EEE243

Assignment- 2

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Section: 02

From the graph,

$$x(t) = \begin{cases} 2, & -2 \le t < -1 \\ 1, & -1 \le t \le 1 \\ 2, & 1 < t \le 2 \\ 0, & \text{otherwise} \end{cases}$$

$$x(w) = \int_{-2}^{-1} 2e^{-jwt}\,dt + \int_{-1}^{1} e^{-jwt}\,dt + \int_{1}^{2} 2e^{-jwt}\,dt$$

now,

$$x_1(w) = 2\int_{-2}^{-1} e^{-jwt}\,dt$$

$$= 2\left[\frac{e^{-jwt}}{-jw}\right]_{-2}^{-1}$$

$$= 2\left[\frac{e^{j2w} - e^{jw}}{jw}\right]$$

again,

$$x_2(w) = \int_{-1}^{1} e^{-jwt}\,dt$$

$$= \left[\frac{e^{-jwt}}{-jw}\right]_{-1}^{1}$$

$$= \left(\frac{e^{jw} - e^{-jw}}{-jw}\right)$$

$$= \frac{2j\sin(w)}{-jw} = \frac{2\sin(w)}{w}$$

again,

$$x_3(w) = 2\int_{1}^{2} e^{-jwt}\,dt$$

$$= 2\left[\frac{e^{-jwt}}{-jw}\right]_{1}^{2}$$

$$= 2\left(\frac{e^{-jw} - e^{-j2w}}{jw}\right)$$

now,

$$X(w) = X_1(w) + X_2(w) + X_3(w)$$

$$= \frac{2(e^{j2w} - e^{jw})}{jw} + \frac{2\sin(w)}{w} + \frac{2(e^{-jw} - e^{-j2w})}{jw}$$

$$= \frac{2e^{j2w} - 2e^{jw} + 2j\sin(w) + 2e^{-jw} - 2e^{-j2w}}{jw}$$

$$= \frac{4\sin(2w) - 2\sin(w)}{w}$$

Ans

$$\begin{cases} e^{j2w} - e^{-j2w} = 2j\sin(2w) \\ e^{jw} - e^{-jw} = 2j\sin(w) \end{cases}$$