

```
1 %{
2 Aidan Chin Midterm 1 part 3 A 10/4/23
3 ECE 202 MATLAB Midterm 1
4 the goal of this script is to show that  $\sin(3wt)$  is equal to  $3\sin(wt) - 4\sin^3(wt)$ 
5  $-4\sin^3(wt)$ 
6 %}
7
8 % *** Prepare workspace ***
9 clear % clear variables to remove chance of error
10 clf % clear figures to make the graph window clear
11
12 % *** Givens ***
13 w = pi; % angular momentum in radians/second
14 tmin = -pi/w; % minimum t value
15 tmax = pi/w; % maximum t value
16 N = 1000; % number of steps to be made between min and max
17 t = linspace(tmin,tmax,1+N); % create array of numbers between tmin
18                                     % and tmax
19
20 % *** Calculation ***
21 a = w.*t; % define a so avoid writing many times later
22 f1 = sin(3.*a); % given sine formula
23 f2 = 3*sin(a) - 4*sin(a).^3; % given sine subtraction formula
24
25 % *** Check ***
26 d = abs(f2) - abs(f1); % check to make sure the 2 formulas are equivalent
27 check = sum(d) % print single number check, should be close to 0
28
29 % the reason we use abs instead of solely sum is because you want to find the
30 % distance of the 2 graphs from each other, and distance is always positive
31
32 % *** Graphing ***
33 plot(t,f1,t,f2,':','LineWidth',3) % plot both formulas on graph with f1 being
34 % solid line, f2 being dotted and linewidth of 3
35 title('ECE 202 Midterm 1 Part 3 B', ...
36       'Proving that  $\sin(3wt) \equiv 3\sin(wt) - 4\sin^3(wt)$ ')
37 % make title and description of figure
38 legend('f1 =  $\sin(3wt)$ ', 'f2 =  $3\sin(wt) - 4\sin^3(wt)$ ') % make legend for figure
39 ylabel('Angular Momentum (radians/second)') % change y axis label
40 xlabel('Time (s)') % change x axis label
41 ylim([-1.5,1.5]) % modify the y axis limits so no overlap on legend
42 grid on % enable the grid on the graph
43
```