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% Name: Lamin Jammeh
% Class: EE480 Online
% Semster: Fall 2023
% MIDTERM

%% ********** Q2 *********
t = 0:0.1:1;
x_t = t;
x_t3 = t/3;
subplot(2,1,1)
plot(t,x_t);
title('X(t Q2)');
xlabel('t');
grid on;
subplot(2,1,2)
plot(t,x_t3);
title('X(t/3) Q2');
xlabel('t');
grid on;

% x(t) is compressed by 1/3 on the y-axis

%% ********** Q3 x(t) & p(t) *********
clear;
clc;
syms t s;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t))
x_t = (p_t + P)*cos(2*pi*t)
subplot(2,1,1)
fplot(p_t,[0,100],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("p(t)");
title("p(t) for 0<=t<=100");

subplot(2,1,2)
fplot(x_t,[0,100],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("x(t)");
title("x(t) for 0<=t<=100");
%% ********** Q3 y(t) *********
clear;
clc;
syms t s;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t))
x_t = (p_t + P)*cos(2*pi*t)
y_t = abs(x_t)
fplot(y_t,[0,100],'r',"LineWidth",2); % Plot x(t) as a function plot
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xlabel('Time (sec)');
ylabel("y(t)");
title("y(t) for 0<=t<=100");
ylim([-1,45]) % assign limits to y axis

%% ********** Q3 z(t) *********
clear;
clc;
syms t s;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t))
x_t = (p_t + P)*cos(2*pi*t)
y_t = abs(x_t)
T_s = 0.01;
h_t = exp(-0.8*t)*heaviside(t)
% i wil be using the Transfer function with Laplace for Low Pass (z(t)

% step 1 Y(s)
Y_s = laplace(y_t);
H_s = laplace(h_t);
Z_s = H_s * Y_s
z_t = ilaplace(Z_s)

%% ********** Q4 **********
clear;
clc;
syms t s;
m = pi/2
X_s = 1 / ((s+3-j*(m))*(s+3+j*(m))*(s));
x_t = ilaplace(X_s)
fplot(x_t,[0,5],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("x(t)");
title("x(t) for 0<=t<=5");
ylim([0,0.1]) % assign limits to y axis
grid on;
```