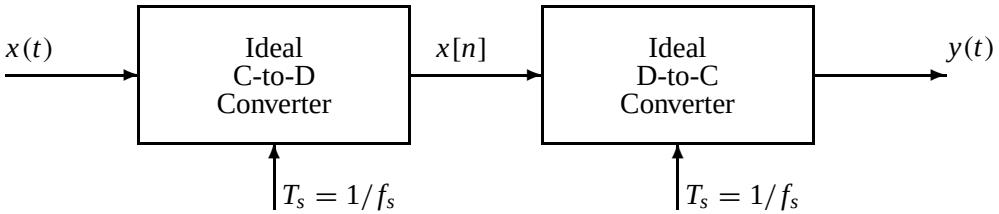
PROBLEM:



Suppose that the output of the D-to-C converter in the above system is found to be

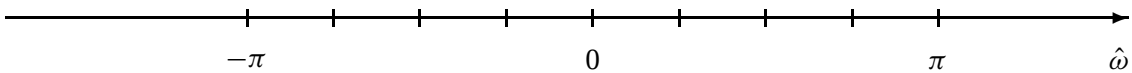
$$y(t) = 5 + 20\cos(2\pi(100)t + \pi/4)$$

when the sampling rate is $f_s = 1/T_s = 400$ samples/second.

(a) Give an equation for $x[n]$ in terms of cosine functions. **Write your answer on the line below.**

Answer: $x[n] =$ _____

Plot the spectrum of $x[n]$ for normalized frequencies $-\pi \leq \hat{\omega} \leq \pi$. **Carefully label and dimension your plot.**



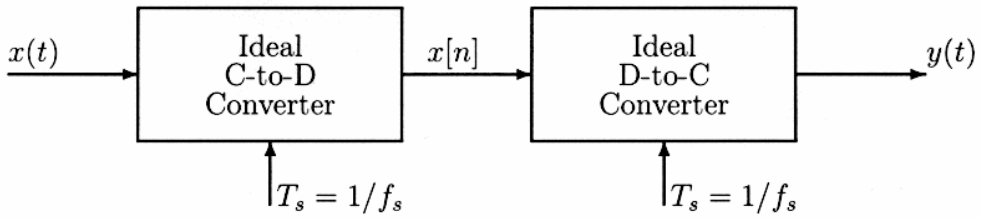
(b) Determine two *different* input signals $x(t) = x_1(t)$ and $x(t) = x_2(t)$ that could have produced the given output of the D-to-C converter. **All of the frequencies in your answers must be positive and less than 400 Hz. Give equations for both inputs on the lines below.**

Answer: $x_1(t) =$ _____

Answer: $x_2(t) =$ _____

McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION



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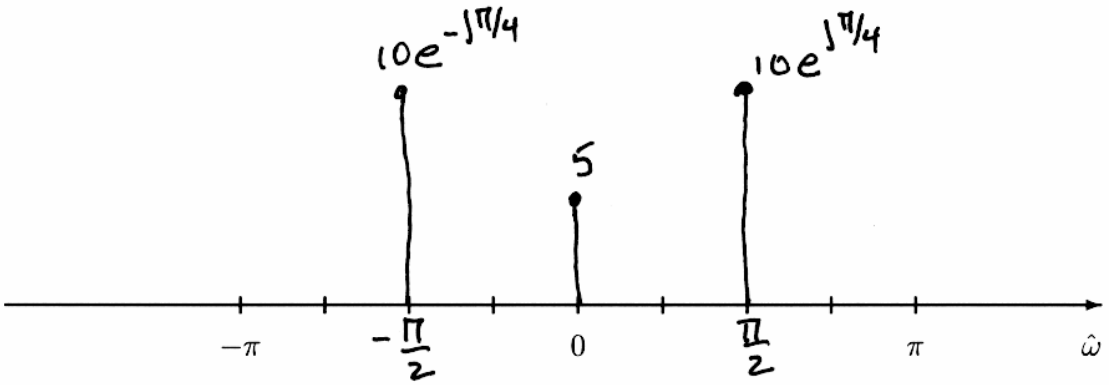
when the sampling rate is $f_s = 1/T_s = 400$ samples/second.

(a) Give an equation for $x[n]$ in terms of cosine functions. **Write your answer on the line below.** $x[n] = y(nT_s) = 5 + 20\cos\left(2\pi(100)\frac{n}{400} + \pi/4\right)$

Answer: $x[n] =$ $5 + 20\cos\left(\frac{\pi}{2}n + \pi/4\right)$

Plot the spectrum of $x[n]$ for normalized frequencies $-\pi \le \hat{\omega} \le \pi$. **Carefully label and dimension your plot to receive full credit.**



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If no aliasing occurs $y(t) = x(t)$

Answer: $x_1(t) =$ $5 + 20\cos(2\pi(100)t + \pi/4)$

If folding occurs the frequency will be $400 - 100 = 300$

Answer: $x_2(t) =$ $5 + 20\cos(2\pi(300)t - \pi/4)$

note − sign