Homework 4

Problem 4.1

```
clc;
clear;


% a ------------------------------------------------------------------------

% Define the values of n for which you want to calculate γ[n]
n_alpha_a = -2:1;
n_beta_a = 0:4;


% origin offset of each function
origin_alpha_a = 3;                                                    % n=0 is
the third index
origin_beta_a = 1;                                                     % n=0 is
the first index


% Define the first pair of α[n] and β[n]
alpha_a = (-0.9).^(1 - n_alpha_a);
alpha_a(2) = 0;                                                        %
corrects n= -1
beta_a = cos(0.25 .* pi .* n_beta_a);
beta_a(1) = 0;


% Calculate γ[n] for the first pair
gamma_a = conv(alpha_a, beta_a);


% Calculate alignment for the graph
origin_gamma_a = origin_alpha_a + origin_beta_a - 1;
n_gamma_a = (0:length(gamma_a)-1)-(origin_gamma_a - 1);


% Plot the nonzero values of γ[n] vs. n for both pairs
figure;
plot(n_gamma_a, gamma_a);
title('Part A');
xlabel('n');
ylabel('γ[n]');
grid on;


% b ------------------------------------------------------------------------

% Define the values of n for which you want to calculate γ[n]
```

```
n_alpha_b = -1:3;
n_beta_b = 1:5;


% origin offset of each function
origin_alpha_b = 2;                                                    % n=0 is
the third index
origin_beta_b = -1;


% Define the second pair of α[n] and β[n]
alpha_b = 36 .^ (n_alpha_b / 2 - 1);
beta_b = (1 ./ (n_beta_b + 1));


% Calculate γ[n] for the first pair
gamma_b = conv(alpha_b, beta_b);


% Calculate alignment for the graph
origin_gamma_b = origin_alpha_b + origin_beta_b - 1;
n_gamma_b = (0:length(gamma_b)-1)-(origin_gamma_b - 1);


% Plot the nonzero values of γ[n] vs. n for both pairs
figure;
plot(n_gamma_b, gamma_b);
title('Part B');
xlabel('n');
ylabel('γ[n]');
grid on;
```

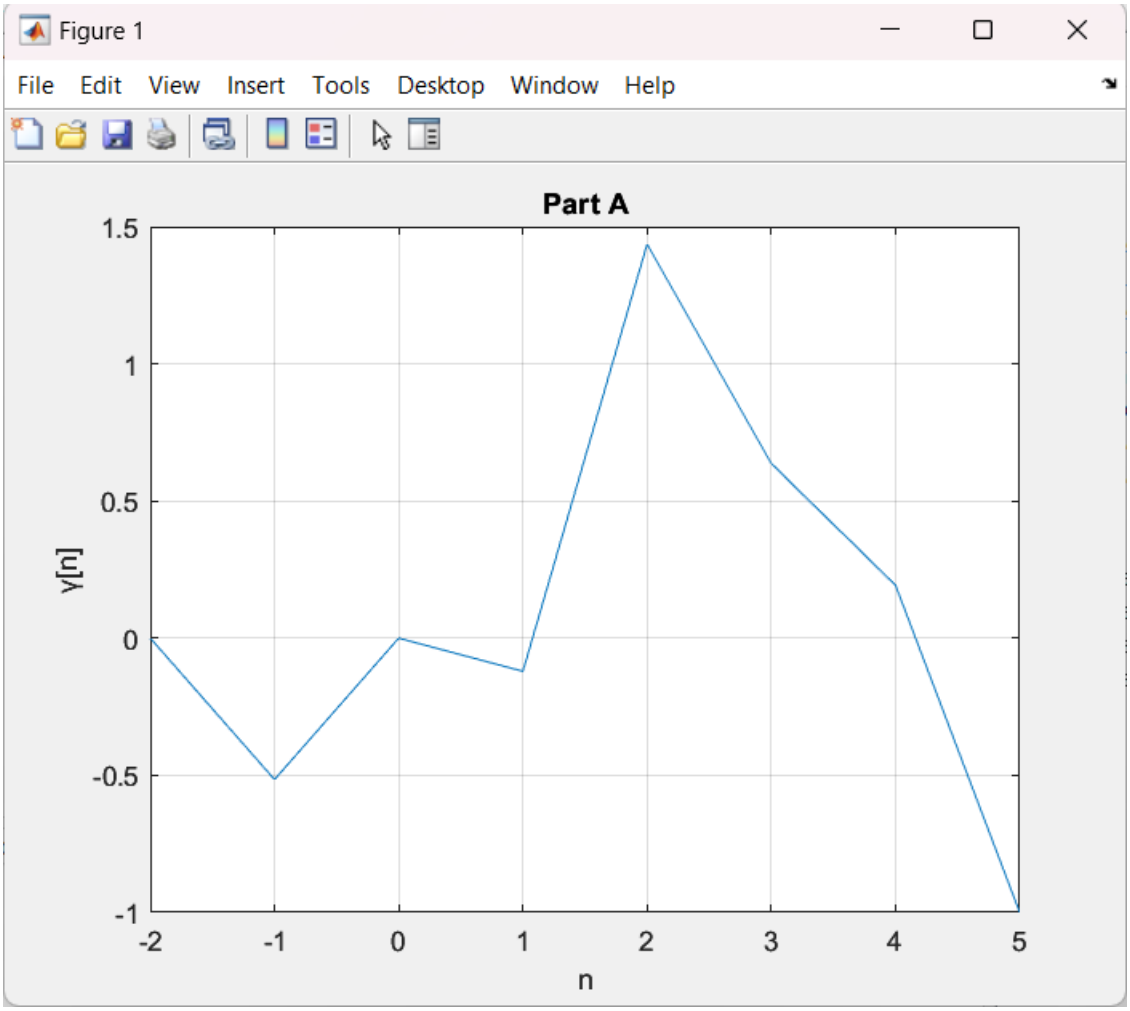
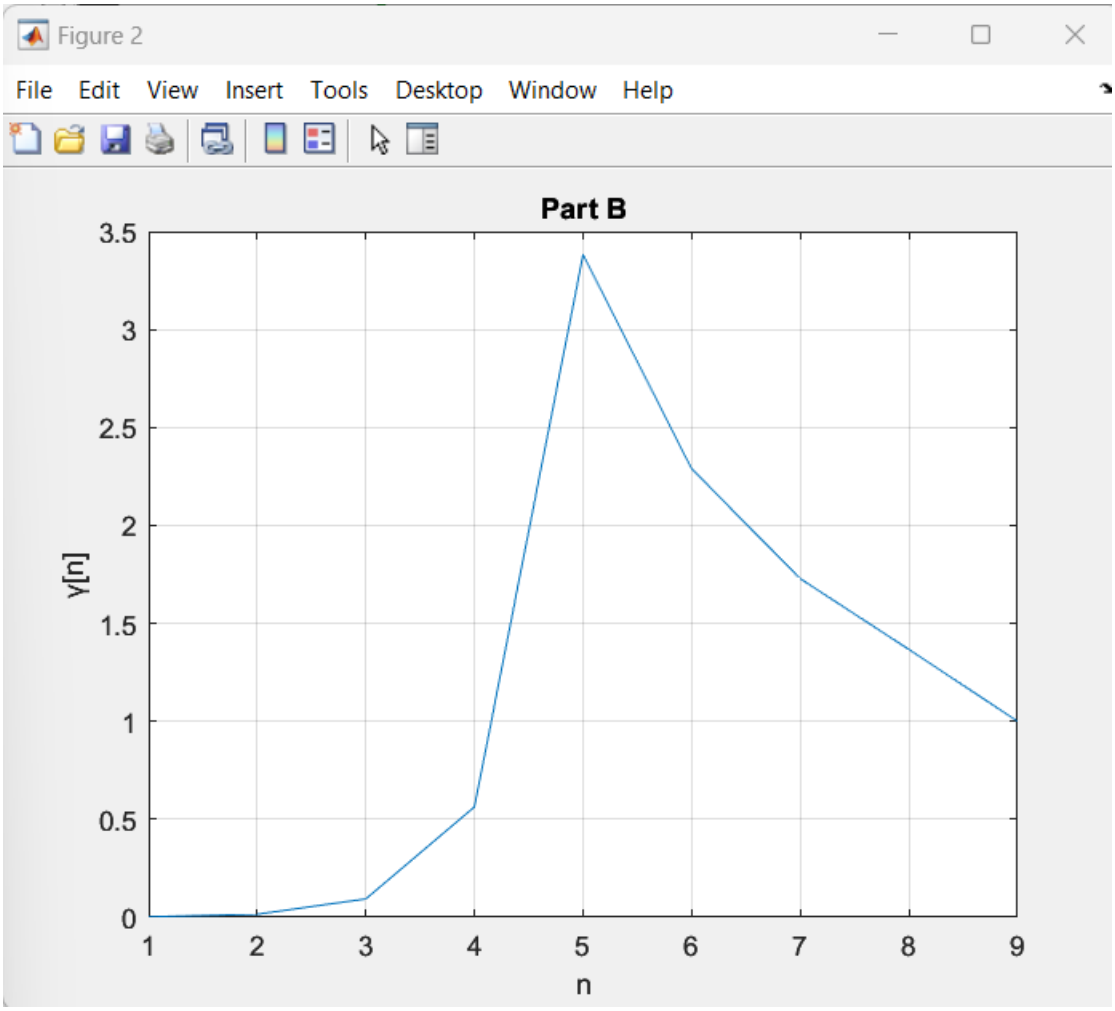


Figure 1
File Edit View Insert Tools Desktop Window Help
Part A
1.5
1
0.5
0
-0.5
-1
y[n]
-2 -1 0 1 2 3 4 5
n



Problem 4.2

```
clc;
clear;


% a ------------------------------------------------------------------

yzi(1) = 7;                                         % yzi[-2] = 7
yzi(2) = -2.5;                                      % yzi[-1] = -2.5

for k=3:18
    yzi(k) = 0.9 * yzi(k-1) - 0.81 * yzi(k-2);      % calculate each value
                                                    % of y(k)
end

k = -2:length(yzi)-3;                               % length of k same as y

figure;
```

```
plot(k, -yzi);
title('Part A');
xlabel('n');
ylabel('y[n]');
grid on;


% b ---------------------------------------------------------------------

yzs(1) = 0;                                         % yzs[-2] = 0
yzs(2) = 0;                                         % yzs[-1] = 0

stepn_1 = [zeros(1,3) ones(1,15)];

k;
x = (0.5 .^ k) .* stepn_1;

for k=3:18
    yzs(k) = 0.9 * yzs(k-1) - 0.81 * yzs(k-2) + 10*x(k) - 15*x(k-2);  % calculate
each value
end

k = -2:length(yzs)-3;

figure;
plot(k, yzs);
title('Part B');
xlabel('n');
ylabel('y[n]');
grid on;

% c ---------------------------------------------------------------------

delta = [zeros(1, 3) ones(1, 15)];              % shows which values in the range are
negative or positive

h(1) = 0;                                           % h[-2] = 0
h(2) = 0;                                           % h[-1] = 0

for k=3:18
    h(k) = 0.9 * h(k-1) - 0.81 * h(k-2) + 10 * delta(k) - 15 * delta(k-2);
end

k = -2:length(h)-3;

figure;
plot(k,h);
title('Part C');
xlabel('n');
ylabel('y[n]');
grid on;
```

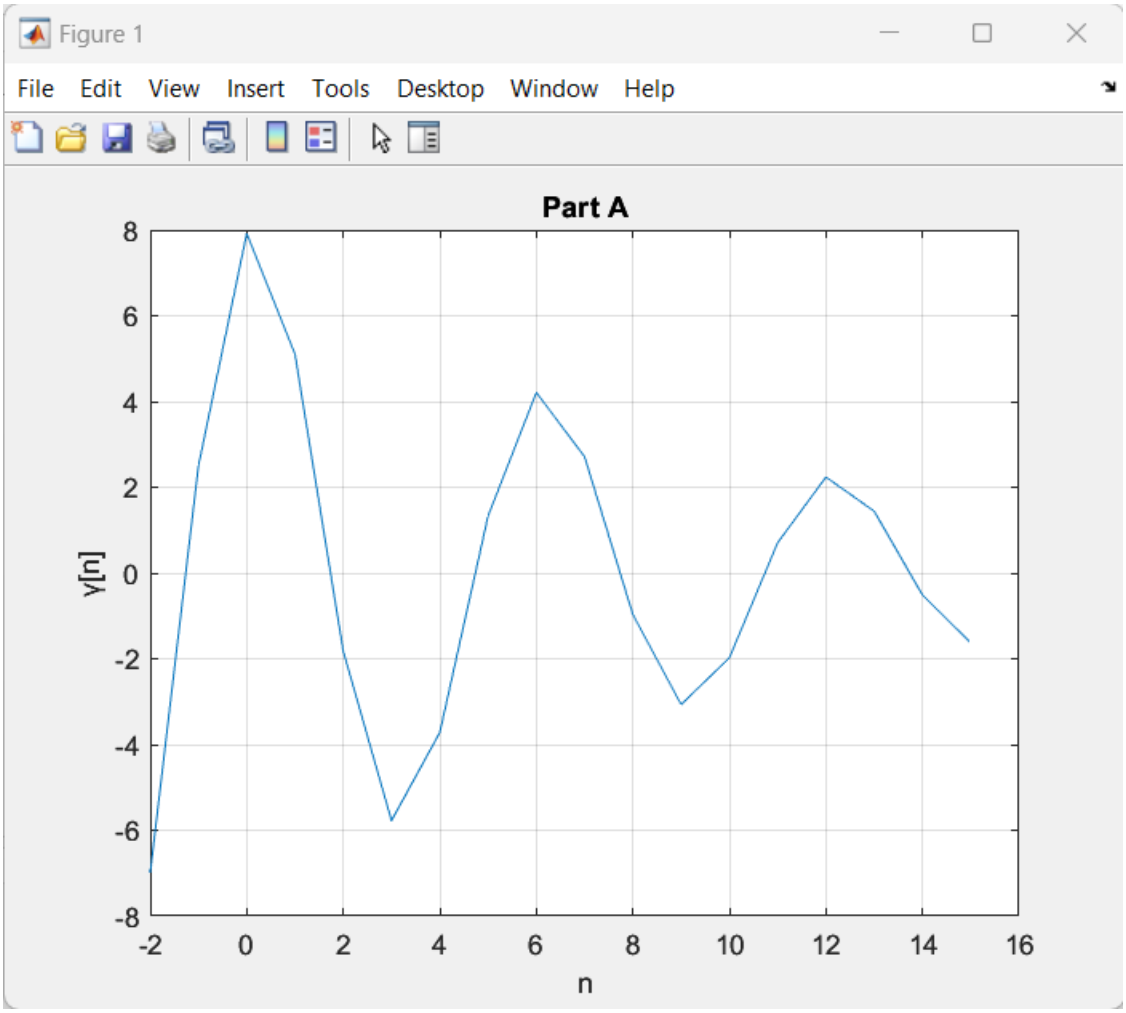


Figure 1
File Edit View Insert Tools Desktop Window Help
Part A
y[n]
n
8
6
4
2
0
-2
-4
-6
-8
-2 0 2 4 6 8 10 12 14 16

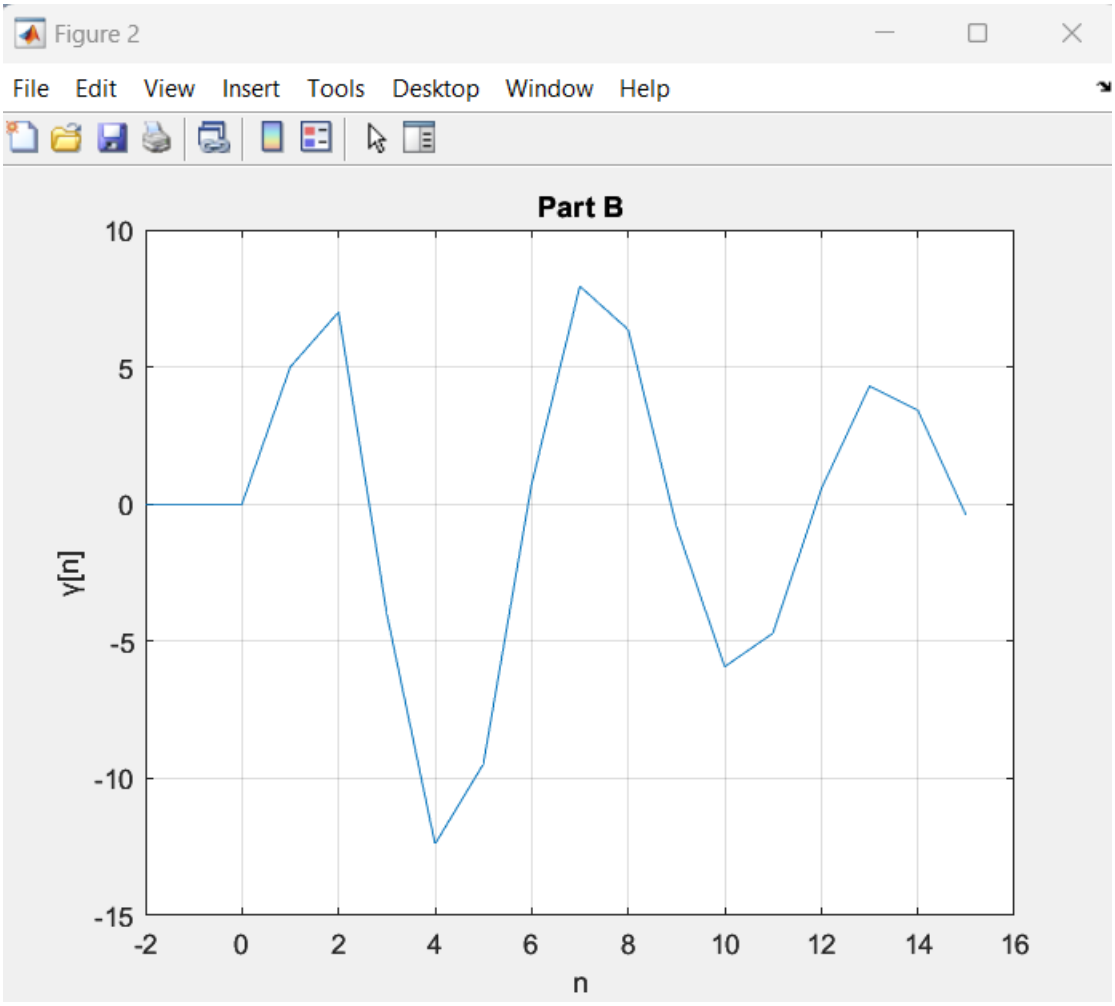
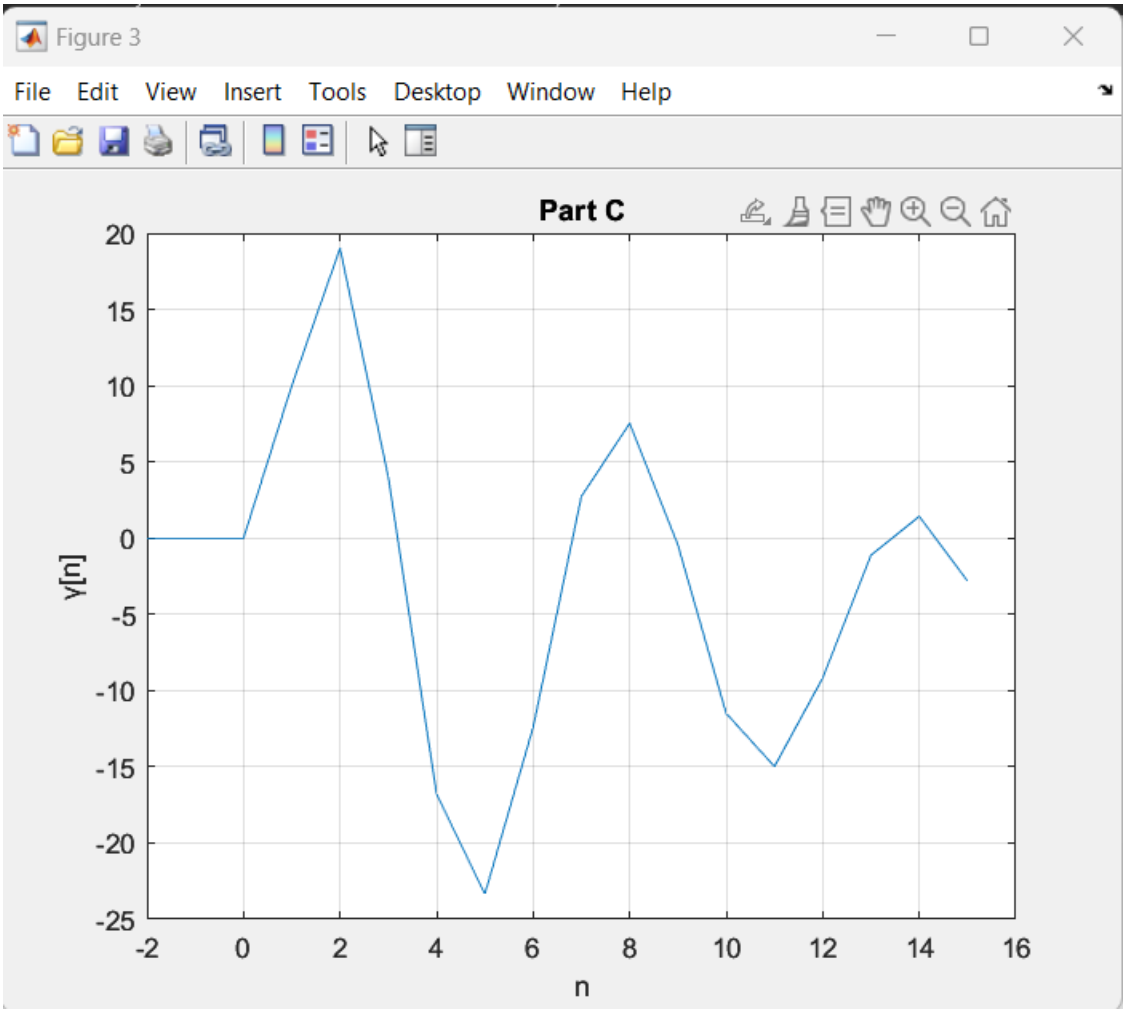


Figure 2
File Edit View Insert Tools Desktop Window Help
Part B
y[n]
n
10
5
0
-5
-10
-15
-2
0
2
4
6
8
10
12
14
16



Problem 4.3

```
clc;
clear;


% a ------------------------------------------------------------------

yzi(1) = -3;                                        % yzi[-2] = -3
yzi(2) = 1.5;                                       % yzi[-1] = 1.5

for k=3:18
    yzi(k) = -0.12 * yzi(k-1) + 0.24 * yzi(k-2);  % calculate each value
                                                    % of y(k)
end

k = -2:length(yzi)-3;                              % length of k same as y

figure;
plot(k, -yzi);
title('Part A');
xlabel('n');
```

```
ylabel('γ[n]');
grid on;


% b ---------------------------------------------------------------------

yzs(1) = 0;                                         % yzs[-2] = 0
yzs(2) = 0;                                         % yzs[-1] = 0

stepn_1 = [ones(1,18)];

k;
x = cos(0.15 * pi * k - ((15*pi)/180))  .* stepn_1;

for k=3:18
    yzs(k) = -0.12 * yzs(k-1) + 0.24 * yzs(k-2) - 6 * x(k-1) + 2 * x(k-2);
end

k = -2:length(yzs)-3;

figure;
plot(k, yzs);
title('Part B');
xlabel('n');
ylabel('γ[n]');
grid on;

% c ---------------------------------------------------------------------

delta = [ones(1, 18)];              % shows which values in the range are negative or
positive

h(1) = 0;                                           % h[-2] = 0
h(2) = 0;                                           % h[-1] = 0

for k=3:18
    h(k) = -0.12 * h(k-1) + 0.24 * h(k-2) - 6 * delta(k-1) + 2 * delta(k-2);
end

k = -2:length(h)-3;

figure;
plot(k,h);
title('Part C');
xlabel('n');
ylabel('γ[n]');
grid on;
```

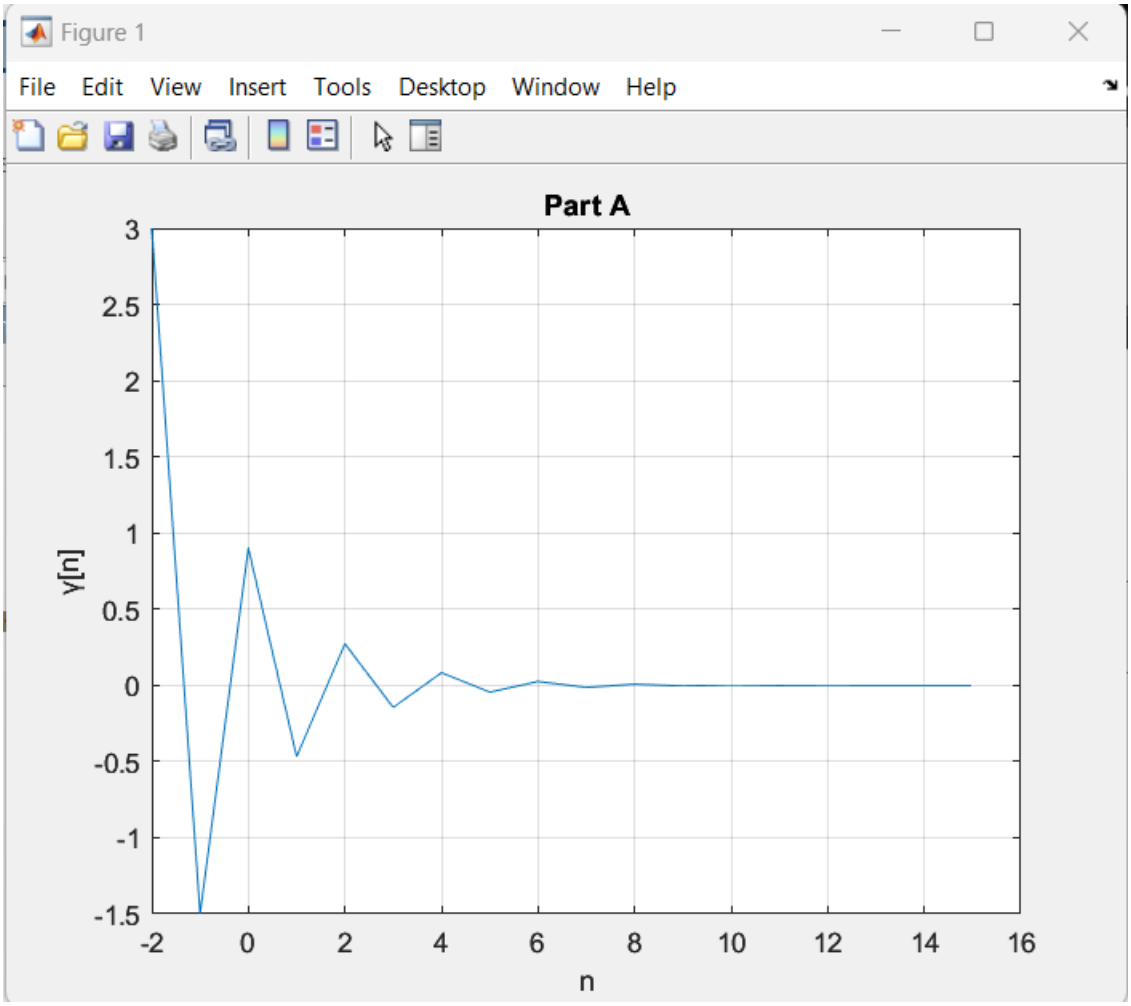


Figure 1
File Edit View Insert Tools Desktop Window Help
Part A
y[n]
n
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0
2
4
6
8
10
12
14
16

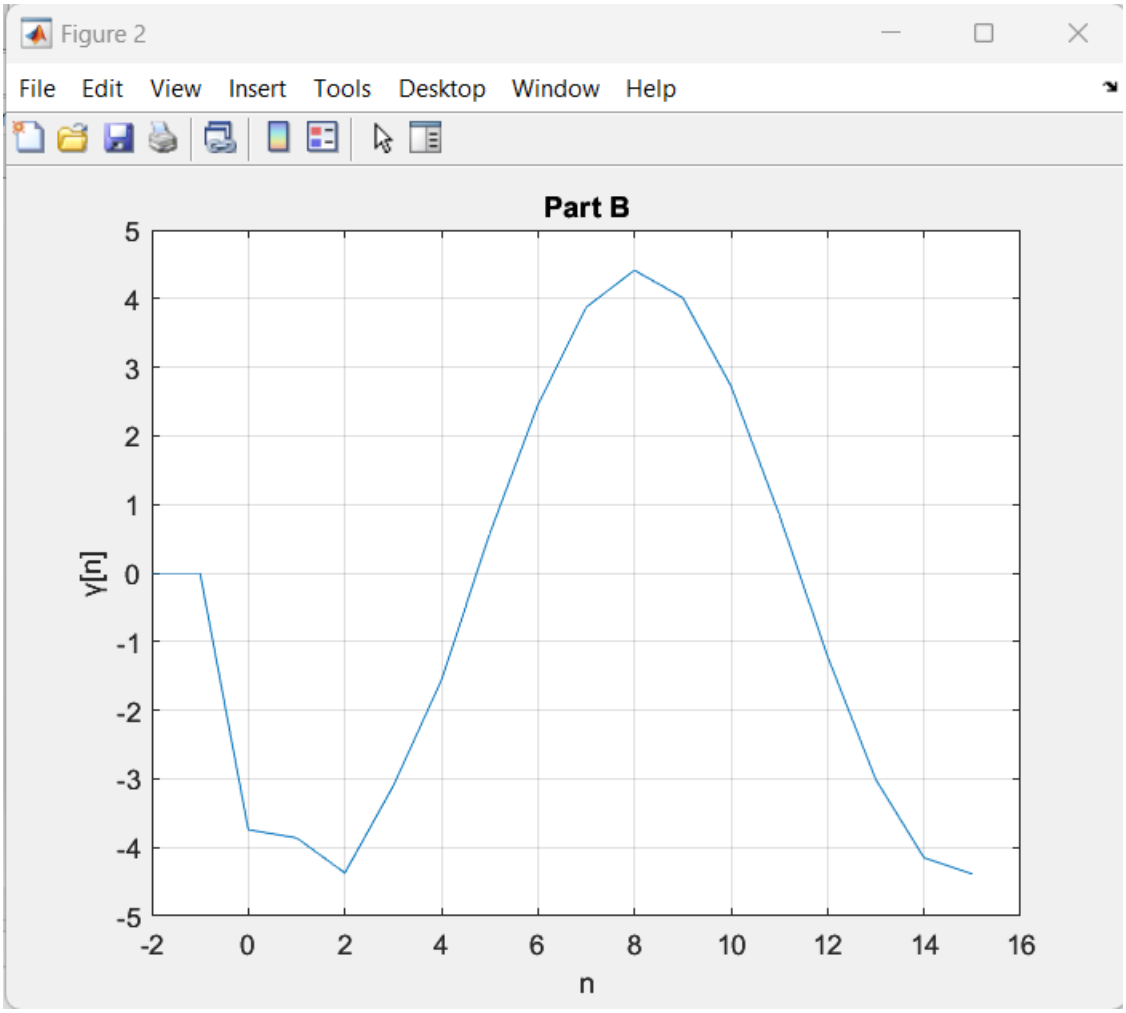


Figure 2
File Edit View Insert Tools Desktop Window Help
Part B
y[n]
n
5
4
3
2
1
0
-1
-2
-3
-4
-5
-2
0
2
4
6
8
10
12
14
16

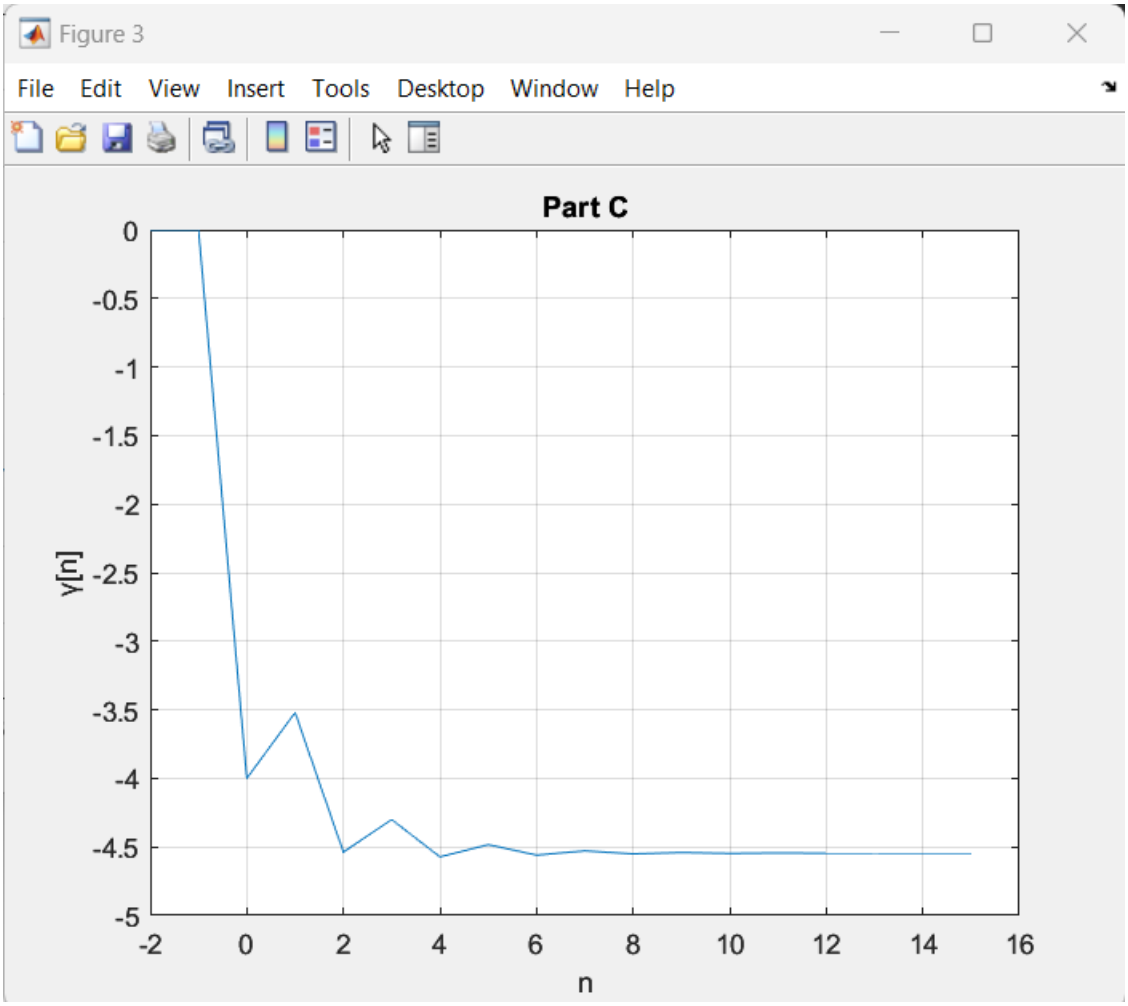


Figure 3
File Edit View Insert Tools Desktop Window Help
Part C
y[n]
n
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-2
0
2
4
6
8
10
12
14
16