```m
% Abhilash Gudgunti
% 1 November, 2024
% ECE 202 Project 1: Phase 2
% Power series expansion of function of form Acos(wt)

clear %clear registers
clf % clear figures
format shortG

% Defining arrays
n = (0:2:10)'; % values of n for the first 6 non-zero terms. (Increments of 2)
a_n = 12*(-1).^(n./2) .*40.^n ./ factorial(n); % Array of values of a_n

%Outputting a table of n and a_n
varnames = {'n','Coefficients (a_n)'};
T = table(n, a_n, 'VariableNames',varnames)

% setting up array of time
tms = linspace(0,200,1000); % time between 0 - 200 ms
t = tms/100; % time in s to compute in functions

%Defining Functions
f1 = a_n(1) * t.^n(1); % The first non zero term
f2 = f1 + a_n(2) * t.^n(2); % The second non zero term
f3 = f2 + a_n(3) * t.^n(3); % The third non zero term
f4 = f3 + a_n(4) * t.^n(4); % The fourth non zero term
f5 = f4 + a_n(5) * t.^n(5); % The fifth non-zero term
f6 = f5 + a_n(6) * t.^n(6); % The sixth non zero term

%Plotting the functions
plot([0,200], [0,0], 'k', 'LineWidth', 1) % x-axis (not shown in legend)
hold on

%Plotting the first five funcitons
p1 = plot(tms, f1, tms, f2, tms, f3, tms, f4, tms, f5, ...
    'LineWidth', 1.5);
hold on
p2 = plot (tms, f6, 'LineWidth', 3); %plotting the last function (f6)

%Setting legends for the figure
LegendText = "n = " + n;
legend([p1;p2], LegendText, Location='bestoutside')


% Figure components
ax = gca; ax.FontSize = 16;
title(sprintf(['ECE 202 Project 1 Phase 2:\nApproximation of ' ...
    'f(x) = 12cos(40t) \nfor 6 non-zero terms']), "FontSize", 19)
xlabel('Time t (in ms)', 'FontSize', 17)
ylabel('f(t)', 'FontSize', 17)
ylim([-15, 15])
xlim([0,20])
ax = gca; ax.GridAlpha = 0.4; % making the grid darker
```

```
54 grid on
55 hold off
```

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>> ECE202_P1_Phase2

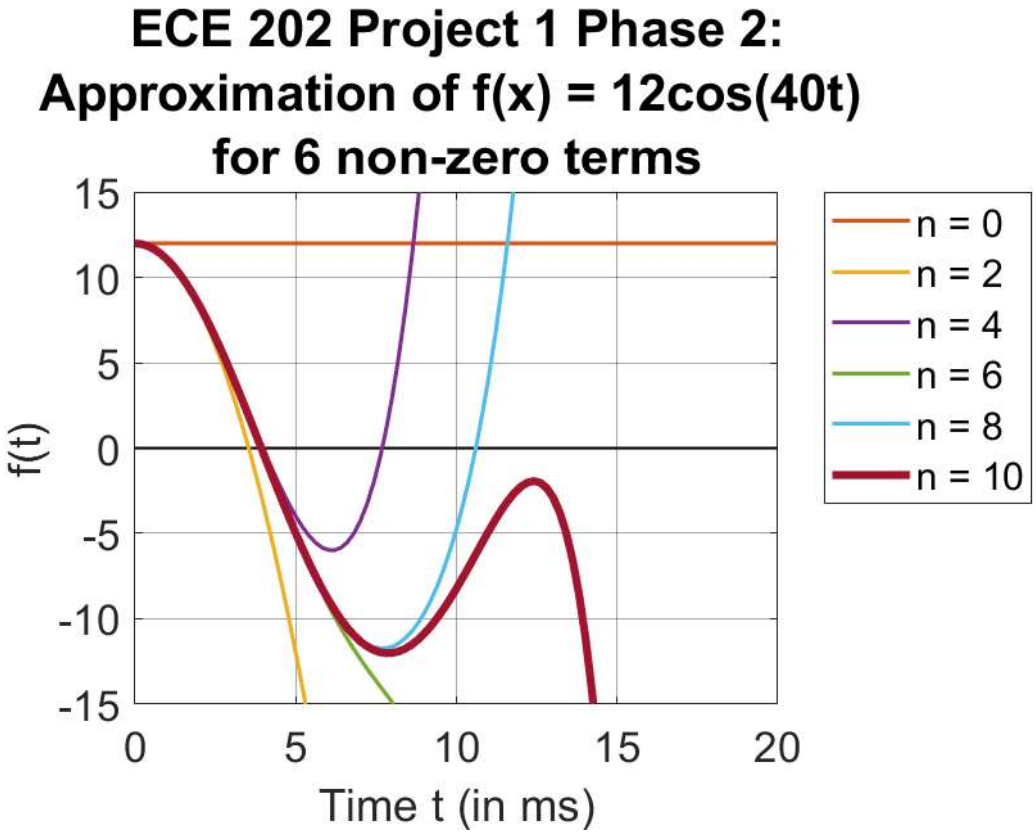
T =

  6×2 table

    n     Coefficients (a_n)
    __    __________________

     0                12
     2             -9600
     4          1.28e+06
     6       -6.8267e+07
     8        1.9505e+09
    10       -3.4675e+10

>>
```


ECE 202 Project 1 Phase 2:
Approximation of f(x) = 12cos(40t)
for 6 non-zero terms
15
10
5
0
-5
-10
-15
f(t)
0
5
10
15
20
Time t (in ms)
n = 0
n = 2
n = 4
n = 6
n = 8
n = 10