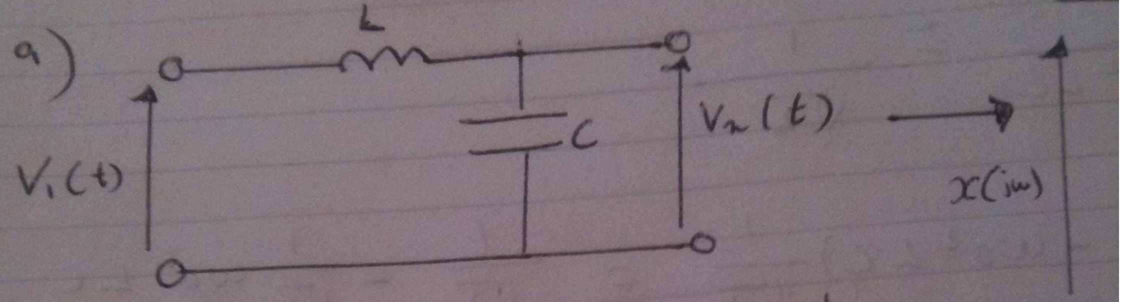
L6)

a)



$$* \quad Z_L = j\omega L \;, \quad Z_c = \frac{-j}{\omega C} = \frac{1}{j\omega C}$$

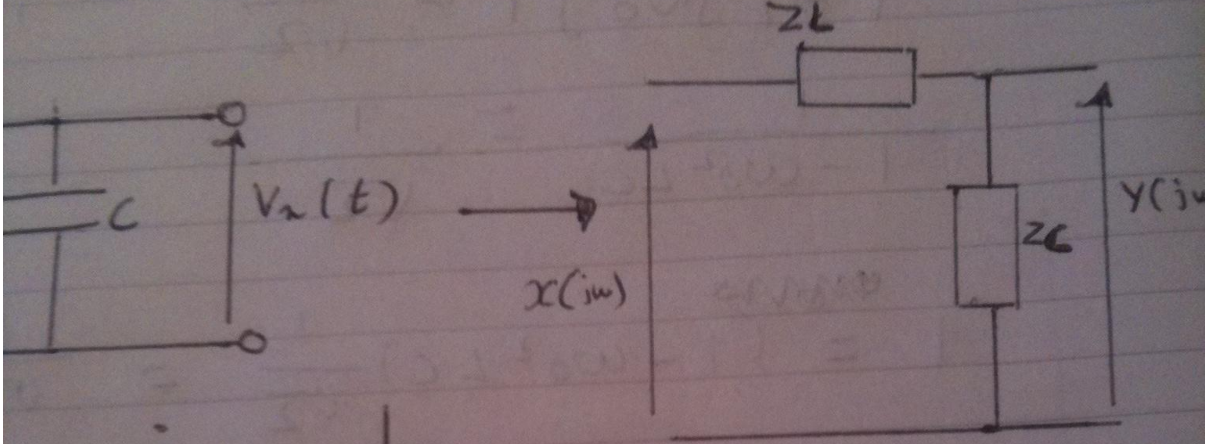
$$H(j\omega) = \frac{Y(j\omega)}{X(j\omega)} \;, \quad y(j\omega) =$$

$$Y(j\omega) = \frac{1}{j\omega C(-j\frac{1}{\omega C} + j\omega L)} X(j\omega)$$

$$H(j\omega) = \frac{1}{-j^2\frac{\omega C}{\omega C} + j^2 \omega^2 LC}$$

$$H(j\omega) = \frac{1}{1-\omega^2 LC} + C$$

2) $$|H(j\omega)| = \frac{1}{1-\omega^2 LC} = 1.1$$



$$= \frac{-j}{wc} = \frac{1}{jwc}$$

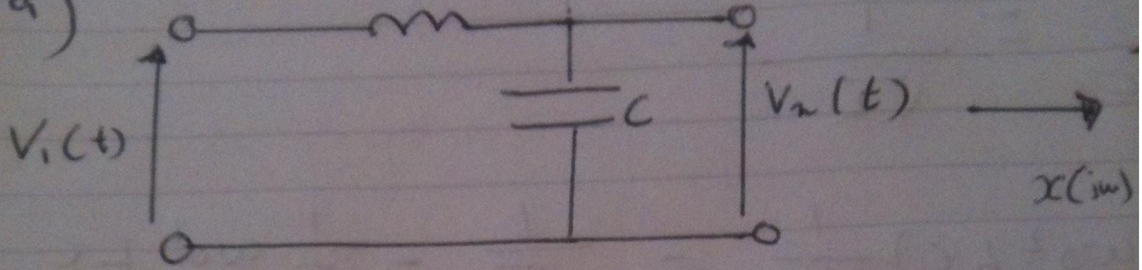
$$y(jw) = \frac{Z_C}{Z_L + Z_C} \cdot x(jw)$$

$$\frac{}{(-j\frac{1}{wc} + jwL)} x(jw)$$

$$\frac{}{\frac{wc}{wc} + j^2 w^2 LC}$$

$$\frac{1}{} + 0j$$

a)



* $Z_L = j\omega L$, $Z_C = \frac{-j}{\omega C} = \frac{1}{j\omega C}$

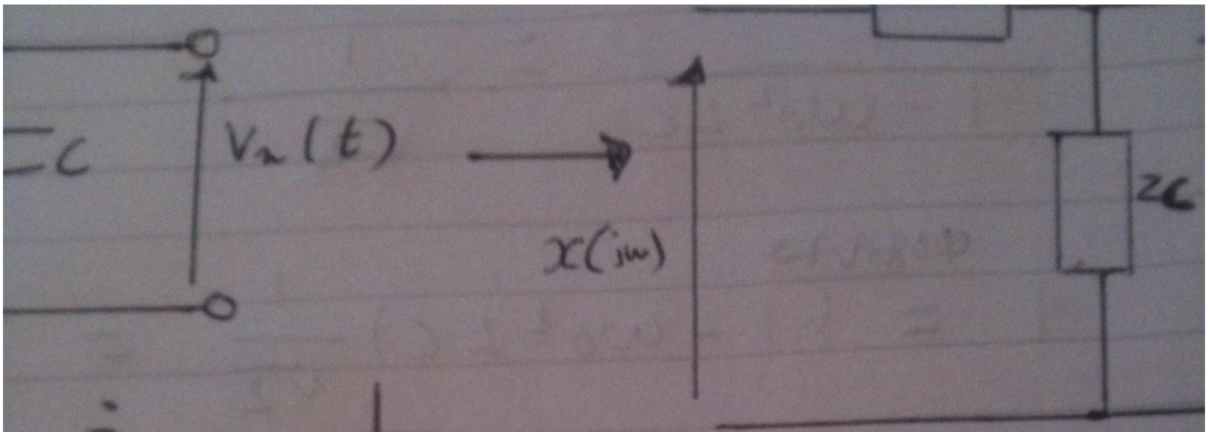
$H(j\omega) = \frac{Y(j\omega)}{X(j\omega)}$, $y(j\omega) =$

$$Y(j\omega) = \frac{1}{j\omega C\left(-j\frac{1}{\omega C} + j\omega L\right)} X(j$$

$$H(j\omega) = \frac{1}{-j^2\frac{\omega C}{\omega C} + j^2\omega^2 LC}$$

$$H(j\omega) = \frac{1}{1-\omega^2 LC} +$$

) $|H(j\omega)| = \frac{1}{1-\omega^2 LC} = 1$



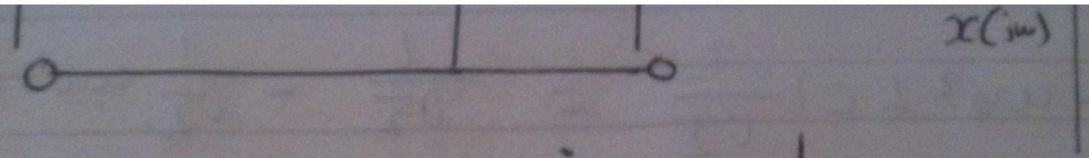
$$\frac{-j}{wc} = \frac{1}{jwc}$$

$$, \quad y(jw) = \frac{Z_c}{Z_L + Z_c} \cdot x(jw$$

$$\overline{\quad\quad(j\frac{1}{wc} + jwL)} \; x(jw)$$

$$\overline{\quad\quad + j^2 w^2 LC}$$

$$\overline{\quad\quad w^2 LC} + 0j$$



$$Z_L = jwL \quad , \quad Z_c = \frac{-j}{wC} = \frac{1}{jwC}$$

$$(jw) = \frac{Y(jw)}{X(jw)} \quad , \quad y(jw) =$$

$$(jw) = \frac{1}{jwC\,(-j\frac{1}{wC} + jwL)}\, x(jw)$$

$$(jw) = \frac{1}{-j^2 \frac{wC}{wC} + j^2 w^2 LC}$$

$$(jw) = \frac{1}{1 - w^2 LC} + 0$$

$$|H(jw)| = \frac{1}{1 - w^2 LC} = 1.1$$

$$H(jw)) = \tan^{-1}(0) = 0^\circ$$

$$) = \frac{y(jw)}{x(jw)} \quad , \quad j(\ldots) \quad Z_L + Z_C$$

$$) = \frac{1}{jwc\,(-j\frac{1}{wc} + jwL)}\, x(jw)$$

$$w) = \frac{1}{-j^2\frac{wc}{wc} + j^2 w^2 LC}$$

$$w) = \frac{1}{1 - w^2 LC} + 0j$$

$$|(jw)| = \frac{1}{1 - w^2 LC} = 1.11$$

$$(jw)) = \tan^{-1}(0) = 0^\circ$$

$w = 10^3$ rad s^{-1} then the output is

$$(t) = |H(jw)|\, A \cos(10^3 t + \angle H($$

$$t) = 1.11 \cos(10^3$$

$\angle H(j\omega)) = \tan^{-1}(0) = 0^\circ$

Since $\omega = 10^3$ rad s^{-1} then the output is given

$$V_2(t) = |H(j\omega)|\, A \cos(10^3 t + \angle H(j\omega))$$

$$V_2(t) = 1.11 \cos(10^3 t)$$

5) when $|H(j\omega_0)|_{max} = \frac{1}{\sqrt{2}} |H(j\omega)|_{max}$

$|H(j\omega)|_{max}$ when $\omega_0 = 0$ rad s^{-1}

$$|H(j\omega)|_{max} = 1$$

$|H(j\omega_0)| = \frac{1}{\sqrt{2}}$, $\frac{\omega_0}{2\pi}$ = cutoff frequency

$$\frac{1}{1-\omega_0^2 LC} = \frac{1}{\sqrt{2}}$$

$$1 = (1-\omega_0^2 LC)\frac{1}{\sqrt{2}} = \frac{1}{\sqrt{2}} - \frac{1}{\sqrt{2}}\omega_0^2 LC$$

$$\frac{1}{\sqrt{2}}\omega_0^2 LC = \frac{1}{\sqrt{2}} - 1$$

$$\omega_0^2 = \frac{\frac{1}{\sqrt{2}} - 1}{\frac{1}{\sqrt{2}} LC} = -4.142 \times 10^6$$

Negative?