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```
clear all;
close all;
clc;
```

Solving for a_0 , a_n , b_n and stating x_N

```
T0 = 2; % Period
w0 = pi;

% x(t) = -1 from 0 to 1
%          1 from 1 to 2

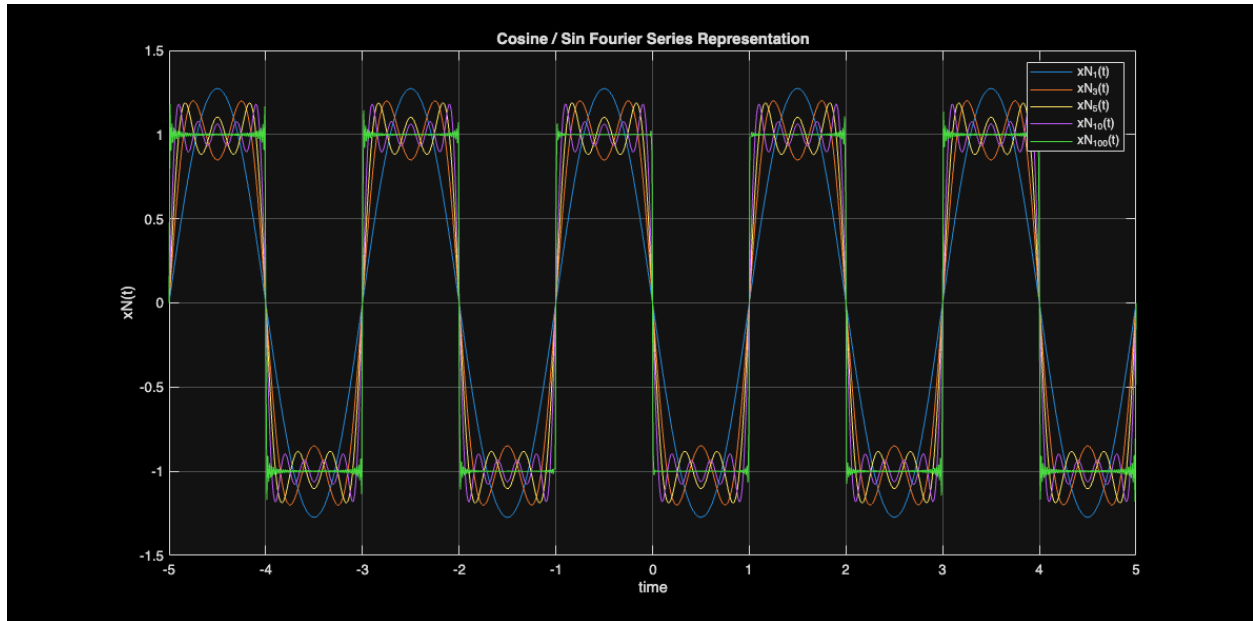
% Calculated  $a_0$ ,  $a_n$ , and  $b_n$  on paper due to the complexity of solving them
% in matlab
a0 = 0;
an = 0;
bN = @(N) (-4./(N*pi)).*(mod(N,2)==1); % odd n -> -4/npi, even n -> 0

t = linspace(-5,5,1000);
```

Question 1: cosine/sin Fourier Series Representation

```
xN = @(t,N) sum(bN(1:N).'* sin((1:N)'*w0.*t), 1);

for N = [1, 3, 5, 10, 100]
figure(1)
plot(t,xN(t,N),'DisplayName',['xN_{' num2str(N) '} (t)'])
hold on
grid on
xlabel('time')
ylabel('xN(t)')
end
legend('show')
title('Cosine / Sin Fourier Series Representation')
```



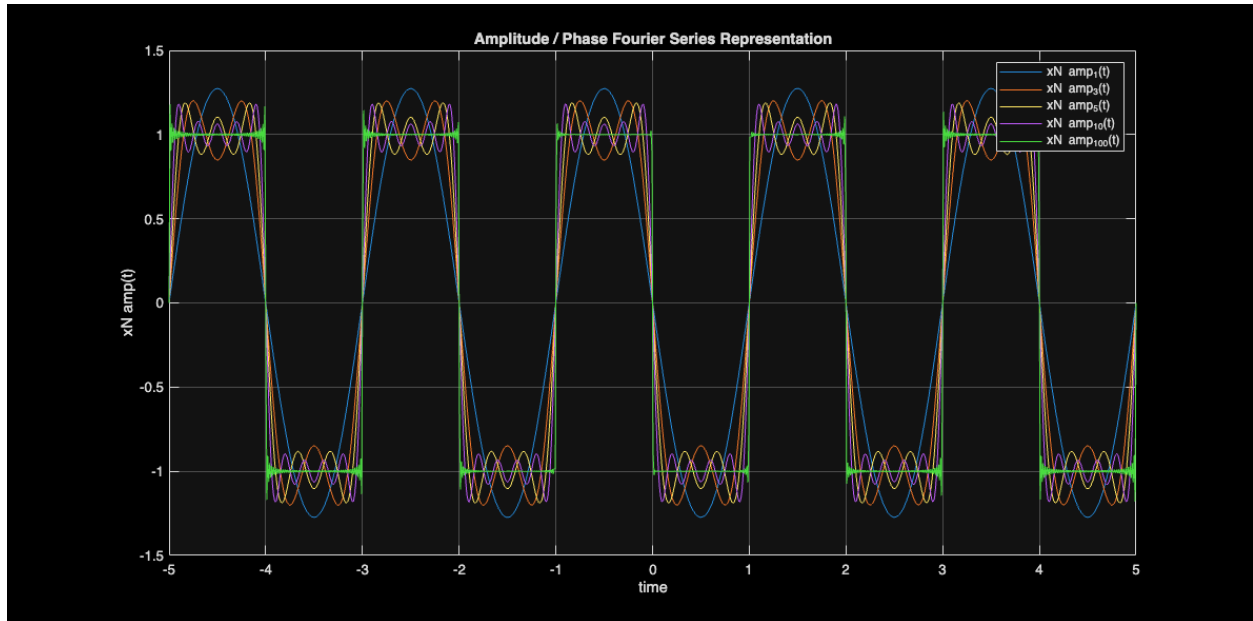
Question 2: amplitude/phase Fourier Series Representation

$c_n = \sqrt{(b_n)^2}$ $\theta_n = -\tan^{-1}(b_n/0) = -\tan^{-1}(-\infty) \rightarrow \pi/2$

```
C_n = @(N) abs((-4./(N*pi)) .* (mod(N,2)==1));
theta_n = pi/2;
```

```
xN_amp = @(t,N) sum( C_n(1:N).' .* cos((1:N)'*w0.*t + theta_n), 1 );
```

```
for N = [1, 3, 5, 10, 100]
figure(2)
plot(t,xN_amp(t,N),'DisplayName',[ 'xN amp{' num2str(N) '}(t)'])
hold on
grid on
xlabel('time')
ylabel('xN amp(t)')
end
legend('show')
title('Amplitude / Phase Fourier Series Representation')
```



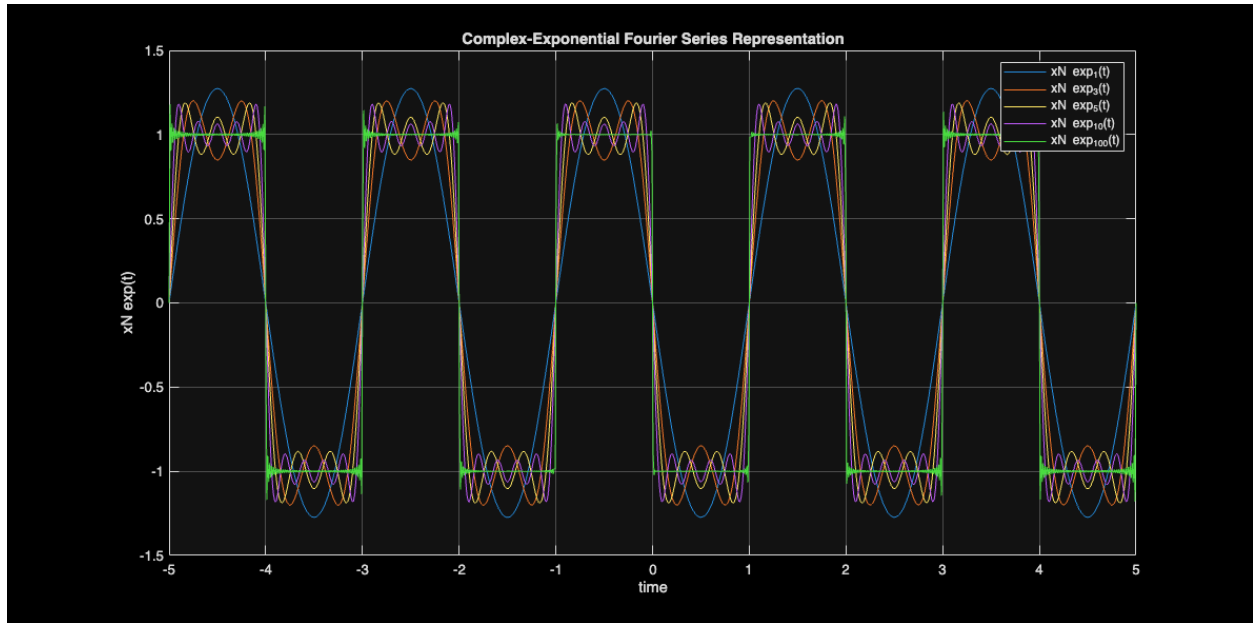
Question 3: complex-exponential Fourier Series Representation

```
% xn = c0 when n = 0
% xn = cn/2 * e^j*theta_n when n > 0
%x_n = x_n^*

c_of = @(n) (mod(abs(n),2)==1).*(2j./(n*pi)); % 0 for even or n=0, 2j(n*p)
for odd

xN_exp = @(t,N) real( sum( c_of(-N:N).'* exp(1j* (-N:N)' *w0 .* t), 1));

hold on;
grid on;
for N = [1, 3, 5, 10, 100]
figure(3)
plot(t,xN_exp(t,N),'DisplayName',['xN exp_{' num2str(N) '} (t)'])
hold on
grid on
xlabel('time')
ylabel('xN exp(t)')
end
legend('show')
title('Complex-Exponential Fourier Series Representation')
```



Published with MATLAB® R2025a