# HW3 Prob – 7

clc; clear; close all;  
  
P = [1 0.5;0.5 2];  
alpha = 0.01;

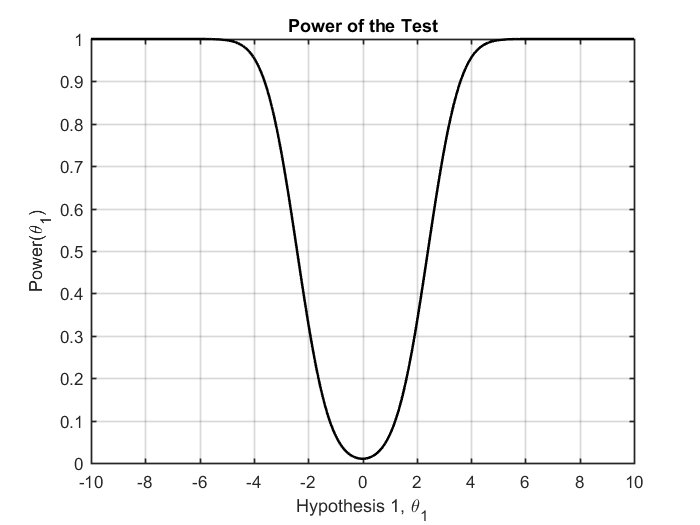
## Threshold

mu\_beta\_z = @(theta\_1) sum(sum(inv(P)))\*theta\_1;  
Var\_beta\_z = sum(sum(inv(P)));  
  
beta\_0 = -norminv(alpha/2,mu\_beta\_z(0),sqrt(Var\_beta\_z));  
  
disp('Threshold \beta\_0:')  
disp(beta\_0)

Threshold \beta\_0:  
 2.7537

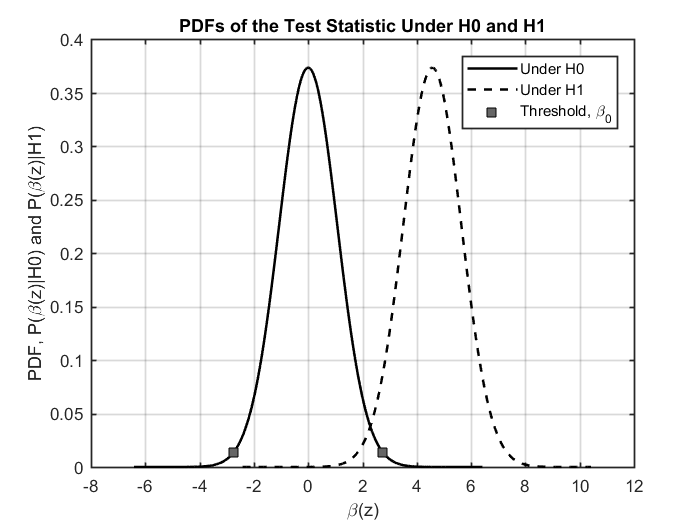
## Power of test

theta\_1\_vec = -10:0.01:10;  
  
mu\_beta\_z\_vec = mu\_beta\_z(theta\_1\_vec);  
  
power\_vec = zeros(1,length(theta\_1\_vec));  
  
for nn = 1:length(theta\_1\_vec)  
 power\_vec(nn) = normcdf(-beta\_0,mu\_beta\_z\_vec(nn),sqrt(Var\_beta\_z));  
 power\_vec(nn) = power\_vec(nn) + 1-normcdf(beta\_0,mu\_beta\_z\_vec(nn),sqrt(Var\_beta\_z));  
end  
  
figure;  
plot(theta\_1\_vec,power\_vec,'Color','k','Linewidth',1.5)  
xlabel('Hypothesis 1, \theta\_1');  
ylabel('Power(\theta\_1)');  
title('Power of the Test')  
 grid on  
 ax = gca;  
 ax.LineWidth = 1;  
 ax.GridColor = [0 0 0];  
 ax.MinorGridColor = 'k';



## beta|H0 and beta|H1 PDFs

six\_sigma = 6\*sqrt(Var\_beta\_z);  
  
del\_beta\_z\_vec = linspace(-six\_sigma,six\_sigma,2000);  
  
theta\_1 = 4;  
x\_H0\_vec = del\_beta\_z\_vec;  
x\_H1\_vec = del\_beta\_z\_vec+theta\_1;  
  
pdf\_beta\_z\_H0 = normpdf(x\_H0\_vec,mu\_beta\_z(0),sqrt(Var\_beta\_z));  
pdf\_beta\_z\_H1 = normpdf(x\_H1\_vec,mu\_beta\_z(theta\_1),sqrt(Var\_beta\_z));  
pdf\_beta\_0 = normpdf([-beta\_0 beta\_0],mu\_beta\_z(0),sqrt(Var\_beta\_z));  
  
figure;  
plot(x\_H0\_vec,pdf\_beta\_z\_H0,'Color','k','Linewidth',1.5);hold on;  
plot(x\_H1\_vec,pdf\_beta\_z\_H1,'--','Color','k','Linewidth',1.5);  
plot([-beta\_0 beta\_0],pdf\_beta\_0,'s','MarkerSize',7,...  
 'MarkerEdgeColor','k',...  
 'MarkerFaceColor',[0.4,0.4,0.4])  
xlabel('\beta(z)');  
ylabel('PDF, P(\beta(z)|H0) and P(\beta(z)|H1)');  
title('PDFs of the Test Statistic Under H0 and H1')  
legend('Under H0','Under H1','Threshold, \beta\_0')  
 grid on  
 ax = gca;  
 ax.LineWidth = 1;  
 ax.GridColor = [0 0 0];  
 ax.MinorGridColor = 'k';  
% axis tight



[*Published with MATLAB® R2017a*](http://www.mathworks.com/products/matlab)