GATE 2023 - EC 50

EE23BTECH11220 - R.V.S.S Varun

Question

Let x1(t) and x2(t) be two band-limited signals having bandwidth B = $4\pi\times10^3$ rad/s each. In the figure below, the Nyquist sampling frequency, in rad/s, required to sample y(t), is

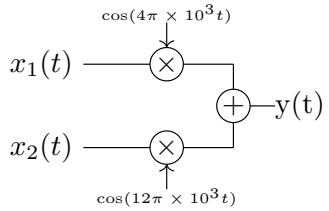


Fig. 0. Enter Caption

(a) $20\pi \times 10^3$
(b) $40\pi \times 10^3$
(c) $8\pi \times 10^3$
(d) $32\pi \times 10^3$ (GATE EC 50)

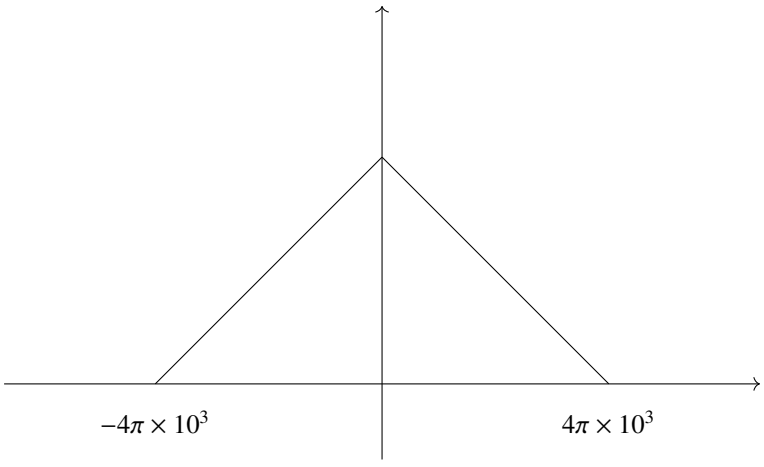
Solution

Symbol	Description
Y(f)	y(t) in frequency domain
ω_m	Maximum frequency of Y(f)
ω_s	Nyquist sampling rate

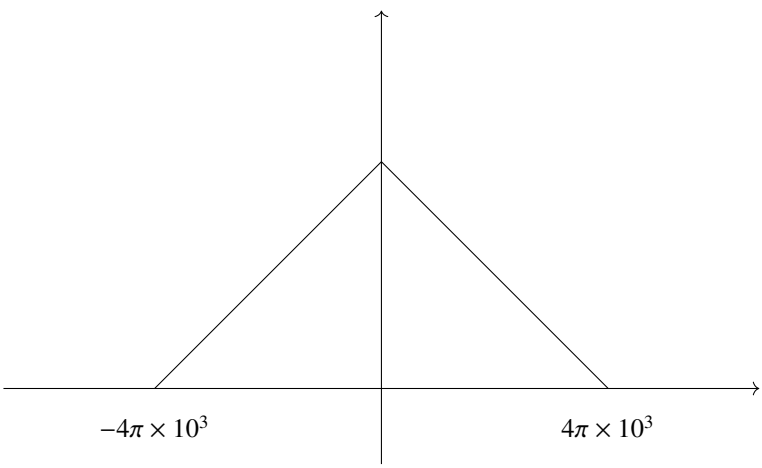
TABLE 0
Caption

$x_1(t)$ and $x_2(t)$ in frequency domain ,

$X_1(f)$



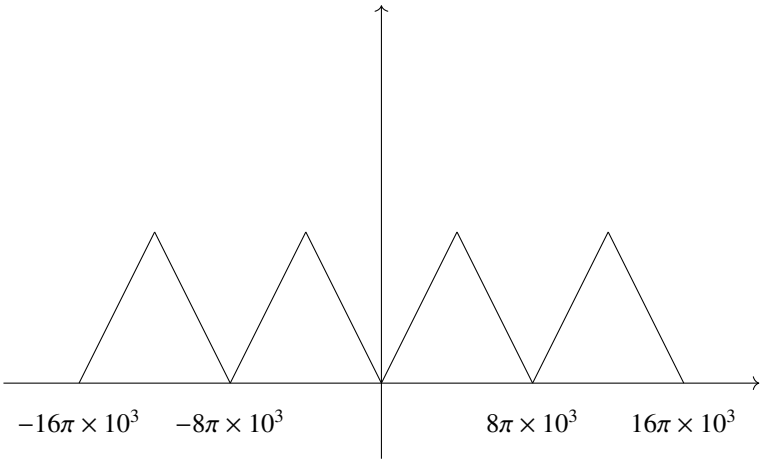
$X_2(f)$



From figure ,

$$y(t) = x_1(t)\cos\left(12\pi \times 10^3\right) + x_2(t)\cos\left(4\pi \times 10^3\right) \quad (1)$$

$Y(f)$



y(t) in frequency domain

$$\omega_m = 16\pi \times 10^3 rad/sec. \quad (2)$$

$$\omega_s = 2\omega_m = 32\pi \times 10^3 rad/sec. \quad (3)$$