Using Matlab, plot $g(t)$ found in part a of 2.32 for $0 \le t \le 20$ s. Then, plot $y(t)$ found in part b of 2.32 for $0 \le t \le 20$ s.

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2.32. A causal linear time-invariant continuous-time system has impulse response

$$h(t) = e^{-t} + \sin t, t \ge 0$$

(a) Compute the output response for all $t \ge 0$ when the input is the unit-step function $u(t)$.
(b) Compute the output response $y(t)$ for all $t \ge 0$ resulting from the input $u(t) - u(t-2)$.

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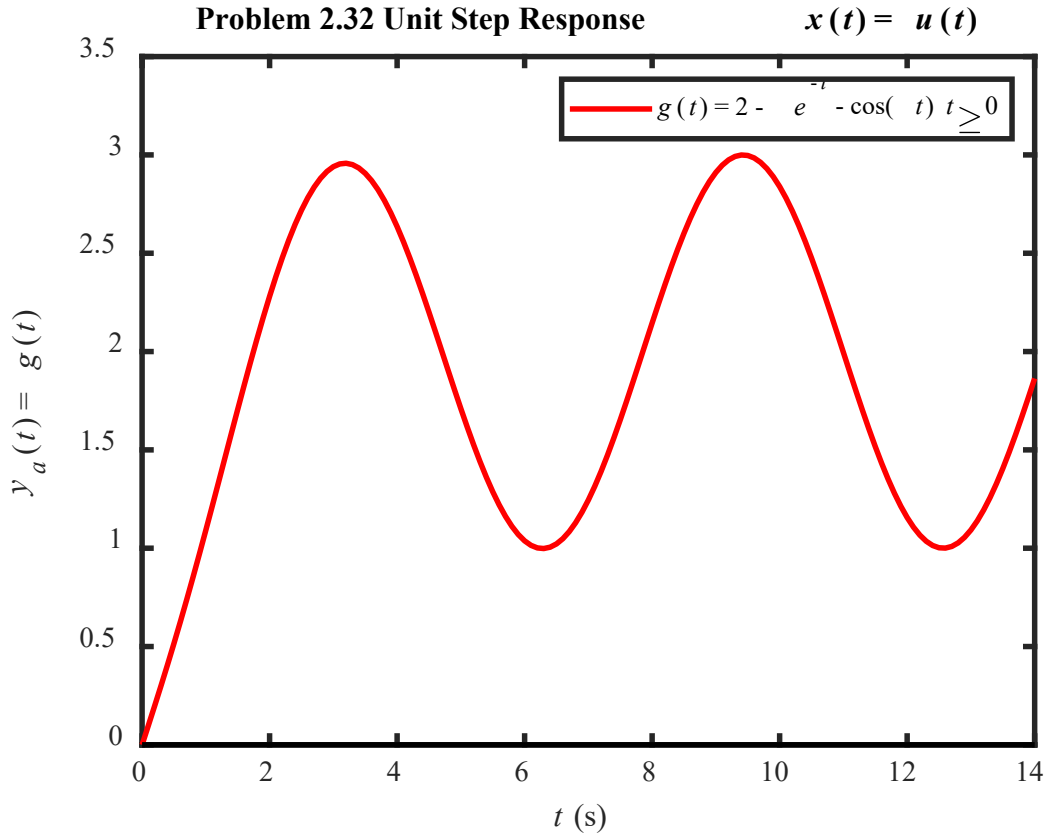
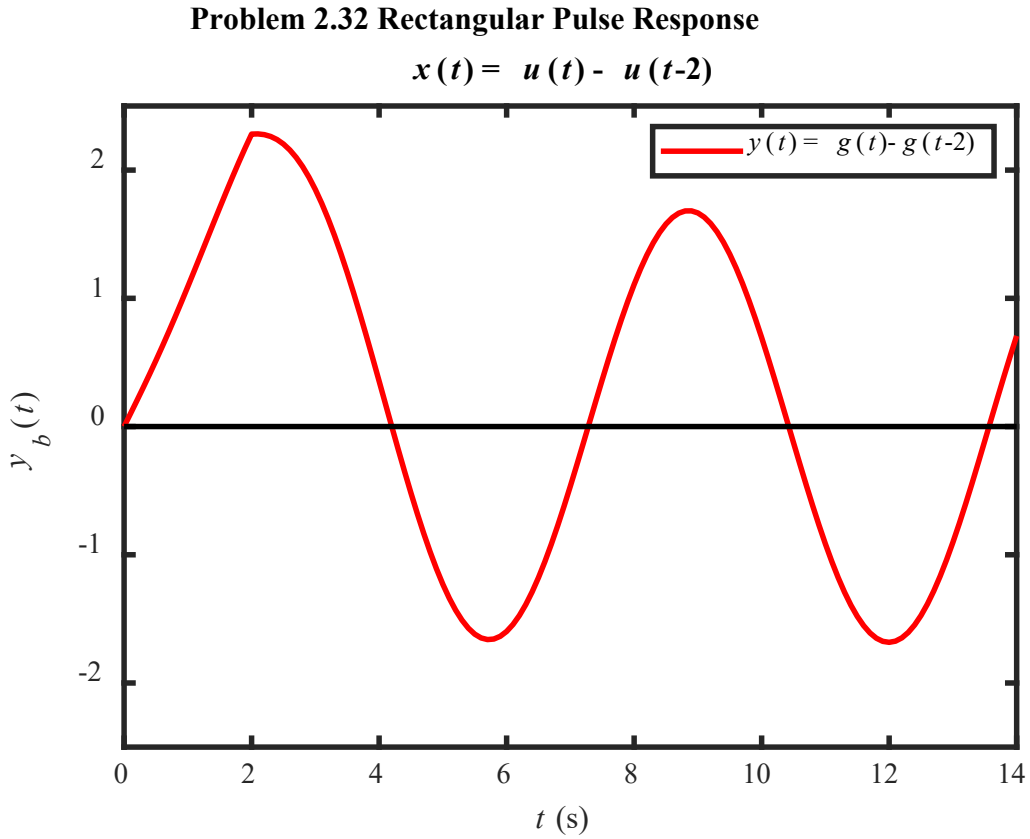
Matlab code-

```
% Chapter 2 prob 2.32 (p2_32.m)
% For a linear time-invariat CT system, the impulse response is
%             h(t) = e^-t + sin(t) t => 0.
% Plot output when the input is: a) xa(t) = u(t) and b) xb(t) = u(t)-u(t-2).
close all; clear; clc;
tstop =14; % How far to go in time in seconds
T = 0.1;                    % Time step
ta = 0:T:tstop;             % Define time vector
h = exp(-ta) + sin(ta);     % impulse response
ya = 2 - exp(-ta) - cos(ta); % unit step output
tb1 = 0:T:2-T; tb2 = 2:T:tstop; % Define time vectors for part b)
yb1 = 2 - exp(-tb1) - cos(tb1);
yb2 = (2-exp(-tb2)-cos(tb2)) - (2-exp(-tb2+2)-cos(tb2-2));
tb = [tb1,tb2]; yb = [yb1,yb2]; % splice together vectors
plot(ta,h,'r',[0 tstop],[0 0],'k-'), % plot impulse response
axis([0 tstop -1.5 1.5]),
ylabel('{\ith}({\itt})','fontsize',16,'fontname','times')
xlabel('{\itt} (s)','fontsize',16,'fontname','times')
title('Problem 2.32 Impulse Response','fontsize',16,'fontname','times')
text(3.5,1.25,'{\ith}({\itt}) = e^{-{\itt}} + sin({\itt}) {\itt} \geq 0',...
    'fontsize',16,'fontname','times')
figure, plot(ta,ya,'r',[0 tstop],[0 0],'k-') % unit step response
axis([0 tstop 0 3.5]),
ylabel('{\ity}_{\ita}({\itt}) = {\itg}({\itt})','fontsize',16,'fontname','times')
xlabel('{\itt} (s)','fontsize',16,'fontname','times')
title('Problem 2.32 Unit Step Response {\itx}({\itt}) = {\itu}({\itt})',...
    'fontsize',16,'fontname','times')
legend('{\itg}({\itt}) = 2 - {\ite}^{-{\itt}} - cos({\itt}) {\itt}\geq0');
figure, plot(tb,yb,'r',[0 tstop],[0 0],'k-')% rect. pulse response
axis([0 tstop -2.5 2.5]),
ylabel('{\ity}_{\itb}({\itt})','fontsize',16,'fontname','times')
xlabel('{\itt} (s)','fontsize',16,'fontname','times')
title({'Problem 2.32 Rectangular Pulse Response',...
'{\itx}({\itt}) = {\itu}({\itt}) - {\itu}({\itt}-2)'},'fontsize',...
    16,'fontname','times')
legend('{\ity}({\itt}) = {\itg}({\itt})-{\itg}({\itt}-2)');
set(findobj('type','line'),'linewidth',2,'markersize',12)
set(findobj('type','axes'),'linewidth',2,'fontsize',14,'fontname','times')
```

a)


Problem 2.32 Unit Step Response
x(t) = u(t)
g(t) = 2 - e^-t - cos(t) t ≥ 0
y_a(t) = g(t)
t (s)

b)


Problem 2.32 Rectangular Pulse Response
x(t) = u(t) - u(t-2)
y(t) = g(t)- g(t-2)
y_b(t)
t (s)