

ECEN220 Tutorial 1 Questions

Block 1: Signals

Q1. What is the difference between a continuous-time signal and a discrete-time signal? Between a discrete-time signal and a digital signal?

Q2. What is the definition of a causal signal? Noncausal signal? Anticausal signal?

Q3. Is the shape of a waveform altered or preserved upon applying a time-shift transformation? Time-scaling transformation? Time-reversed transformation?

Q4. If signal $y(t)$ is obtained from $x(t)$ by applying the transformation $y(t) = x(-4t-8)$, determine the values of the transformation parameters a and T .

Q5. If $x(t) = t^3$ and $y(t) = 8t^3$, are $x(t)$ and $y(t)$ related by a transformation?

Q6. What type of transformations connect $x(t) = 4t$ and $y(t) = 2(t+4)$?

Q7. Define even-symmetrical and odd-symmetrical waveforms.

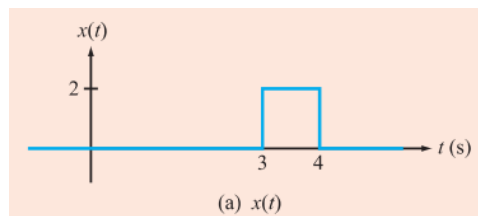
Q8. State the periodicity property of a signal.

Q9. Which of the following functions have even-symmetrical waveforms, odd-symmetrical waveforms, or neither? a) $x_1(t) = 3t^2$, b) $x_2(t) = \sin(2t)$, c) $x_3(t) = \sin^2(2t)$, d) $x_4(t) = 4e^{-t}$, e) $x_5(t) = |\cos 2t|$

Q10. How is $u(t)$ related to $u(-t)$?

Q11. How is $u(t)$ related to $\delta(t)$?

Q12. If $x(t)$ is as shown in the picture below, determine its time derivative $x'(t)$ and plot it.



Q13. If the time constant of a negative exponential function is doubled in time, will the corresponding waveform decay faster or slower?

Q14. Signals are divided into three power/energy class. What are they?

Q15. Determine the values P_{av} and E for a pulse signal given by $x(t) = 5 \text{rect}\left(\frac{t-3}{4}\right)$

Q16. Provide definitions or explain the meaning of the following terms:

Analog signal

Dirac delta function

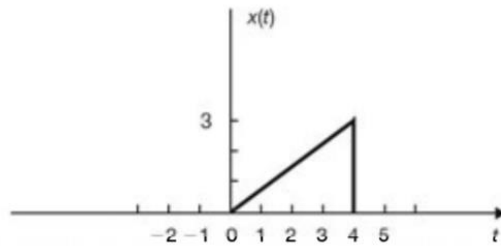
Exponential waveform

Impulse function

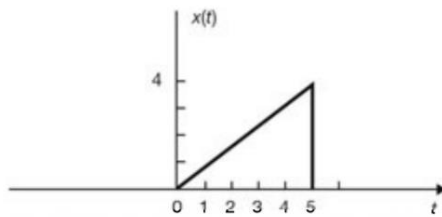
Unit step function

Q17. A continuous-time signal $x(t)$ is shown below. Sketch and label each of the following signals.

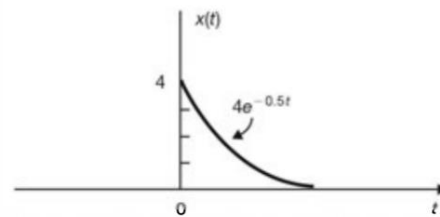
(a) $x(t-2)$; (b) $x(2t)$; (c) $x(t/2)$; (d) $x(-t)$



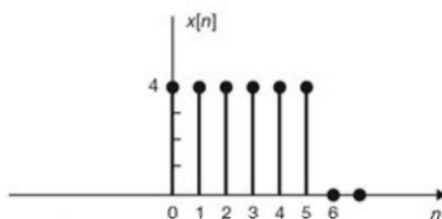
Q18. Sketch and label the even and odd components of the signals shown below.



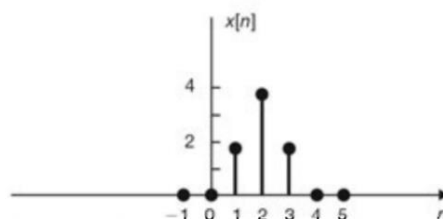
(a)



(b)



(c)



(d)

Q19. Show that the product of two even signals or of two odd signals is an even signal and that the product of an even and an odd signal is an odd signal.

Q20. Determine whether or not this signal is periodic. If it is periodic, determine its fundamental period.

$$x(t) = \cos\left(t + \frac{\pi}{4}\right)$$

Q21. Determine whether or not this signal is periodic. If it is periodic, determine its fundamental period.

$$x[n] = \cos\frac{\pi}{3}n + \sin\frac{\pi}{4}n$$

Q22. Determine whether the following signal is energy signal, power signal, or neither.

$$x(t) = A \cos(\omega_0 t + \theta)$$

Q23. Determine the duration of $\{3, \underline{1}, 4, 6\}$.

Q24. If the mean value of $x[n]$ is 3, what transformation results in a zero-mean signal?

Q25. Determine the fundamental period and fundamental angular frequency of

$$x[n] = 3\cos(0.56\pi n + 1).$$

Q26. Compute the fundamental angular frequency of $x[n] = 2\cos(5.1\pi n + 1)$.