

EXERCICIO 1

```
close all  
clear  
clc
```

```
n=0:99
```

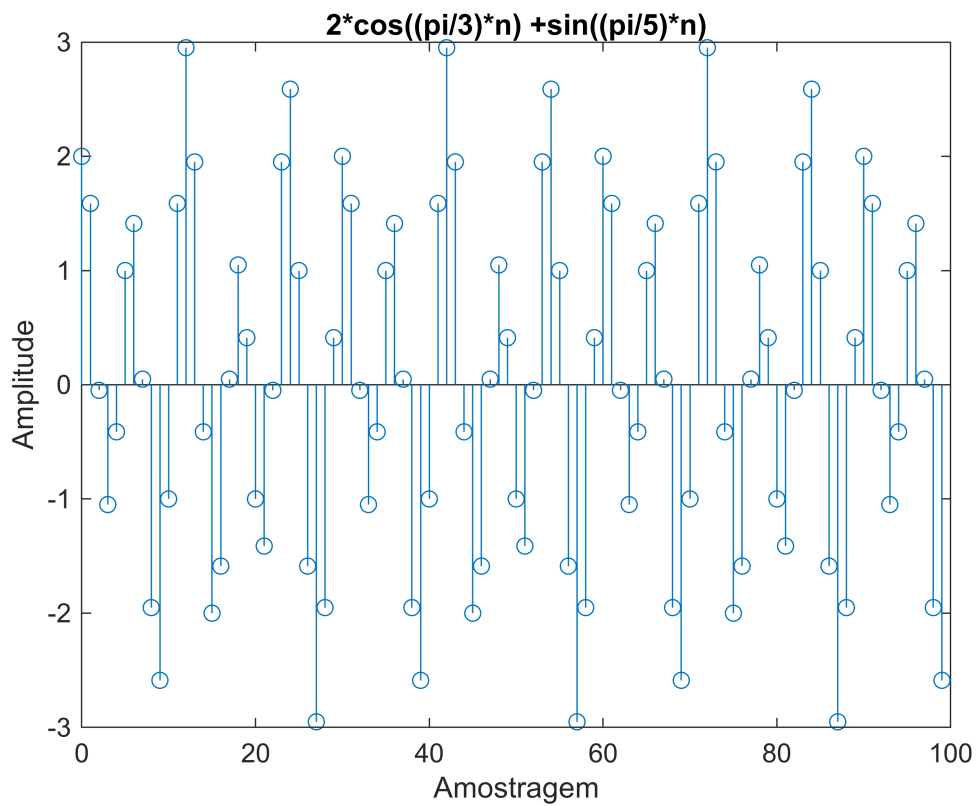
```
n = 1×100  
    0    1    2    3    4    5    6    7    8    9   10   11   12 ...
```

```
n1=0:49
```

```
n1 = 1×50  
    0    1    2    3    4    5    6    7    8    9   10   11   12 ...
```

```
x=2*cos((pi/3)*n) +sin((pi/5)*n);
```

```
% a)  
figure  
stem(n,x)  
xlabel("Amostragem")  
ylabel("Amplitude")  
title("2*cos((pi/3)*n) +sin((pi/5)*n)")
```

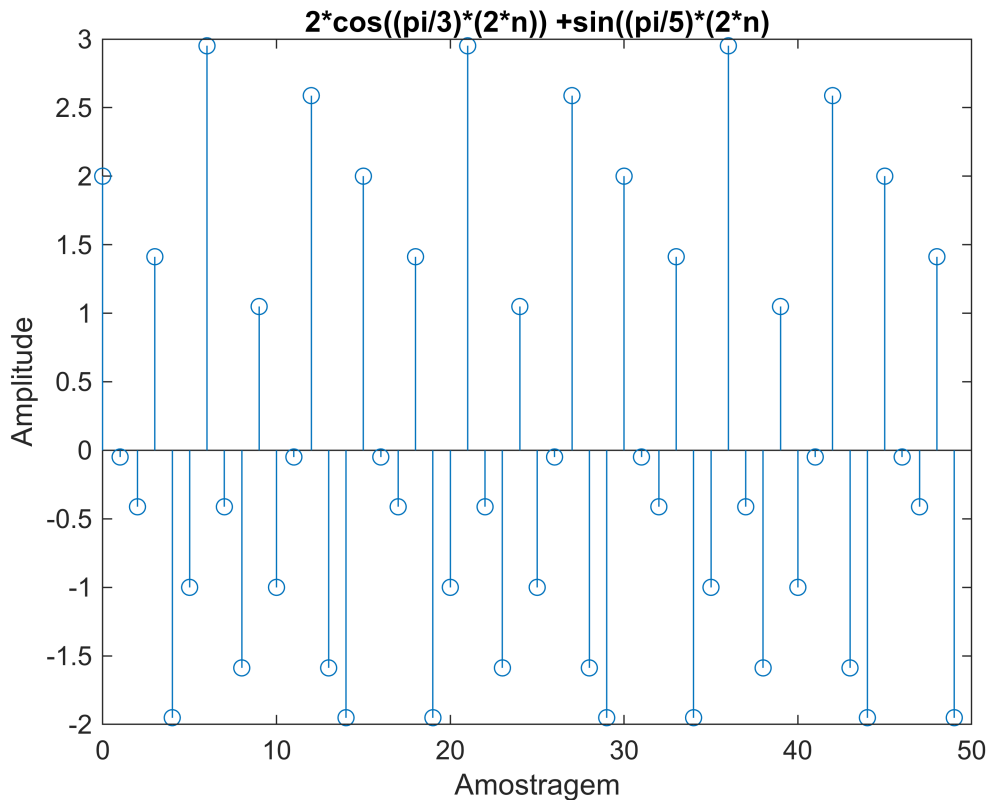


```
% b)
```

$y_0 = 1 \times 50$

2.0000	-0.0489	-0.4122	1.4122	-1.9511	-1.0000	2.9511	-0.4122 ···
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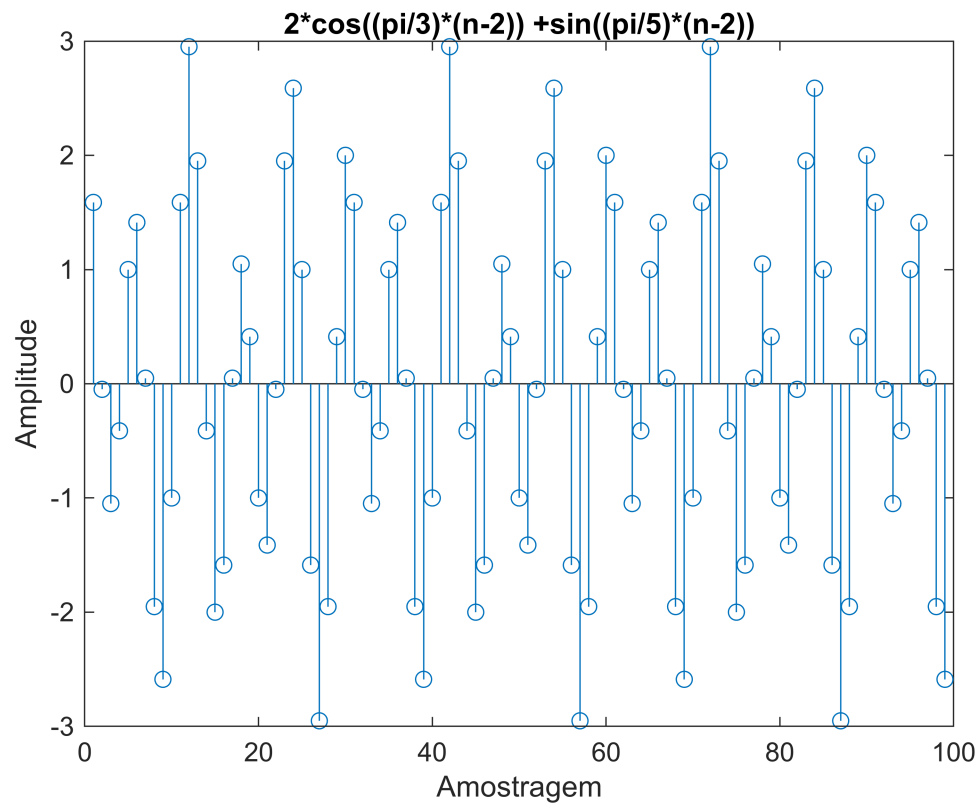
```
figure
stem(n1,y0)
xlabel("Amostragem")
ylabel("Amplitude")
title("2*cos((pi/3)*(2*n)) +sin((pi/5)*(2*n))")
```



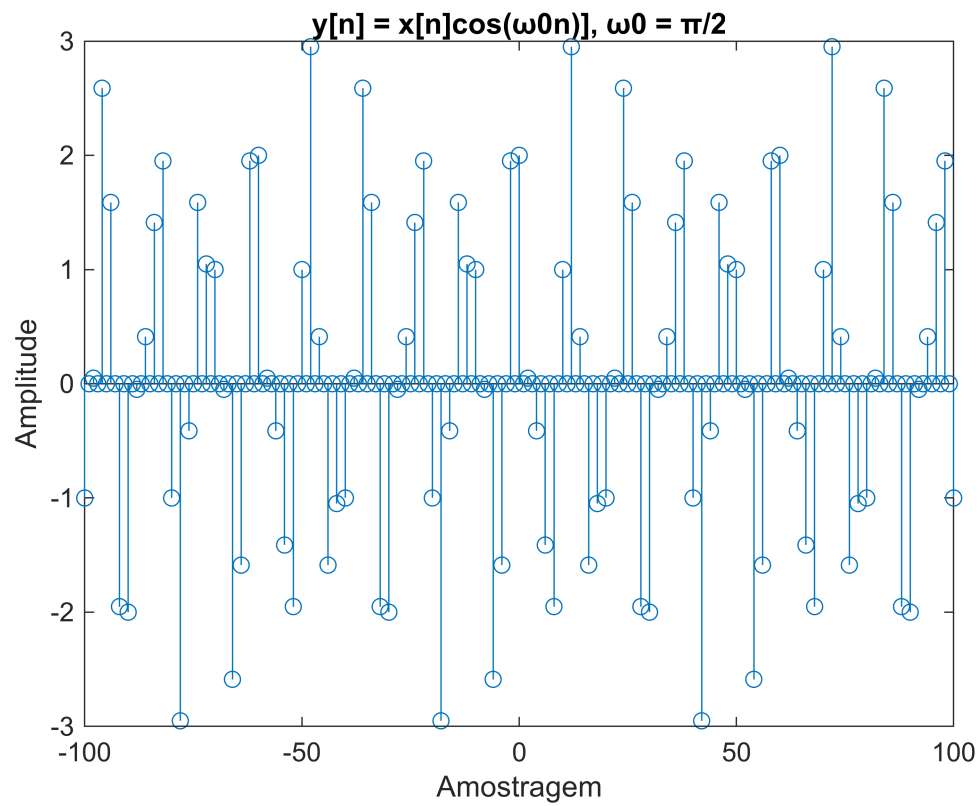
```
%2
%y1=2*cos((pi/3).*(-n)) +sin((pi/5).*(-n));
y1=indices_inverter(x)
```

```
y1 = 1x100
-2.5878  -1.9511   0.0489   1.4122   1.0000  -0.4122  -1.0489  -0.0489 ...
```

```
figure
stem(n,y1)
xlabel("Amostragem")
ylabel("Amplitude")
title("2*cos((pi/3)*(-n)) +sin((pi/5)*(-n)))")
```

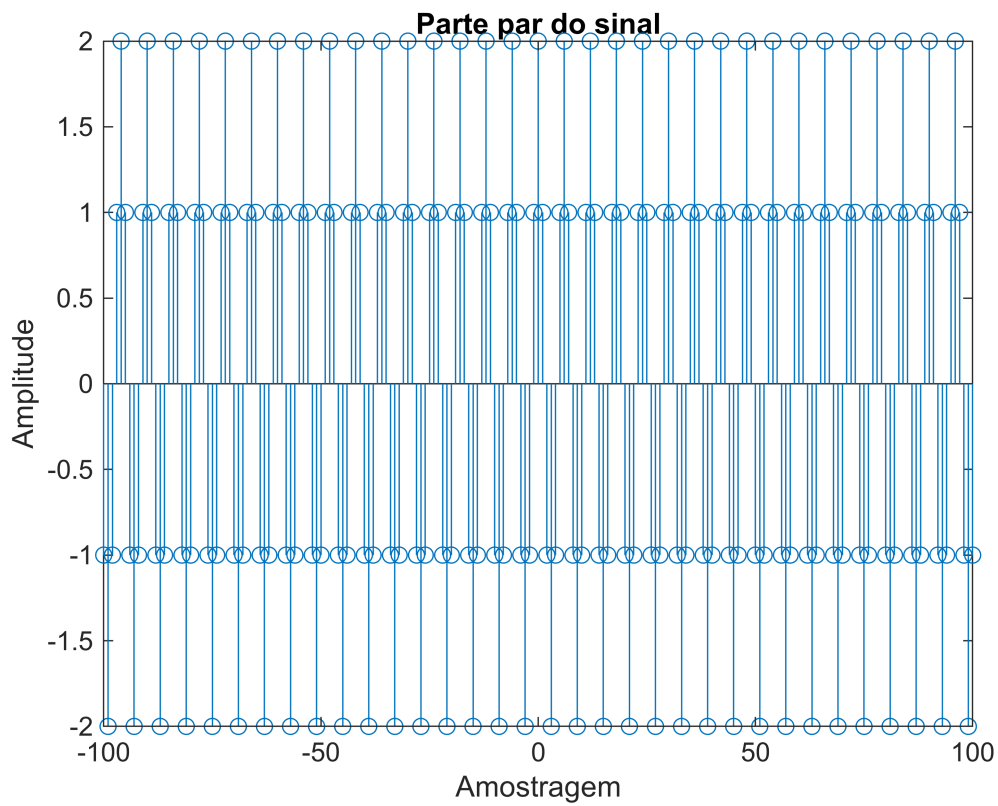



```
%4
n0 = -100:100;
x0 = 2*cos(pi/3*n0) + sin(pi/5*n0);
% Chamando a função para processar o sinal
y3 = cos_signal(x0);
figure
stem(n0,y3)
xlabel("Amostragem")
ylabel("Amplitude")
title("y[n] = x[n]cos(ω0n)], ω0 = π/2")
```

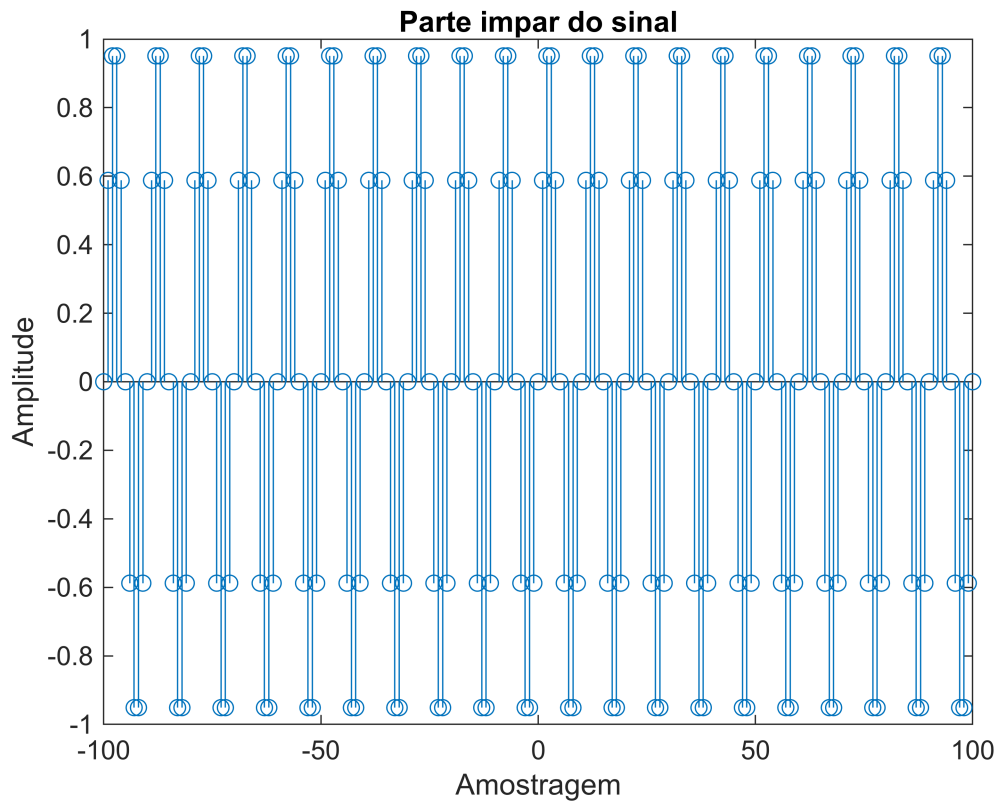


```
%5
[xpar, ximpar] = decompor_sinal(x0);

figure
stem(n0, xpar)
title('Parte par do sinal')
xlabel("Amostragem")
ylabel("Amplitude")
```



```
figure
stem(n0, ximpar)
title('Parte impar do sinal')
xlabel("Amostragem")
ylabel("Amplitude")
```



```
% c)
period = length(n0);
potencia_sinal = sinal_potencia(x, period);
% 2.469122691055866
```

EXERCICIO 2

```
A= 0.5;
B= 2;
% y=A*x + B

% a) i
x20 = [1, zeros(1, 10)]; % impulso no instante n = 0
y20 = A*x20 + B;

figure
stem(y20);
xlabel("Amostragem")
ylabel("Amplitude")
title('Resposta do sistema a um impulso');
```



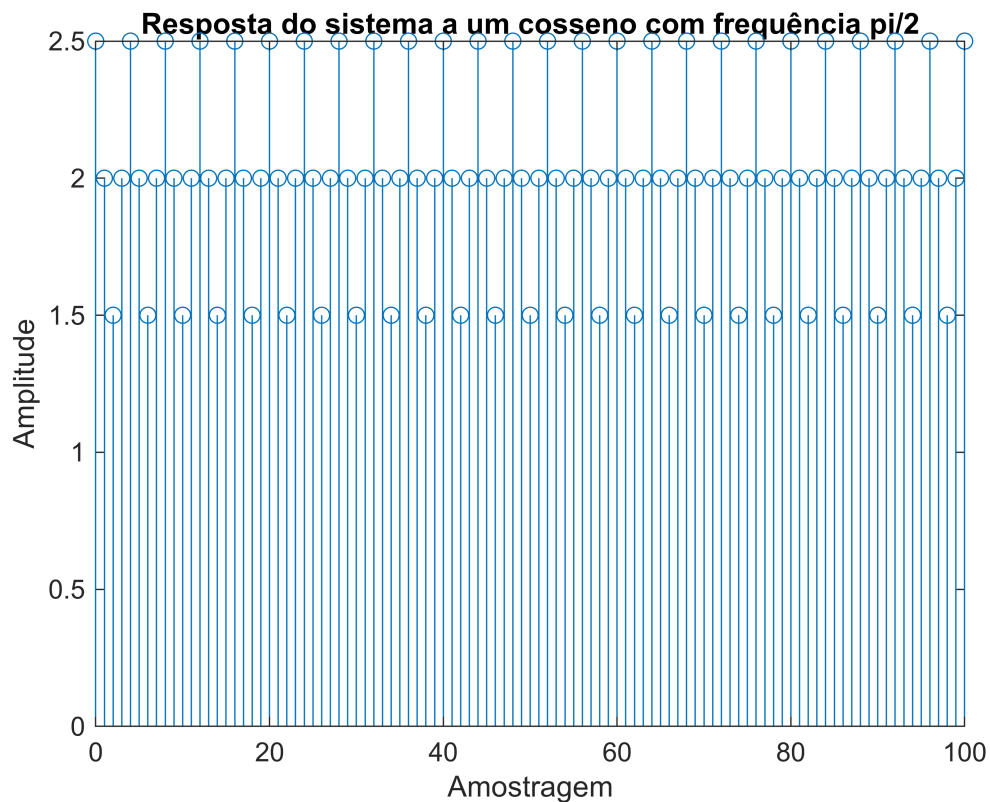
```
% a) ii
x21 = ones(1, 11); % degrau unitário a partir de n = 0
y21 = A*cumsum(x21) + B; % função cumsum() calcula a soma acumulada de x
figure
stem(y21);
xlabel("Amostragem")
ylabel("Amplitude")
title('Resposta do sistema a uma sequência de degrau unitário');
```




```
% a) iii  
n23 = 0:100;  
N23 = pi/2
```

```
N23 = 1.5708
```

```
x23 = cos(N23*n23);  
  
y23 = A*x23 + B;  
  
figure  
stem(n23, y23);  
xlabel("Amostragem")  
ylabel("Amplitude")  
title('Resposta do sistema a um cosseno com frequência pi/2');
```



```
% B)
%ADITIVIDADE
x1B = [1, 2, 3, 4, 5]; % sinal 1
x2B = [5, 4, 3, 2, 1]; % sinal 2

y1B = A*x1B + B;
y2B = A*x2B + B;

figure;
subplot(2,2,1);
stem(x1B);
title('Sinal de entrada x1[n]');
xlabel('n');
ylabel('x1[n]');

subplot(2,2,2);
stem(x2B);
title('Sinal de entrada x2[n]');
xlabel('n');
ylabel('x2[n]');

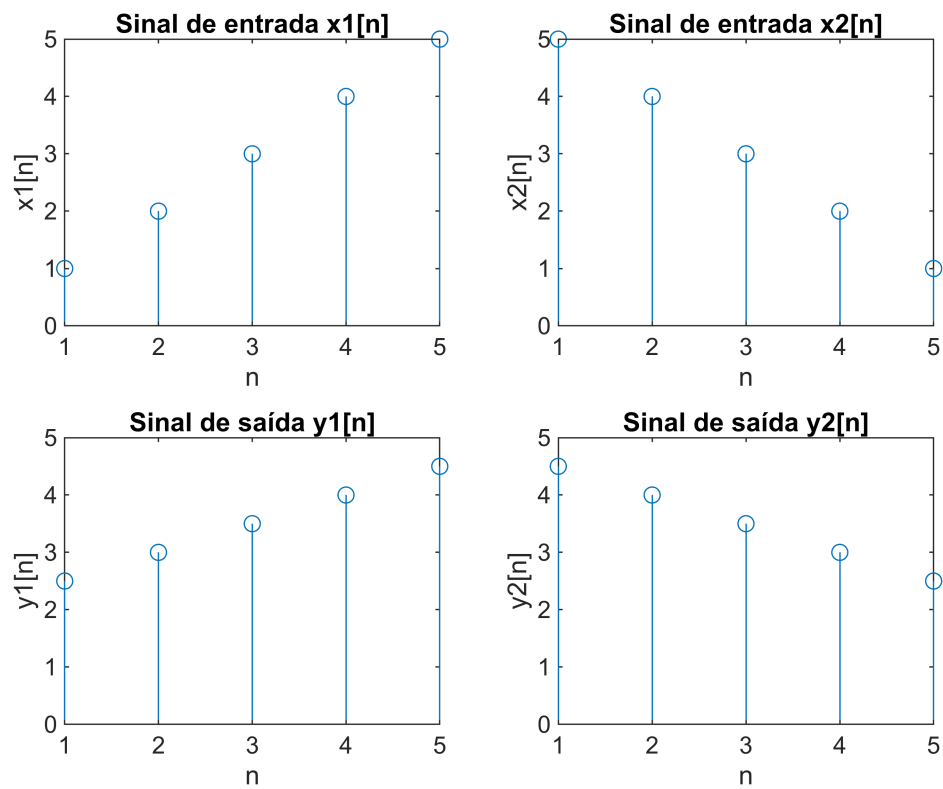
subplot(2,2,3);
stem(y1B);
title('Sinal de saída y1[n]');
xlabel('n');
```

```

ylabel('y1[n]');

subplot(2,2,4);
stem(y2B);
title('Sinal de saída y2[n]');
xlabel('n');
ylabel('y2[n]');

```



```

% HOMOGENEIDADE

```

```

k = 2;

```

```

y3B = A*(k*x1B) + B;

```

```

% Plot do sinal de entrada e saída

```

```

figure;

```

```

stem(k*x1B);

```

```

title('Sinal de entrada k*x1[n]');

```

```

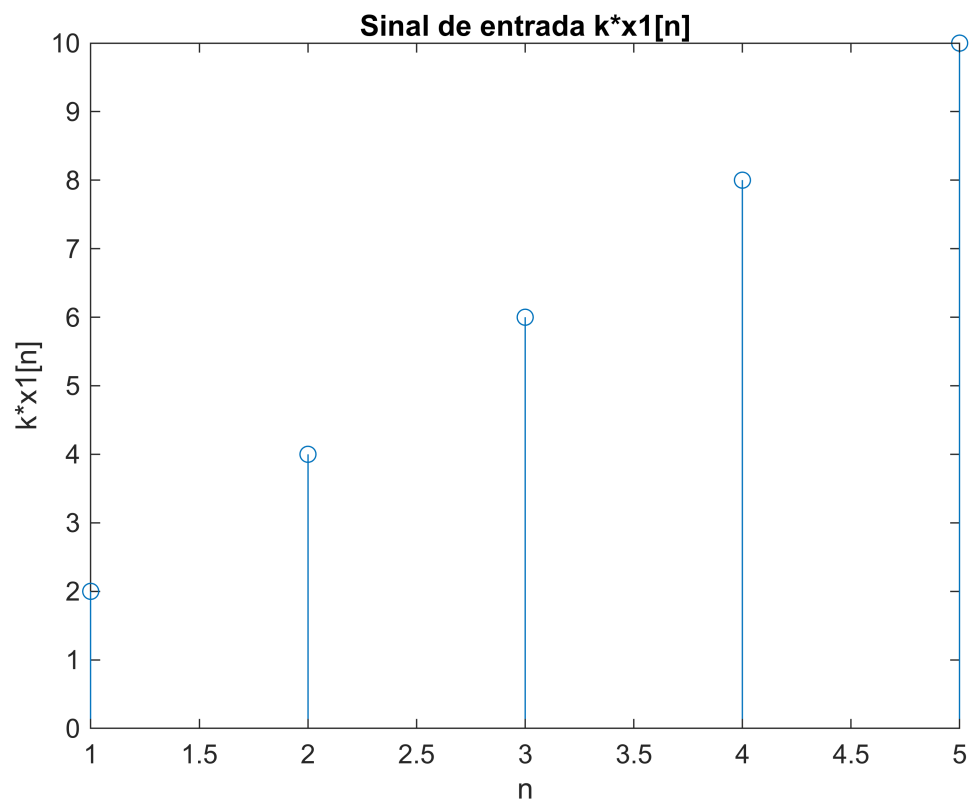
xlabel('n');

```

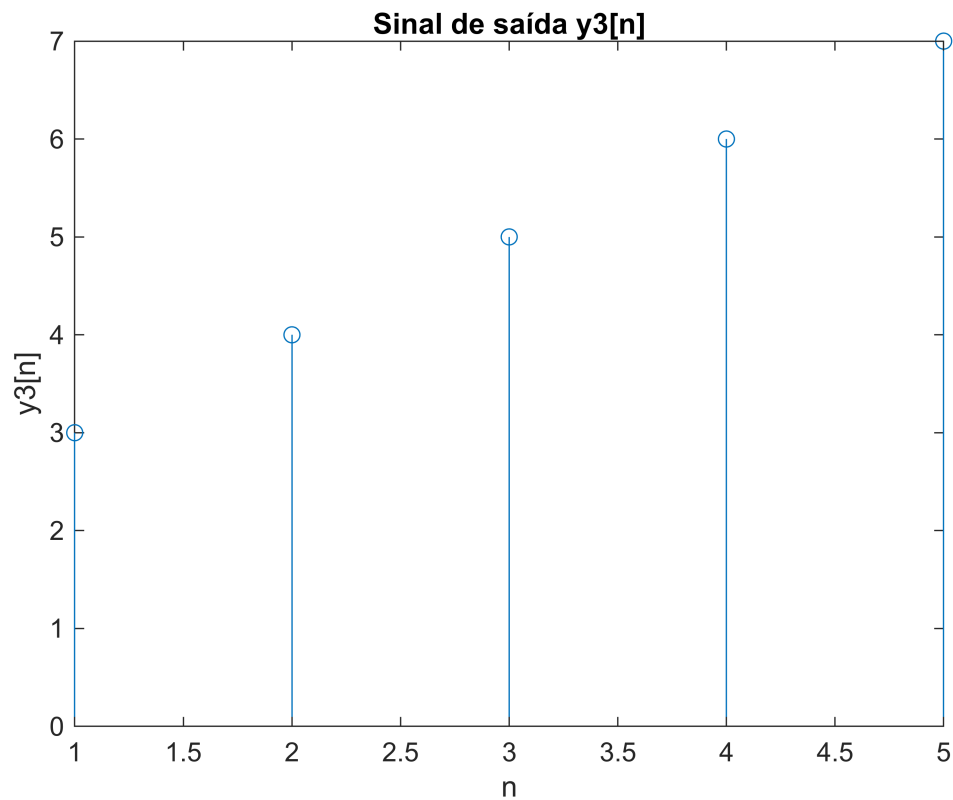
```

ylabel('k*x1[n]');

```



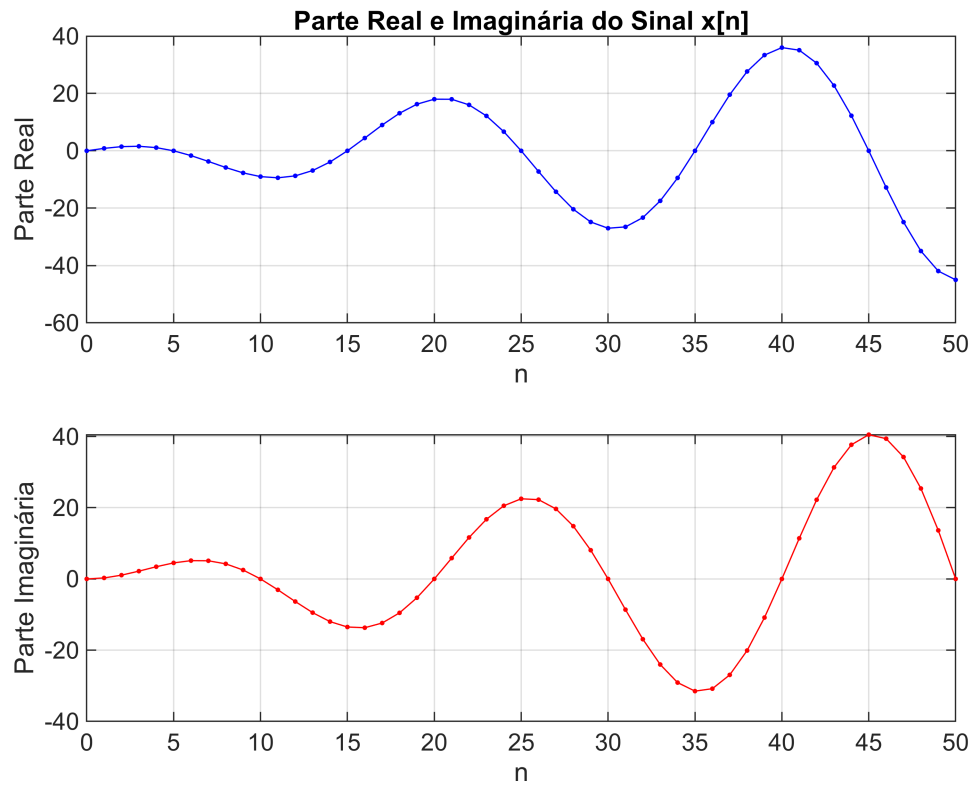
```
stem(y3B);  
title('Sinal de saída  $y3[n]$ ');  
xlabel('n');  
ylabel('y3[n]');
```



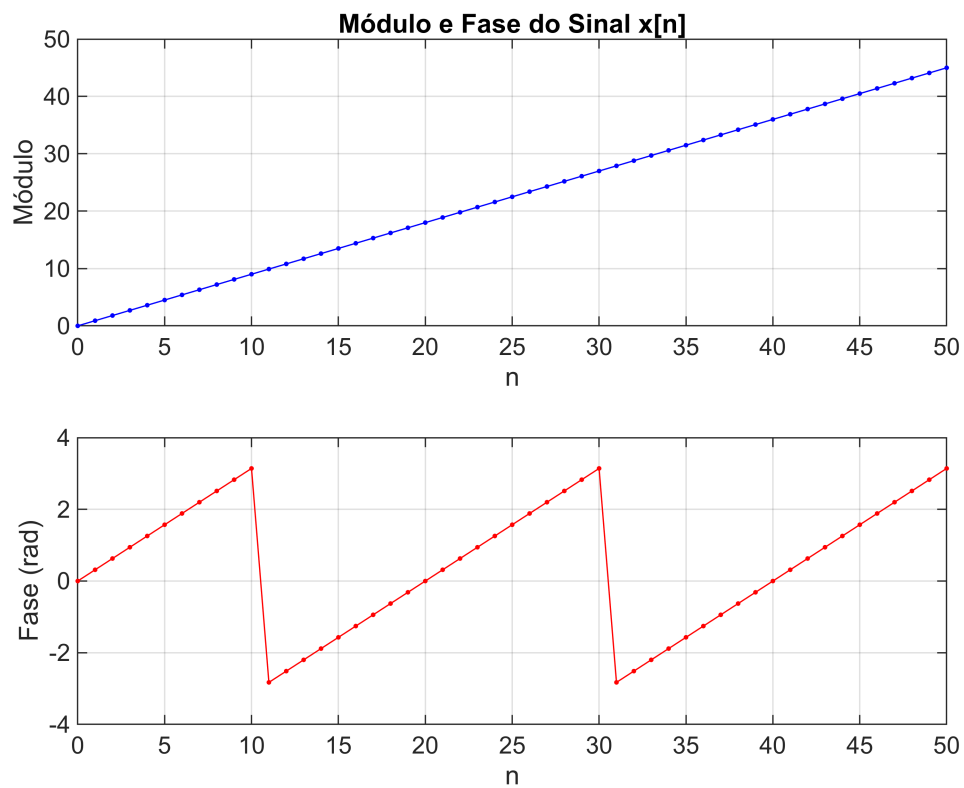
EXERCICIO 3

```
n = 0:50;
x3 = 0.9 * n .* exp(1j*(pi/10)*n);

% Parte Real e Parte Imaginária
figure;
subplot(2,1,1);
plot(n,real(x3),'b.-');
xlabel('n');
ylabel('Parte Real');
title('Parte Real e Imaginária do Sinal x[n]');
grid on;
subplot(2,1,2);
plot(n,imag(x3),'r.-');
xlabel('n');
ylabel('Parte Imaginária');
grid on;
```



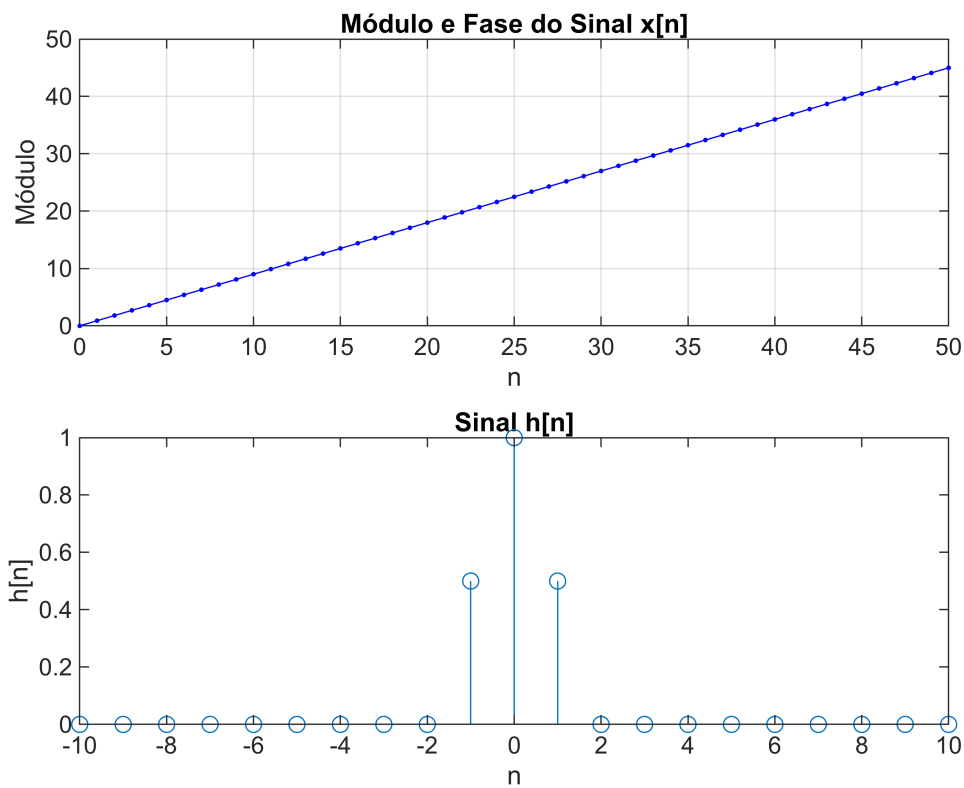
```
% Módulo e Fase
figure;
subplot(2,1,1);
plot(n,abs(x3),'b.-');
xlabel('n');
ylabel('Módulo');
title('Módulo e Fase do Sinal  $x[n]$ ');
grid on;
subplot(2,1,2);
plot(n,angle(x3),'r.-');
xlabel('n');
ylabel('Fase (rad)');
grid on;
```



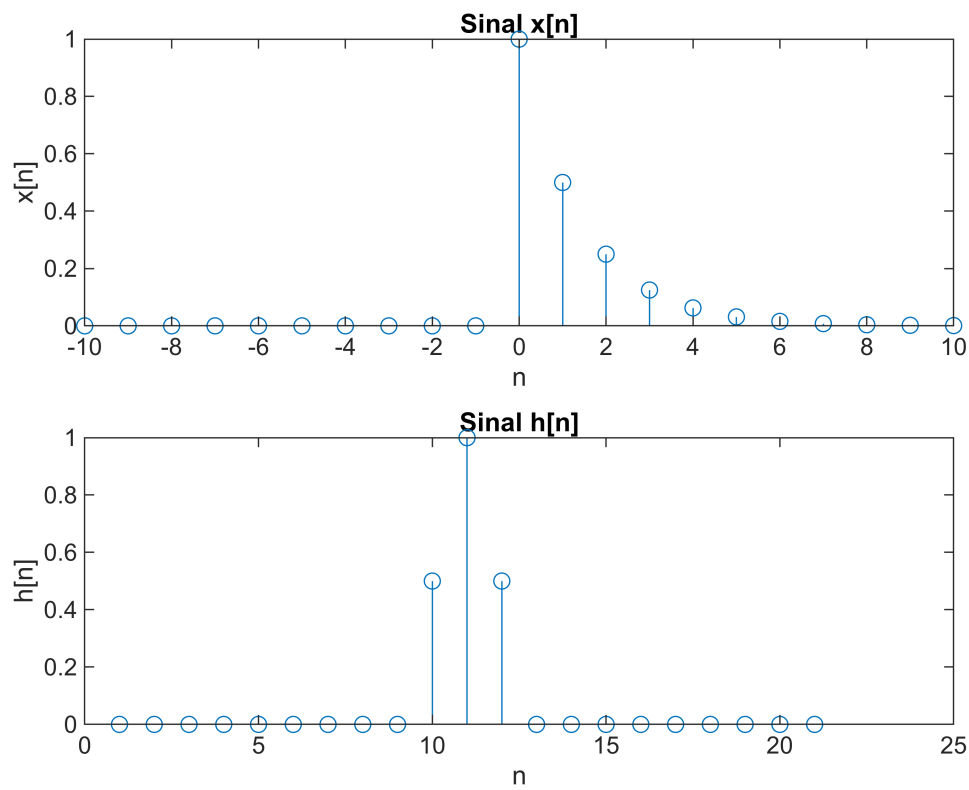
EXERCICIO 4

```
% a)
% Definição dos sinais
n4 = -10:10;
x4a = (1/2).^n4 .* (n4>=0);

h = zeros(size(n4));
h(n4 == 0) = 1;
h(n4 == -1) = 0.5;
h(n4 == 1) = 0.5;
```

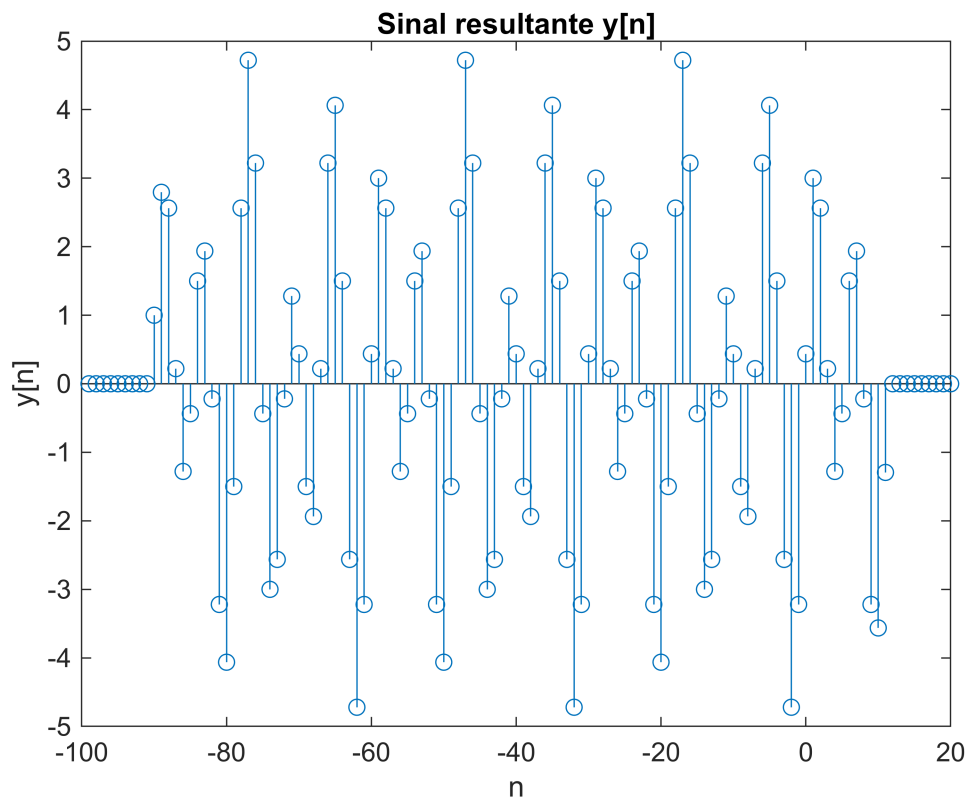


```
% Plot dos sinais
figure
subplot(2,1,1);
stem(n4,x4a);
xlabel('n');
ylabel('x[n]');
title('Sinal x[n]');
subplot(2,1,2);
stem(h);
xlabel('n');
ylabel('h[n]');
title('Sinal h[n]');
```

```
% b)
y4b = conv(x,h);
ny = -(length(x)-1):(length(h)-1);

figure
stem(ny,y4b);
xlabel('n');
ylabel('y[n]');
title('Sinal resultante y[n]');
```



Funções

```
function comprimido = indices_impares(vetor)
    comprimido = vetor(1:2:end);
end

function reverso = indices_inverter(x)

    % Determina o tamanho do sinal de entrada
    N = length(x);

    % Inicializa o sinal de saída
    reverso = zeros(1,N);

    % Calcula o sinal reverso de x
    for n = 1:N
        reverso(n) = x(N-n+1);
    end
end

function shift = indices_shift(x, n)
    shift = x(n-2:length(x));
end
```

```

function cosseno = cos_signal(x)
    w0 = pi/2;
    n = -100:100;
    % Calculando a função coseno
    cosine = cos(w0*n);
    % Multiplicando o sinal de entrada pelo coseno
    cosseno = x.*cosine;
end

function [xp, xi] = decompor_sinal(x)
    n = -100:100;
    % Calculando a parte par do sinal
    xp = (x + fliplr(x))/2;
    % Calculando a parte ímpar do sinal
    xi = (x - fliplr(x))/2;
end

function potencia = sinal_potencia(x, period)
    N = period;
    n = 0:N-1;
    x_cycle = 2*cos(pi/3*n) + sin(pi/5*n);
    potencia = (1/N) * sum(abs(x_cycle).^2);
end

```