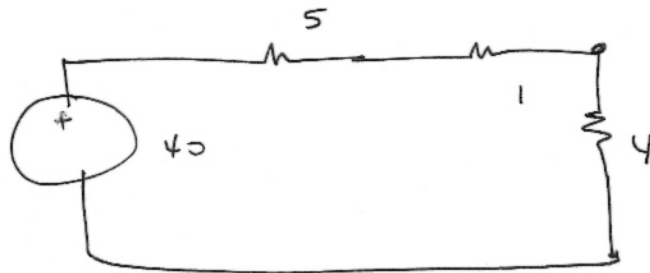


EE 207 S 101.

HW 4 Sol.

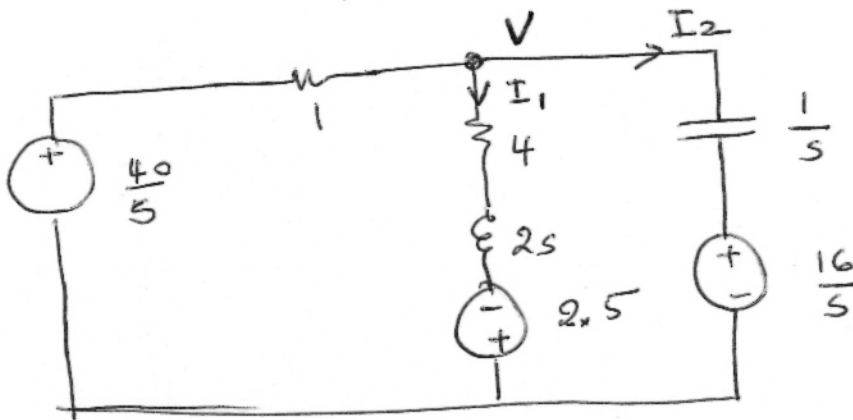
Pb 1



$t < 0$

$$i_L(0^-) = \frac{50}{10} = 5 \text{ A}$$

$$v_c(0^-) = \frac{4}{10} \times 40 = 16 \text{ V}$$



$$V = I_1(2.5 + 4) - 2.5$$

$$V - \frac{16}{5} = I_2 \left( \frac{1}{5} \right)$$

$$\frac{40}{5} = V = 1(I_1 + I_2)$$

$$\begin{bmatrix} 2.5 + 4 & 0 & -1 \\ 0 & \frac{1}{5} & -1 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ V \end{bmatrix} = \begin{bmatrix} 2.5 \\ -\frac{16}{5} \\ \frac{40}{5} \end{bmatrix} \dots$$

→  $I_1, I_2, V$

Solve.

or

$$\left\{ \begin{array}{l} I_1 = \frac{V+2.5}{2s+4} \\ I_2 = Vs-16 \\ \frac{40}{s} - V = \frac{V+2.5}{2s+4} + Vs-16 \end{array} \right.$$

$$(40-Vs)(2s+4) = [V+2.5 + (Vs-16)(2s+4)]s$$

$$\begin{aligned} 80s + 160 - 2s^2V - 4Vs &= Vs + 2.5s \\ &+ 2Vs^3 + 4Vs^2 - 32s^2 - 64s \\ V[-2s^2 - 4s - 5 - 2s^3 - 4s^2] &= 2.5s - 32s^2 \\ &- 64s - 80s - 160 \end{aligned}$$

$$* V = \frac{-32s^2 - 141.5s - 160}{-2s^3 - 6s^2 - 5s}$$

$$\begin{aligned} -2s^3 - 6s^2 - 5s &= -2s \left[ s^2 + 3s + \frac{5}{2} \right] \\ &= -2s \left[ \left( s + \frac{3}{2} \right)^2 + \left( \frac{1}{2} \right)^2 \right] \end{aligned}$$

after PFE  $\longrightarrow$

$$* v(t) = \left[ 32 - 0.5 e^{-1.5t} \left( 32 \cos 0.5t + 5 \sin 0.5t \right) \right] \times u(t)$$

$$v(t) = v_c(t) \quad \left[ \text{voltage over the whole capacity} \right]$$

B.  $Y(s) = X(s) e^{-2s}$

$X(s) = \frac{3}{(s-1)(s+2)} = \frac{-1}{s+2} + \frac{1}{s-1}$  using PFE

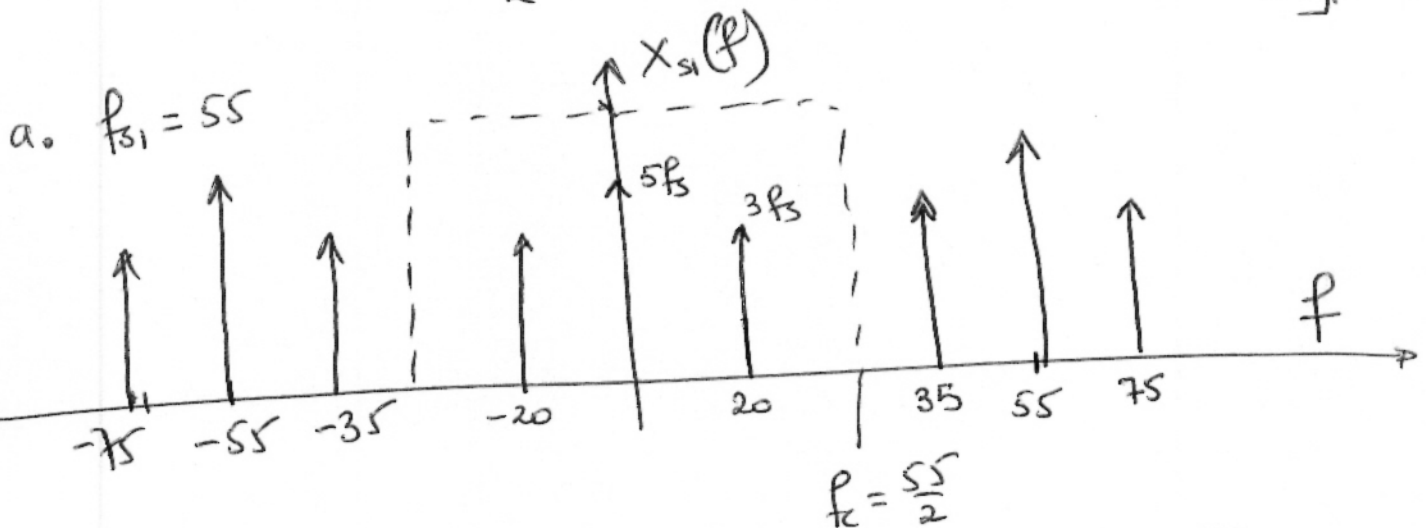
$x(t) = -e^{-2t} u(t) + e^t u(t)$

$y(t) = -e^{-2(t-2)} u(t-2) + e^{t-2} u(t-2)$

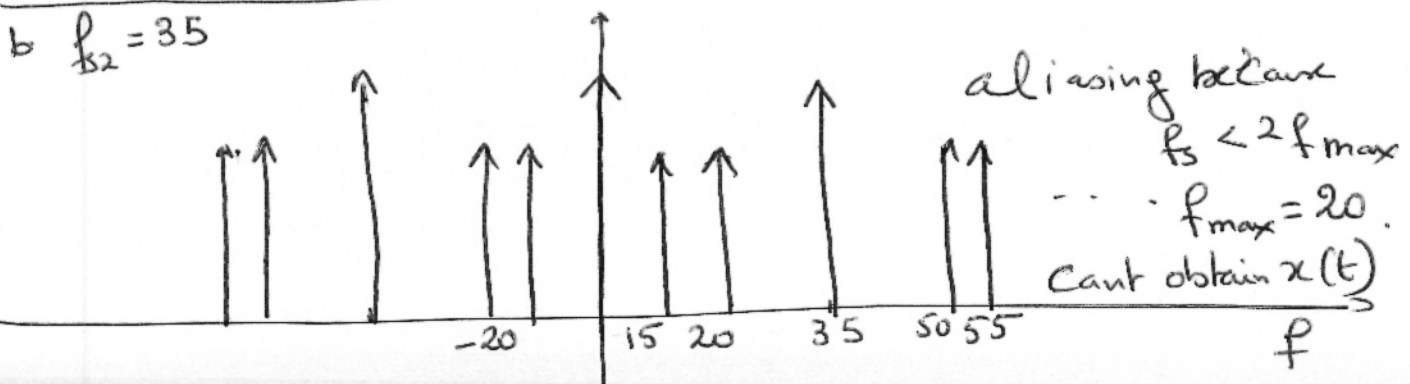
Pb2  $x(t) = 5 + 6 \cos 2\pi(20)t$

$X(f) = 5\delta(f) + 3\delta(f-20) + 3\delta(f+20)$

$X_s(f) = \sum_k \left[ 5\delta(f - kf_s) + 3\delta(f - 20 - kf_s) + 3\delta(f + 20 - kf_s) \right]$



no aliasing, can obtain by LP filter



$$\frac{X(z)}{z^n}$$

$$X(z) = \frac{5z^2 - 8z}{(z+0.5)(z-3)}$$

$$\frac{X(z)}{z} = \frac{5z - 8}{(z+0.5)(z-3)} = \frac{A}{z+0.5} + \frac{B}{z-3}$$

$$A = \frac{5z-8}{z-3} \Big|_{-0.5} = \frac{-2.5-8}{-3.5} = \frac{-10.5}{-3.5} = 3$$

$$B = \frac{5z-8}{z+0.5} \Big|_3 = \frac{7-8}{3.5} = \frac{-1}{3.5} = -\frac{2}{7}$$

$$X(z) = \frac{3z}{z+0.5} + \frac{2z}{z-3} = \frac{3}{1+0.5z^{-1}} + \frac{2}{1-3z^{-1}}$$

$$\longrightarrow x(n) = 3 \left(-\frac{1}{2}\right)^n u(n) + 2 (3)^n u(n)$$