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% Aaron Bruner
% C16480080
% MATLAB 1
clear; clc; close all;
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%1
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf('=====\\n');
fprintf('\\tPart 1\\n');
fprintf('=====\\n');

n = -100:100;
x = (10*(n.^4+20*n.^3-1000))./(n.^2+100).^2;

xmax = max(x);
xmin = min(x);
nmax = n(x==xmax);
nmin = n(x==xmin);

fprintf('xmax = %0.3f\\n', xmax);
fprintf('xmin = %0.3f\\n', xmin);
fprintf('nmin = \\n');
fprintf('      %0.3f\\n', nmin);
fprintf('\\n');
fprintf('nmax = \\n');
fprintf('      %0.3f\\n', nmax);
fprintf('\\n');
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                               1b                               %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
[garbage,values] = min((x-5).^2);
nzero = n(values);
fprintf('zero = %0.3f\\n', nzero);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%2
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf('=====\\n');
fprintf('\\tPart 2 - Figures\\n');
fprintf('=====\\n');

s = 0.01; % sampling time
ta = -10:s:10;

x = 4.*((ta>=-5)&(ta<-3)) + sqrt(25-ta.^2).*((ta>=-3)&(ta<4)) + ...
    3.*((ta>=4)&(ta<8));
x1= -2.*x;

figure();
subplot 121;
hold on;
plot([-10,10],[0,0],'LineStyle','-','Color',[0,0,0],'LineWidth',1);

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plot([0,0],[-15,15], 'LineStyle', '-', 'Color', [0,0,0], 'LineWidth', 1);

pla = plot(ta,x, 'LineStyle', '-', 'Color', [0.8,0,0], 'LineWidth', 2);
p2a = plot(ta-3,x1, 'LineStyle', ':', 'Color', [0,0.8,0], 'LineWidth', 2);
plot([7,10],[0,0], 'LineStyle', ':', 'Color', [0,0.8,0], 'LineWidth', 2);

hold off;
axis([-10,10,-15,10]);
title('Plot For Q2a');
xlabel('t');
ylabel('x(t)');
legend([pla,p2a], 'x(t)', '-2x(t+3)', 'Location', 'northeast');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                               2b                               %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
tb = -15:s:15;
x = 4.*((tb>=-5)&(tb<-3)) + sqrt(25-tb.^2).*((tb>=-3)&(tb<4)) + ...
    3.*((tb>=4)&(tb<8));

subplot 122;
hold on;
plot([-15,15],[0,0], 'LineStyle', '-', 'Color', [0,0,0], 'LineWidth', 1);
plot([0,0],[-5,10], 'LineStyle', '-', 'Color', [0,0,0], 'LineWidth', 1);

p1b = plot(tb,x, 'LineStyle', '-', 'Color', [0.8,0,0], 'LineWidth', 2);
p2b = plot(tb*1.25,x*0.5, 'LineStyle', ':', 'Color',
    [0,0.8,0], 'LineWidth', 2);

hold off;
axis([-10,15,-5,10]);
title('Plot For Q2b');
xlabel('t');
ylabel('x(t)');
legend([p1b,p2b], 'x(t)', '0.5*x(0.75*t)', 'Location', 'northeast');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                               2c                               %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
tc = -10:s:10;
x = 4.*((tc>=-5)&(tc<-3)) + sqrt(25-tc.^2).*((tc>=-3)&(tc<4)) + ...
    3.*((tc>=4)&(tc<8));

figure();
subplot 211;
hold on;

plot([-10,10],[0,0], 'LineStyle', '-', 'Color', [0,0,0], 'LineWidth', 1);
plot([0,0],[-5,10], 'LineStyle', '-', 'Color', [0,0,0], 'LineWidth', 1);

evenx1 = 0.5.*x;
evenx2 = 0.5.*x(end:-1:1);
even = evenx1 + evenx2;
plc = plot(tc,even, 'LineStyle', '-', 'Color', [0.8,0,0], 'LineWidth', 2);

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hold off;
axis([-10,10,-5,10]);
title('Plot For Q2c - Even Function');
xlabel('t');
ylabel('x(t)');
legend(plc,'Ev{x(t)}','Location','northeast');

subplot 212;
hold on;
plot([-10,10],[0,0],'LineStyle','-','Color',[0,0,0],'LineWidth',1);
plot([0,0],[-5,10],'LineStyle','-','Color',[0,0,0],'LineWidth',1);

oddx1 = 0.5.*x;
oddx2 = 0.5.*-x(end:-1:1);
odd = oddx1 + oddx2;
plc = plot(tc,odd,'LineStyle','-','Color',[0.8,0,0],'LineWidth',2);

hold off;
title('Plot For Q2c - Odd Function');
xlabel('t');
ylabel('x(t)');
legend(plc,'Odd{x(t)}','Location','northeast');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%3
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
fprintf('=====\n');
fprintf('\tPart 3 - Figures\n');
fprintf('=====\n');

s=0.01;
t=-2:s:14;
t2=t(2:end);

x = (2.*t).*((t>=0)&(t<3)) + (18-4.*t).*((t>=3)&(t<6)) + ...
    (t-12).*((t>=6)&(t<12));
y = diff(x)/s;

figure();
hold on;

plot([-2,14],[0,0],'LineStyle','-','Color',[0,0,0],'LineWidth',1);
plot([0,0],[-10,10],'LineStyle','-','Color',[0,0,0],'LineWidth',1);

p1 = plot(t,x,'LineStyle','-','Color',[0.8,0,0],'LineWidth',2);
p2 = plot(t2,y,'LineStyle',':','Color',[0,0.8,0],'LineWidth',2);

hold off;
title('Plot for Q3a - Derivative Signal');
xlabel('t');
ylabel('x(t)');
legend([p1,p2],'Original Function - x(t)',...
    'First Derivative - d/dt x(t)','Location','northeast');

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%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%                               3b                               %
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

y = cumsum(x)*s;

figure();
hold on;

plot([-2,14],[0,0],'LineStyle','-','Color',[0,0,0],'LineWidth',1);
plot([0,0],[-10,10],'LineStyle','-','Color',[0,0,0],'LineWidth',1);

p1 = plot(t,x,'LineStyle','-','Color',[0.8,0,0],'LineWidth',2);
p2 = plot(t,y,'LineStyle',':','Color',[0,0.8,0],'LineWidth',2);

hold off;
title('Plot for Q3b - Integral Signal');
xlabel('t');
ylabel('x(t)');
legend([p1,p2],'Original Function - x(t)','Integrated Function x(t)',...
        'Location','southwest');

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

clear;

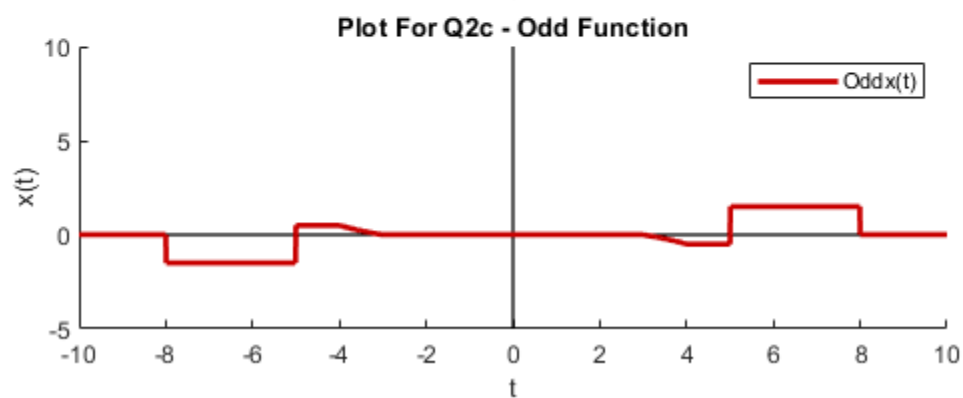
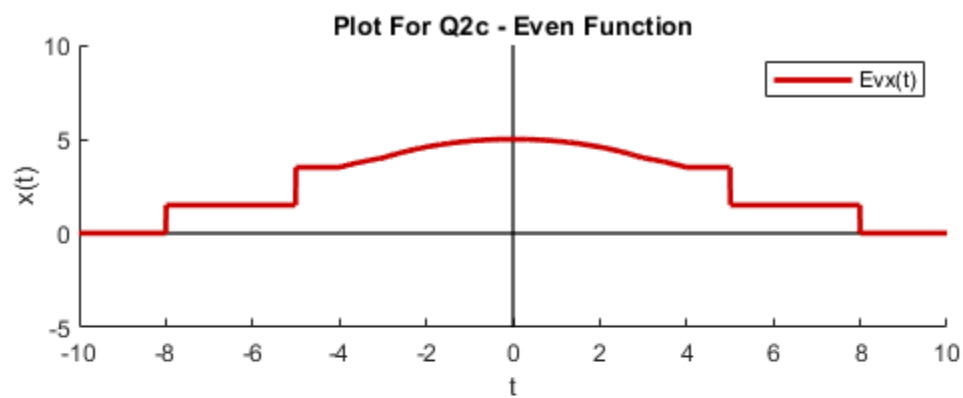
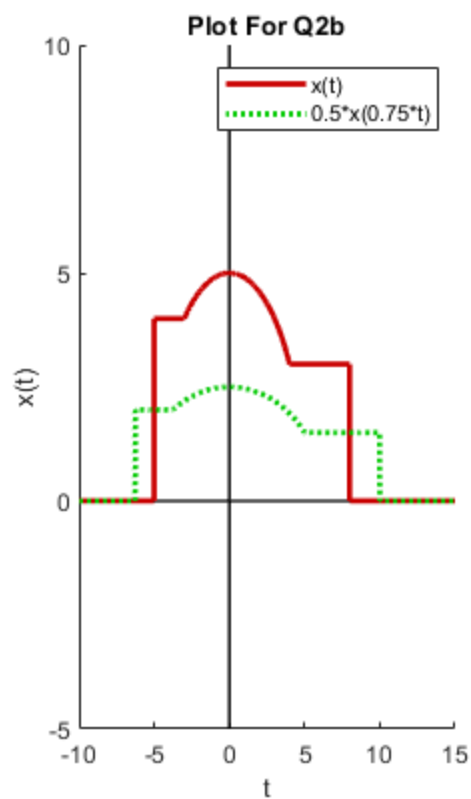
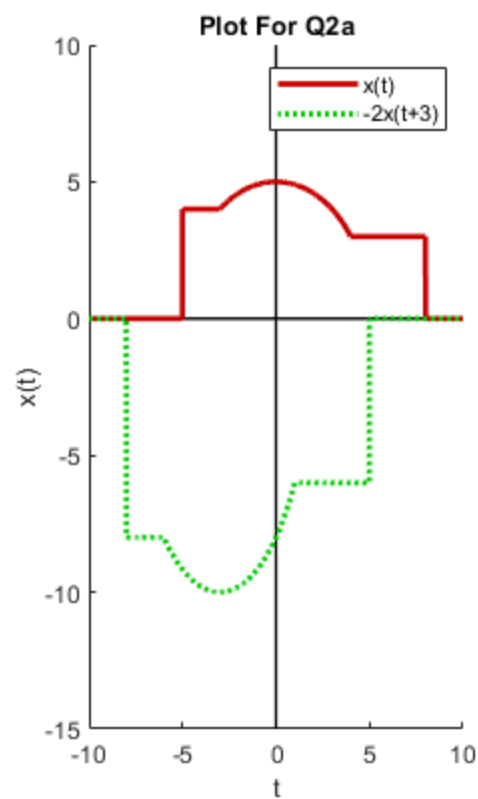
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Part 1
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xmax = 13.490
xmin = -2.753
nmin =
    -9.000

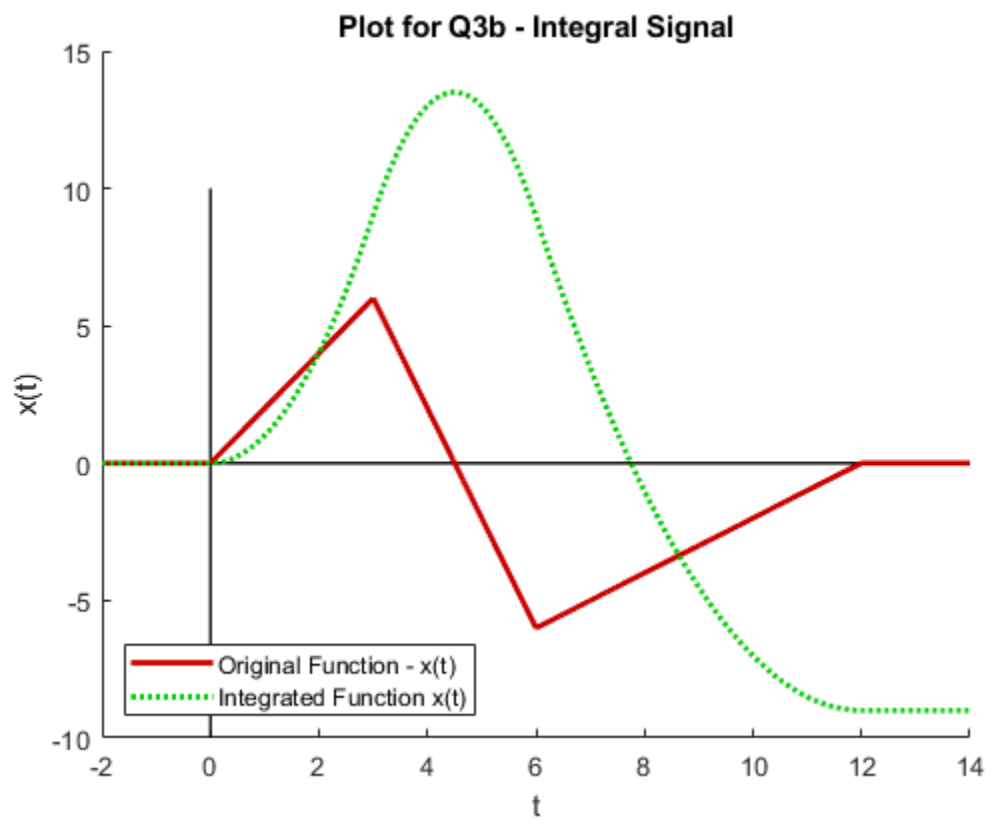
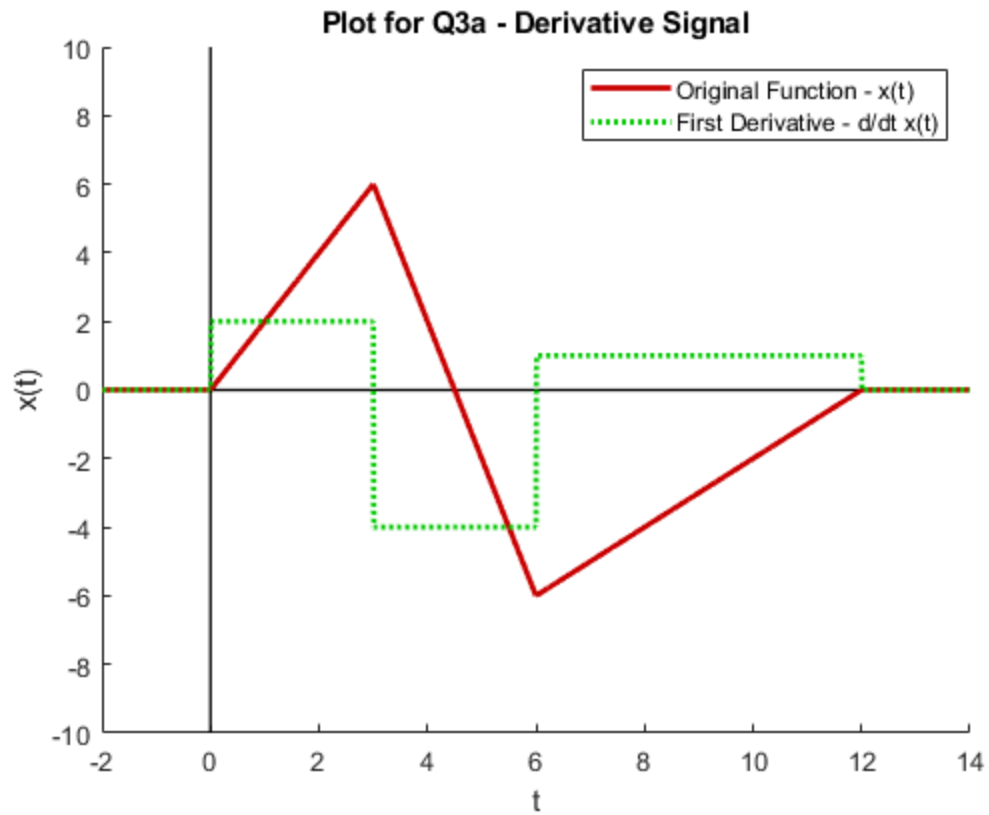
nmax =
    30.000

zero = 8.000
=====
Part 2 - Figures
=====
Part 3 - Figures
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