Signal Assignment

Prepared by: Qusay Mohammad Bdier

ID Number: 1220649

**Instructor**: Dr. Mahran Qaraan

Section : 3

Contents

Question 1:

```
Editor - D:\University\signal\project\Q(1)\Untitled.m
Untitled.m  ✕  +
1 -    t = 0:0.01:20;
2      %defind equation of function x1(t)
3 -    x1=heaviside(t-6) - heaviside(t-12);
4      %defind equation of function x2(t)
5 -    x2=heaviside(t-4) + (t-8).*heaviside(t-8) - 2*(t-9).*heaviside(t-9) + (t-13).*heaviside(t-13);
6 -    plot(t,x1);
7 -    title('signal x_1(t) = u(t-6) - u(t-12)');
8 -    xlabel('Time t');
9 -    ylabel('x_1(t)');
10 -   plot(t,x2);
11 -   title('signal x_2(t) = u(t-4) + r(t-8) - 2r(t-9) + r(t-13)');
12 -   xlabel('Time t');
13 -   ylabel('x_2(t)');
```
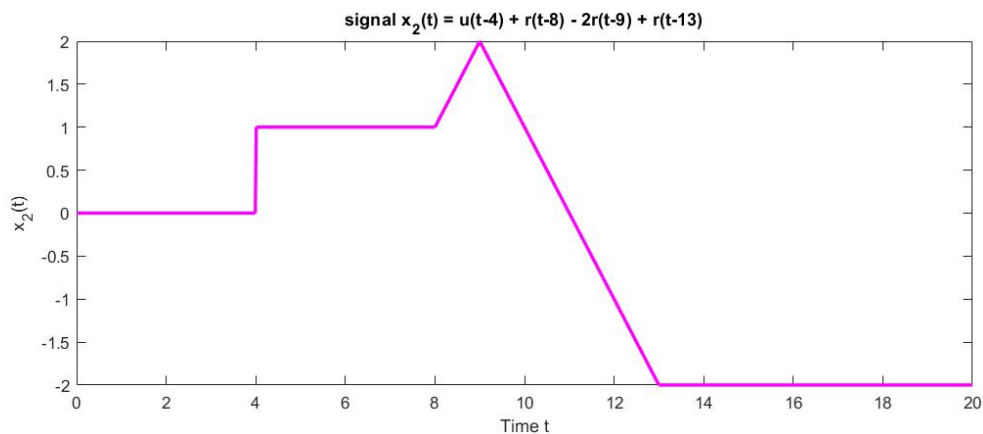
1- $x1(t) = u(t-6) - u(t-12)$

Plot:
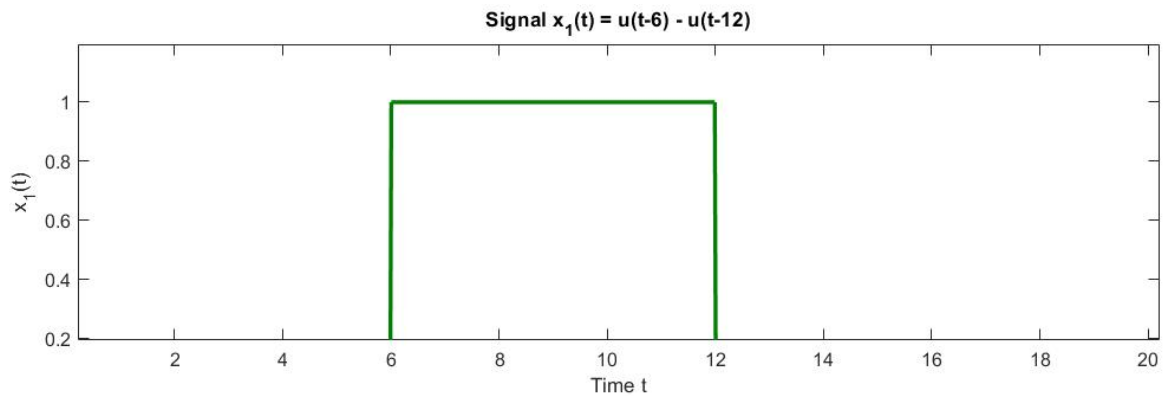
2- $x2(t) = u(t-4) + r(t-8) - 2r(t-9) + r(t-13)$ in the time interval = [0, 20]
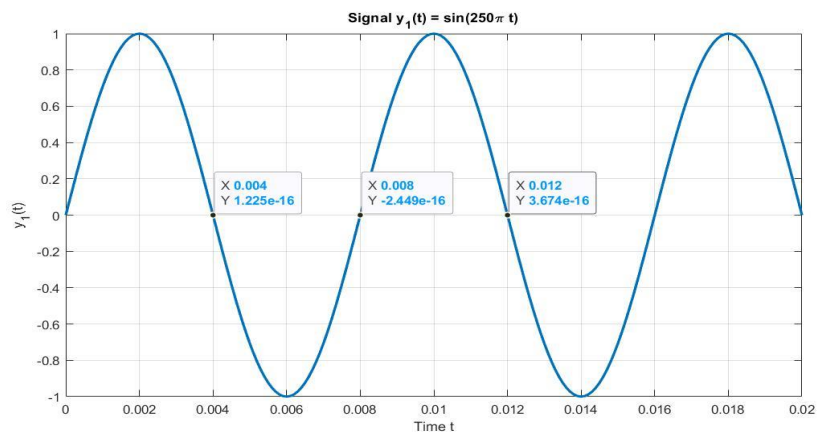
Plot:

Question 2:

Command Window

```
>> t = 0:0.0001:0.02;
>> y1 = sin(250*pi*t);
>> y2 = cos(1000*pi*t);
>>
>> m = y1 + y2;
>> n = y1 - y2;
>> % Plot y1(t)
>> subplot(2,2,1);
>> plot(t, y1, 'LineWidth', 2);
>> title('Signal y_1(t) = sin(250\pi t)');
>> xlabel('Time t');
>> ylabel('y_1(t)');
>> % Plot y2(t)
>> subplot(2,2,2);
>> plot(t, y2, 'LineWidth', 2);
>> title('Signal y_2(t) = cos(1000\pi t)');
>> xlabel('Time t');
>> ylabel('y_2(t)');
>> % Plot m(t) = y1 + y2
>> subplot(2,2,3);
>> plot(t, m, 'LineWidth', 2);
>> title('Signal m(t) = y_1(t) + y_2(t)');
>> xlabel('Time t');
>> ylabel('m(t)');
>> % Plot n(t) = y1 - y2
>> subplot(2,2,4);
>> plot(t, n, 'LineWidth', 2);
>> title('Signal n(t) = y_1(t) - y_2(t)');
>> xlabel('Time t');
>> ylabel('n(t)');
```
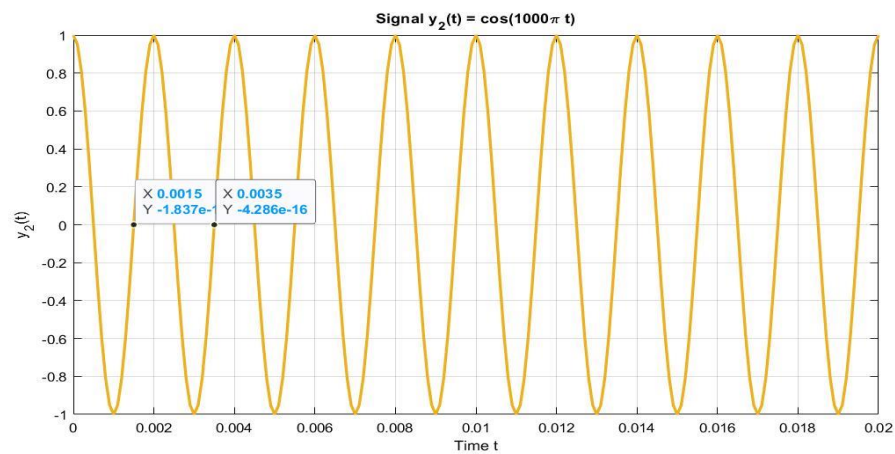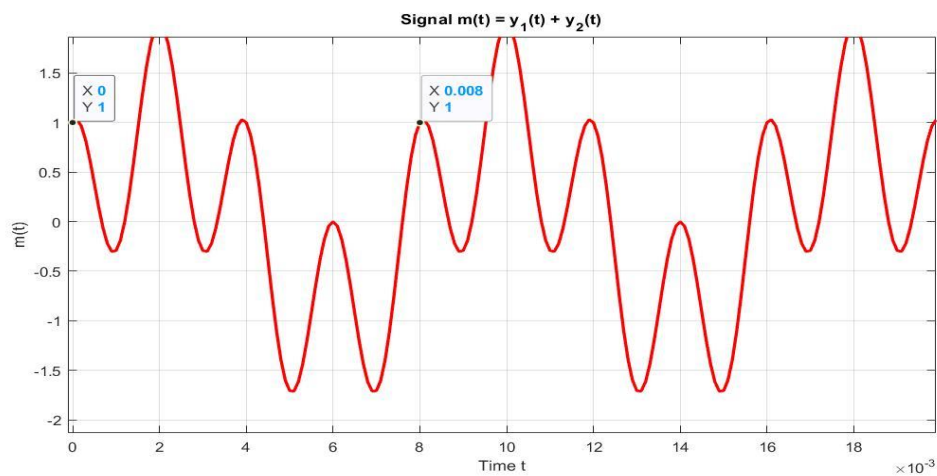
1-
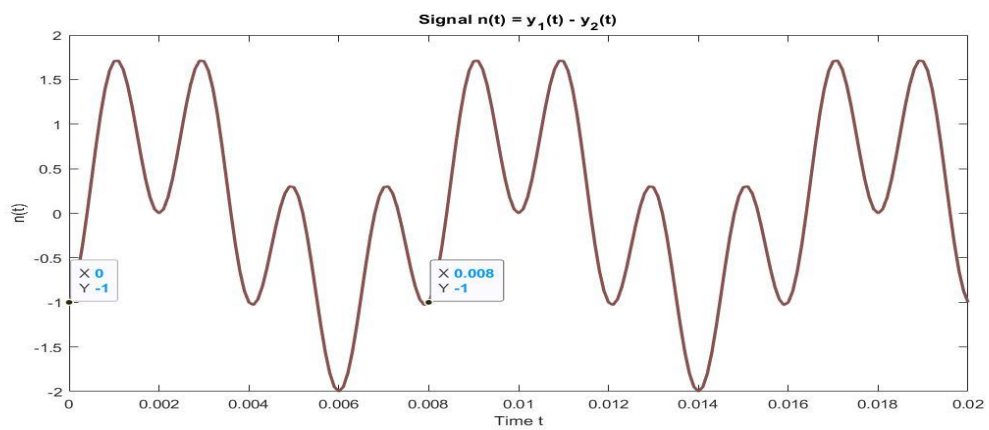
a- y1(t)= sin(250πt)

Plot:

b- y2(t)= cos(1000πt)

Plot:

Signal $y_2(t) = \cos(1000\pi t)$

c- m(t)= y1+y2

Plot:

Signal $m(t) = y_1(t) + y_2(t)$

d- n(t)= y1–y2

Plot:

Signal $n(t) = y_1(t) - y_2(t)$

$m(t) = y_1(t) + y_2(t)$

$m(t) = \sin(250\pi t) + \cos(1000\pi t)$

$w_1 = 250\pi \implies \delta_1 = 125 \quad , \quad T_1 = 1/125 = 0.0085\ (S)$

$w_2 = 1000\pi \implies \delta_1 = 500 \quad , \quad T_1 = 1/500 = 0.002\ (S)$

* The fundemental frequency "δ_0" is the GCD of ($\delta_1 \& \delta_2$)

$\therefore GCD = \boxed{125 = \delta_0} \implies \boxed{T_0 = 0.008}$

* From the graph $X_1 = 0, \quad X_2 = 0.008$

$\Delta X = 0.008 - 0 = \boxed{0.008 = T_0}$

So m(t) is period.

$m(t) = y_1(t) + y_2(t)$

$m(t) = \sin(250\pi t) + \cos(1000\pi t)$

$w_1 = 250\pi \implies \delta_1 = 125 \quad , \quad T_1 = 1/125 = 0.0085\ (S)$

$w_2 = 1000\pi \implies \delta_1 = 500 \quad , \quad T_1 = 1/500 = 0.002\ (S)$

* The fundemental frequency "δ_0" is the GCD of ($\delta_1 \& \delta_2$)

$\therefore GCD = \boxed{125 = \delta_0} \implies \boxed{T_0 = 0.008}$

* From the graph $X_1 = 0, \quad X_2 = 0.008$

$\Delta X = 0.008 - 0 = \boxed{0.008 = T_0}$

So m(t) is period.

$\therefore n(t) = y_1(t) + y_2(t) \implies n(t) = \sin(250\pi t) - \cos(1000\pi t)$

$\implies \Delta X$ from graph $= 0.008 - 0 = 0.008\ (S)$

$\implies$ from $GCD \implies \delta_0 = 125 Hz \quad \underline{\underline{\Large S}} \quad \dfrac{1}{\Delta X} = 125 Hz$

$\therefore$ the n(t) is period.

Question 3:

Code:

```
Editor - D:\University\signal\project\Q(3)\Untitled3.m
  Untitled3.m  ×  +
1 -      syms y(t);
2 -      dy(t) = diff(y(t), t);
3 -      dy2(t) = diff(y(t), t,2);
4 -      eequation = dy2(t) + 2*dy(t) + 4*y(t) == 5*cos(1000*t);
5 -      initial1 = y(0) == 0;
6 -      initial2 = dy(0) == 0;
7 -      solution = dsolve(eequation, initial1, initial2);
8
```
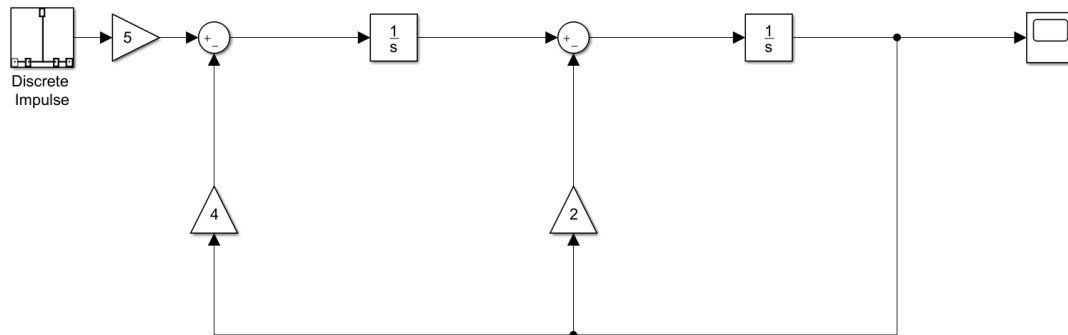
Solution:

sin(3^(1/2)*t)*((625*cos(1000*t - 3^(1/2)*t))/124999500002 - (625*cos(1000*t + 3^(1/2)*t))/124999500002 - (1249995*sin(1000*t + 3^(1/2)*t))/499998000008 + (1249995*sin(1000*t - 3^(1/2)*t))/499998000008 + (1250005*3^(1/2)*cos(1000*t + 3^(1/2)*t))/1499994000024 + (1250005*3^(1/2)*cos(1000*t - 3^(1/2)*t))/1499994000024 + (312499375*3^(1/2)*sin(1000*t + 3^(1/2)*t))/374998500006 + (312499375*3^(1/2)*sin(1000*t - 3^(1/2)*t))/374998500006) - (5*3^(1/2)*cos(3^(1/2)*t)*((sin(t*(3^(1/2) - 1000)) - cos(t*(3^(1/2) - 1000))*(3^(1/2) - 1000))/((3^(1/2) - 1000)^2 + 1) + (sin(t*(3^(1/2) + 1000)) - cos(t*(3^(1/2) + 1000))*(3^(1/2) + 1000))/((3^(1/2) + 1000)^2 + 1)))/6 - (1250005*3^(1/2)*exp(-t)*sin(3^(1/2)*t))/749997000012 - (1249995*exp(-t)*cos(3^(1/2)*t))/(4*(500*3^(1/2) - 250001)*(500*3^(1/2) + 250001))

Question 4:

$$y''(t) + 2y'(t) + 4y(t) = 5x(t)$$

$$y''(t) + 2y'(t) = \boxed{5x(t) - 4y(t)} \quad \cdots\cdots ① \; q_0$$

$$\int y''(t) + 2y'(t) \cdot dt = \int q_0$$

$$y'(t) + 2y(t) = \int q_0$$

$$y'(t) = \boxed{\int q_0 - 2y(t)} \quad \cdots\cdots ② \; q_1$$

$$\int y'(t) = \int \int q_0 - 2y(t) \cdot dt$$

$$\boxed{y(t) = \int q_1 \cdot dt} \quad \text{-----}$$

Impulse Response

Simulation:
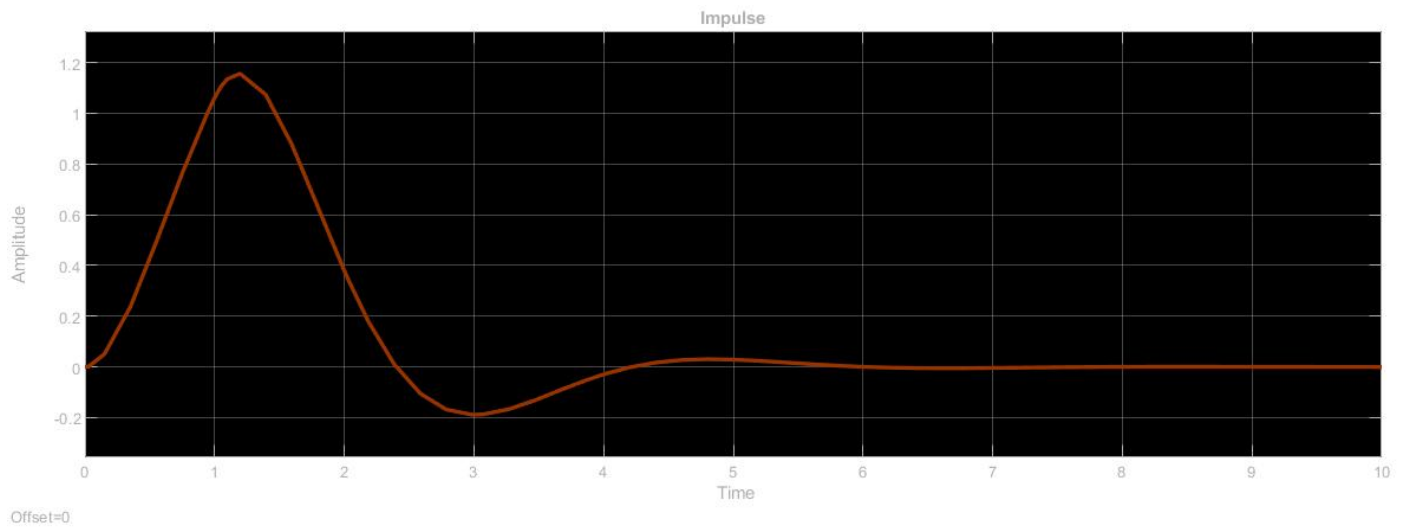
Plot:

Step Response

Simulation:
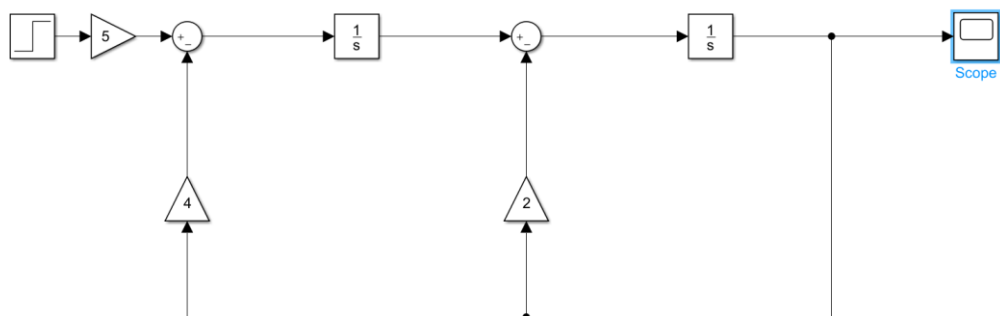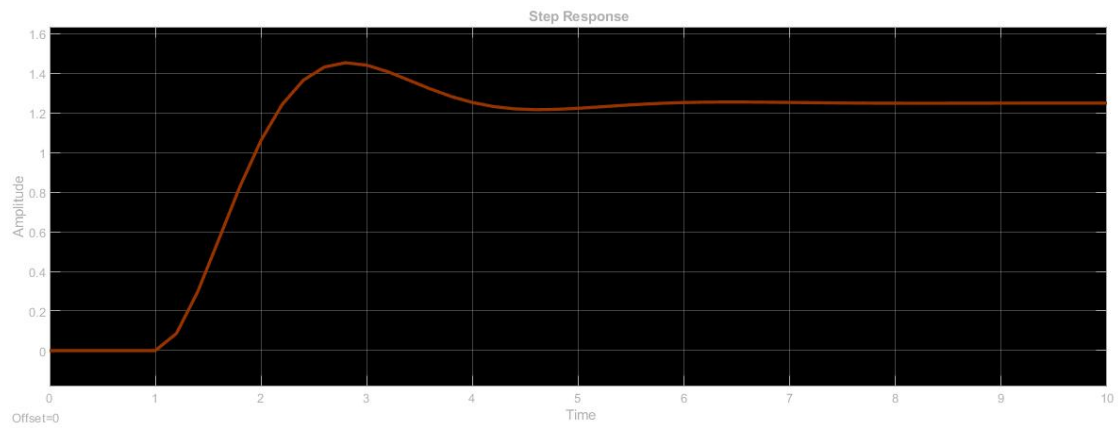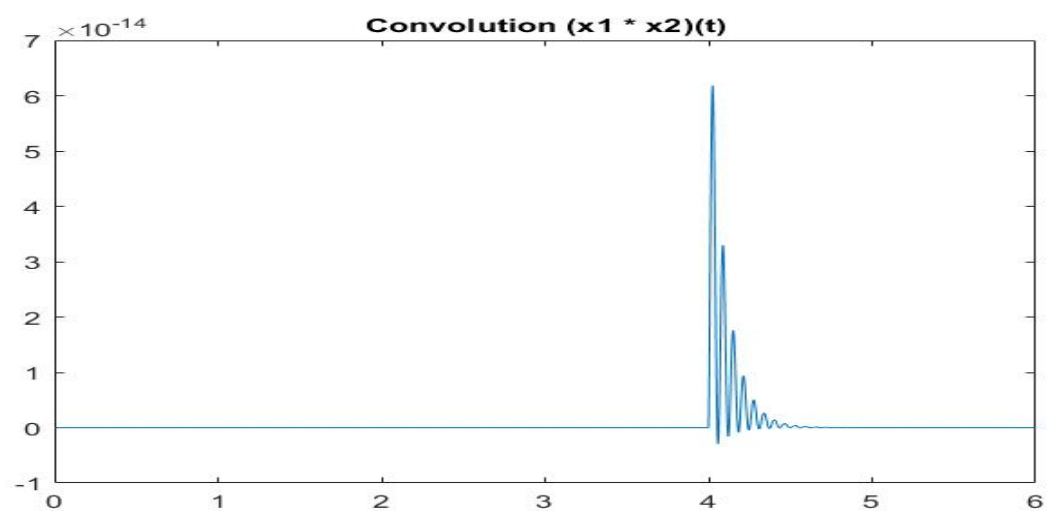
Plot:

Step Response

Question 5:

Plot:

Code:

```
Editor - D:\University\signal\project\Q(5)\Untitled.m
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    t= 0:0.0001:3;
    x1=(10*exp(-10*t)).*rectpuls((t-4)/4);
    x2=(10*exp(-10*t)).*rectpuls((t-6)/8).*cos(100*t);
    my_conv=conv(x1,x2);
    t= 0:0.0001:6;
    plot(t,my_conv);
    title('Convolution (x1 * x2)(t)');
```
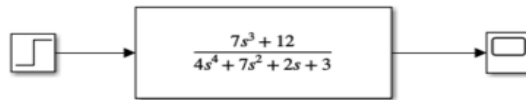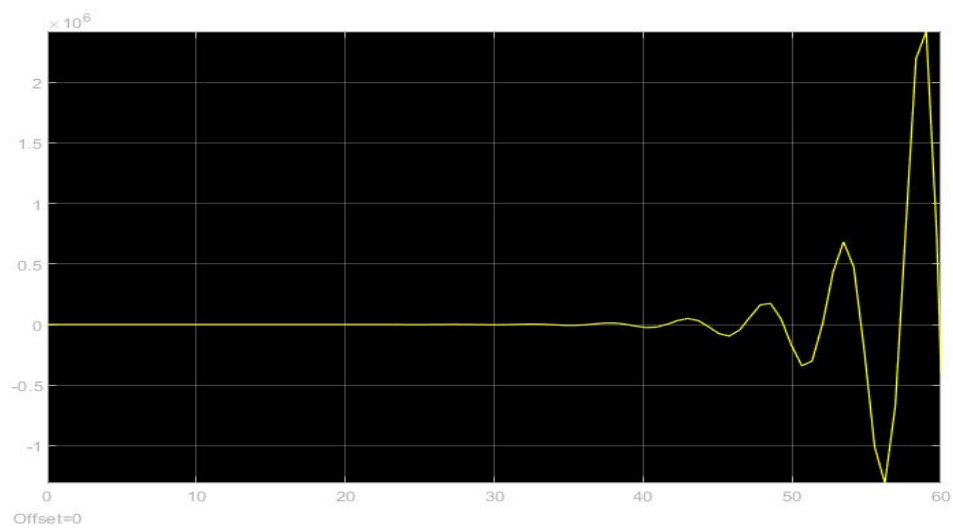
Plot:

Convolution (x1 * x2)(t)

Question 6:

Simulation:

$$\frac{7s^3 + 12}{4s^4 + 7s^2 + 2s + 3}$$

Plot:

Question 7:

Code:

```
Editor - D:\University\signal\project\Q(7)\Untitled2.m
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1    syms s;
2    numrtater=[1000 1000];
3    denumrater=[1 4 2];
4    hs= tf(numrtater,denumrater);
5    bode(hs);
6    grid on;
```

Command Window

```
hs =

  1000 s + 1000
  -------------
  s^2 + 4 s + 2

Continuous-time transfer function.
```

fx >>

Plot:

Bode Diagram