'Assignment-01'

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Sec: 07

Course: CSE251

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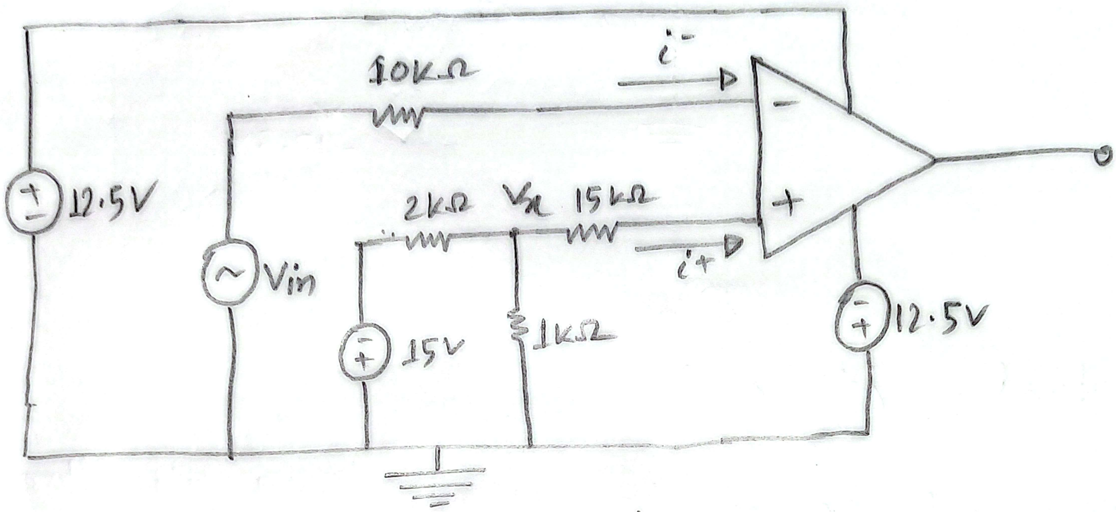
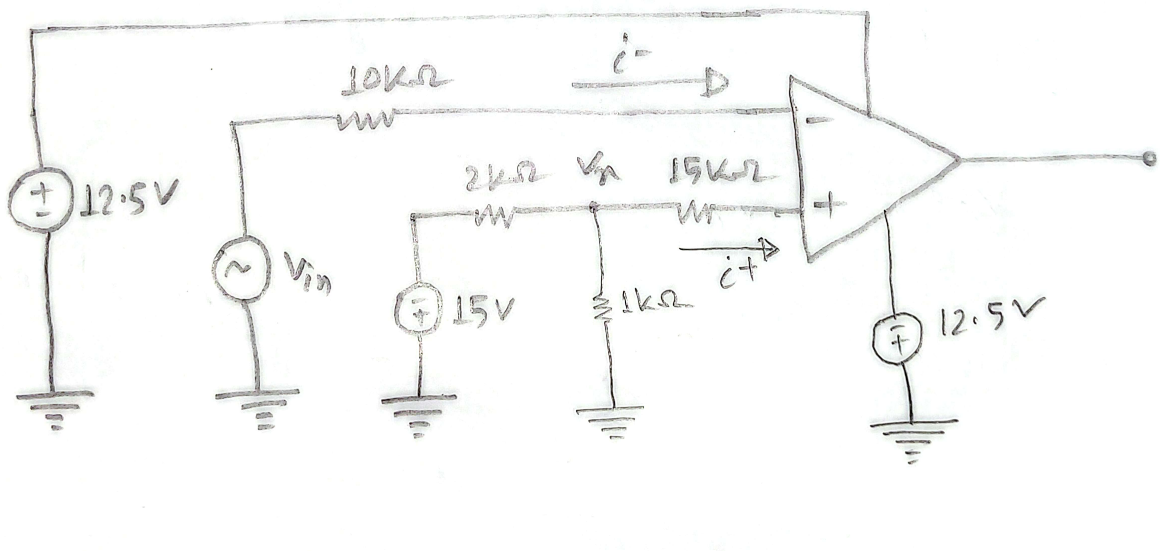
Ans. to the que. no - 1

(a)

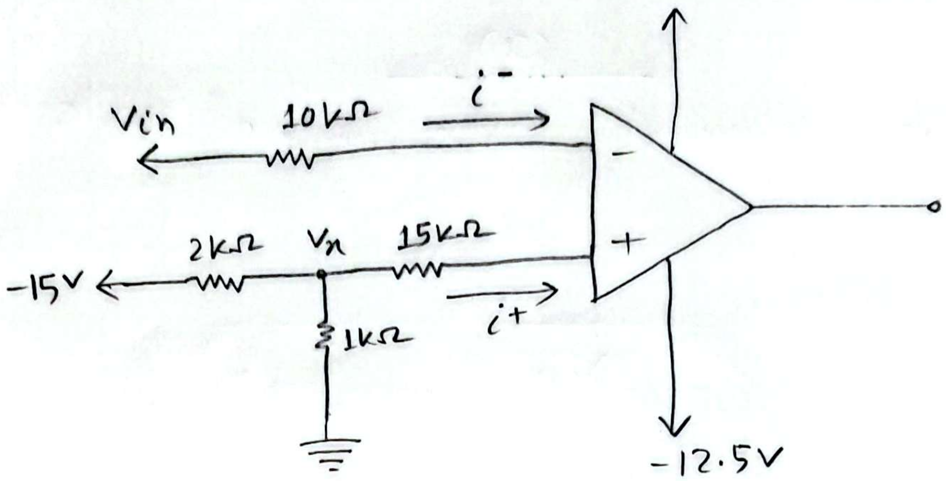
The given circuit with ground node at the bottom node,



At first, with ground node,



Finally,



(b)

Given that, $i^+ = 0\,A$.

So, KCL at V_x node, assumming all the current are outgoing.

$$\frac{V_x - (-15)}{2} + \frac{V_x - 0}{1} = 0$$

$$\Rightarrow \frac{V_x + 15}{2} + V_x = 0$$

So, This is the KCL equation at node V_x.

Now,

$$\frac{V_x + 15 + 2V_x}{2} = 0$$

$$\Rightarrow 3V_x = -15$$

$$\Rightarrow V_x = -5\,V$$

$$\therefore V_x = -5\,V$$

(Ans.)

(c)

From the equation of part (b), we see that as the $i^+ = 0$, the $2k\Omega$ and $1k\Omega$ resistors are in series. Hence, the equation that we have is the same as 'Voltage Divider Rule' equation on $1k\Omega$ resistor.

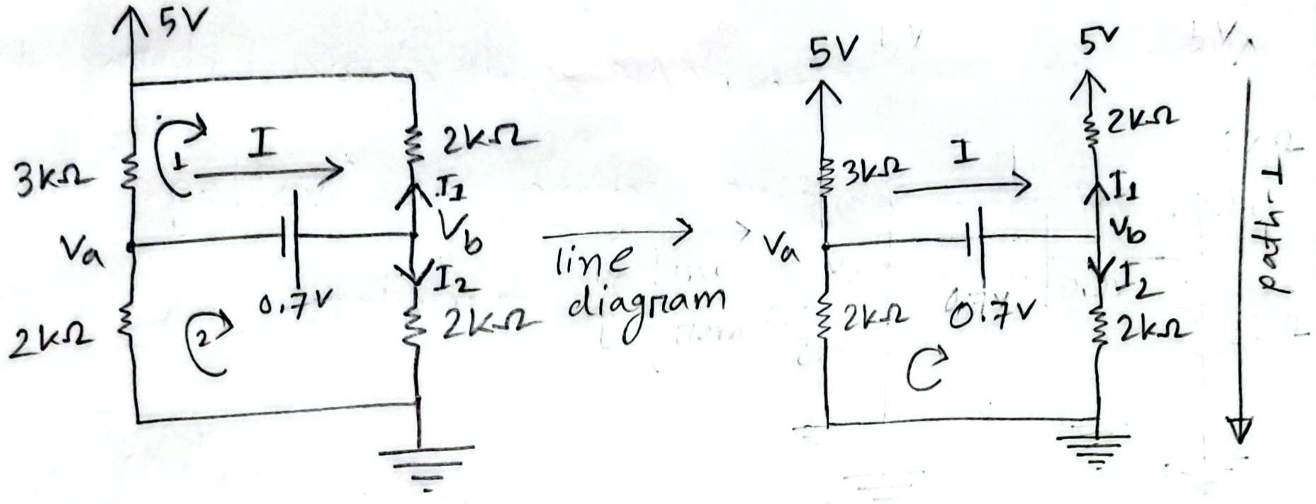
So, we can say that, this equation is similar to Voltage Divider Rule equation.

(Ans.)

Ans. to the que. no - 02

(a)

Given circuit,



KVL at path-1,

$$-2I_1 + 2I_2 = 5 - 0$$

$$\Rightarrow -2I_1 + 2I_2 = 5$$

Now, KVL at loop,

$$2I_2 - 0.7 + 2 \cdot I_2 = 0$$

$$\Rightarrow I_2 = 0.175 \text{ mA}$$

So,

$$-2I_1 + 2I_2 = 5$$

$$\Rightarrow 2I_1 = 2I_2 - 5$$

$$\Rightarrow I_1 = \frac{2I_2 - 5}{2}$$

$$\Rightarrow I_1 = -2.325 \text{ mA}$$

KCL at V_b,

$$I = I_1 + I_2$$

$$= -2.325 + 0.175$$

$$= -2.15 \text{ mA}$$

Now,

$$\therefore \frac{V_b - 0}{2} = I_2 = 0.175$$

$$\Rightarrow V_b = 2 \times 0.175 = 0.35 \text{ V}$$

again, $$\frac{V_a - 0}{2} = -I_2$$

$$\Rightarrow V_a = -2I_2$$

$$\Rightarrow V_a = -2 \times 0.175$$

$$\Rightarrow V_a = -0.35 \text{ V}$$

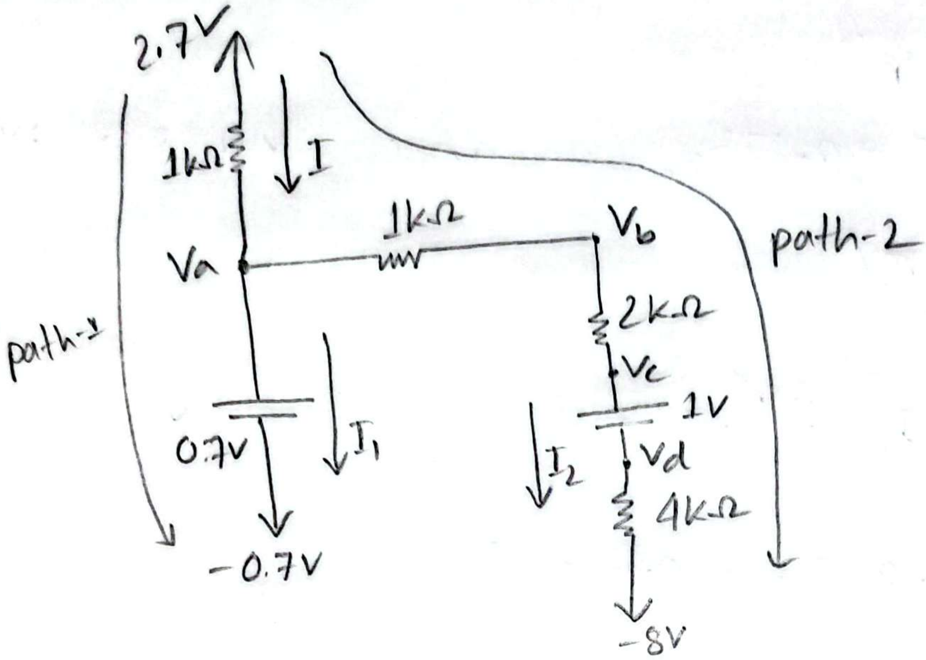
So, $V_a = -0.35$ V

$V_b = 0.35$ V (Ans.)

$I = -2.15$ mA

(b)

given circuit,



KVL at path-1,

$$1I + 0.7 = 2.7 - (-0.7)$$

$$\Rightarrow I = 2.7 \text{ mA}$$

KVL at path-2,

$$I + I_2 + 2I_2 + 1 + 4I_2 = 2.7 - (-8)$$

$$\Rightarrow I + 7I_2 = 9.7$$

$$\Rightarrow 7I_2 = 9.7 - I = 9.7 - 2.7$$

$$\Rightarrow 7I_2 = 7$$

$$\Rightarrow I_2 = 1 \text{ mA}$$

Now, KCL at Va,

$$I = I_1 + I_2$$

$$\Rightarrow I_1 = I - I_2$$

So, $I_1 = 2.7 - 1$

$= 1.7 \text{ mA}$

Again, V_a, V_b, V_c, V_d are 4 unknown voltages. So,

for V_a,

$$\frac{V_a - 2.7}{1} = -I$$

$$\Rightarrow V_a - 2.7 = -2.7$$

$$\Rightarrow V_a = 0 \text{ V}$$

for V_b,

$$\frac{V_a - V_b}{1} = I_2$$

$$\Rightarrow V_a - V_b = 1$$

$$\Rightarrow V_b = -1 \text{ V}$$

for V_c,

$$\frac{V_b - V_c}{2} = I_2$$

$$\Rightarrow V_b - V_c = 2$$

$$\Rightarrow -V_c = 3$$

$$\Rightarrow V_c = -3 \text{ V}$$

for V_d,

$$\frac{V_d - (-8)}{4} = 1$$

$\Rightarrow V_d + 8 = 4$

$\Rightarrow V_d = -4\ V$

Finally,

$I = 2.7\ mA$

$I_1 = 1.7\ mA$

$I_2 = 1\ mA$

$V_a = 0\ V$

$V_b = -1\ V$

$V_c = -3\ V$

$V_d = -4\ V$

(Ans.)

Ans. to the que. no-03

Given,

$$f = \frac{d^2x}{dt^2} + 10y + \int(10z - 9)\,dt$$

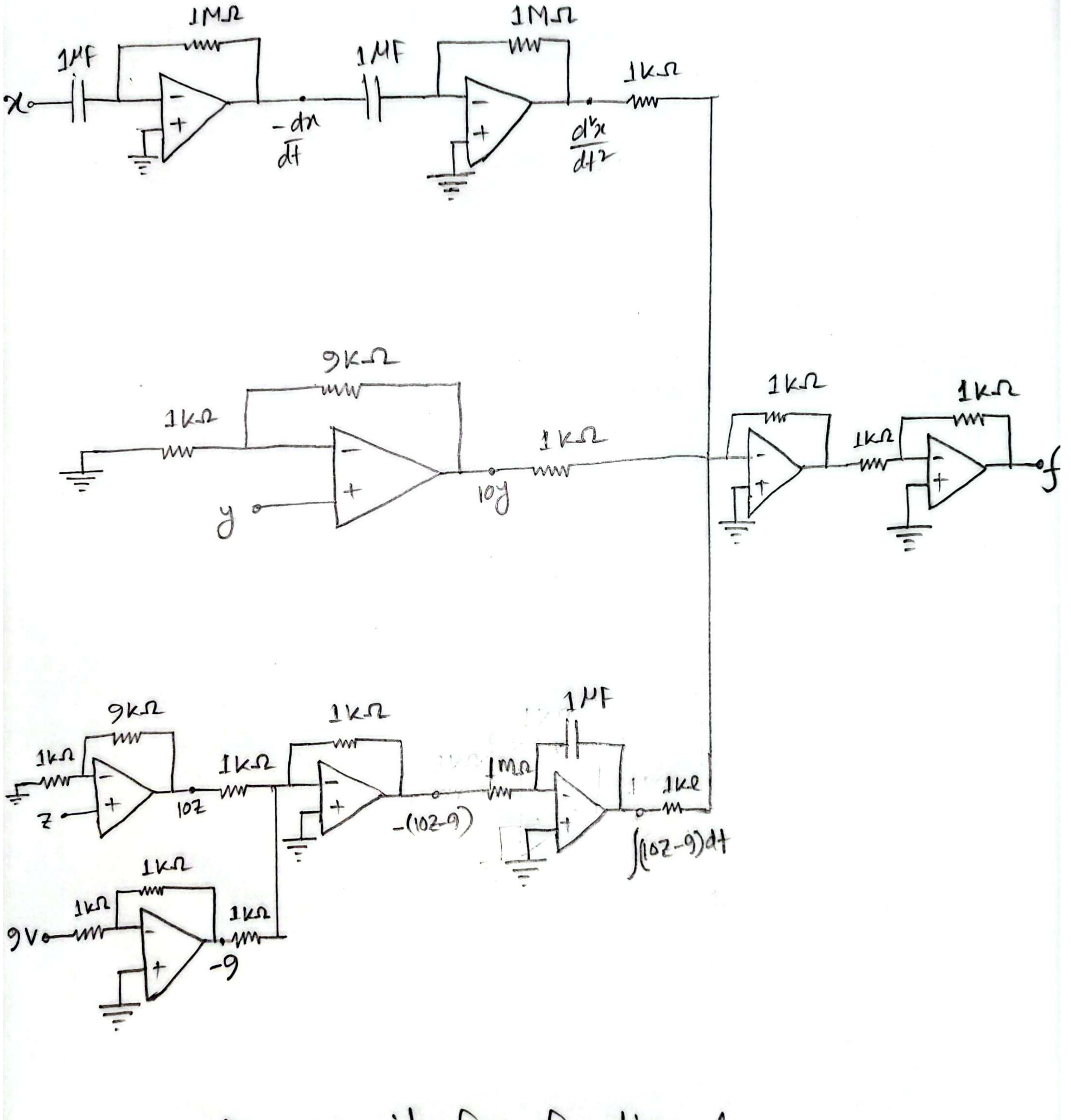
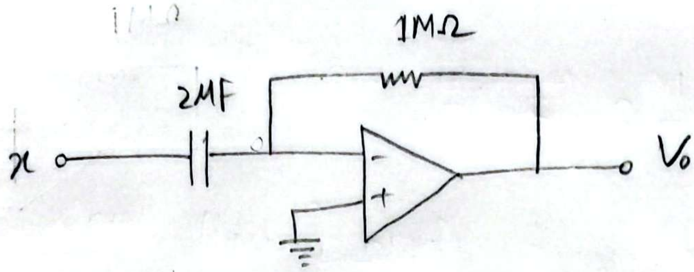


fig: circuit for function f

Ans. to the que. no-4

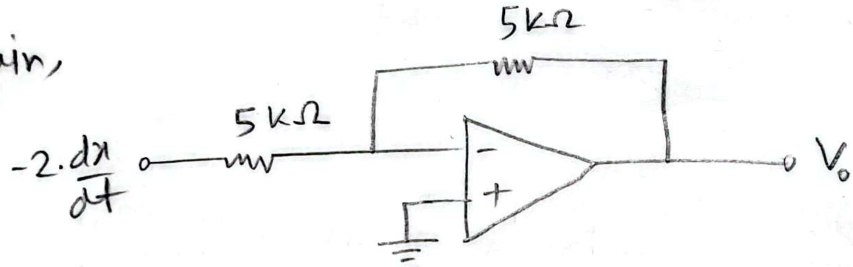
Firstly,



$$\therefore V_o = -(2\times10^{-6} \times 1\times10^{6}) \times \frac{dx}{dt}$$

$$= -2\cdot\frac{dx}{dt}$$

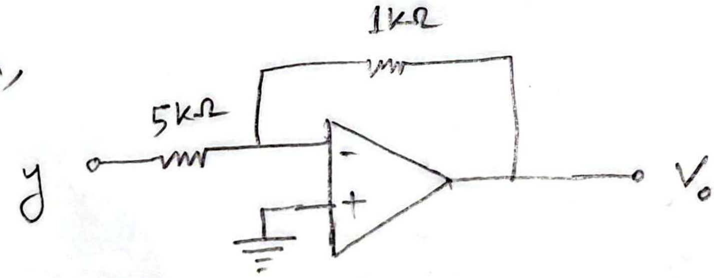
again,



$$\therefore V_o = -\frac{\cancel{5}}{\cancel{5}} \times -2\cdot\frac{dx}{dt}$$

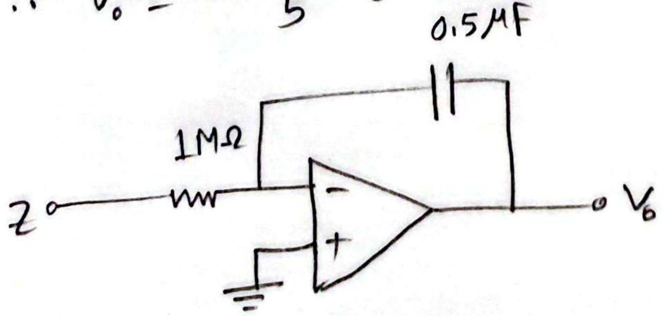
$$= 2\cdot\frac{dx}{dt}$$

Then,



$$\therefore V_o = -\frac{1}{5}\cdot y$$

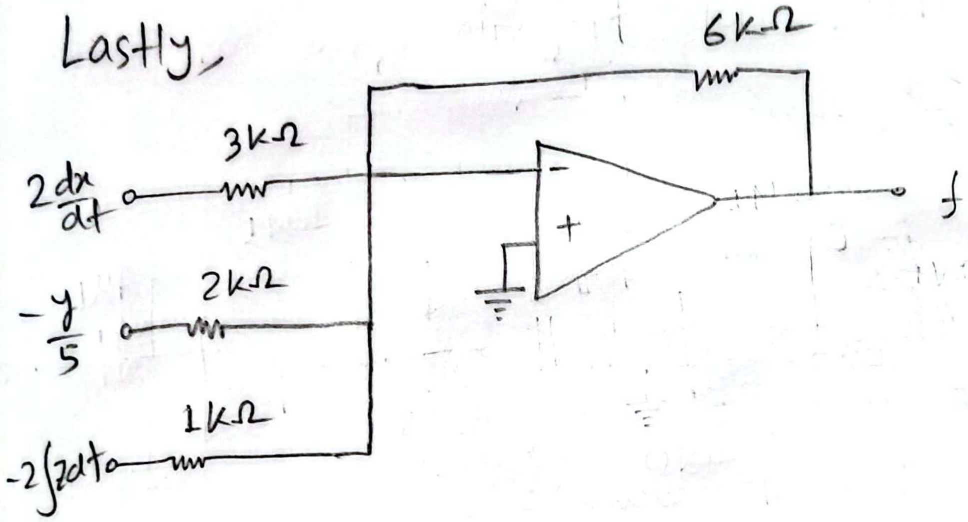
again,



$$\therefore V_o = \frac{-1}{(0.5\times10^{-6}\times 1\times10^{6})}\int z\,dt$$

$$= -2\int z\,dt$$

Lastly,



$$\therefore f = -6\times\left\{\frac{2\frac{dx}{dt}}{3}+\frac{\left(\frac{-y}{5}\right)}{2}+\left(\frac{-2\int z\,dt}{1}\right)\right\}$$

$$= -4\frac{dx}{dt}+\frac{3y}{5}+12\int z\,dt$$

So, $f = 12\int z\,dt + \frac{3y}{5} - 4\frac{dx}{dt}$

(Ans.)