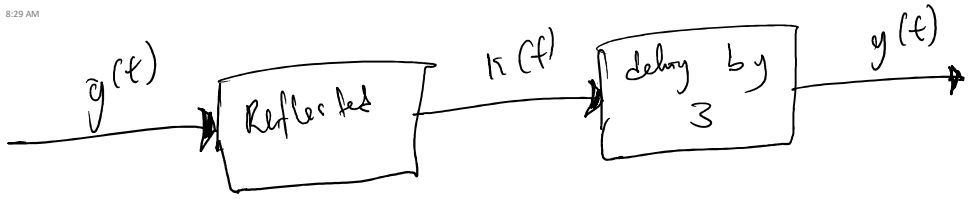
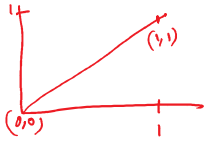
1a

Wednesday, October 25, 2023 8:29 AM





$g(t) = mt + b$

$b = 0$

$m = \frac{1-0}{1-0} = 1$

$g(t) = t$

$g(t)$ reflected $= k(t)$

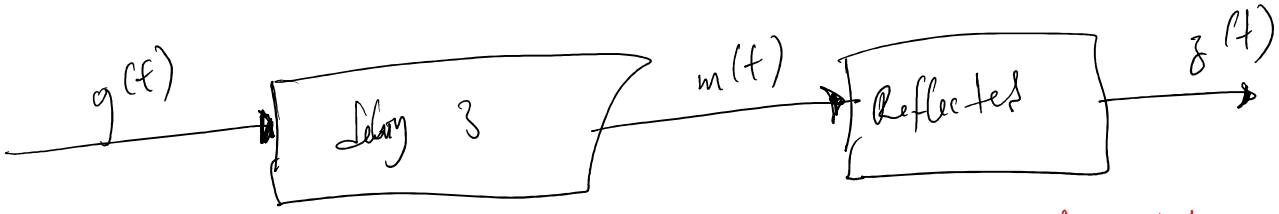
$k(t) = g(-t)$ Ans

$k(t)$ delay $= y(t)$

delay $= 3$

$y(t) = k(t+3)$ Ans

Check matlab for plots



$g(t) = t$

$g(t)$ delay by $3 = m(t)$

$m(t) = g(t+3)$

$m(t) = t+3$ Ans

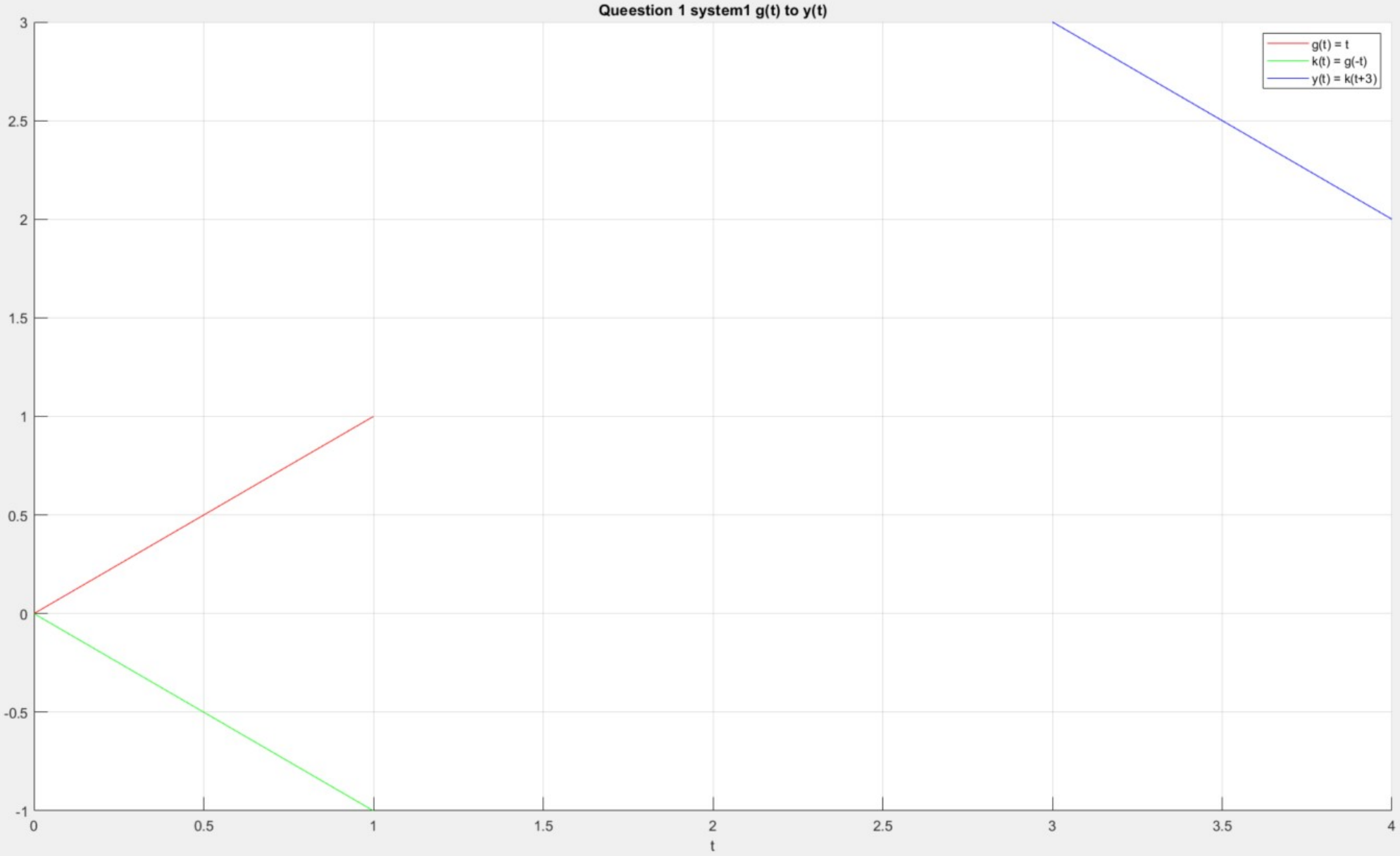
$m(t)$ reflected by $z(t)$

$z(t) = m(-t)$

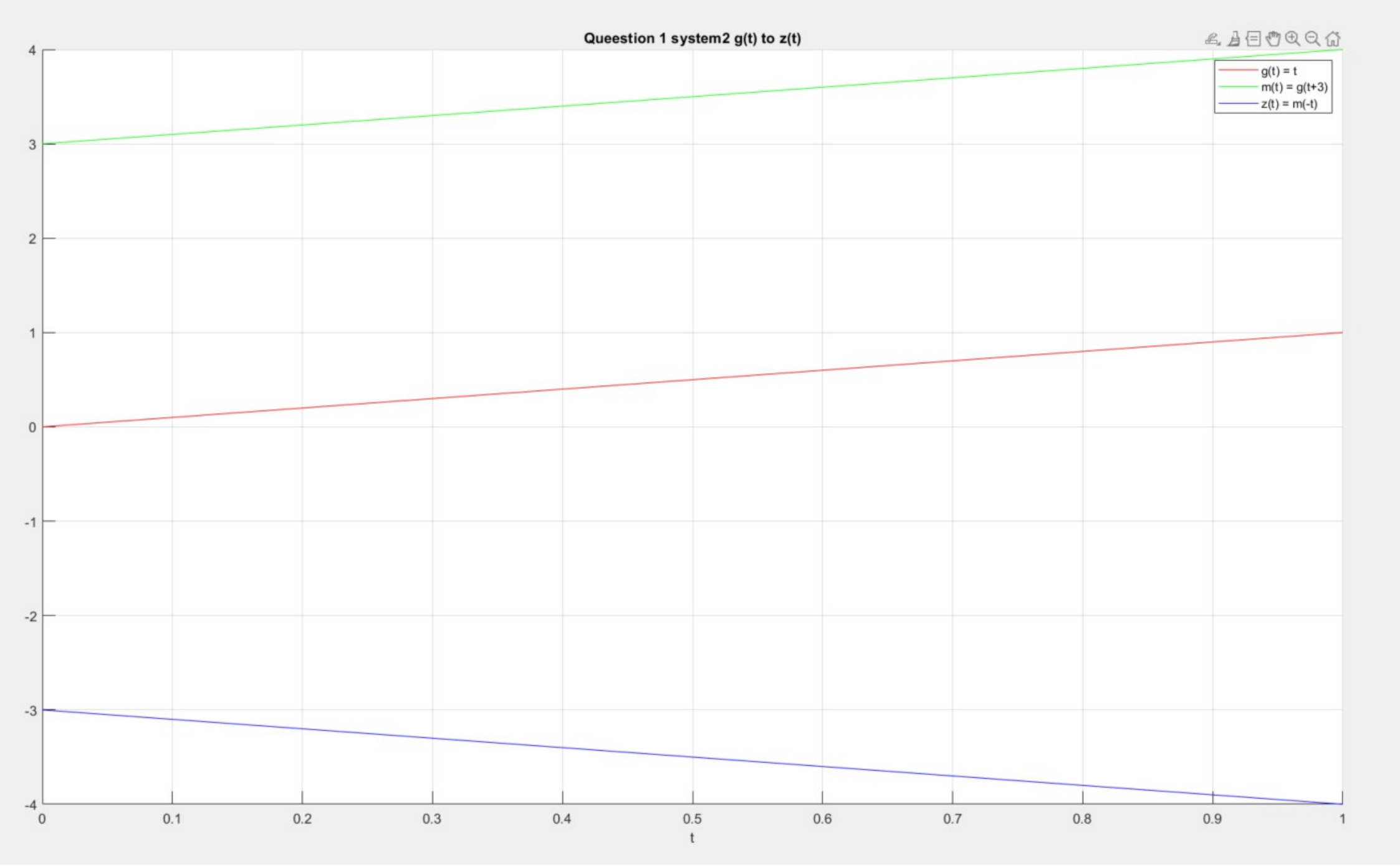
$z(t) = -t-3$ Ans

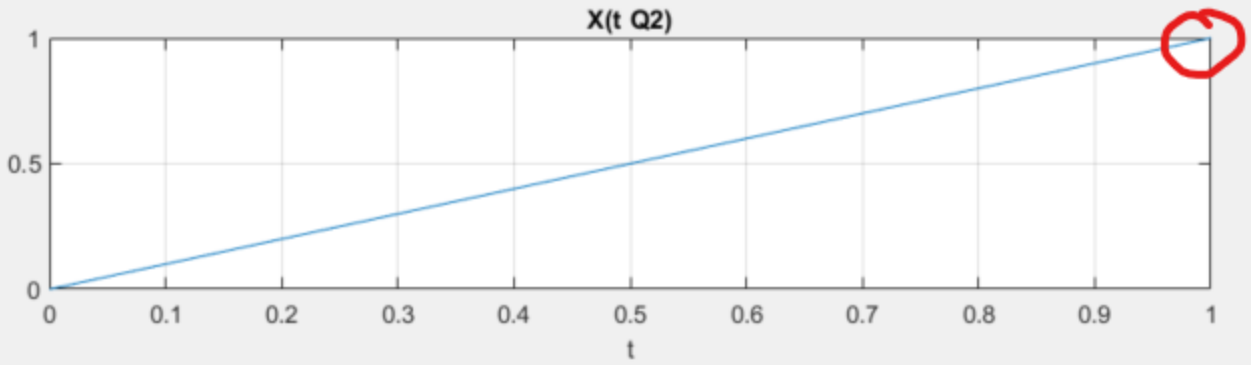
```
>> %% ********** Q1 *********
t= 0:1;
g_t = t
k_t = -t
y_t = k_t+3
hold on
plot(t,g_t,'r')
plot(t,k_t,'g')
plot(t+3,y_t,'b')
hold off
title('Queestion 1 system1 g(t) to y(t)');
xlabel('t');
legend('g(t) = t','k(t) = g(-t)','y(t) = k(t+3)');
grid on;
```

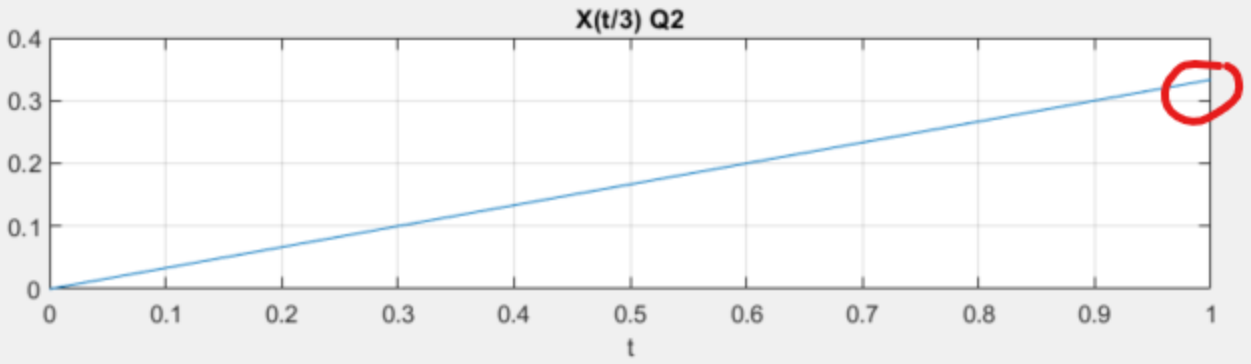
```
g_t =

     0     1


k_t =

     0    -1


y_t =

     3     2

>>
```


Queestion 1 system1 g(t) to y(t)
g(t) = t
k(t) = g(-t)
y(t) = k(t+3)
3
2.5
2
1.5
1
0.5
0
-0.5
-1
0
0.5
1
1.5
2
2.5
3
3.5
4
t

```
>> %% *********** Q1a *********
t= 0:1;
g_t = t
m_t = g_t+3
z_t = -m_t
hold on
plot(t,g_t,'r')
plot(t,m_t,'g')
plot(t,z_t,'b')
hold off
title('Queestion 1 system2 g(t) to z(t)');
xlabel('t');
legend('g(t) = t','m(t) = g(t+3)','z(t) = m(-t)');
grid on;

g_t =

     0     1


m_t =

     3     4


z_t =

    -3    -4

>>
```


Queestion 1 system2 g(t) to z(t)
g(t) = t
m(t) = g(t+3)
z(t) = m(-t)
4
3
2
1
0
-1
-2
-3
-4
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
t



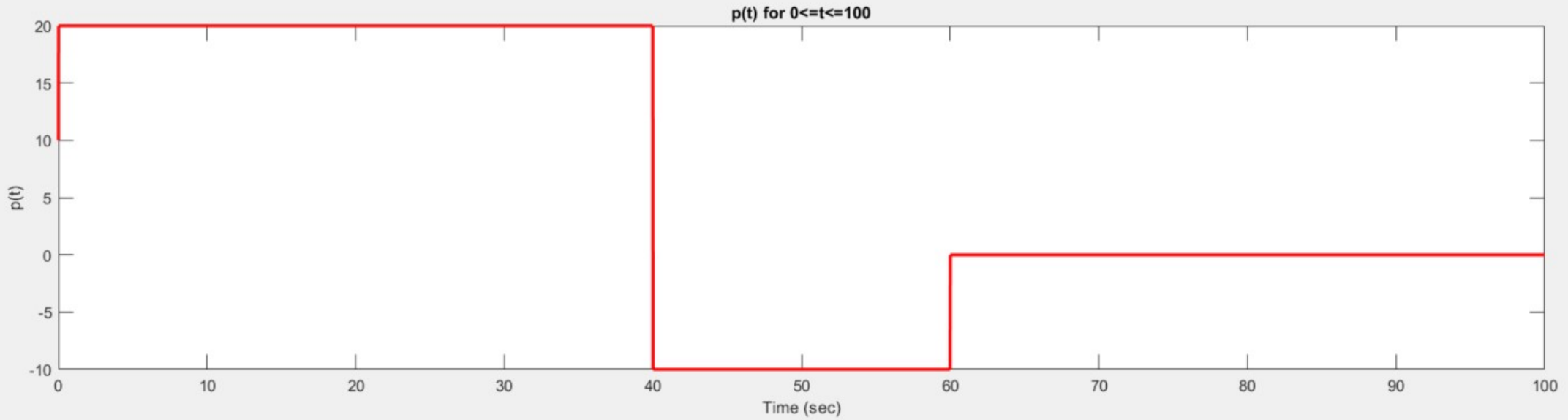


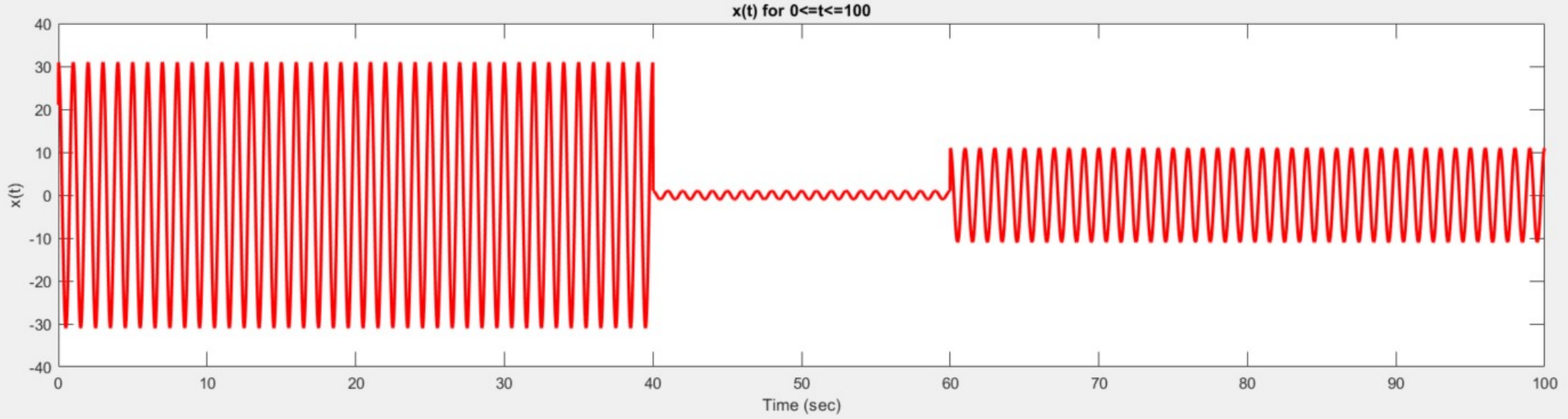
Command Window

```
>> %% ********** Q2 *********
t = 0:0.1:1;
x_t = t;
x_t3 = t/3;
subplot(2,1,1)
plot(t,x_t);
title('X(t Q2)');
xlabel('t');
grid on;
subplot(2,1,2)
plot(t,x_t3);
title('X(t/3) Q2');
xlabel('t');
grid on;

% x(t) is compressed by 1/3 on the y-axis
```

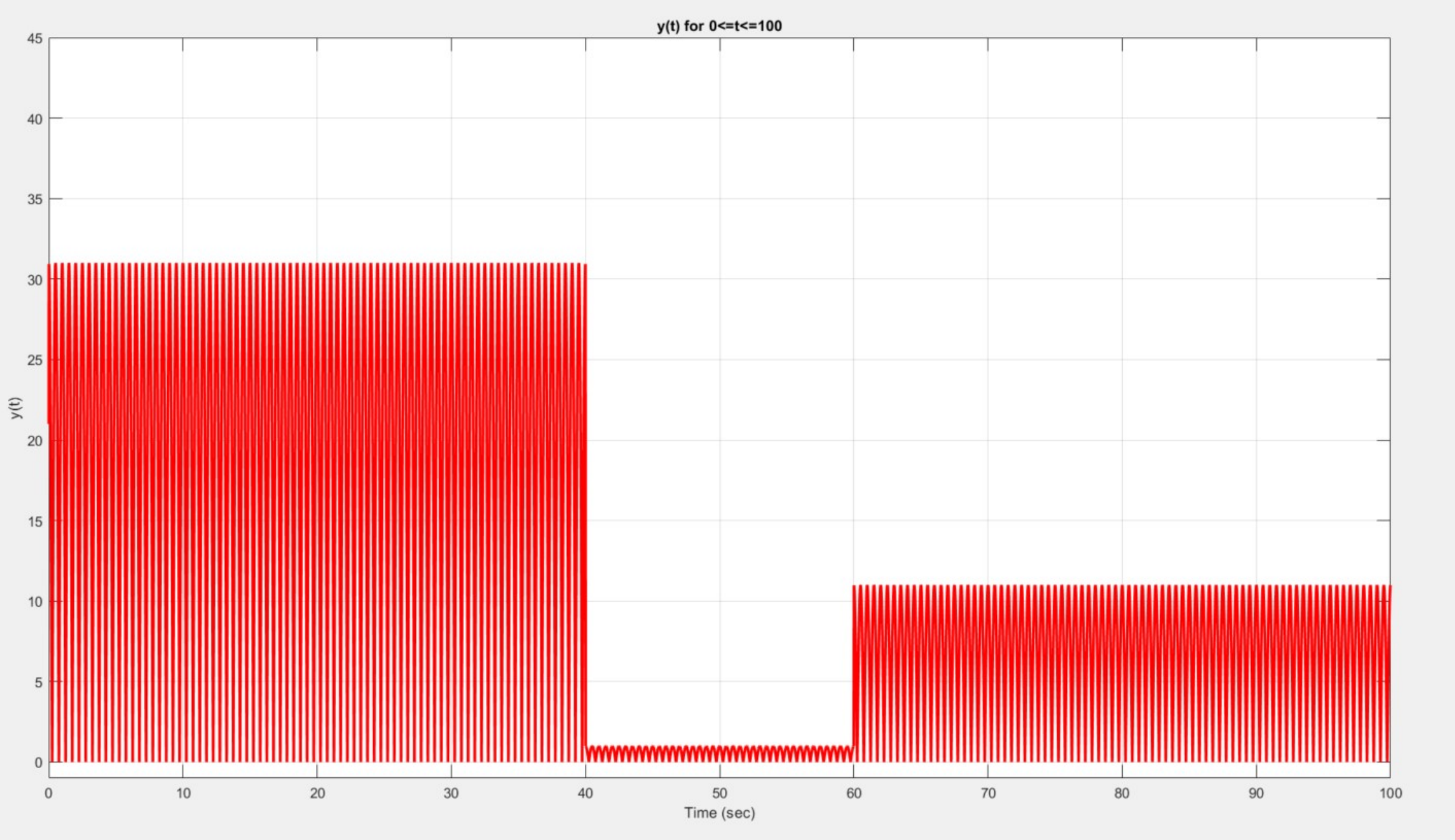
```
>> %% ********** Q3 x(t) & p(t) *********
syms t s;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t))
x_t = (p_t + P)*cos(2*pi*t)
subplot(2,1,1)
fplot(p_t,[0,100],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("p(t)");
title("p(t) for 0<=t<=100");

subplot(2,1,2)
fplot(x_t,[0,100],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("x(t)");
title("x(t) for 0<=t<=100");
```

```
P =

(11*abs(10*heaviside(t - 60) - 30*heaviside(t - 40) + 20*heaviside(t)))/10


x_t =

cos(2*pi*t)*((11*abs(10*heaviside(t - 60) - 30*heaviside(t - 40) + 20*heaviside(t))) ↙
/10 - 30*heaviside(t - 40) + 10*heaviside(t - 60) + 20*heaviside(t))

>>
```

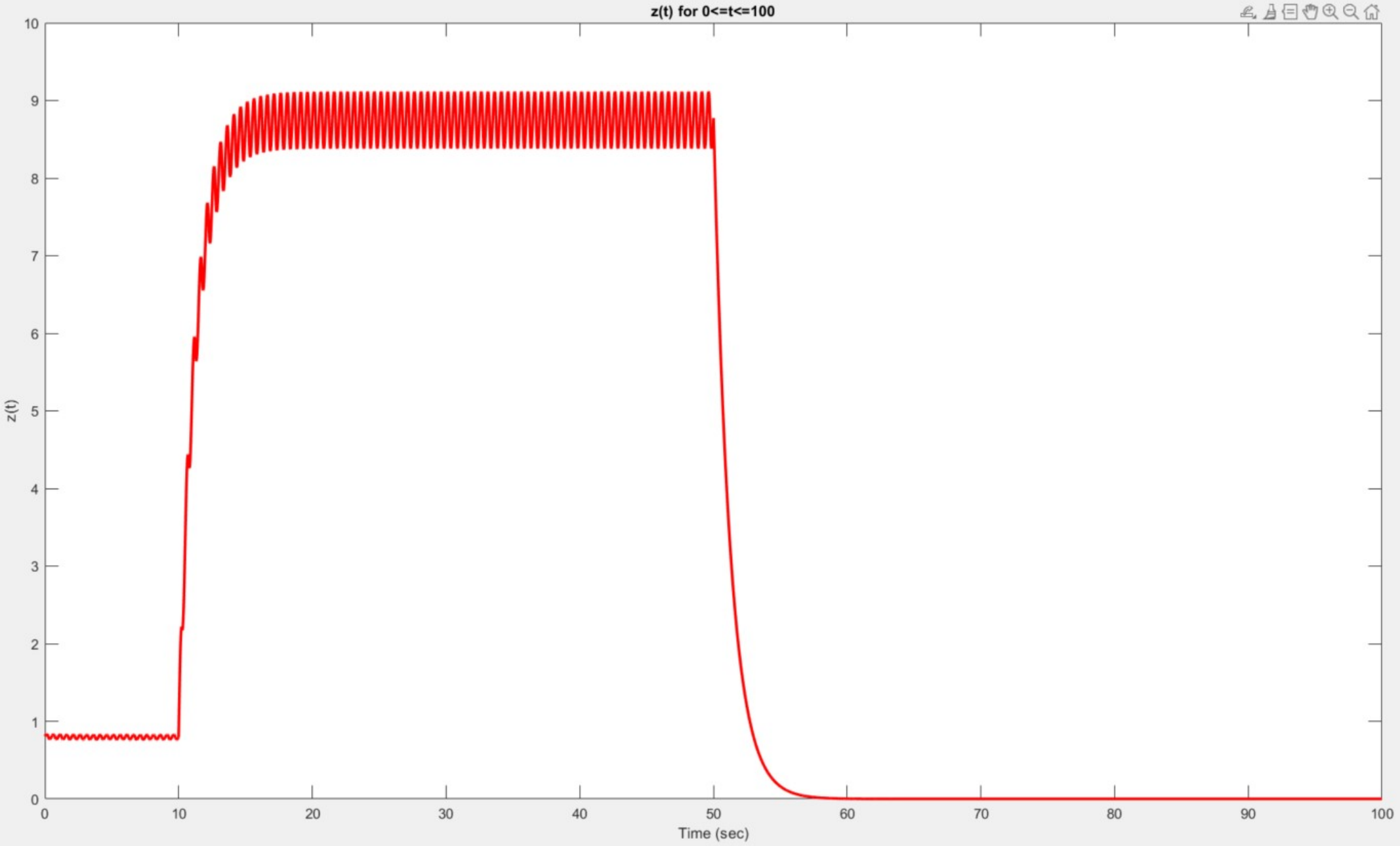

p(t) for 0<=t<=100
p(t)
Time (sec)
20
15
10
5
0
-5
-10
0
10
20
30
40
50
60
70
80
90
100


x(t) for 0<=t<=100
x(t)
Time (sec)
40
30
20
10
0
-10
-20
-30
-40
0
10
20
30
40
50
60
70
80
90
100

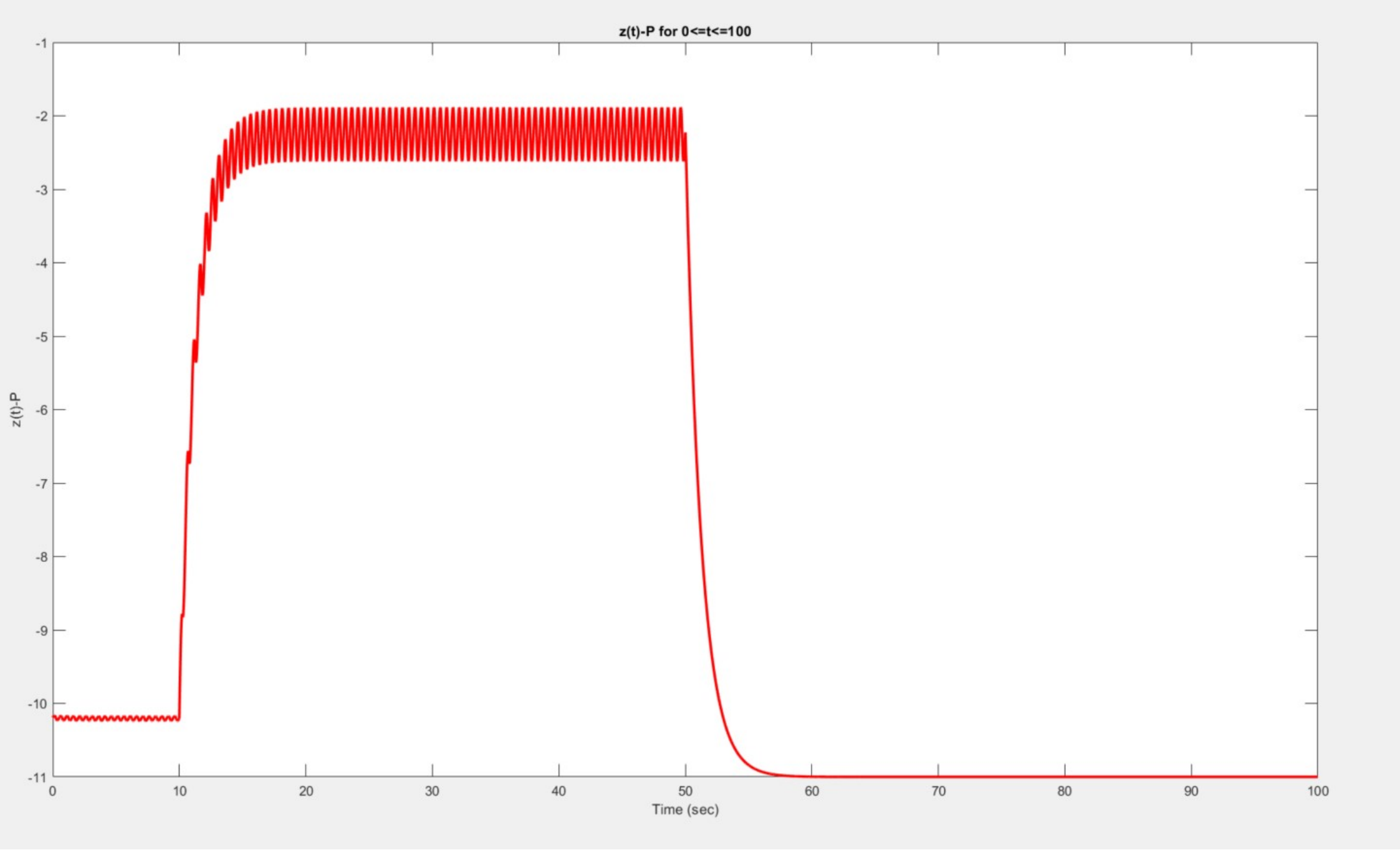
```
>> %% ********** Q3 y(t) *********
syms t s;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t))
x_t = (p_t + P)*cos(2*pi*t)
y_t = abs(x_t)
fplot(y_t,[0,100],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("y(t)");
title("y(t) for 0<=t<=100");
ylim([-1,45]) % assign limits to y axis

P =

(11*abs(10*heaviside(t - 60) - 30*heaviside(t - 40) + 20*heaviside(t)))/10


x_t =

cos(2*pi*t)*((11*abs(10*heaviside(t - 60) - 30*heaviside(t - 40) + 20*heaviside(t))) ↙
/10 - 30*heaviside(t - 40) + 10*heaviside(t - 60) + 20*heaviside(t))

y_t =

abs(cos(2*pi*t))*((11*abs(10*heaviside(t - 60) - 30*heaviside(t - 40) + 20*heaviside ↙
(t)))/10 - 30*heaviside(t - 40) + 10*heaviside(t - 60) + 20*heaviside(t))

>>
```


y(t) for 0<=t<=100
y(t)
Time (sec)
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70
80
90
100

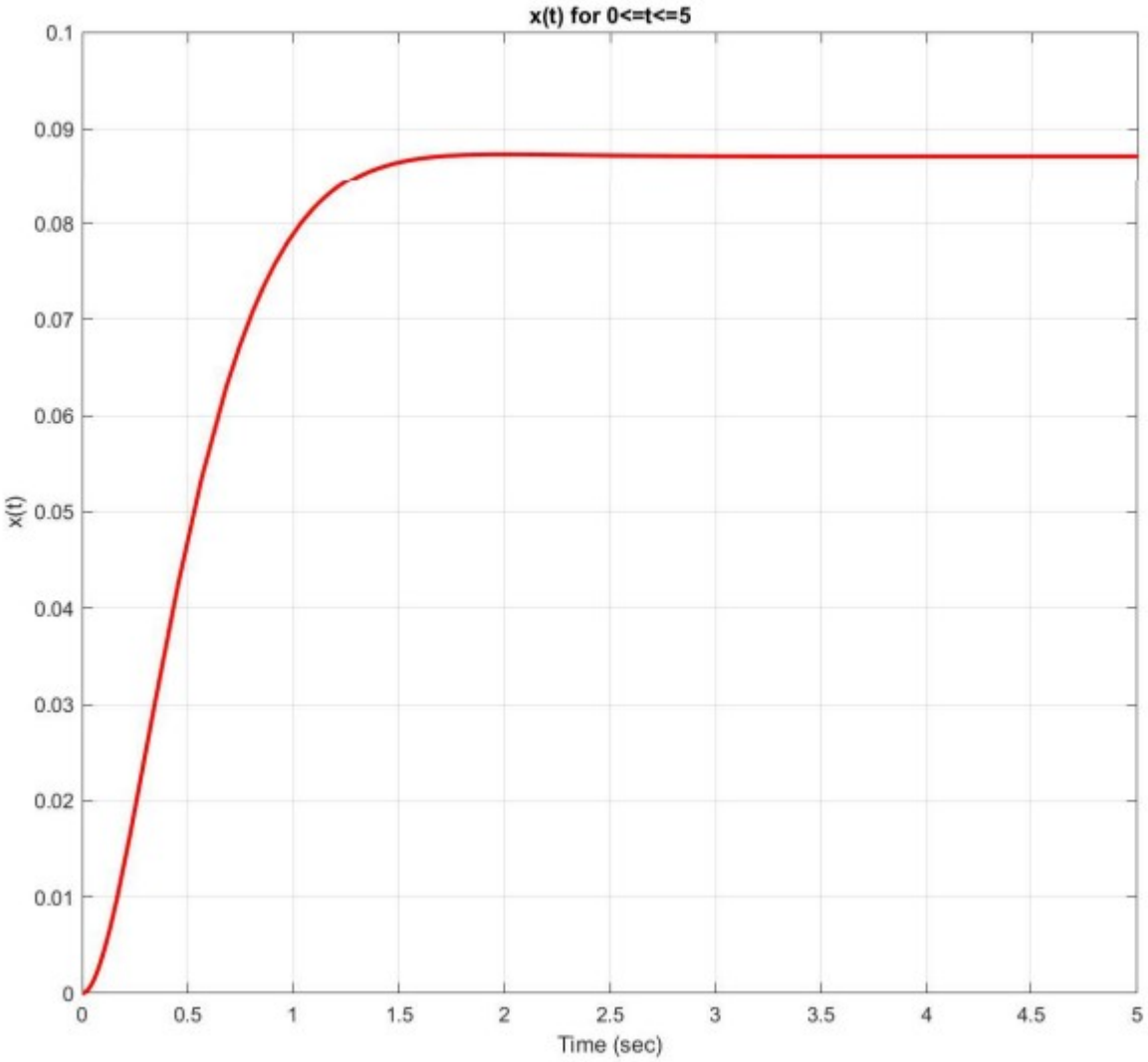
```
>> %% ********** Q3 z(t) *********
clear;
clc;
t = 0:0.01:100;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t));
x_t = (p_t + P).*cos(2.*pi.*t);
y = abs(x_t);
T_s = 0.01;
h = exp(-0.8.*t).*heaviside(t)
% i wil be using the Transfer function with Laplace for Low Pass (z(t)

z_t = conv(y,h,'same')*T_s;
disp(z_t)
plot(t,z_t,'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("z(t)");
title("z(t) for 0<=t<=100");
```


z(t) for 0<=t<=100
z(t)
Time (sec)
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60
70
80
90
100

```
>> %% ********** Q3 z(t)-P *********
clear;
clc;
t = 0:0.01:100;
p_t = 20*(heaviside(t) - heaviside(t-40)) - 10*(heaviside(t-40)-heaviside(t-60));
P = 1.1*abs(min(p_t));
x_t = (p_t + P).*cos(2.*pi.*t);
y = abs(x_t);
T_s = 0.01;
h = exp(-0.8.*t).*heaviside(t)
% i wil be using the Transfer function with Laplace for Low Pass (z(t)

z_t = conv(y,h,'same')*T_s;
z_p = z_t - P
plot(t,z_p,'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("z(t)-P");
title("z(t)-P for 0<=t<=100");
```


z(t)-P for 0<=t<=100
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
z(t)-P
0
10
20
30
40
50
60
70
80
90
100
Time (sec)

```
>> %% ********** Q4 **********
syms t s;
m = pi/2
X_s = 1 / ((s+3-j*(m))*(s+3+j*(m))*(s));
x_t = ilaplace(X_s)
fplot(x_t,[0,5],'r',"LineWidth",2); % Plot x(t) as a function plot
xlabel('Time (sec)');
ylabel("x(t)");
title("x(t) for 0<=t<=5");
ylim([0,0.1]) % assign limits to y axis
grid on;

m =

    1.5708

x_t =

- 4/((- 6 + pi*1i)*(6 + pi*1i)) - (exp((t*(- 6 + pi*1i))/2)*2i)/(pi*(- 6 + pi*1i)) - ↙
(exp(-(t*(6 + pi*1i))/2)*2i)/(pi*(6 + pi*1i))

>>
```


x(t) for 0<=t<=5
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
x(t)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Time (sec)

Q5

Wednesday, October 25, 2023 6:28 AM

$$y''(t) + 0.5y'(t) + 0.15y(t) = x(t)$$

$$\mathcal{L}\{y''(t)\} + 0.5\mathcal{L}\{y'(t)\} + 0.15\mathcal{L}\{y(t)\} = \mathcal{L}\{u(t)\}$$

$$s^2Y(s) - s\,y(0) - y'(0) + 0.5\left(sY(s) - y(0)\right) + 0.15\,Y(s) = \frac{1}{s}$$

$$s^2Y(s) - s - 1 + 0.5sY(s) - 0.5 + 0.15Y(s) = \frac{1}{s}$$

$$Y(s)\left(s^2 + 0.5s + 0.15\right) - s - 1 - 0.5 = \frac{1}{s}$$

$$Y(s)\left(s^2 + 0.5s + 0.15\right) = \frac{1}{s} + s + 1.5$$

$$Y(s) = \frac{1 + s^2 + 1.5s}{s\left(s^2 + 0.5s + 0.15\right)}$$

Ans

When input is $x(t) = 2u(t)$

$$Y(s) = \left(\frac{2}{s} + s + 1.5\right) \Big/ \left(s^2 + 0.5s + 0.15\right)$$

$$Y(s) = \frac{2 + s^2 + 1.5s}{s\left(s^2 + 0.5s + 0.15\right)}$$

Ans

```
>> %% ********** Q5 **********
syms t s;
%for input x(t) = u(t)
Y_s = (1/s + s + 0.5)/(s^2 +0.5*s+0.15);
y_t = ilaplace(Y_s)

%for input x(t) = 2u(t)
Y_s1 = (1/s + s + 0.5)/(s^2 +0.5*s+0.15);
y_t1 = ilaplace(Y_s1)
```

```
y_t =

20/3 - (17*exp(-t/4)*(cos((5^(1/2)*7^(1/2)*t)/20) + (5^(1/2)*7^(1/2)*sin((5^(1/2)*7^ ↙
(1/2)*t)/20))/7))/3


y_t1 =

20/3 - (17*exp(-t/4)*(cos((5^(1/2)*7^(1/2)*t)/20) + (5^(1/2)*7^(1/2)*sin((5^(1/2)*7^ ↙
(1/2)*t)/20))/7))/3

>>
```