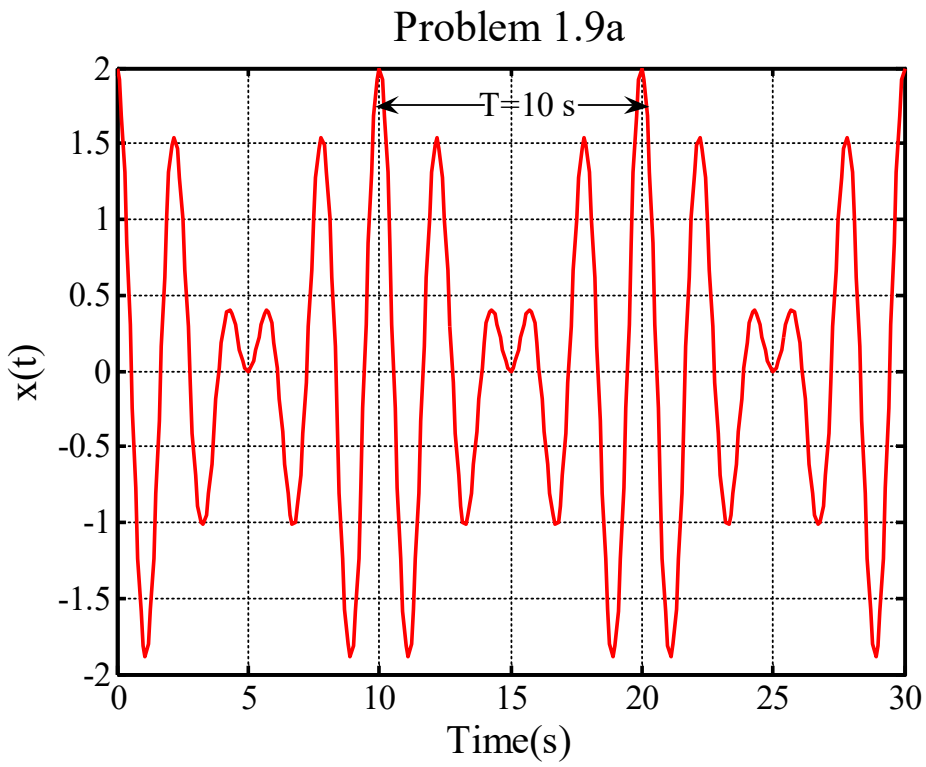
1.9. Use an analytical method to determine if the signals (a)–(f) are periodic; if so, find the fundamental period. Use MATLAB to plot each signal, and verify your prediction of periodicity. Use a small enough time increment for the continuous-time signals to make your plot smooth (see Problem 1.2).

(a) $x(t) = \cos \pi t + \cos(4\pi t/5)$

- For $x(t)$ to be periodic, we need the ratio $T_1 / T_2 = q/r$ where q and r are integers.
- $T_1 = 2\pi/\omega_1 = 2\pi/\ \pi = 2$ s and $T_2 = 2\pi/\omega_2 = 2\pi/\ (4\pi/5) = 10/4 = 5/2$ s
- $T_1 / T_2 = 2/(5/2) = 4/5 = q/r \Rightarrow$ **PERIODIC!**
- Fundamental period $T = r\ T_1 = 5(2) = 10$ s

```
% Problem 1.9a (p1_09a.m)
% Generate plot of x(t)=cos(pi*t)+ cos(4*pi*t/5)
%
T = 10; %Fundamental period
t=0:T/100:3*T;
x = cos(pi*t)+ cos(4*pi*t/5);
plot(t,x,'r-','linewidth',2)
grid
axis([0 3*T -2 2]);
ylabel('x(t)','fontsize',16,'fontname','times')
xlabel('Time(s)','fontsize',16,'fontname','times')
title('Problem 1.9a','fontsize',18,'fontname','times')
set(findobj('type','axes'),'fontname','times','fontsize',14)
set(findobj('type','line'),'linewidth',1.5)
set(findobj('type','line'),'markersize',18)
set(findobj('type','axes'),'linewidth',2)
```



1.9. Use an analytical method to determine if the signals (a)–(f) are periodic; if so, find the fundamental period. Use MATLAB to plot each signal, and verify your prediction of periodicity. Use a small enough time increment for the continuous-time signals to make your plot smooth (see Problem 1.2).

(e) $x[n] = \sin(10\,\pi n/3)$

- For $x[n]$ to be periodic, we need $\Omega = 10\pi/3 = 2\pi\, q/r$ where q & r are integers.
- $(10\pi/3)/(2\pi) = 5/3 = q/r \Rightarrow$ **PERIODIC!**
- Fundamental period is $r = 2\pi q/\Omega = (2\pi 5)/(10\pi/3) \Rightarrow$ ***r = 3***

```
% Problem 1.9e (p1_09e.m)
% EE 313 Signals and Systems
% Generate plot of x[n]=sin(10*pi*n/3)
clear; clc; close all
r = 3; % fundamental period
n = 0:1:3*r;% plot 3 periods
x = sin(10*pi*n/3);
stem(n,x,'r.','linewidth',2,'markersize',22)
axis([0 3*r -1.2 1.2]);
ylabel('x[n]','fontsize',16,'fontname','times')
xlabel('\it n','fontsize',16,'fontname','times')
title('Problem 1.9e','fontsize',18,'fontname','times')
set(findobj('type','text'),'fontname','times','fontsize',14)
set(findobj('type','axes'),'linewidth',2,'fontname','times',
'fontsize',14)
```