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% Michael Gagliardi 11/27/2020 ECE 202 2020 MATlab Exercise 5
% Equations from: Carl R. (Rod) Nave; Department of Physics and Astronomy; Georgia...
% State University
% http://hyperphysics.phy-astr.gsu.edu/hbase/trid.html
% Graphing a sinosoid and two sinusoids whose sum is equivalent
%Formula for turning the product of two sinusoids into the sum of two...
%sinusoids: cos(a)cos(b)=0.5(cos(a+b)+cos(a-b))

%----original function-------

tms = linspace(0,200,501); %intialize  time array in ms
t = tms/1000; % time in seconds for computations
a = 60.*t - 1.8; %defining a since it is used multiple times
b = 100.*t + 1.2; %defining b since it is used multiple times
ft=12.*cos(a).*cos(b); %original function

%-----2 sinusoids that add up to original-----

f1t = 6*cos(a+b); %%function 1, the '6' coefficent is accounting for the 0.5...
%in the formula, and the '12' coefficent of the original function
f2t = 6*cos(a-b); %%function 2, the '6' coefficent is accounting for the 0.5...
%in the formula, and the '12' coefficent of the original function
check1 = f1t+f2t-ft; %%checking that the sum of both functions add to original...
%should output a straight line at 0
check2 = sum(abs(check1)) %%second check, should output 0
% using abs function in above check since it is a sinusoid, values are...
% expected to have a negative equivalent in the output which could...
% output result in an outputted 0 despite being incorrect

%------plotting-------

plot(tms, check1,'black', tms, ft,'g', tms, f1t,'r', tms, f2t,'b',  'LineWidth', 2)

ax = gca;
ax.FontSize = 12; % increasing font size

grid on %turning grid on
ax.GridAlpha = 0.3; %making grid thicker/easier to see
xlabel('time (ms)', 'FontSize',15) %labeling the x axis
ylabel('y values', 'FontSize',15) %labeling the y axis
title('2 Sinusoids Whose Sum is Equivalent to a Third')
legend('check','original','function 1','function 2') %creating the legend


```