Pset4

```matlab
% d.)
A = rand(9, 5)*2-1;
B = rand(7, 2)*2-1;
C = rand(9)*2-1;
D = rand(5)*2-1;

orthnA = gramSchmidt_guy(A);
orthnB = gramSchmidt_guy(B);
orthnC = gramSchmidt_guy(C);
orthnD = gramSchmidt_guy(D);

isAorthn = isOrthonormal_guy(orthnA);
isBorthn = isOrthonormal_guy(orthnB);
isCorthn = isOrthonormal_guy(orthnC);
isDorthn = isOrthonormal_guy(orthnD);

a = complex(rand(9,1)*2-1, rand(9,1)*2-1);
b = complex(rand(7,1)*2-1, rand(7,1)*2-1);
c = complex(rand(9,1)*2-1, rand(9,1)*2-1);
d = complex(rand(5,1)*2-1, rand(5,1)*2-1);

aProjA = orthoProj_guy(a, orthnA);
bProjB = orthoProj_guy(b, orthnB);
cProjC = orthoProj_guy(c, orthnC);
dProjD = orthoProj_guy(d, orthnD);

norm(aProjA - a)
norm(bProjB - b)
norm(cProjC - c)
norm(dProjD - d)
```

ans =

   6.2256

ans =

   4.6720

ans =

  10.4589

ans =

   4.6364

e)

```matlab
% setting up the guassian distributions
[n, mu] = ndgrid(0:.01*pi:2*pi, 0:pi/2:2*pi);
sig = 1;
gauss =  @(x, mu, sig) exp( - (n - mu).^2 / sig^2 ) /
 sqrt(2*pi*sig^2);

gaussians = gauss(n, mu, sig);       % the gaussian distributions

% The plots of the sinusoid and gaussians
sinarr = sin(n);
plot(n(:,1), sinarr(:,1))
hold on
for i = 1:5
    plot(n(:,1), gaussians(:,i))
end
title('Gaussians and the Sine Function');
ylabel('Amplitude');
xlabel('Angle (rad)');
legend('Sine', '1st Gaussian', '2nd Gaussian','3rd Gaussian', ...
                                    '4th Gaussian','5th
 Gaussian');


% Getting sine estimation
orthnGaussians = gramSchmidt_guy(gaussians);
sinEstmProp = orthoProj_guy( sinarr(:,1), orthnGaussians);
sinEstm = 0;
for i = 1:5
    sinEstm = sinEstm + sinEstmProp(i)*orthnGaussians(:,i);
end

% subplot plotting
figure
subplot(2,1,1)
plot(n(:,1), sinarr(:,1), 'b')
hold on
plot(n(:,1), sinEstm, 'r' )
title('Sine and its Estimation');
xlabel('Angle (rad)');
ylabel('Amplitude');
legend('Sine', 'Estimate');

subplot(2,1,2)
hold on
for i = 1:5
    plot(n, orthnGaussians(:,i))
end
title('Orthonormal Basis Functions');
xlabel('Angle (rad)');
```
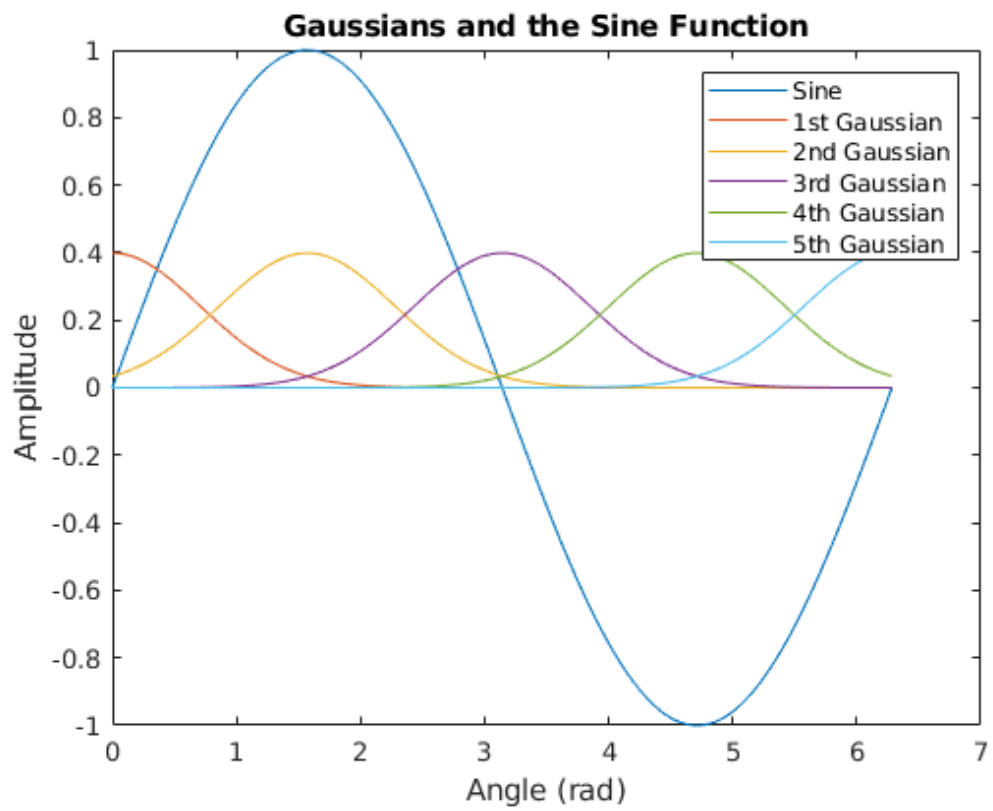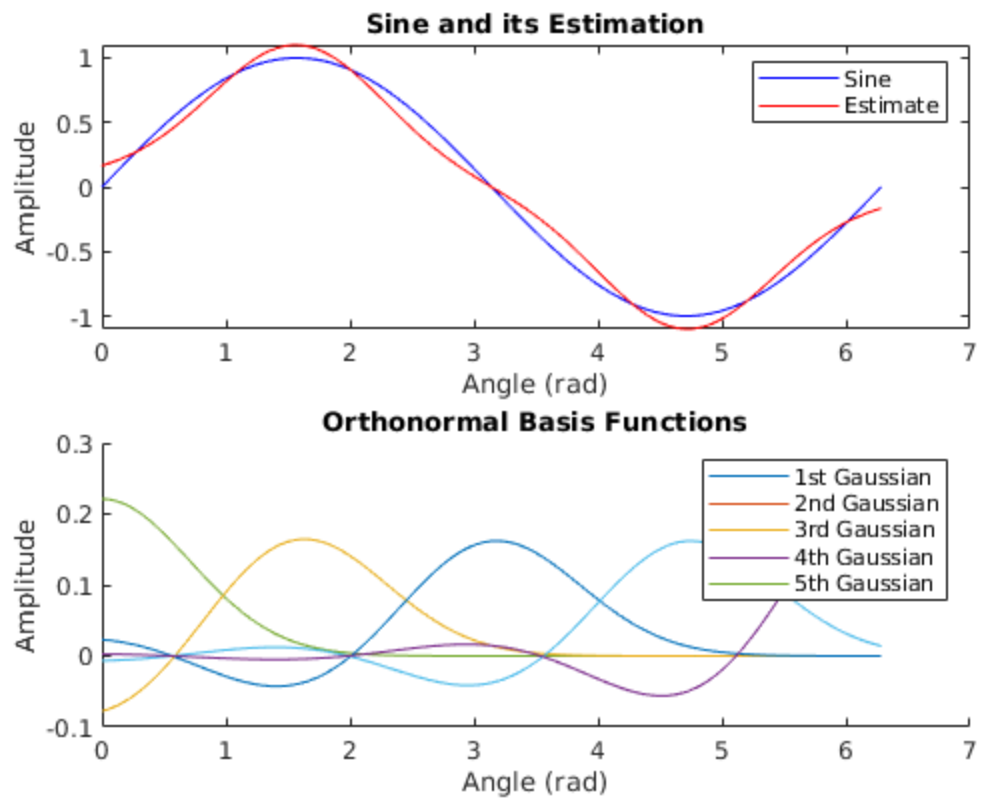
```
ylabel('Amplitude');
legend('1st Gaussian', '2nd Gaussian', '3rd Gaussian', '4th
 Gaussian', '5th Gaussian');
```


Gaussians and the Sine Function

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