Q. $x(t) = \frac{1}{\pi}\int_0^{\infty} |X(\omega)| \cos(\omega t + \angle X(\omega))\, d\omega$. Prove.

y. $x(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} X(\omega) \cdot e^{j\omega t}\, d\omega$

Now, if we apply mod.

Phase Term because of Mod.

$$x(t) = \frac{1}{2\pi}\left(\int_0^{\infty} |X(\omega)|\, e^{j(\omega t + \angle X(\omega))} + \int_0^{\infty} |X(+\omega)|\, e^{-j(\omega t + \angle X(\omega))}\right)$$

(-ve because $0 \to \infty$)

$|X(-\omega)| = |X(\omega)|$ as X is a Real signal.

$$= \frac{1}{\cancel{2}\pi}\int_0^{\infty} |X(\omega)|\, \cancel{2}\cos(\omega t + \angle X(\omega))$$

$$= \frac{1}{\pi}\int_0^{\infty} |X(\omega)| \cos(\omega t + \angle X(\omega))$$

Question 2 :-

Non zero signal $x(t) \xrightarrow{LPF} y(t)(a>0)$

$y(t) \xrightarrow{HPF} z(t)\ (b>0)$

(i) Relation b/w a and b.
(ii) FT of $x(t)$ is 0 where?

(i) $x(t) \xrightarrow{LPF} y(t)$ (All frequencies above a are cutoff).

$y(t) \xrightarrow{HPF} x(t)$ (All frequencies below b are cutoff).

∴ As we get back $x(t)$, it means no frequencies were deleted in the LPF, and as we get back $x(t)$, no frequencies were cut off by HPF too. This is because AN LTI SYSTEM CANNOT ADD Frequencies.

∴ From this, we can say.

$$\boxed{a > b}$$

(ii) The FT of B is necessarily 0 in all regions that ~~[illegible]~~ are 0. These regions are all regions with a frequency $>a$, as shown above.