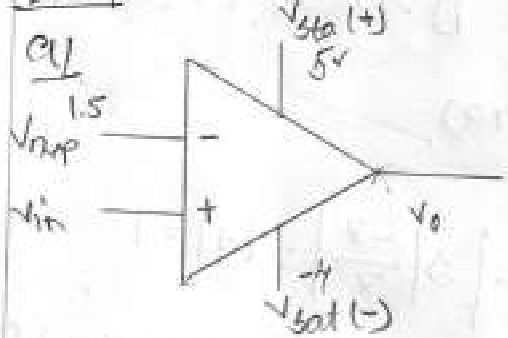
BRAC
UNIVERSITY

Inspiring Excellence

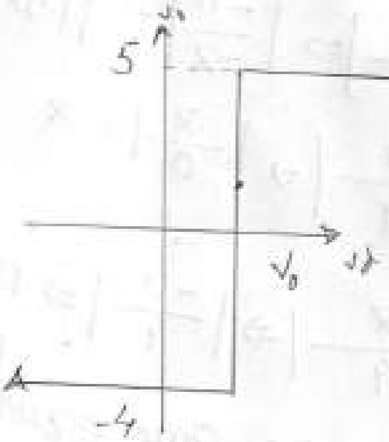
Name	**:**	Md.Tasnim Muttaki
Id	**:**	21101216
Subject	**:**	Digital Electronics
Course code	**:**	CSE 251
Section	**:**	02

$\boxed{9\text{-}9}$

a)



b)



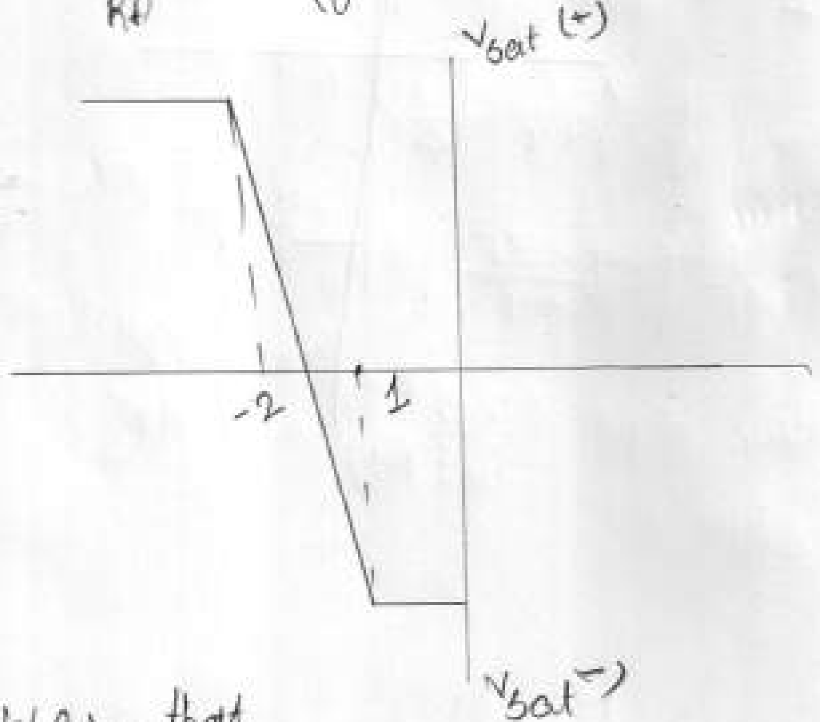
Q-10 Part-1 a) $R_i = 2k\Omega$, $R_f = 10k\Omega$, $V_{sat}(+) = 10$

$V_{sat}(-) = -5$

Now,

$$-\frac{R_i \cdot V_{sat}^{+}}{R_f} = -\frac{2 \times 10}{10} = -\frac{20}{10} = -2.$$

$$-\frac{R_i \cdot V_{sat}^{(-)}}{R_f} = -\frac{2 \times (-5)}{10} = \frac{10}{10} = 1$$



b) Given that

$V_i = 0.1 \sin(\omega t)$

$$V_o = -\frac{R_f}{R_i} V_i = \frac{10}{2} 0.1 \sin(\omega t)$$
$$= 0.5 \sin(\omega t)$$

Part-2 (e1) $\frac{R_i \times 2}{R_i + R_f} = 1$

$\Rightarrow 2R_i = R_i + R_f$

$\Rightarrow R_i = R_f$

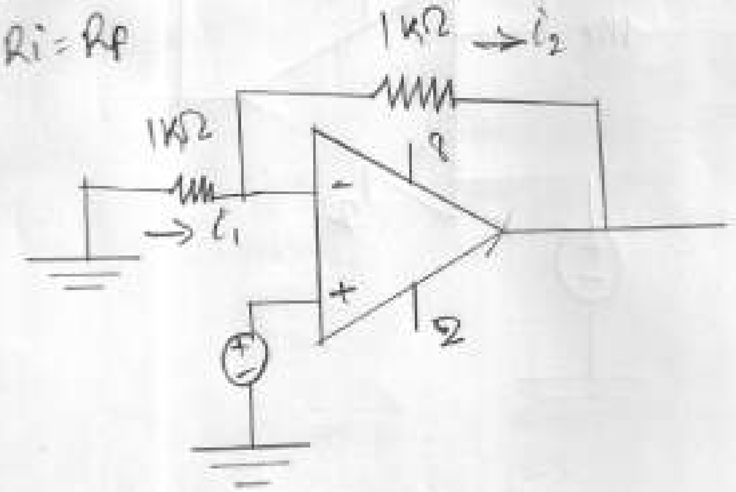
Again,

$\frac{R_i \times 8}{R_i + R_f} = 4$

$\Rightarrow 8R_i = 4R_i + 4R_f$

$\Rightarrow 4R_i = 4R_f$

$\Rightarrow R_i = R_f$



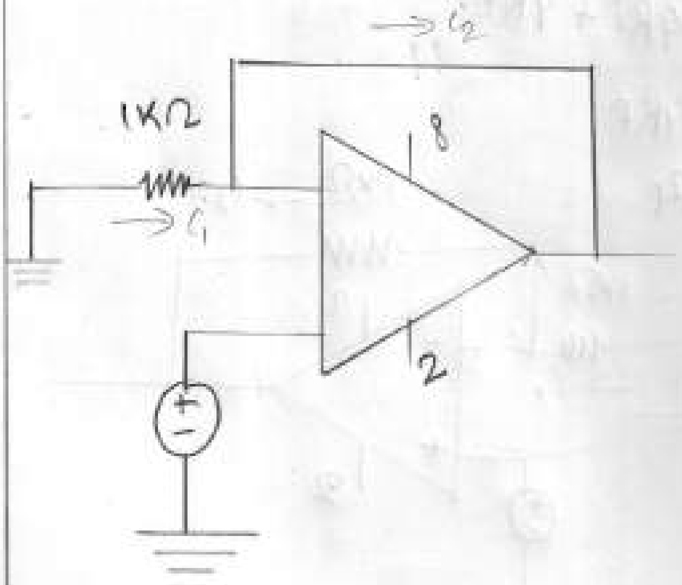
b/ $\left(1+\frac{R_f}{R_i}\right) \geq 1$

$\Rightarrow (1+1) > 1$

$\Rightarrow 2 > 1$

$\therefore$ Voltage gained.

c/



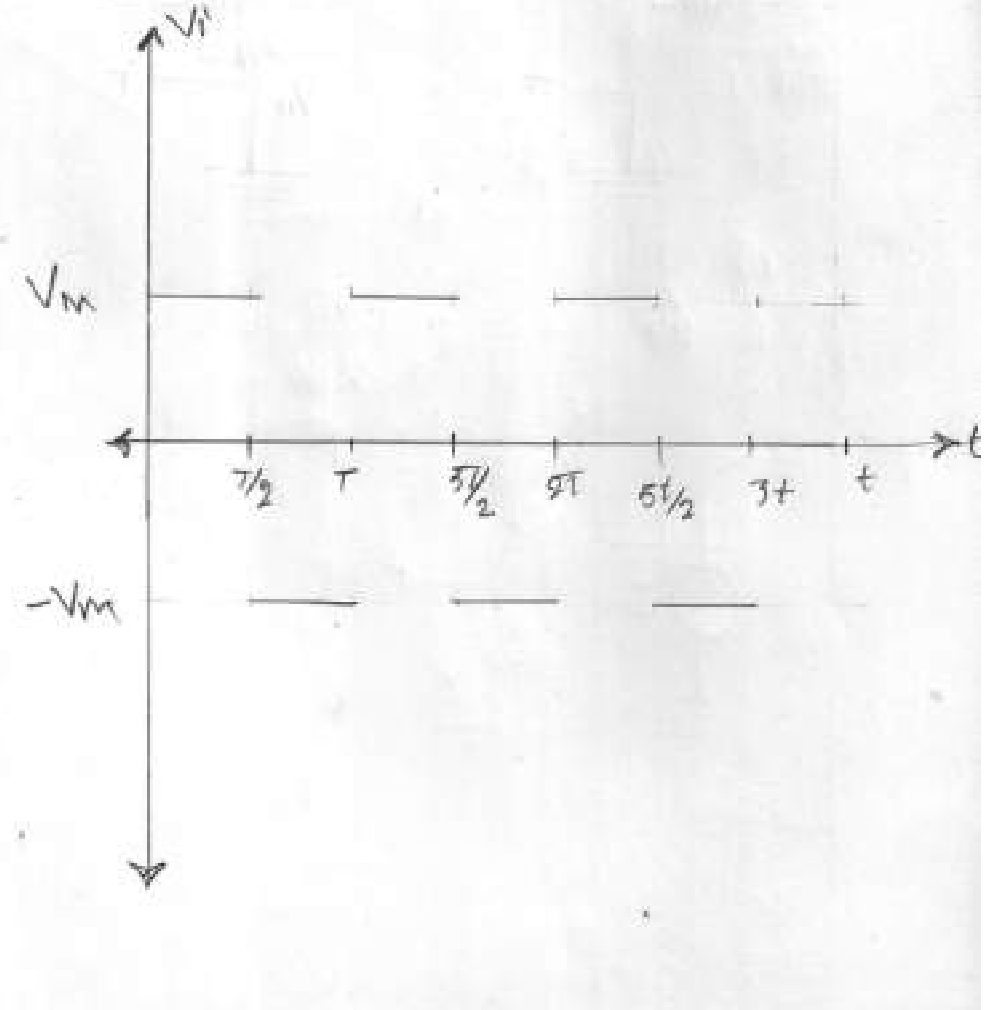
9-13

We know,

$v_0 = -RC\frac{dV_i}{dt}$

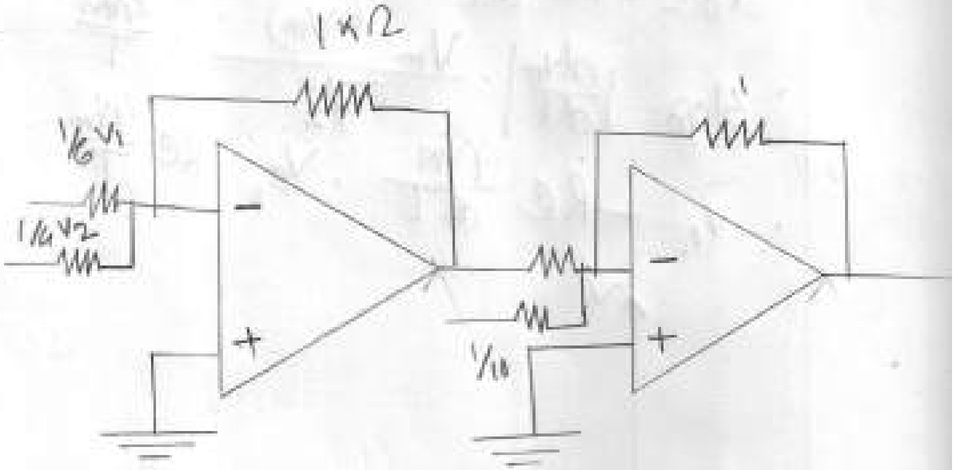
$\therefore$ Slope $= \left|\frac{dV_m}{dt}\right| = \frac{V_m-(-V_m)}{T/2} = \frac{4V_m}{T}$

$\therefore v_{o_1} = -RC\frac{4V_m}{dT}$, $V_{o_2} = RC\frac{4V_m}{T}$



Q-15

$V_o = 6V_1 - 10V_2 + 4V_3$



9-2 (1)

Given that, $h = 10m$, $P = h\rho g$

Now,

$P = 10 \times 1000 \times 9.8 = 98000 \Rightarrow 0.967$ atm

$= \cancel{9.8 \times 10^{-8}} = 9.\cancel{67} \cdot 8$

Hence,

in 0.5 atm voltage changes $2.5v$ $\frac{2.5}{0.5} = 5v$

1 " " " $\frac{2.5}{0.5} = 5v$

Now.

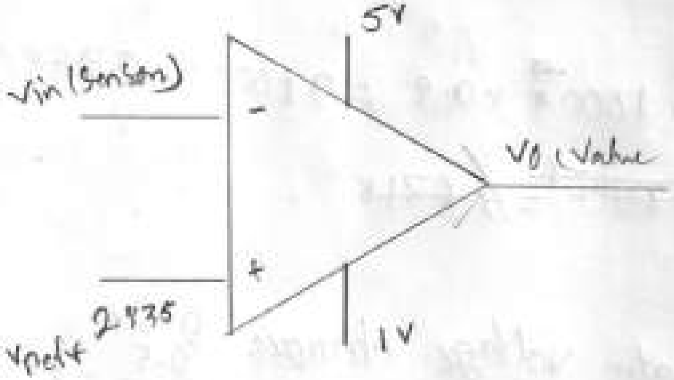
in $(0.967 - 0.5)$ atm voltage change $(0.967 - 0.5) \times 5$
$= 2.335$

$\therefore$ Voltage at 0.967 amp $= .5 + 2.335$
$= 2.835V$

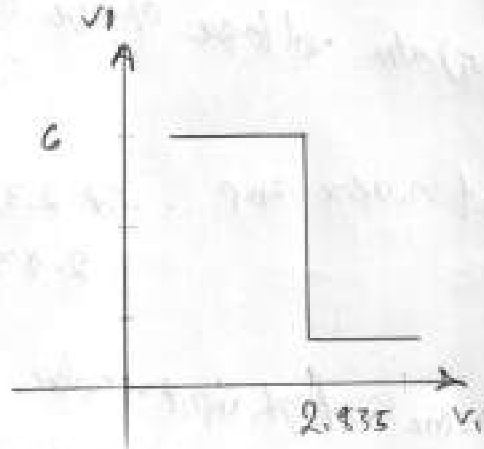
$\therefore$ High pressure $\Rightarrow$ high input $\Rightarrow$ valve open $V^- = 1V$

low pressure $\Rightarrow$ low input $\Rightarrow$ valve close $V^+ = 6V$

∴ the Op-Amp generate



(ii) VTC will be



Q-3/ a) Here non-inverting is grounded so the voltage will be $V_+ = 0V$, becuse the inverting node is connected to the feedback it will act as an virtual ground. thats why voltage will be $V_- = 0V$

b) The relation between I_1 and I_2 is:

$$I_1 = \frac{V_1 - 0}{R} \Rightarrow \frac{V_1}{R} = I_2$$

$$\therefore I_1 = I_2$$

c) Here, $\frac{V_1}{R} = C \times \frac{d(V_c)}{dt}$

$$\Rightarrow \frac{V_1}{R} = C \times \frac{d}{dt}(0 - V_0)$$

$$\Rightarrow \frac{d}{dt} V_0 = -\frac{1}{RC} V_1$$

$$\therefore V_0 = \frac{-1}{RC} \int V_1 \, dt$$

d) Given that,

$R = 10\,k\Omega,\ C = 0.1\,\mu F,\ t = 1ms$

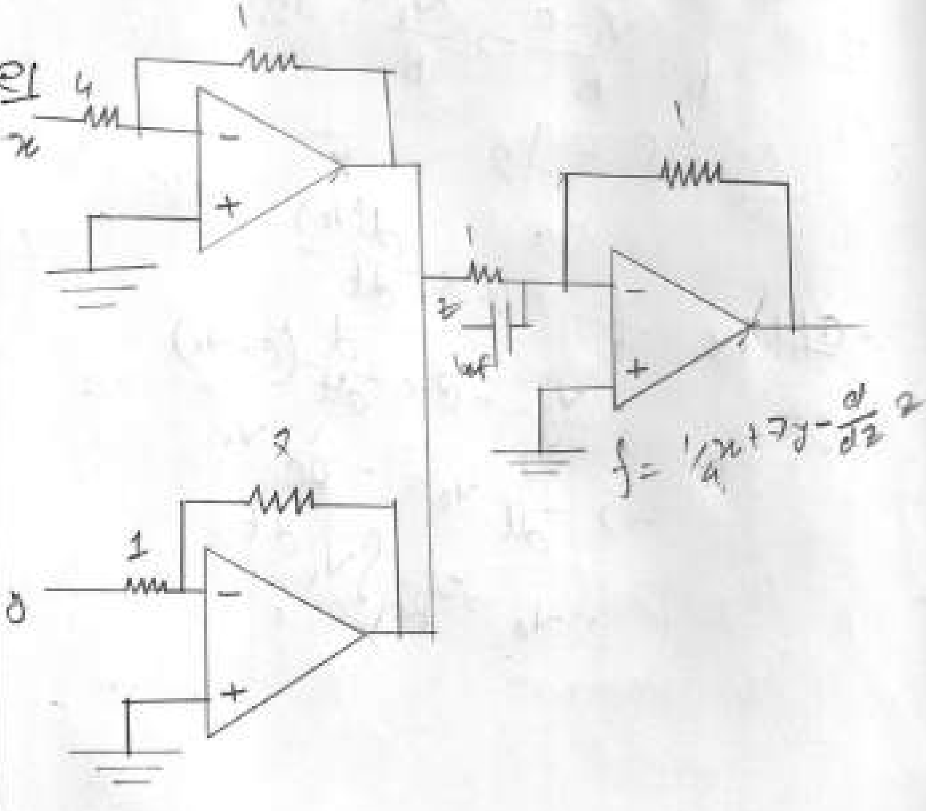
We knows

$$v_0 = -\frac{1}{RC}\int V_i\,dt$$

$$= -\frac{1}{RC}\cdot V_m\cdot t \quad = -\frac{1\times 2}{2\times 10^3\times 0.1\times 10^{-3}}$$

$$= 1v$$

e)



Q-11

i) We know.

$y = mx + c$

Now. $I = mV_s - \frac{V_0}{R}$

(ii) Given that.

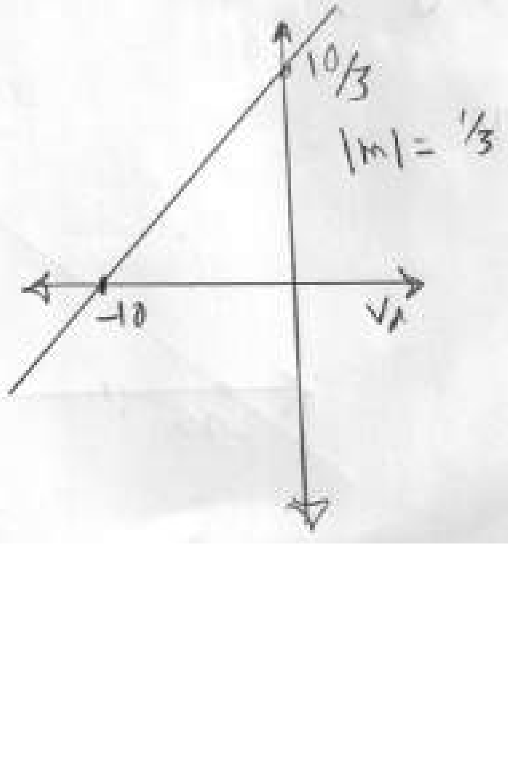
$V_0 = 10^v$, $R = 3k\Omega$

$\therefore$ slope $|m| = \frac{1}{3}$

$\therefore$ x axis $V_1 = -10^v$

$\therefore$ y-axis $c = -\frac{V_0}{R} = -\frac{(-10)}{3} = \frac{10}{3}$ mA

(iii)



Q-12) (i) ∴ Equation of representing curve

$y = mx + c$

$\Rightarrow I = \frac{V_S}{R} + I_0$

(ii) Given that,

$V_0 = 10V \quad R = 5K\Omega$

$\therefore |m| = \frac{1}{5}$

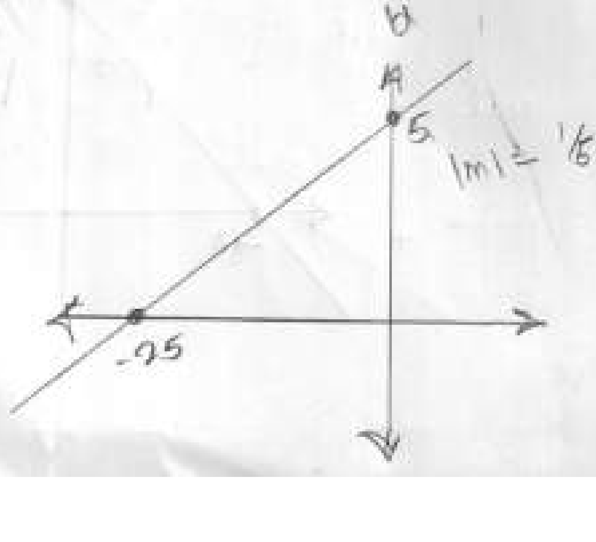
$\therefore x$ axis $\quad I_0 R = -V_0$

$\Rightarrow -V_0 = -5 \times 5$

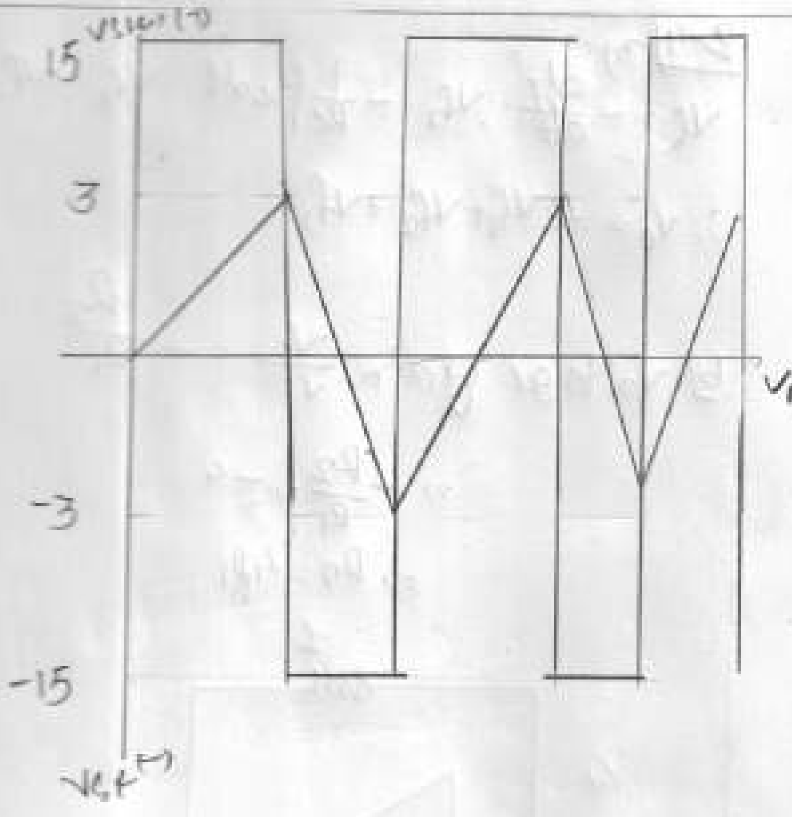
$\Rightarrow \therefore V_0 = -25V$

$\therefore y$ axis $= c = I_0 = 5mA$

(iii)



Q-17



2-4) a)

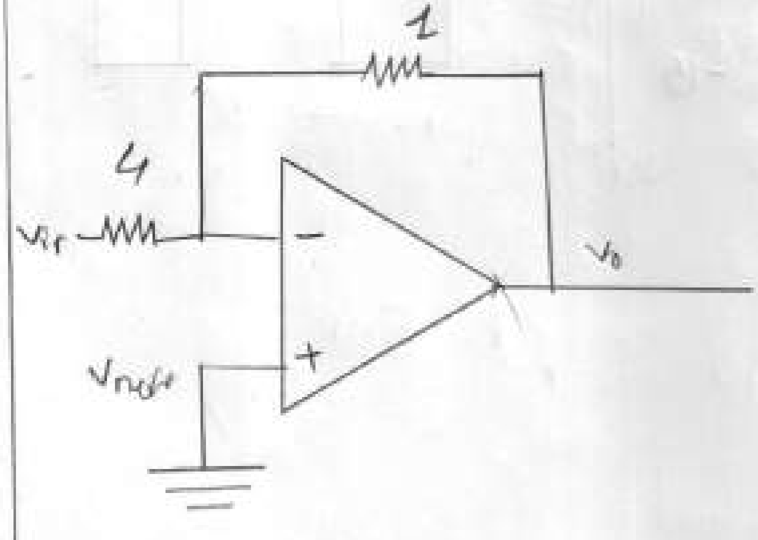
$V_{f} = -\frac{dy}{dt}$, $V_{f_2} = -\frac{1}{RC}\int x\,dt$, $V_{f_3} = -V_{f_1} = \frac{dy}{dt}$

$\therefore V_{f} = -V_{f_1} + V_{f_2} + V_{f_3}$

b) Voltage gain $\frac{V_o}{V_i} = -\frac{R_2}{R_1}$

$\Rightarrow -\frac{R_2}{R_1} = -4$

$\Rightarrow R_2 = 4R_1$



c) let, $v_i = 0.5 \sin \omega t$

$v_0 = K v_i$

$= K$

Amplitude = ?

$v_0 = |K| \times 0.5$

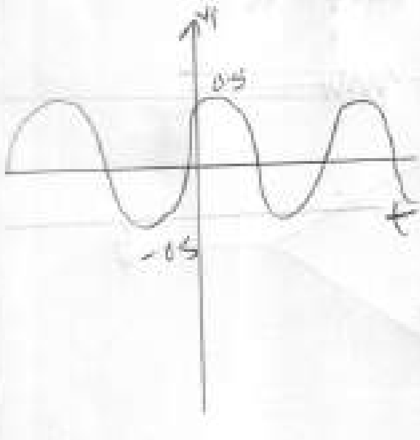
$= 4 \times 0.5 = 2V$

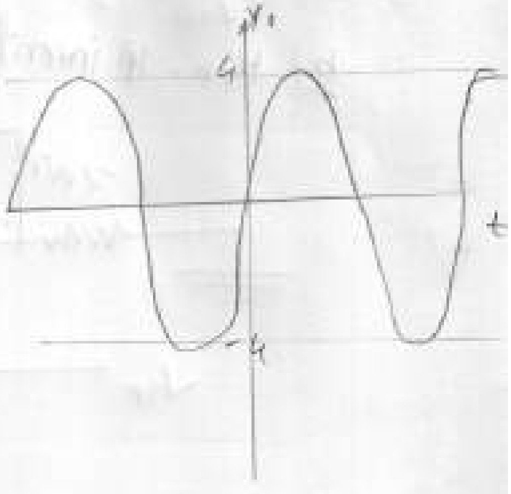
d) let, $v_i = 0.5 \sin \omega t$

$v_0 = -4 v_i$

$\Rightarrow v_0 = -4 \times 0.5 \sin \omega t$

$\Rightarrow v_0 = -2 \sin \omega t.$





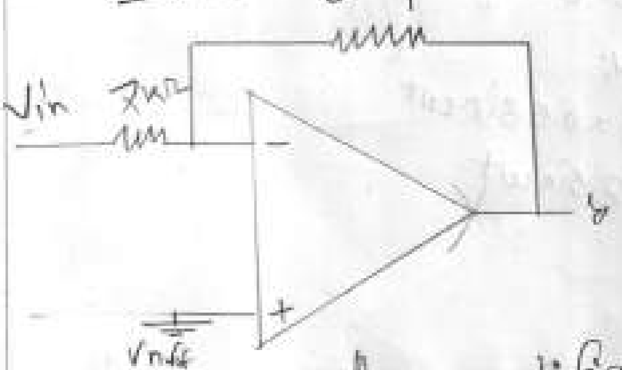
Q-5) $V_1 = -\frac{1}{R_1C_1}\int \sin \omega t$

$V_2 = R_2C_2 \frac{dv}{dt} \Rightarrow R_2C_2 \frac{d}{dt}\left\{-\frac{1}{R_1C_1}\int \sin x\, dt\right\}$

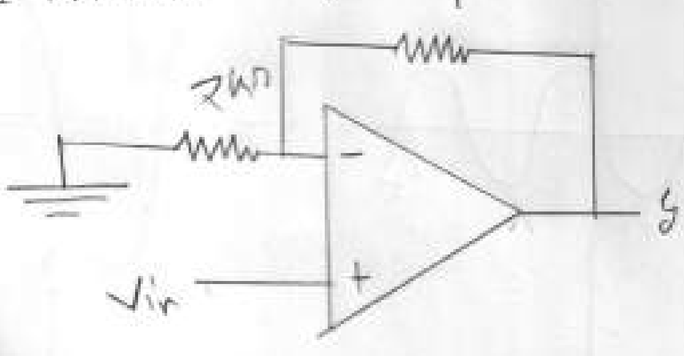
$V_0 = -\frac{R_4}{R_3}(V_1 + V_2)$

$V_1 = -\frac{R_4}{R_3}\left\{-\frac{1}{R_1C_1}\int \sin x\, dt + R_2C_2 \frac{d}{dt}\left\{-\frac{1}{R_1C_1}\int \sin x\, dt\right\}\right.$

Q-6) a) Inverting amplifire



b) Non-inverting amplifire



Q-7]

a) $V_{f_1} = -\frac{1}{4}x$, $V_{f_2} = -\frac{dy}{dt}$, $V_{f_3} = -\int z\,dz$

$V_{f_3} = -(-\int z\,dt) = \int z\,dt$

$V_0 = -(V_{f_2} + V_{f_3} + V_{f_1})$

$\Rightarrow V_0 = -\left(-\frac{1}{4}x + \int z\,dt - \frac{dy}{dt}\right)$

b) $V_0 = -4V_i$

$\Rightarrow -4 = -\frac{R_2}{R_1}$

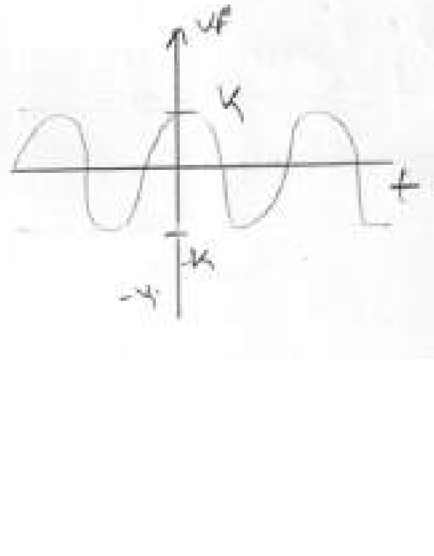
$\Rightarrow R_2 = 4R_1$

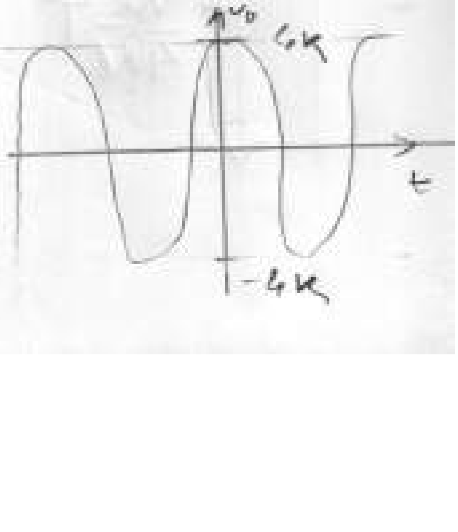
$\therefore V_0 = -4V_i$

c) let,

$V_i = K\sin\omega t$

$V_0 = -4K\sin\omega t$





$\underline{d|}$ $R_1 = \frac{0.1}{4\times10^{-3}} = 25\ k\Omega$

$R_2 = -A_{CL} R_1$

$= -(-4) \times 25 = 100\ k\Omega$

$(0, V_m)\ (T/2, 0)$

$\frac{t-0}{0-T/2} = \frac{V_i - V_m}{V_m - 0}$, $\frac{t}{-T/2} = \frac{V_i - V_m}{V_m}$

$V_i - V_m = \frac{tV_m}{-T/2}$, $V_i = \frac{2tV_m}{-T} + V_m \Rightarrow V_m(-\frac{2t}{T} + 1)$

$\underline{2\text{-}14|}$ $V_i = V_m\left(-\frac{2}{T}\right)t + V_m$

$V_i = \left(-\frac{2V_m}{T}\right)t + V_m$

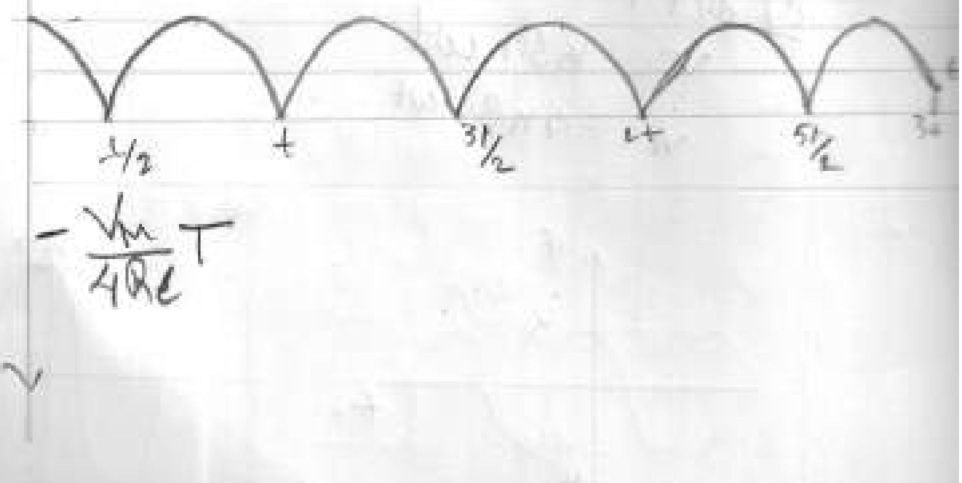
$V_o = -\frac{1}{RC}\int V_i(t)\,dt \Rightarrow -\frac{1}{RC}\int_0^{T/2}\left(\left(\frac{2V_m}{T}\right)t + V_m\right)dt$

$= -\frac{1}{RC}\left[\frac{V_m T}{4} + \frac{1}{2}V_m T\right]$

$V_o = -\frac{V_m}{4RC}T$

V_i

$-\frac{V_m T}{4RC}$



$-\frac{V_m}{4RC}T$

Q-8| Given that $D=(0,7)$, $E=(7,0)$, $C=(0,-4)$

$A=(-4,0)$, $B=(-4,7)$

Now

$|m_{DE}| = \left|\frac{0-7}{7-0}\right| \Rightarrow \left|\frac{-7}{7}\right| = |-1| = 1$

$|m_{CD}| = \left|\frac{-4-7}{0-7}\right| \Rightarrow \left|\frac{-11}{-7}\right| \Rightarrow |1.571| = 1.571$

$|m_{AB}| = \left|\frac{7-0}{-4+4}\right| \Rightarrow \left|\frac{7}{0}\right| = \infty$

$|m_{BC}| = \left|\frac{-4-7}{0+4}\right| \Rightarrow \left|\frac{-11}{4}\right| \Rightarrow 1.571$

$|BC| < |DE| < |AB|$

Here slope CD & BC are equal and slope DE is negative and slope AB is infinity.