

```
1 % Aidan Chin
2 % 12/10/23
3 % ECE 202: Project 1 phase 4
4
5 %---initialize---
6
7 format shortG
8 clear
9 clc
10
11 %---setup---
12
13 A = 7; %amplitude of sinusoid
14 w = 10; %angular frequency of sinusoid
15 num_terms = 6; %number of non-zero terms
16 tmin = 0; %min time in ms
17 tmax = 500; %max time in ms
18 N = 1000; %number of points for plotting
19
20 t_ms = linspace(tmin,tmax,N); % make time array t in seconds from 0s to 0.5s
21 t = t_ms/1000; % convert time t to ms from 0ms to 500ms
22
23 n = [0:2:10]; % n values of non-zero coefficients
24 a_n = (-1).^(n/2).*(20.^n)*7./factorial(n); % a_n values of non-zero coefficients
25
26 %make a table
27 T = table(n',a_n','VariableNames',{ 'n values', ...
28     'a_n values (Non-zero coefficients)'});
29
30 % ---- old calculations ----
31
32 f1 = a_n(1)*t.^n(1); % First term
33 f2 = f1 + a_n(2)*t.^n(2); % 1-2 term
34 f3 = f2 + a_n(3)*t.^n(3); % 1-3 terms
35 f4 = f3 + a_n(4)*t.^n(4); % 1-4 terms
36 f5 = f4 + a_n(5)*t.^n(5); % 1-5 terms
37 f6 = f5 + a_n(6)*t.^n(6); % 1-6 terms
38
39 % ---- plotting with new calc----
40
41 f = zeros([1 N]);
42
43 hold on %keeps from making new plots
44
45 for i = 1:num_terms
46     f = f + a_n(i)*t.^n(i);
47     if i < 6
48         p(i)=plot(t_ms,f,'LineWidth', 2);
49     else
50         p(i)=plot(t_ms,f,'LineWidth', 4);
51         plot([tmin,tmax], [0,0], 'k', 'LineWidth', 1)
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52     end
53 end
54
55 hold off
56 grid on %turn on gridlines
57 ax = gca; %initialize gca
58 ax.GridAlpha = 0.4; %change grid
59 ax.FontSize = 16; %change chart font size
60
61 title(sprintf("ECE 202 Project 1 Phase 4: Power series expansion \n of " + ...
62     "f(t)=%gcos(%gt) up to first %g non-zero " + ...
63     "terms",A,w,num_terms),Interpreter='latex',FontSize=21)
64 %make title
65 xlabel("Time (t) in miliseconds","FontSize",18)
66 %add title for x
67 ylabel(sprintf("First six non-zero terms of " + ...
68     "f(t)=%gcos(%gt)",A,w),Interpreter='latex',FontSize=18)
69 %add title for y
70 ylim([-1*(A+3) A+3])
71 %change bounds
72 terms = 1:6;
73 legend(p,"terms: "+ terms + ", n = " + n,Location="southoutside", ...
74     FontSize=18,NumColumns=3)
75 %create legend automatically
76
77 checkf = sum(f-f6) %checks difference between old and new calculations
78 %should be 0
79
```

T =

6x2 table

n values	a_n values (Non-zero coefficients)
0	7
2	-1400
4	46667
6	-6.2222e+05
8	4.4444e+06
10	-1.9753e+07

checkf =

0

>>

ECE 202 Project 1 Phase 4: Power series expansion  
of  $f(t)=7\cos(10t)$  up to first 6 non-zero terms

