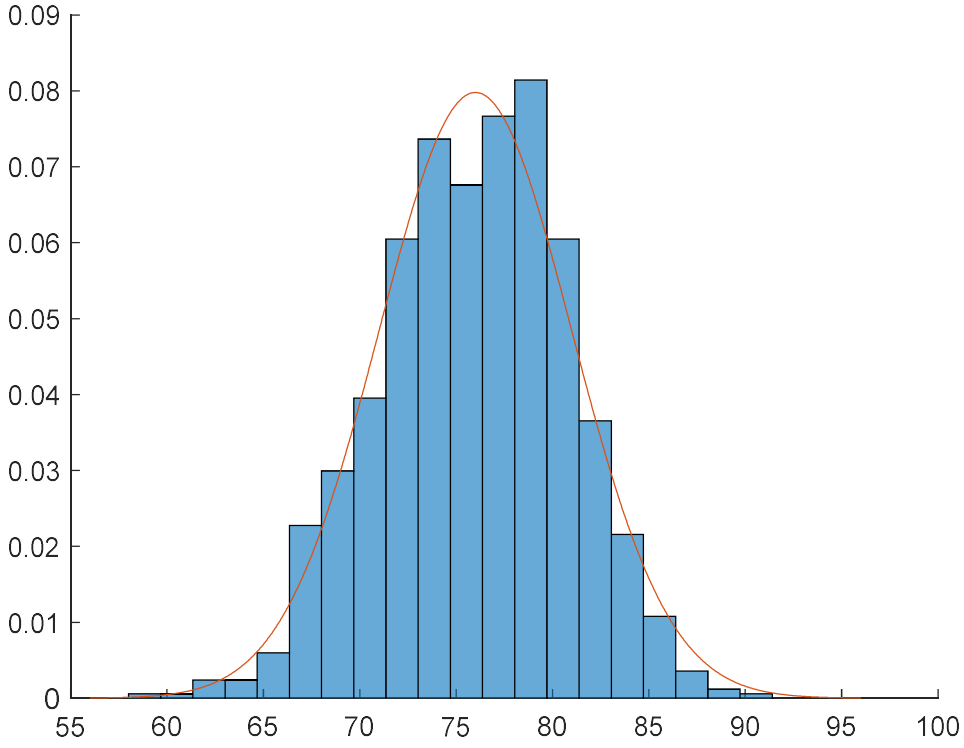
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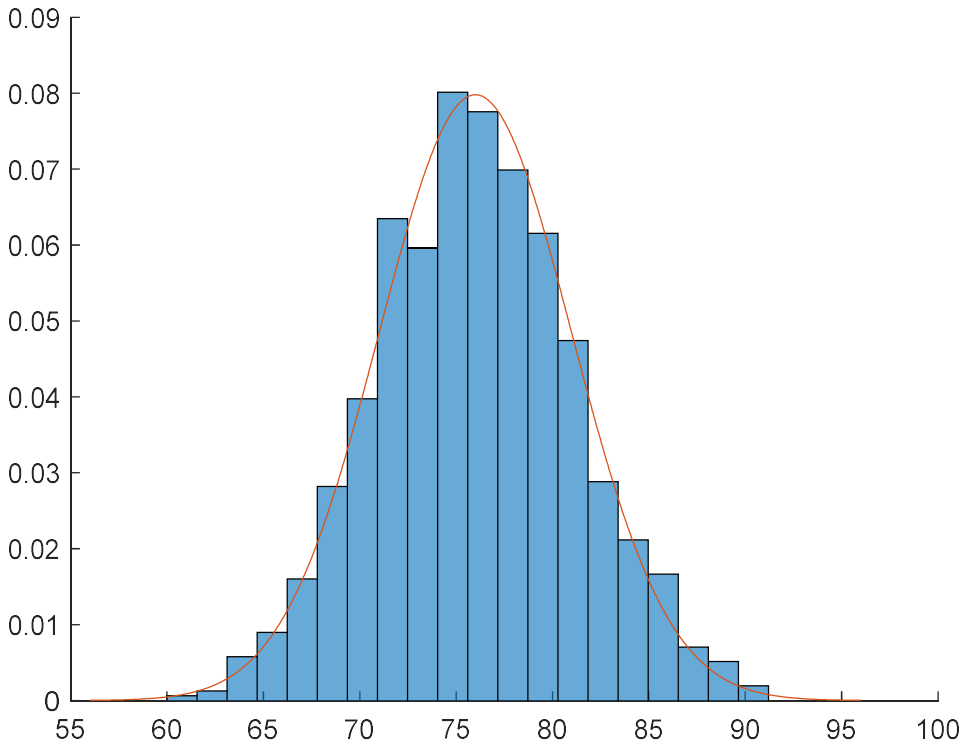
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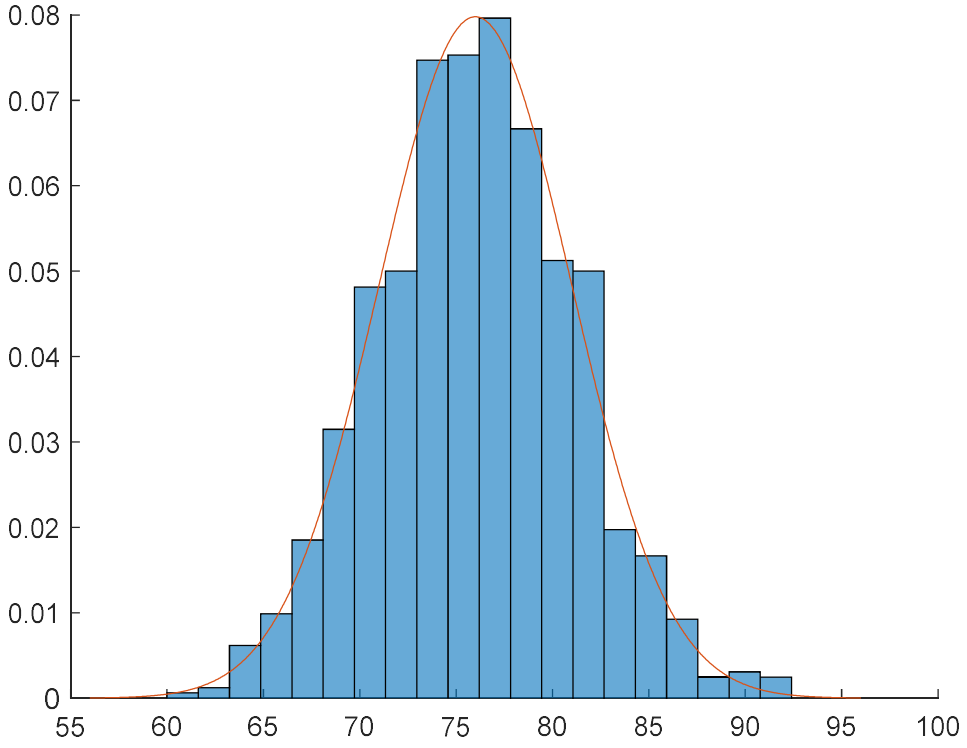
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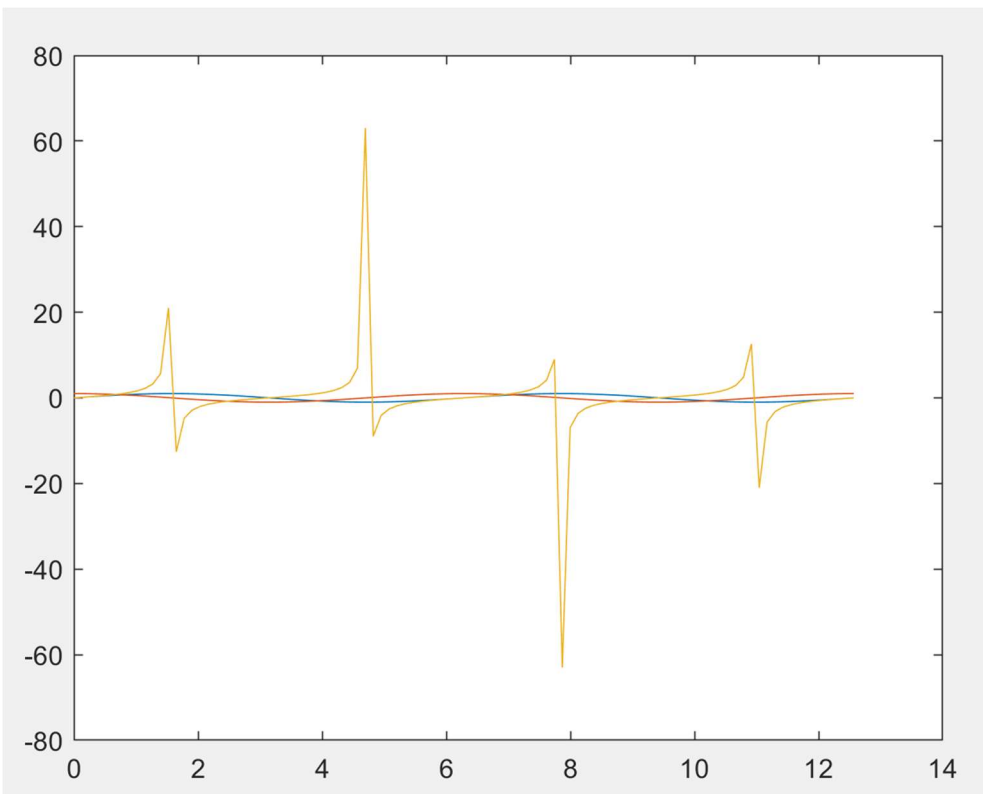
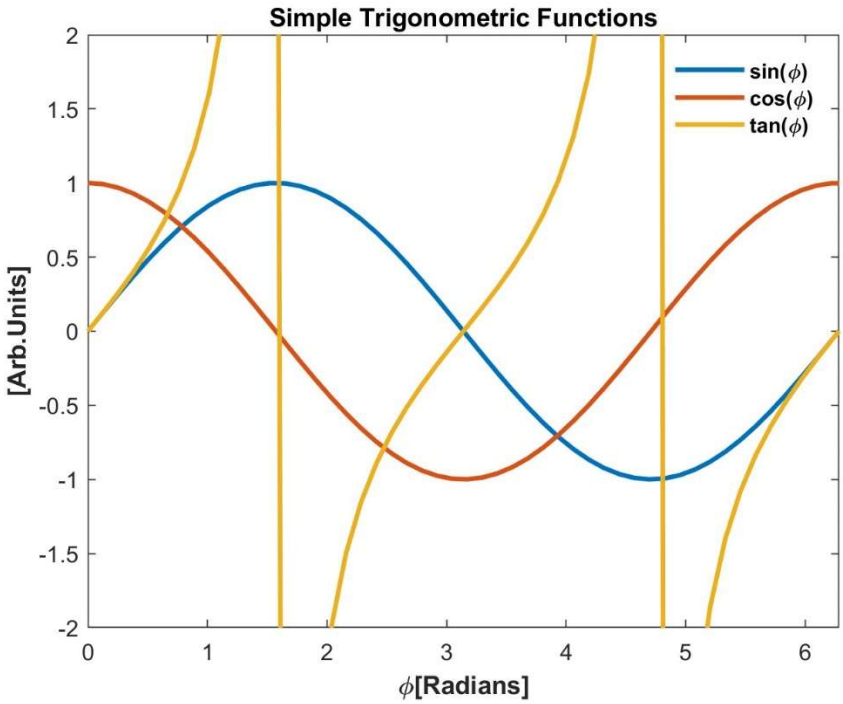
Post lab

```
%Ezra Alcon-Kirshman, OPT 211 lab 2, Post-Lab

x  = linspace(0,4*pi); %creates array from 0 to 14 with 1000 points
y1 = sin(x);
y2 = cos(x);
y3 = tan(x);

plot(x,y1,x,y2,x,y3,'LineWidth', 2) %plots y1, y2, and y3 with x

title('Simple Trigonometric Functions')
xlabel('\phi[Radians]','fontweight','bold')
ylabel('[Arb.Units]','fontweight','bold')
legend('sin(\phi)','cos(\phi)','tan(\phi)','fontweight','bold','edgeColor',[1
1 1])
ylim([-2 2])
xlim([0 2*pi])
```

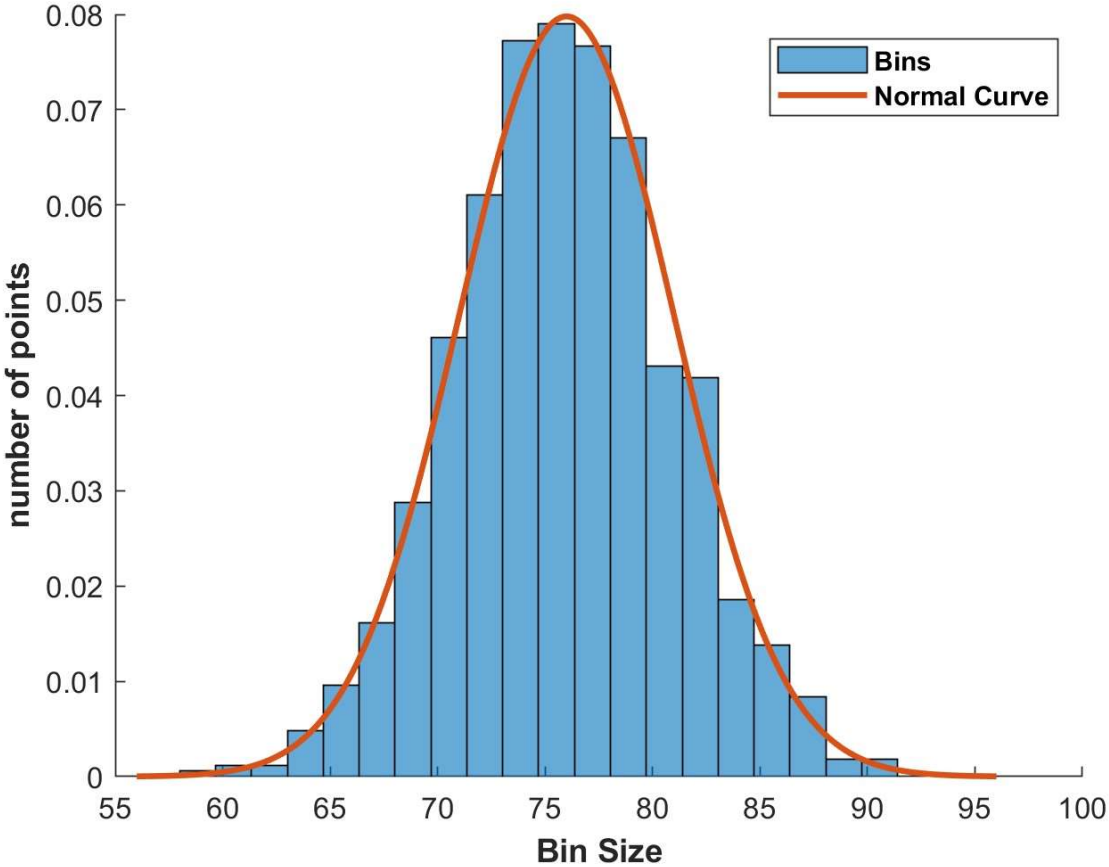
```
>> OPT211_lab2_PostLab
```






```
function guassDistribution(m,s,np,b)

%Ezra Alcon-Kirshman, OPT 211 lab 2, gaussian distribution practice

x = s*randn(1,np)+m; % Generate normal (Gaussian) distribution in a discrete,
1D array

y = linspace(m-4.*s,m+4.*s,1000);

figure
hold on
histogram(x,b,'Normalization','pdf') %plot discrete normal distribution
plot(y,(1 ./ (s * sqrt(2 * pi))) * exp(-((y - m).^2) / (2 *
s^2)),'LineWidth', 2) %plots y in guassian function
hold off
xlabel('Bin Size','fontweight','bold')
ylabel('number of points','fontweight','bold')
legend('Bins', 'Normal Curve', 'fontweight' , 'bold')
```

```
>> guassDistribution(76,5,1000,20)
```


Bins
Normal Curve
number of points
Bin Size
0.08
0.07
0.06
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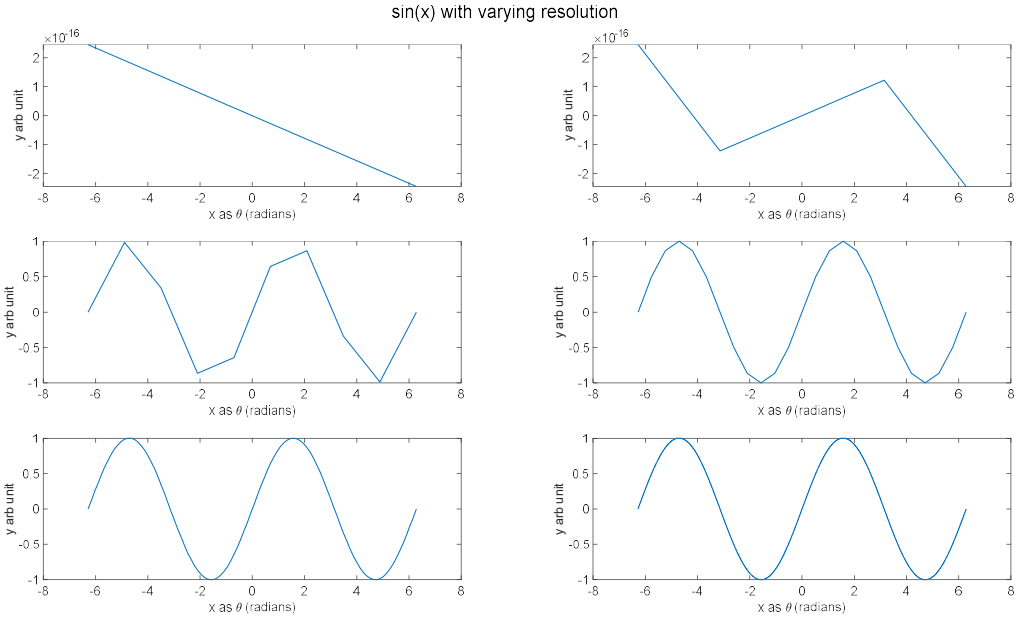
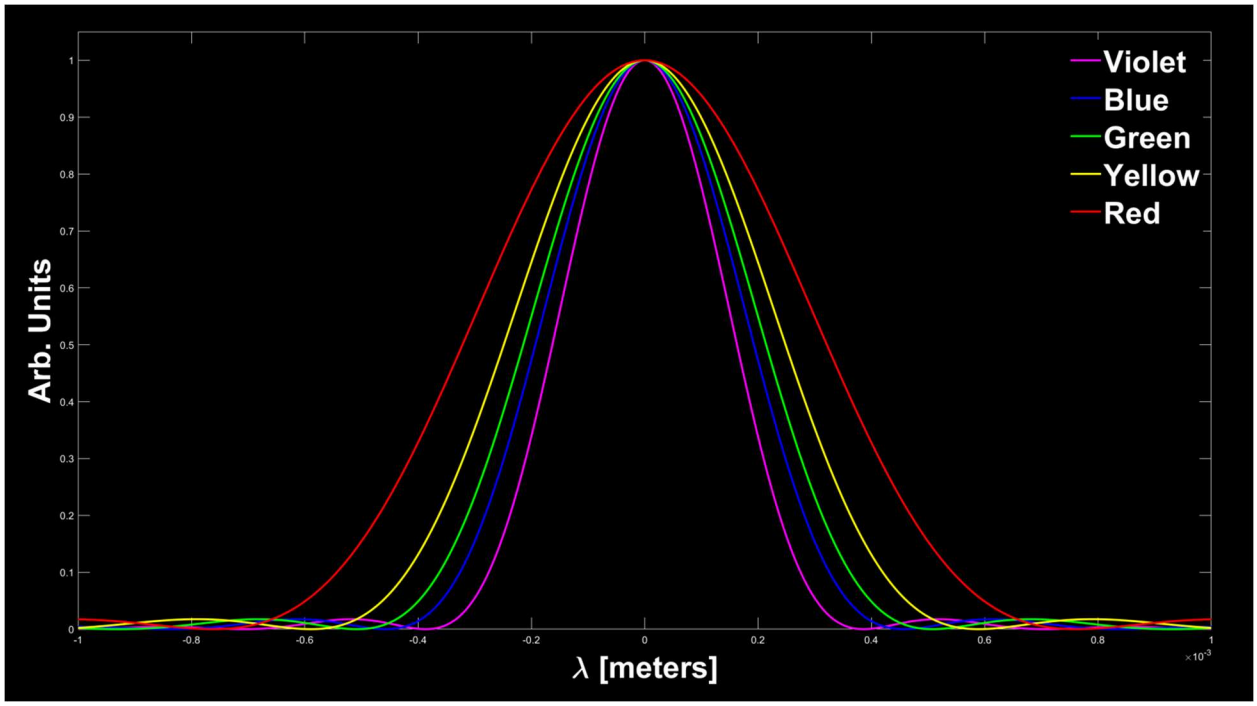

sin(x) with varying resolution
y arb unit
x as θ (radians)

```
%Ezra Alcon-Kirshman, OPT 211 lab 2, Post-Lab

lam1=380E-9; % Wavelength of light in meters, violet
lam2=450E-9; % Wavelength of light in meters, blue
lam3=500E-9; % Wavelength of light in meters, green
lam4=580E-9; % Wavelength of light in meters, yellow
lam5=750E-9; % Wavelength of light in meters, red
R=5E-3; % Distance from aperture to observation plane in meters
a=3E-6; % Radius of the aperture in meters
Io=1; % Define Initial intensity of light
q=linspace(-1E-3,1E-3,1000); % Define radial distance from optical axis in
observation plane in meters
N = R/(2*a);

x1 = ((pi*q)./(lam1.*N));
x2 = ((pi*q)./(lam2.*N));
x3 = ((pi*q)./(lam3.*N));
x4 = ((pi*q)./(lam4.*N));
x5 = ((pi*q)./(lam5.*N));


I1 = Io.*(2.*(besselj(1,x1)./x1)).^2; % intensity for violet
I2 = Io.*(2.*(besselj(1,x2)./x2)).^2;% intensity for blue
I3 = Io.*(2.*(besselj(1,x3)./x3)).^2; % intensity for green
I4 = Io.*(2.*(besselj(1,x4)./x4)).^2; % intensity for yellow
I5 = Io.*(2.*(besselj(1,x5)./x5)).^2; % intensity for red

plot(q, I1,'m', q,I2,'b', q,I3,'g', q,I4,'y', q,I5,'r', 'LineWidth', 2)

ylim([0 1.05])
title('Diffraction Limited Spot Size','fontsize' , 30)
xlabel('\lambda [meters]','fontweight','bold', 'fontsize' , 30)
ylabel('Arb. Units','fontweight','bold', 'fontsize' , 30)
legend('Violet', 'Blue', 'Green', 'Yellow', 'Red',
'fontweight','bold','edgeColor','black', 'fontsize' ,30, 'textcolor',
'white', 'color', 'black')
set(gca, 'color', [0 0 0])
set(gca, 'XColor', 'white', 'YColor', 'white')
set(gcf,'color', 'black')
```

```
>> OPT211_lab2_postLabP3
```



(for best viewing experience use an OLED 😊)

4. n0, I actually have no idea. Idk maybe 3 hours but I spend a long time trying to make something a loop and broke it and then I spend I long time making this epic graph…