Contents

PREAMBLE

DO NOT REMOVE THE LINE BELOW

```
clear;
```

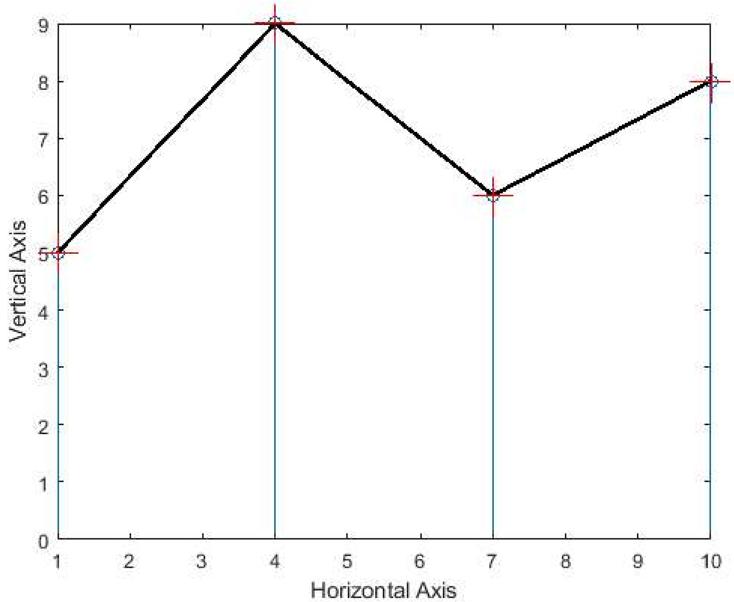
QUESTION 1: COMMENTING

========================

```
% Copy and comment every line of the following MATLAB script. Say what
% each line is doing in your comment. Explain each MATLAB line by using
% no more than one comment line, as done in the first line below. Run and
% publish the script:

a=zeros(1,10)                                  % Generate and print a 1x10 row vector of zeros
b=ones(4,2)                                    % Generate and print a 4x2 matrix of ones
c= size(b);                                    % Gets size of matrix b and returns the dimensions in a vector
abs([-2.2 , 3])                                % Calculates the absolute value of each element in the array [-2.2, 3]
floor(1.6)                                     % Rounds down the value of 1.6 to the nearest integer
d=[1:-2.5:-9];                                 % Creates a row vector starting at 1, with steps of 2.5, until 9
f=d(2); g=sin(pi/2);                           % Extracts the second element of d and computes sine of pi/2 (sine(pi/2) = 1)
K=[1.4, 2.3; 5.1, 7.8];                        % Creates a 2x2 matrix with specified values
m=K(1,2);                                      % Extracts first row of K matrix
n=K(:,2);                                      % Extracts second column of K matrix
p=K(1,2);                                      % Extracts element in first row and second column of K
comp = 10+40i;                                 % Creates a complex number with real part 10 and imaginary part 40
real(comp)                                     % Extracts the real part of the complex number comp
imag(comp)                                     % Extracts the imaginary part of the complex number comp
abs(comp)                                      % Calculates the absolute value (magnitude) of the complex number comp
angle(comp)                                    % Calculates the phase angel (in radians) of the complex number comp
disp('haha, MATLAB is fun');                   % Displays the string "haha, MATLAB is fun" in th ecommand window
3^2                                            % Calculates 3 raised to the power of 2
4==4                                           % Checks if 4 is equal to 4
[2==8 3~=5]                                    % Checks if 2 is equal to 8, and if 3 is not equal to 5, returns [false true]
x=[1:3:10];                                    % Creates a row vector starting at 1, with steps of 3, until 10
y=[5 9 6 8];                                   % Creates a row vector with the specified values
tic; pause(0.2); toc                           % Measures the elapsed time for a pause of 0.2 seconds
q = zeros(10,1);                               % Creates a 10 x 1 column vector filled with zeros
for ii = 1:10                                  % Starts a loop from ii = 1 to 10
    q(ii) = ii^2;                              % Assigns the square of ii to the ii-th element of q
end                                            % Ends the loop
figure(129);                                   % Creates a figure window with the ID 129
stem(x,y)                                      % Creates a stem plot of x versus y
hold on;                                       % Holds the current plot so that the new plots can be added
plot(x,y, 'k', 'linewidth', 2)                 % Plot x versus y with a black line of width 2
plot(x,y,'+r', 'markersize', 20);              % Plot x versus y with red plus markers of size 20
hold off;                                      % Releases the hold on the current plot
xlabel('Horizontal Axis')                      % Labels the x-axis as "Horizontal Axis"
ylabel('Vertical Axis')                        % Labels the y-axis as "Vertical Axis"
```

```
a =

     0     0     0     0     0     0     0     0     0     0
```

```
b =

     1     1
     1     1
     1     1
     1     1


ans =

    2.2000    3.0000


ans =

     1


ans =

    10


ans =

    40


ans =

   41.2311


ans =

    1.3258

haha, MATLAB is fun

ans =

     9


ans =

  logical

   1


ans =

  1×2 logical array

   0   1

Elapsed time is 0.211086 seconds.
```

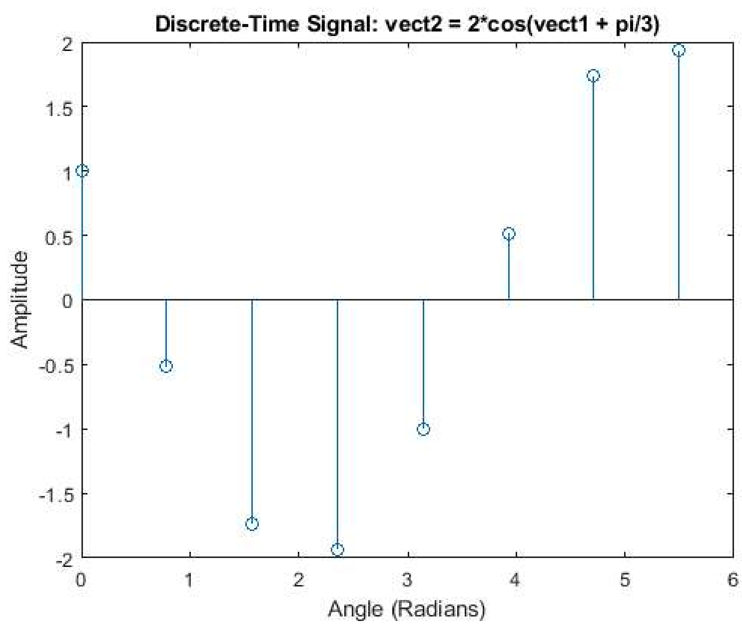


QUESTION 2: PLOTTING

=======================

2(a) PLOT RESULT

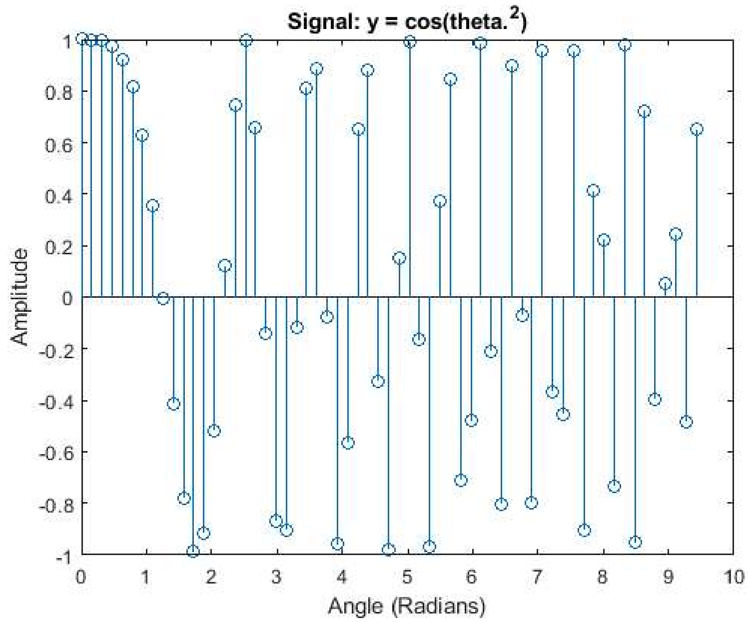
```
% Given
vect1 = [0 pi/4 2*pi/4 3*pi/4 4*pi/4 5*pi/4 6*pi/4 7*pi/4];         % Angle values
vect2 = 2*cos(vect1 + pi/3);                                          % Discrete-time signal

% plot using stem
stem(vect1, vect2)                                                    % Plot vect2 as discrete-time signal
xlabel('Angle (Radians)')                                             % Label x-axis
ylabel('Amplitude')                                                   % Label y-axis
title('Discrete-Time Signal: vect2 = 2*cos(vect1 + pi/3)')            % Title of the plot
```



2(b) PLOT RESULT

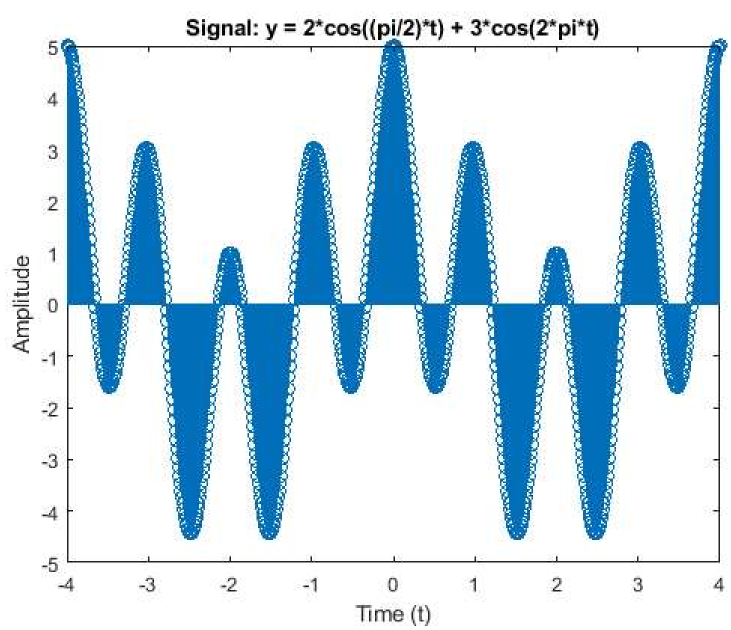
```
% Given
theta = 0 : pi/20 : 3*pi;                                             % Angle ranges 0 to 3*pi with step size pi/20
y = cos(theta.^2);                                                    % Discrete-time signal

% plot using stem
```

```
stem(theta, y)                                      % Plot y versus theta
xlabel('Angle (Radians)')                           % Label x-axis
ylabel('Amplitude')                                 % Label y-axis
title('Signal: y = cos(theta.^2)')                  % Title of the plot
```



2(c) PLOT RESULT

```
% Given
t = -4 : 0.01 : 4;                                  % Time ranges between -4 <= t <= 4, with step size 0.01
y = 2*cos((pi/2)*t) + 3*cos(2*pi*t);                % Signal equation

% plot using stem
stem(t, y)                                          % Plot y versus t
xlabel('Time (t)')                                  % Label x-axis
ylabel('Amplitude')                                 % Label y-axis
title('Signal: y = 2*cos((pi/2)*t) + 3*cos(2*pi*t)') % Title of the plot
```



QUESTION 3: COMPLEX ROOTS

=======================

3(a) WRITE FUNCTION IN SEPARATE FILE (TEMPLATE PROVIDED)

```
type('myroots.m')
```

```
function r = myroots(n, a)
% myroots: Find all the nth roots of the complex number a
%
% Input Args:
%   n: a positive integer specifying the nth roots
%   a: a complex number whose nth roots are to be returned
%
% Output:
%   r: 1xn vector containing all the nth roots of a

% Converting to polar
A = abs(a);                                                % Magnitude of coomplex number
phi = angle(a);                                            % Argument (phase) of a

% nth root
roots = zeros(1,n);                                        % Initializes vector to stores the roots
for k = 0 : n-1;                                           % loops through n times

    % Formula for nth root
    r(k+1) = (A^(1/n)) * exp(1i * (phi + 2*pi*k)/n);       % r(k+1) is nth root (MATLAB starts from 1)
end

end
```

3(b) ANSWER QUESTION

```
% The command "help myroots" gives an explanation of what the root does,
% what inputs are needed, and what the outputs are. Essentially, it has the
% same description as the comments at the top in the myroots.m file. The
% purpose of this command would help to define a function does, what the
% proper inputs for the function are, and how the function outputs the
% information. This would be useful for debugging in otder to figure out if
% there is a problem with the way prior code is inputing information, and
% how it is handling the output after the function use.
```

3(c) OUTPUT RESULTS

```
% Calculate 5th root of -1
a1 = -1;                                % Defines a = -1, or defines what we are finding the root of
root1 = 5;                              % Defines the root number
root_a1 = myroots(root1,a1);            % Creates the function to calculate the root
disp(root_a1);                          % Displays the root

% Calculates the 11th root of 2048j
a2 = 2048 * 1i;                         % Defines a = 2048j, since i is imaginary
root2 = 11;                             % Defines the root number
root_a2 = myroots(root2,a2);            % Calls the function to calcluate the root
disp(root_a2);                          % Displays the root
```

```
  Columns 1 through 4

   0.8090 + 0.5878i  -0.3090 + 0.9511i  -1.0000 + 0.0000i  -0.3090 - 0.9511i

  Column 5

   0.8090 - 0.5878i

  Columns 1 through 4

   1.9796 + 0.2846i   1.5115 + 1.3097i   0.5635 + 1.9190i  -0.5635 + 1.9190i

  Columns 5 through 8

  -1.5115 + 1.3097i  -1.9796 + 0.2846i  -1.8193 - 0.8308i  -1.0813 - 1.6825i

  Columns 9 through 11

  -0.0000 - 2.0000i   1.0813 - 1.6825i   1.8193 - 0.8308i
```