Solution of 315 Test 10 F07

1. (a) Write a functional description of the time-domain signal below as the product of two functions of *t*.

$$x(t) = \text{rect}(t)\sin(2\pi t)$$

(b) Write a functional description of the frequency-domain signal below as the sum of two functions of *f*.

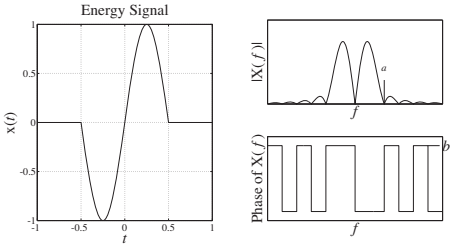
$$X(f) = \text{sinc}(f) * (j/2)\left[\delta(f+1) - \delta(f-1)\right]$$

$$X(f) = (j/2)\text{sinc}(f+1) - (j/2)\text{sinc}(f-1)$$

(c) Find the numerical values of *a* and *b*.

a is at the first positive-frequency null of $\text{sinc}(f-1)$ which occurs at $f = 2$. Therefore *a* = 2.

The phase values are all either $\pi/2$ or $-\pi/2$ because of the $(j/2)$ factor. Therefore $b = \pi/2$.



2. (a) Write a functional description of the time-domain signal below as the convolution of two functions of *t*.

$$x(t) = \text{tri}(2t) * \delta_2(t)$$

(b) Write a functional description of the frequency-domain signal below as the product of two functions of *f*.

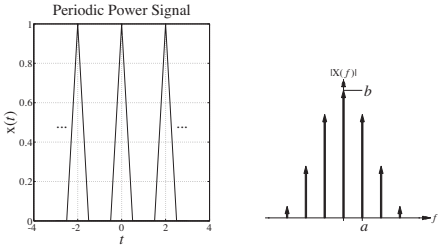
$$X(f) = (1/2)\text{sinc}^2(f/2) \times (1/2)\delta_{1/2}(f)$$

$$X(f) = (1/4)\text{sinc}^2(f/2)\delta_{1/2}(f)$$

(c) Find the numerical values of *a* and *b*.

a is the location of the first positive-frequency impulse which is at $f = 1/2$. Therefore $a = 1/2$.

b is the strength of the impulse at zero. Therefore $b = 1/4$.



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(b) Write a functional description of the frequency-domain signal below as the sum of two functions of *f*.

$$X(f) = 2\,\text{sinc}(2f) * (j/2)\left[\delta(f+1) - \delta(f-1)\right]$$

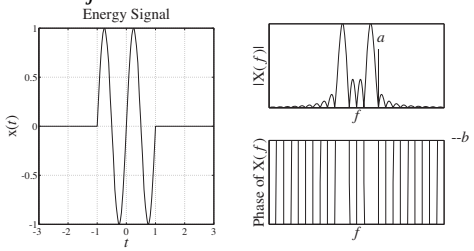
$$X(f) = j\,\text{sinc}(2(f+1)) - j\,\text{sinc}(2(f-1))$$

(c) Find the numerical values of *a* and *b*.

a is at the second positive-frequency null of $\text{sinc}(2(f-1))$ which occurs at $f = 3/2$.

Therefore *a* = 3/2.

The phase values are all either $\pi/2$ or $-\pi/2$ because of the *j* factor. Therefore $b = \pi/2$.



2. (a) Write a functional description of the time-domain signal below as the convolution of two functions of *t*.

$$x(t) = \text{tri}(t) * \delta_2(t)$$

(b) Write a functional description of the frequency-domain signal below as the product of two functions of *f*.

$$X(f) = \text{sinc}^2(f) \times (1/2)\delta_{1/2}(f)$$

$$X(f) = (1/2)\,\text{sinc}^2(f)\,\delta_{1/2}(f)$$

(c) Find the numerical values of *a* and *b*.

a is the location of the first positive-frequency impulse which is at $f = 1/2$. Therefore $a = 1/2$.

b is the strength of the impulse at zero. Therefore $b = 1/2$.