6.3000: Signal Processing

Discrete-Time Fourier Series

Synthesis Equation

$$f[n] = f[n+N] = \sum_{k=\langle N \rangle} a_k \, e^{j\frac{2\pi k}{N}n}$$

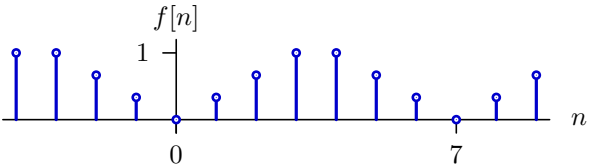
Analysis Equation

$$a_k = \frac{1}{N} \sum_{n=\langle N \rangle} f[n] \, e^{-j\frac{2\pi k}{N}n}$$

September 18, 2025

Find the DT Fourier Series Coefficients

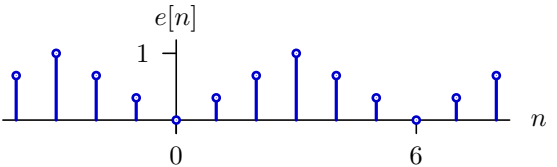
Let $f[n]$ represent a periodic DT signal with period $N = 7$:



Determine the Fourier series coefficients $F[k]$ for $f[n]$.

Find the DT Fourier Series Coefficients

How would the answer change if the period were $N = 6$?

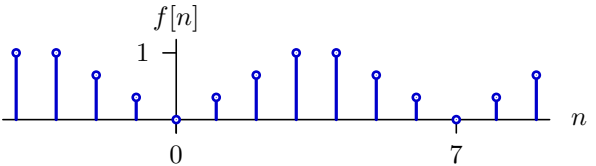


Determine the Fourier series coefficients $E[k]$ for $e[n]$.

Find the DT Fourier Series Coefficients

Consider a new signal $g[n]$ derived from $f[n]$ as follows:

$$g[n] = 9 - 3f[n-1]$$



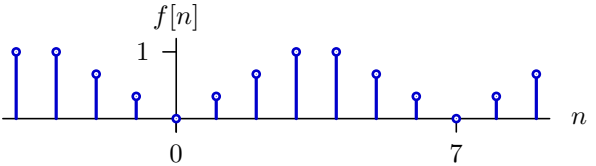
Find the DTFS coefficients of $g[n]$.

Find the DT Fourier Series Coefficients

Consider another new signal

$$h[n] = (-1)^n f[n]$$

where

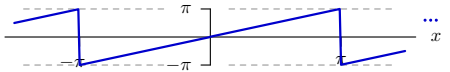


Find the DTFS coefficients of $h[n]$.

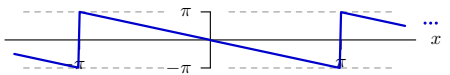
Angular Trends

Which of the following plots shows the angle of e^{-jx}?

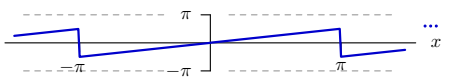
A



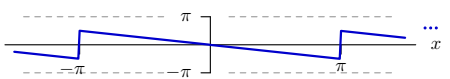
B



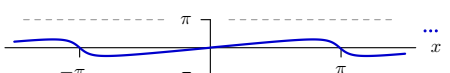
C



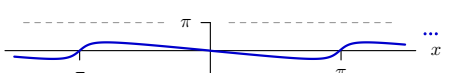
D



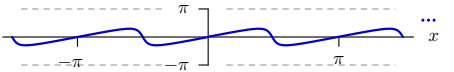
E



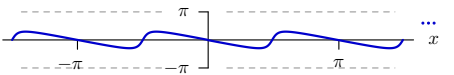
F



G



H



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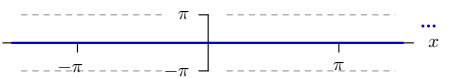

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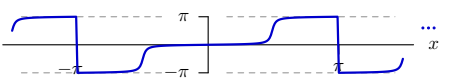
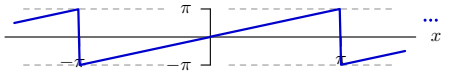
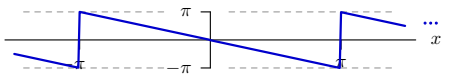


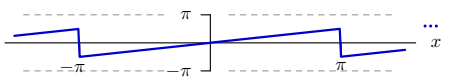
K

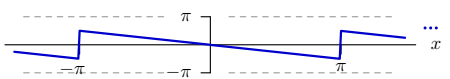
Angular Trends

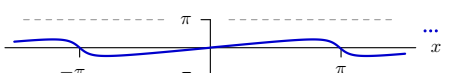
Which of the following plots shows the angle of $(1 + 0.8e^{jx})$?

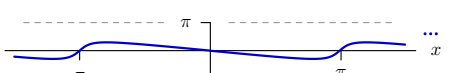
A 

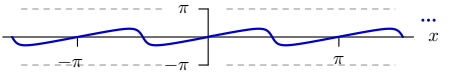
B 

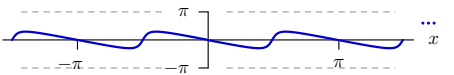
C 

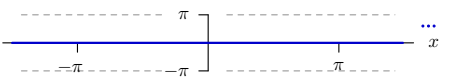
D 

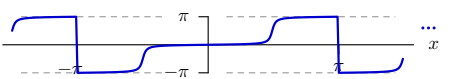
E 

F 

G 

H 

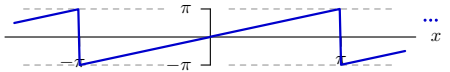
I 

J 

K 

Angular Trends

Which of the following plots shows the angle of $\left(\frac{1+0.4e^{jx}}{2+0.8e^{jx}}\right)$?

A


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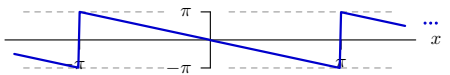

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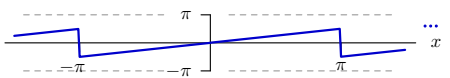

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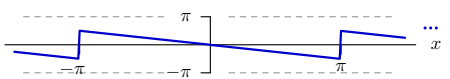
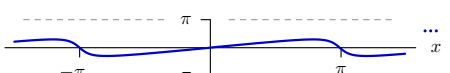


E


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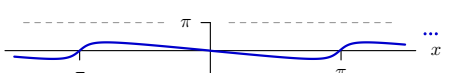

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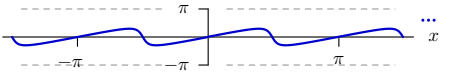

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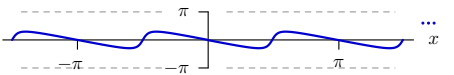

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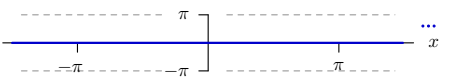

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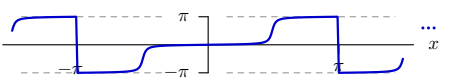
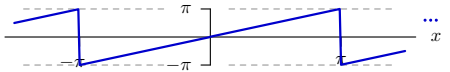
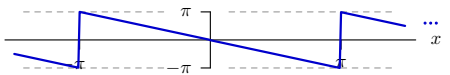


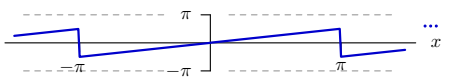
K

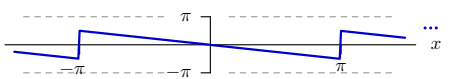

Angular Trends

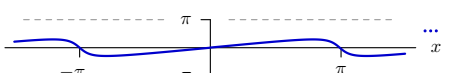
Which of the following plots shows the angle of $(1 + e^{jx})$?

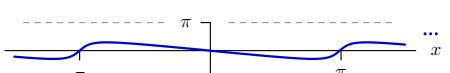
A 

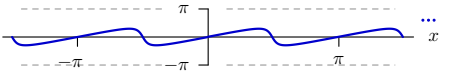
B 

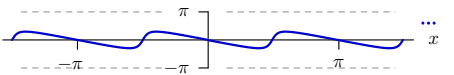
C 

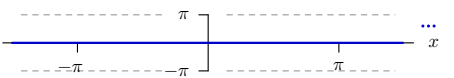
D 

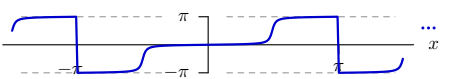
E 

F 

G 

H 

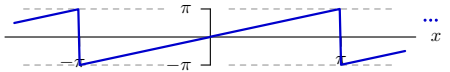
I 

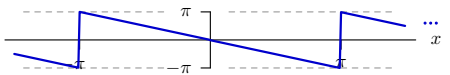
J 

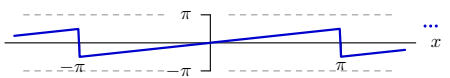
K 

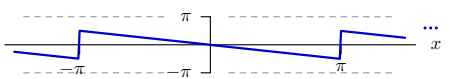
Angular Trends

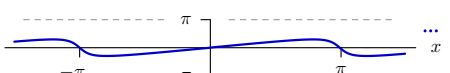
Which of the following plots shows the angle of $(1 + 0.8e^{j2x})$?

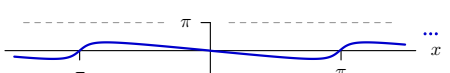
A 

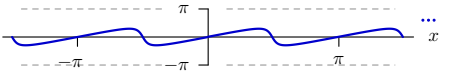
B 

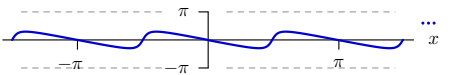
C 

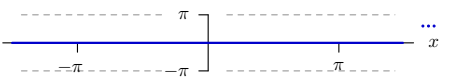
D 

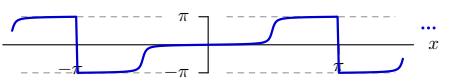
E 

F 

G 

H 

I 

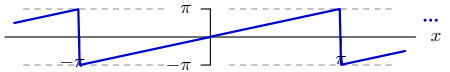
J 

K 

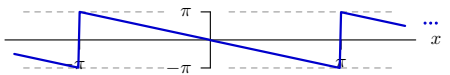
Angular Trends

Which of the following plots shows the angle of $(0.9e^{jx}+0.8e^{-jx})$?

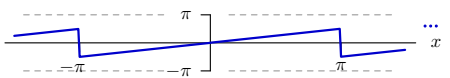
A



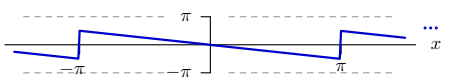
B



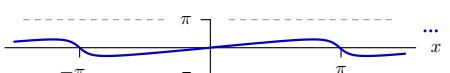
C



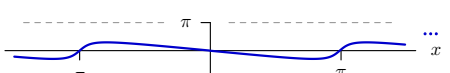
D



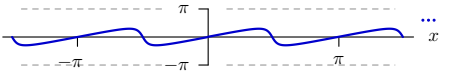
E



F



G



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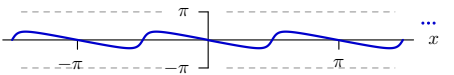

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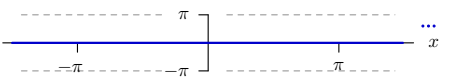

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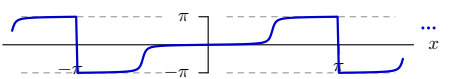
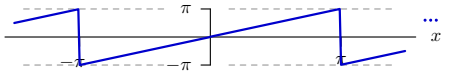


K

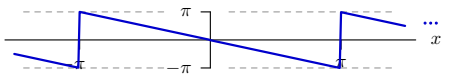
Angular Trends

Which of the following plots shows the angle of $\left(\frac{1}{1+0.8e^{jx}}\right)$?

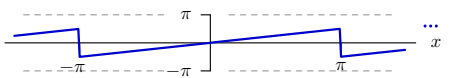
A



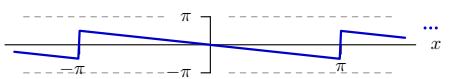
B



C



D



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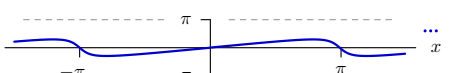

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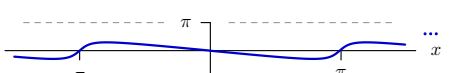

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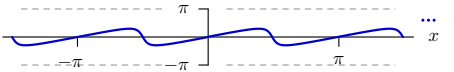

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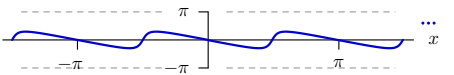

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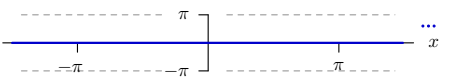

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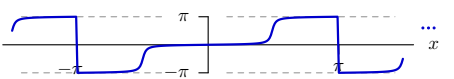

K