Faculty of Engineering & Technology

Electrical & Computer Engineering Department

Signals & Systems

ENEE2313

Report

MATLAB Assignment

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Instructor : **Dr. Mahran Quraan**

Section : 1

Date : 17/08/2024

Question 1: Generate and plot the following signals using MATLAB :

1. $x_1(t) = 5\sin(100\pi t)$

Code :

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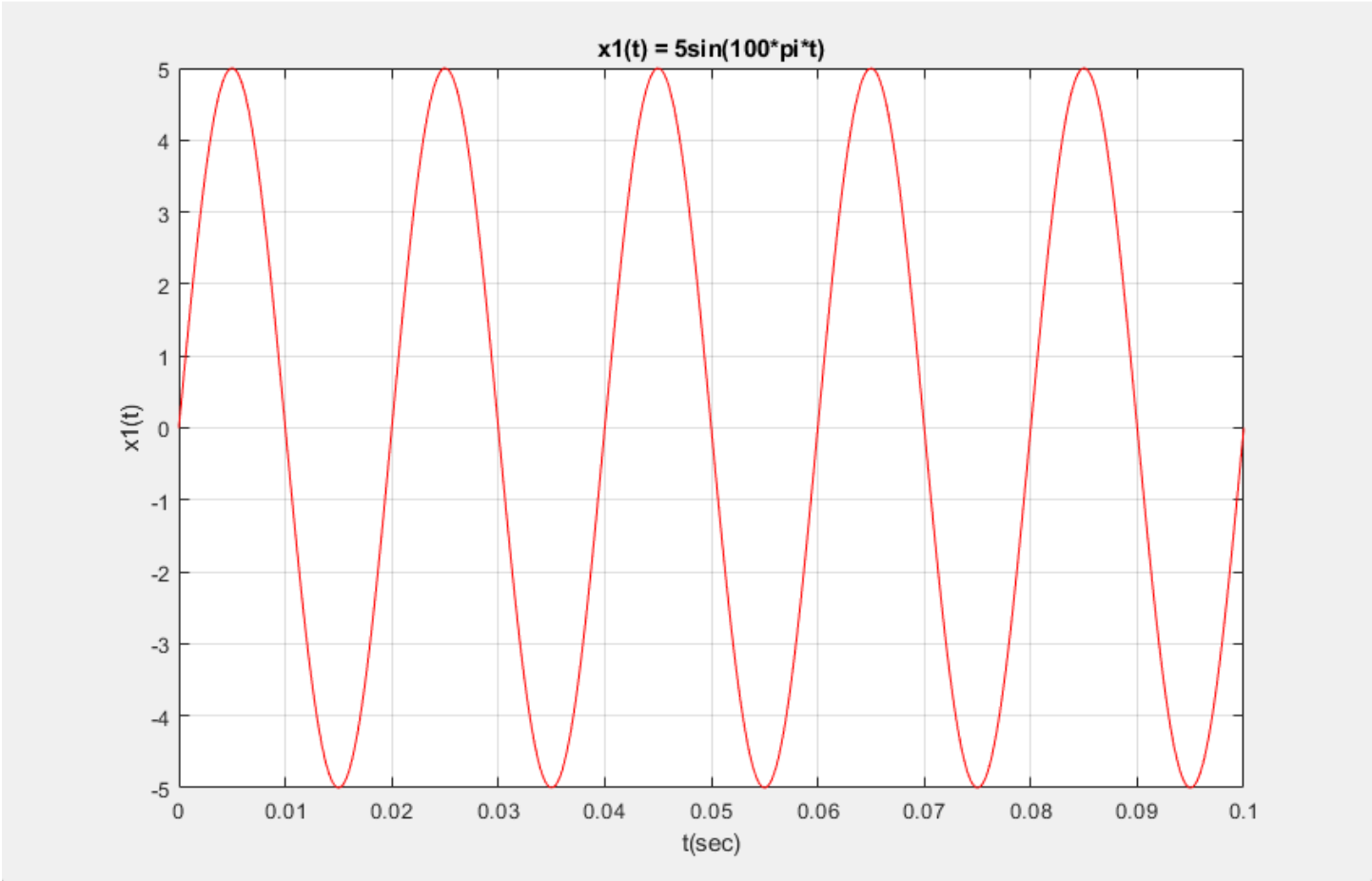
Q1_1.m

```
%Mohammed Saada
%1221972
t = 0: 0.0001:0.1;
xl = 5*sin(100*pi*t);
plot(t,xl,'r');
xlabel('t(sec)');
ylabel('xl(t)');
title('xl(t) = 5sin(100*pi*t)');
grid on;
```

Simulation :



$2.\ x_2(t) = 5\sin(100\pi t) + 3\cos(300\pi t)$

Code :

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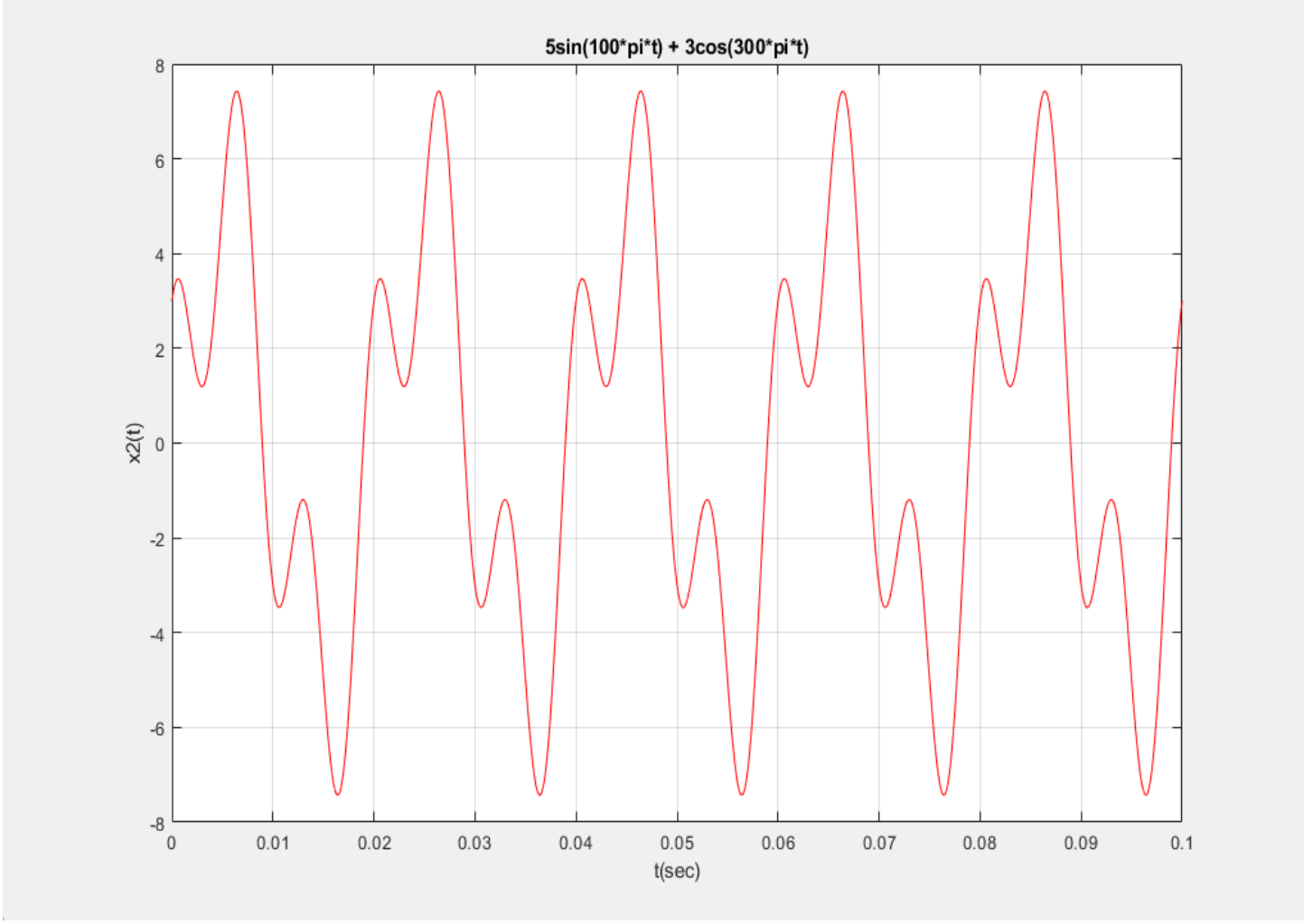
Q1_2.m

```
%Mohammed Saada
%1221972
t = 0: 0.0001:0.1;
x2 = 5*sin(100*pi*t) + 3*cos(300*pi*t);
plot(t,x2,'r');
xlabel('t(sec)');
ylabel('x2(t)');
title('5sin(100*pi*t) + 3cos(300*pi*t)');
grid on;
```

Simulation :



3. $x_3(t) = \pi(0.25t - 0.75) + \pi(0.5t - 1.5)$ in the time interval [0,5].

Code :

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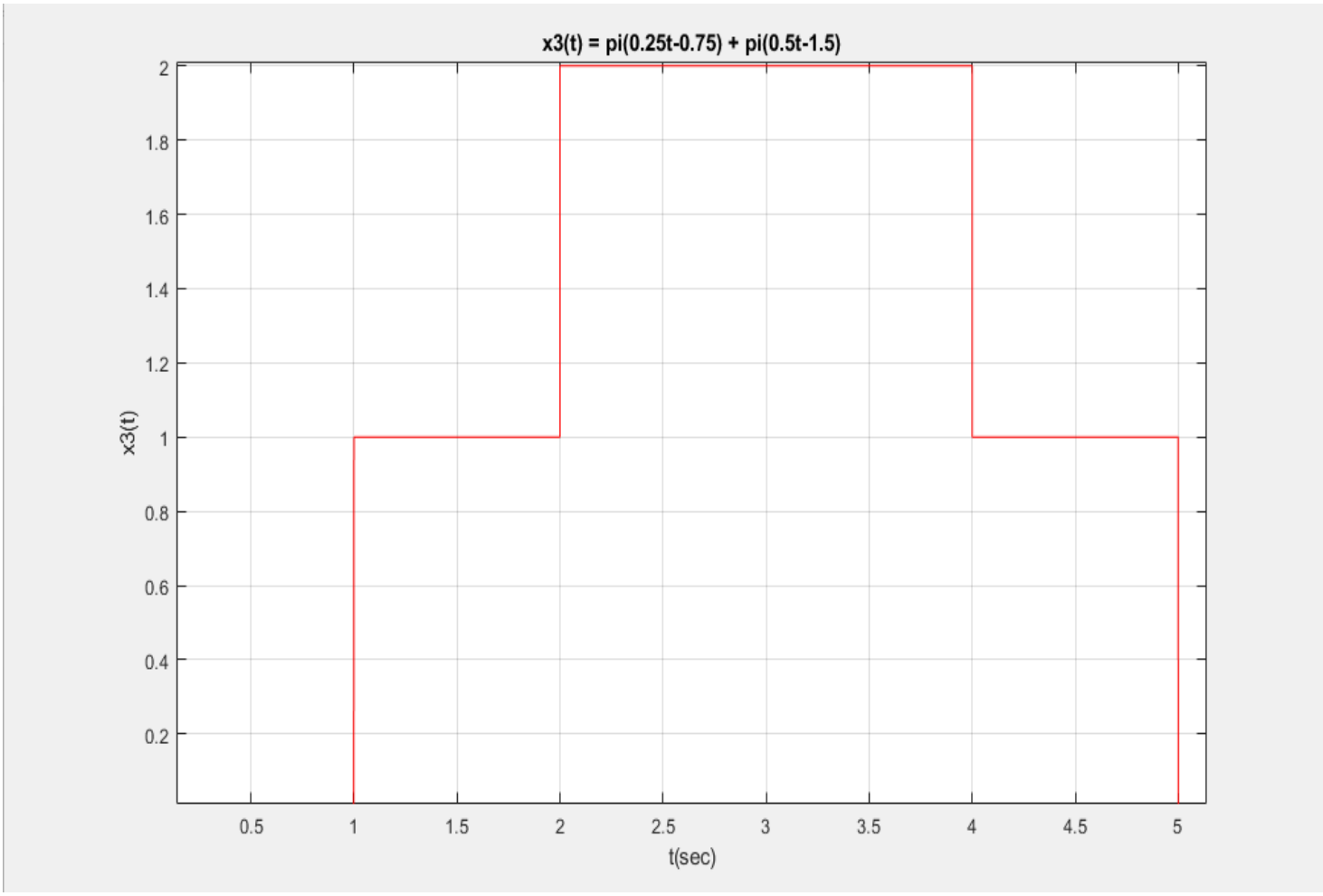
Q1_3.m

```
%Mohammed Saada
%1221972
t = 0: 0.0001:5;
f1 = rectpuls((t-3)/4);
f2 = rectpuls((t-3)/2);
x3 = f1 + f2;
plot(t,x3,'r');
xlabel('t(sec)');
ylabel('x3(t)');
title('x3(t) = pi(0.25t-0.75) + pi(0.5t-1.5)');
grid on;
```

Simulation :



4. $x_4(t) = 2u(t) - 2r(t) + 4u(t-2) + 2r(t-2) - 2u(t-3)$ in the time interval [-4,4].

Code :

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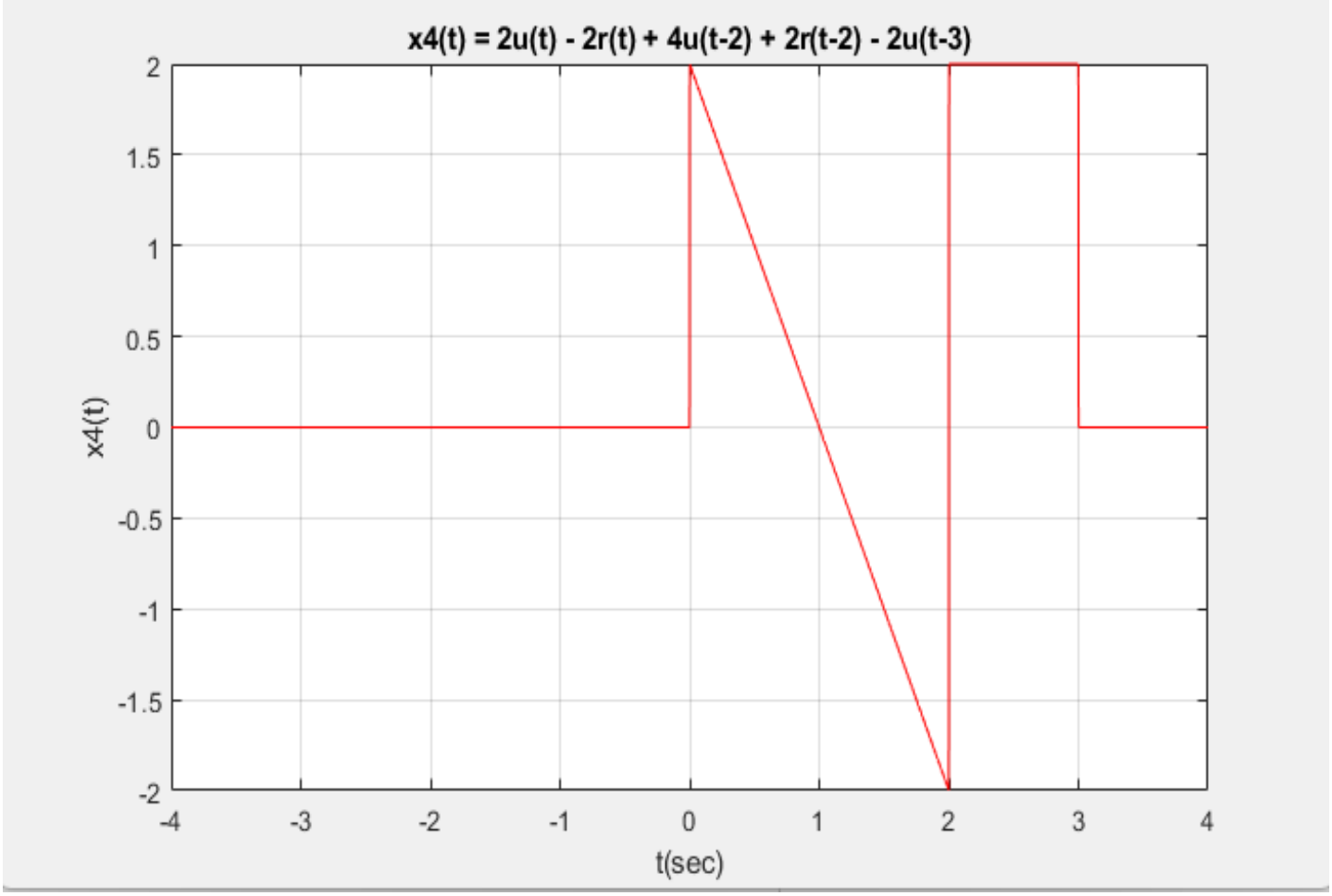
Q1_4.m

```
%Mohammed Saada
%1221972
t = -4:0.001:4;
f1 = 2 * heaviside(t);
f2 = 2 * t.*heaviside(t);
f3 = 4 * heaviside(t-2);
f4 = 2 *(t-2).*heaviside(t-2);
f5 = 2 * heaviside(t-3);
x4 = f1 - f2 + f3 + f4 - f5;
plot(t,x4,'r');
xlabel('t(sec)');
ylabel('x4(t)');
title('x4(t) = 2u(t) - 2r(t) + 4u(t-2) + 2r(t-2) - 2u(t-3)');
grid on;
```

Simulation :



Question 2: Write the MATLAB scripts that solve the following differential equation using zero initial conditions.

$$\mathbf{0.001}\frac{\boldsymbol{dy(t)}}{\boldsymbol{dt}}\mathbf{+2}\boldsymbol{y(t)}\mathbf{=5}\boldsymbol{cos(1000t)}$$

MATLAB Code :

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Q2.m

```
% Mohammed Saada
% 1221972

clc;
clear all;

syms y(t);
dy(t) = diff(y(t),t);
Equation = 0.001*dy(t) + 2*y(t) == 5*cos(1000*t);
initial = y(0)==0;

solution = dsolve(Equation,initial)
```

Solution :

Command Window

```
solution =

5^(1/2)*cos(1000*t - atan(1/2)) - 2*exp(-2000*t)

>>
```

Question 3: Use Simulink (MATLAB) to simulate the following System then show and plot the impulse and step responses of the system.

$$\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = 2x(t)$$

Separate and Inegrate :

$$\boldsymbol{y'' + 2y' = 2x - y = \ q_0}$$

Integrate both sides:

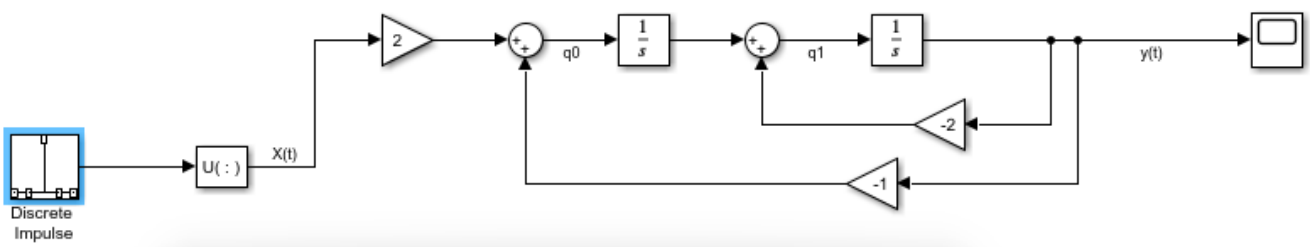
$$\boldsymbol{y' + 2y = \int q_0}$$

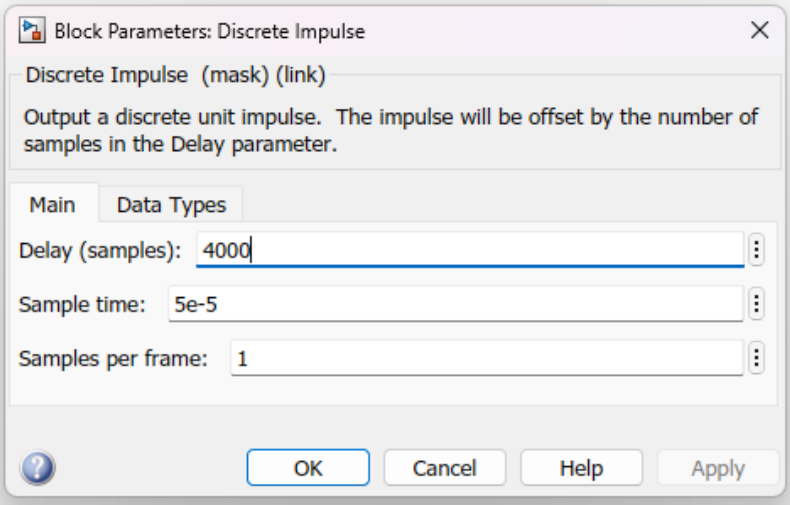
$$\boldsymbol{y' = \int q_0 - 2y = \ q_1}$$

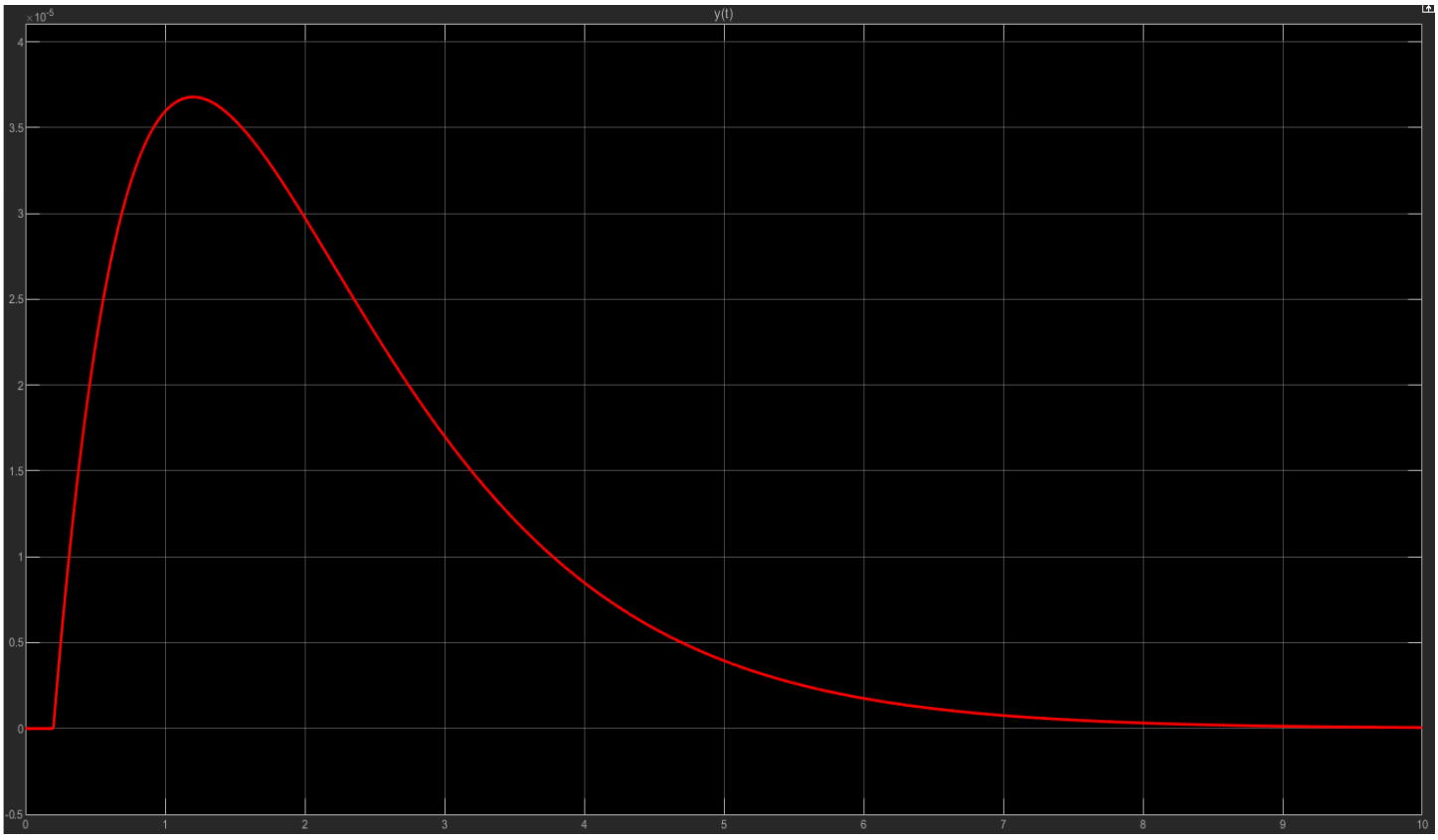
Integrate both sides:

$$\boldsymbol{y = \int q1}$$

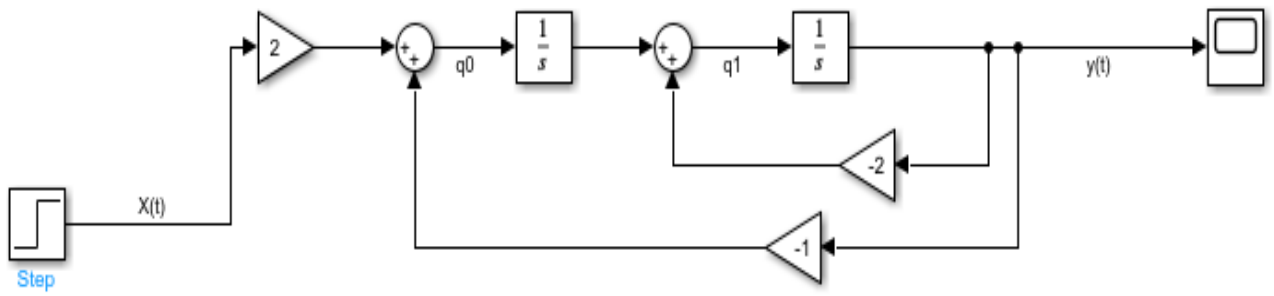
Impulse Response :

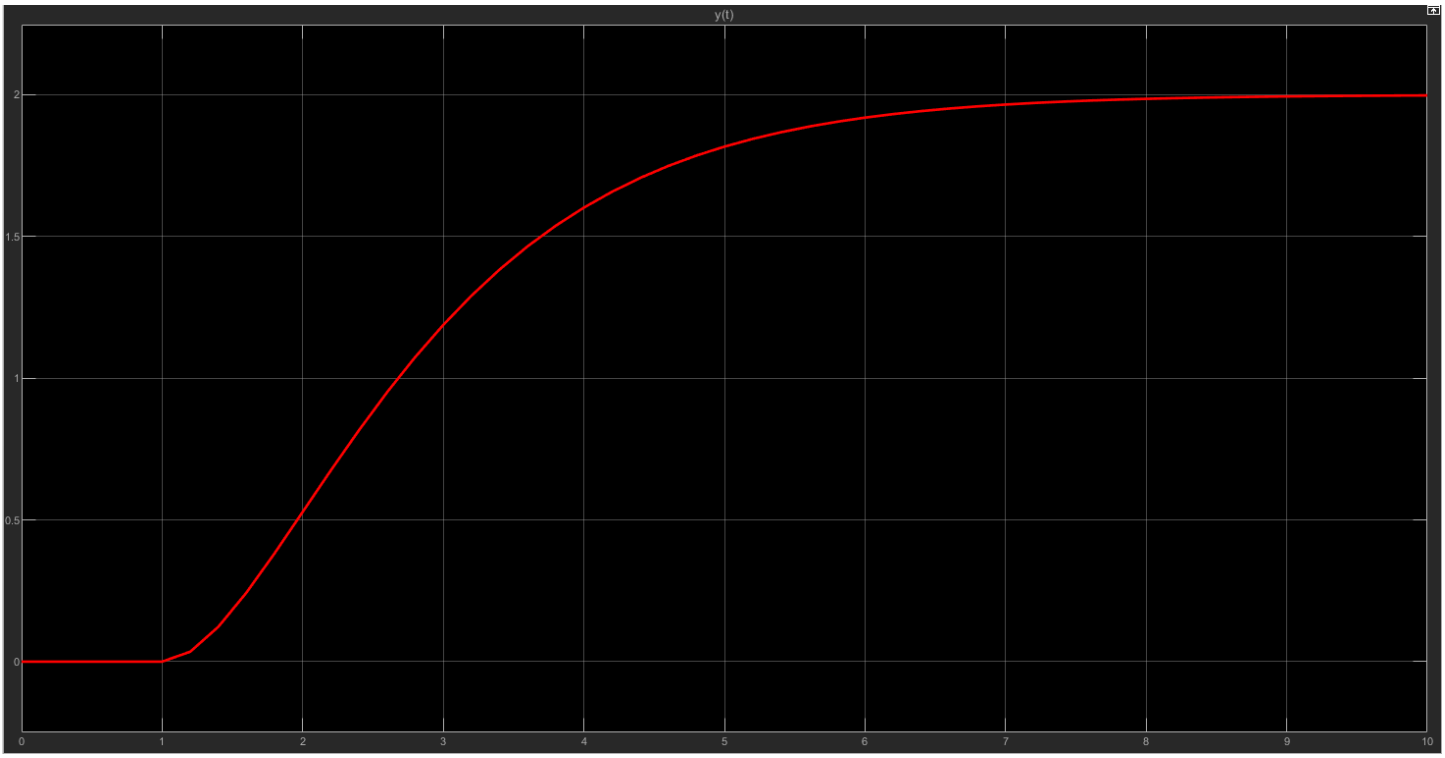






Step Response :





Question 4: Write a program that computes and plots the convolution $(x_1(t) * x_2(t))$ of the functions:

$$x_1(t) = \pi\left(\frac{1}{2}t - 2\right) \qquad x_2(t) = e^{-t}u(t-2)$$

Code :

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Q4.m

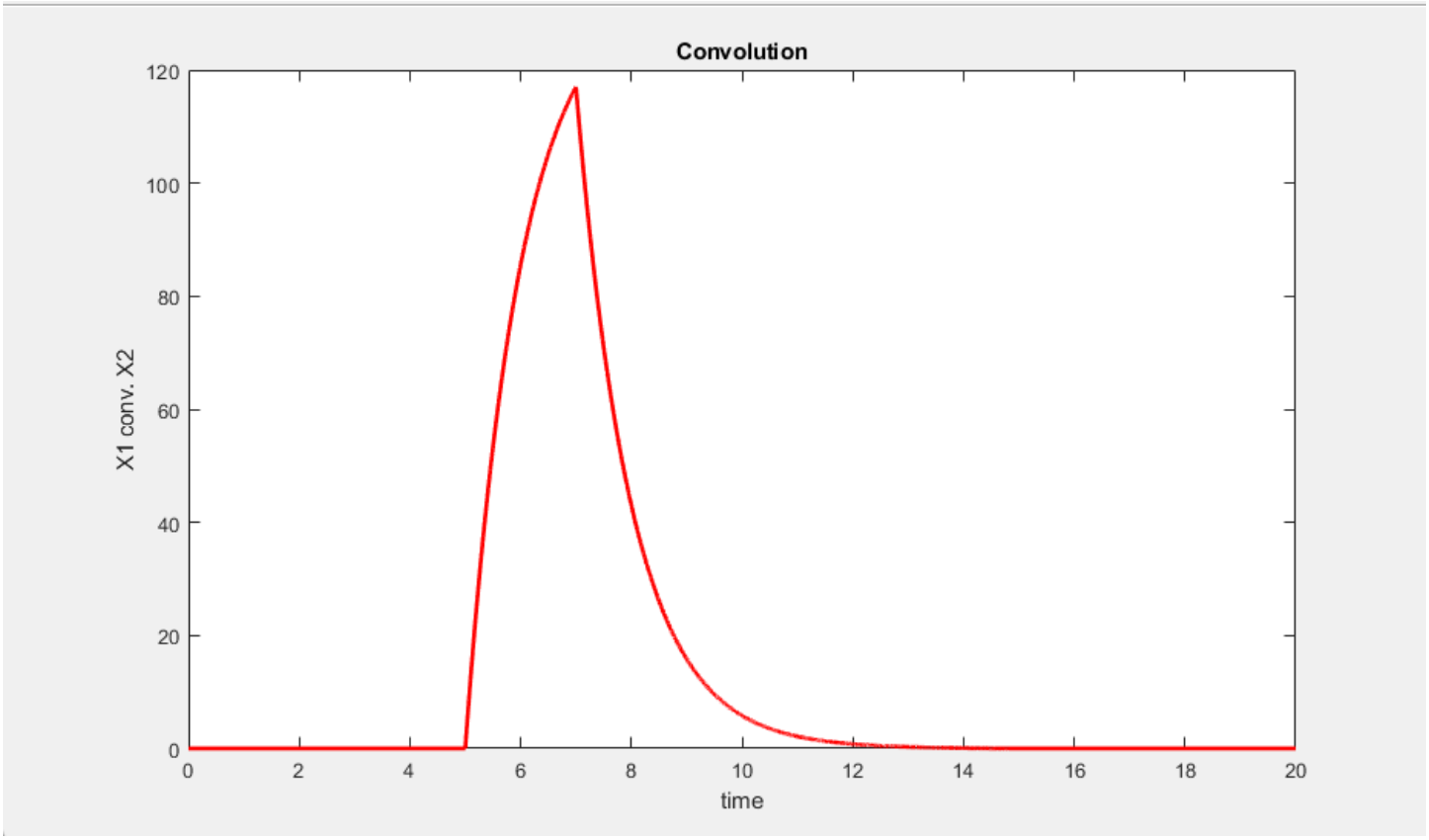
```
% Mohammed Saada
% 1221972

clc;
clear all;
t=0:0.001:10;
x1 = rectpuls(0.5*t-2);
x2 = exp(-t).*heaviside(t-2);

res = conv(x1,x2);
t=0:0.001:20;
plot(t,res,'r','LineWidth',2);
xlabel('time');
ylabel('X1 conv. X2');
title('Convolution');

```

Simulation :



Question 5: Plot the frequency response (semi-log scale) of a system with the following transfer function:

$$H(s) = 10000\frac{s+1}{s^2+4s+2}$$

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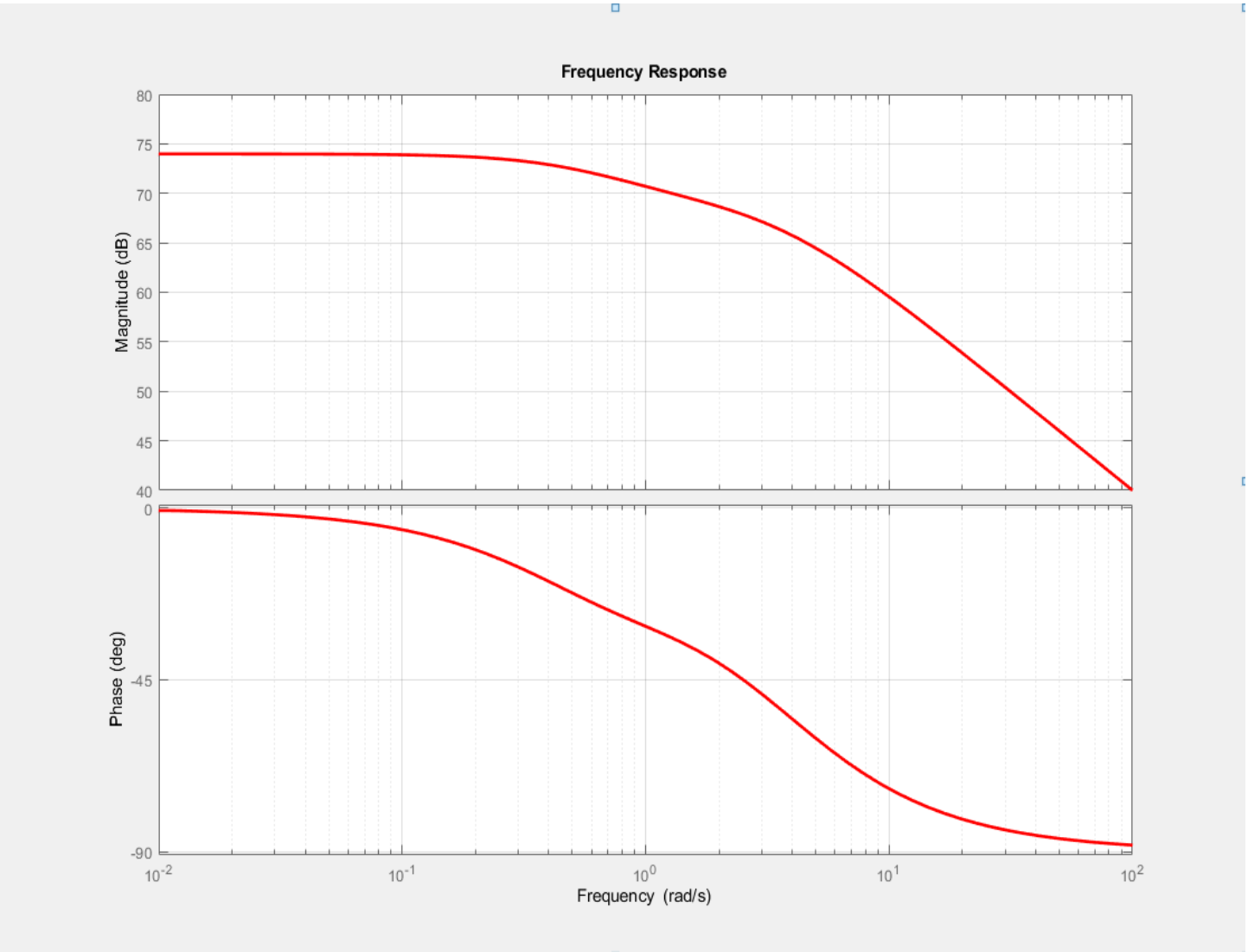
Q5.m

```
% Mohammed Saada
%1221972

clc;
clear all;

syms s;
Y = [10000 10000];
X = [1 4 2];

H = tf(Y,X);

bode(H,'r');
grid on;
title('Frequency Response');
```

Simulation :



Thank You