Part-A solutions

1 (a) → 10

O/P voltage due to the input offset current

$$V_{oios} = \left(1+\frac{R_F}{R_1}\right)\left(\frac{R_1 R_F}{R_1+R_F}\right) I_B^+ - I_B^- R_F$$

$$= R_F\left(I_B^+ - I_B^-\right) = R_F I_{os} \quad \text{— (i)} \quad \text{— } 2$$

For inverting amplifier.

$$V_{oios} = 10K(75\times10^{-9}) = 0.75mV \quad \text{— } 2$$

For non-inverting amplifier.

$$V_{oios} = 9K(75\times10^{-9}) = 0.675mV \quad \text{— } 2$$

1 (b). For inverting amplifier.

$$V_{ovos} = \left(\frac{-R_F}{R_1}\right) V_{ios}$$

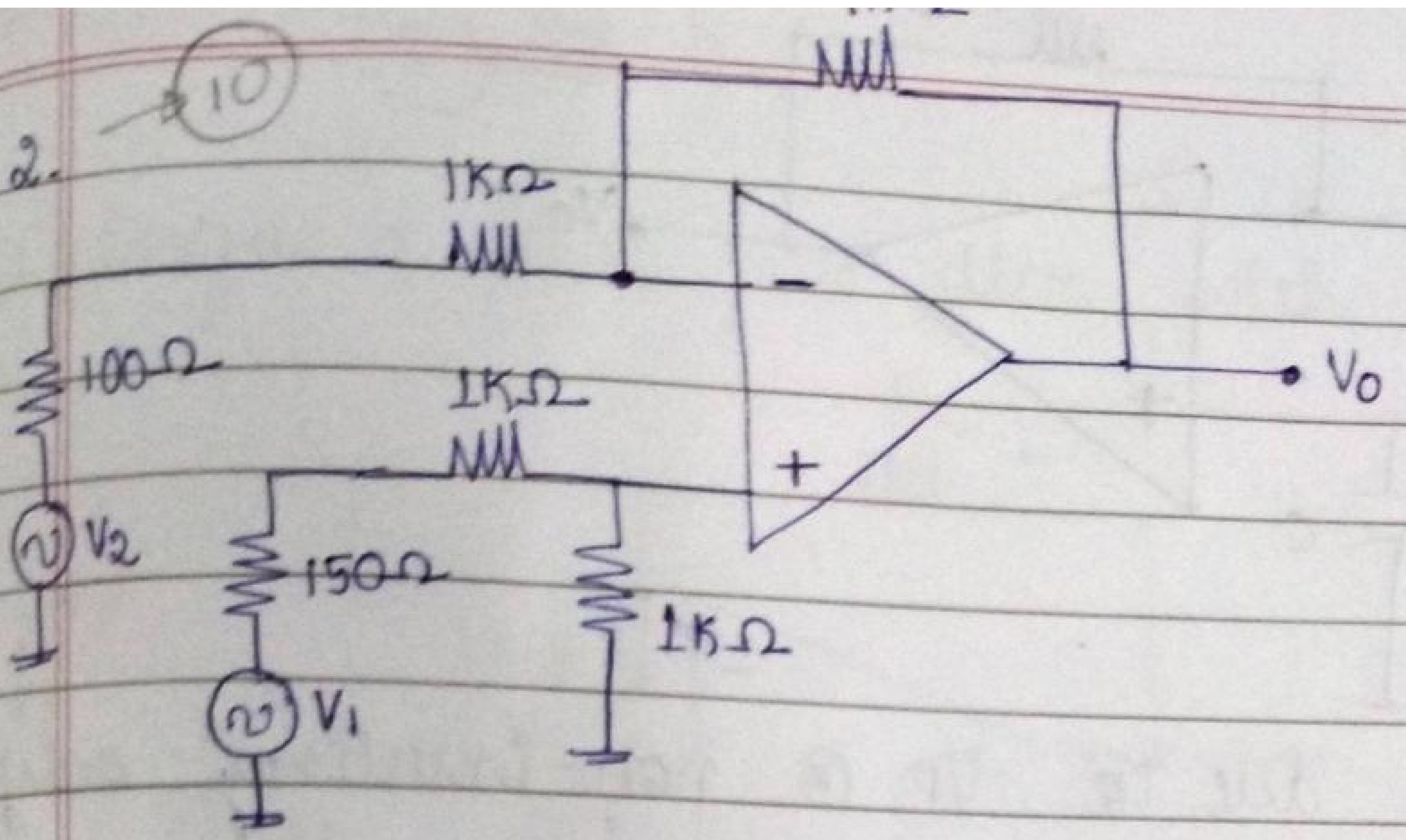
$$= -10\times3m = -30mV \quad \text{— } 2$$

For non-inverting amplifier

$$V_{ovos} = \left(1+\frac{R_F}{R_1}\right) V_{ios} \quad \text{— } 2$$

$$= +10\times3m = 30mV$$

2. (10)



output voltage V_o due to V_1 only

$$V_{o1} = \left(1 + \frac{1K}{1K}\right) V_1 \left(\frac{1K}{1.15K + 1K}\right) \quad \text{— (2)}$$

output voltage V_o due to V_2 only

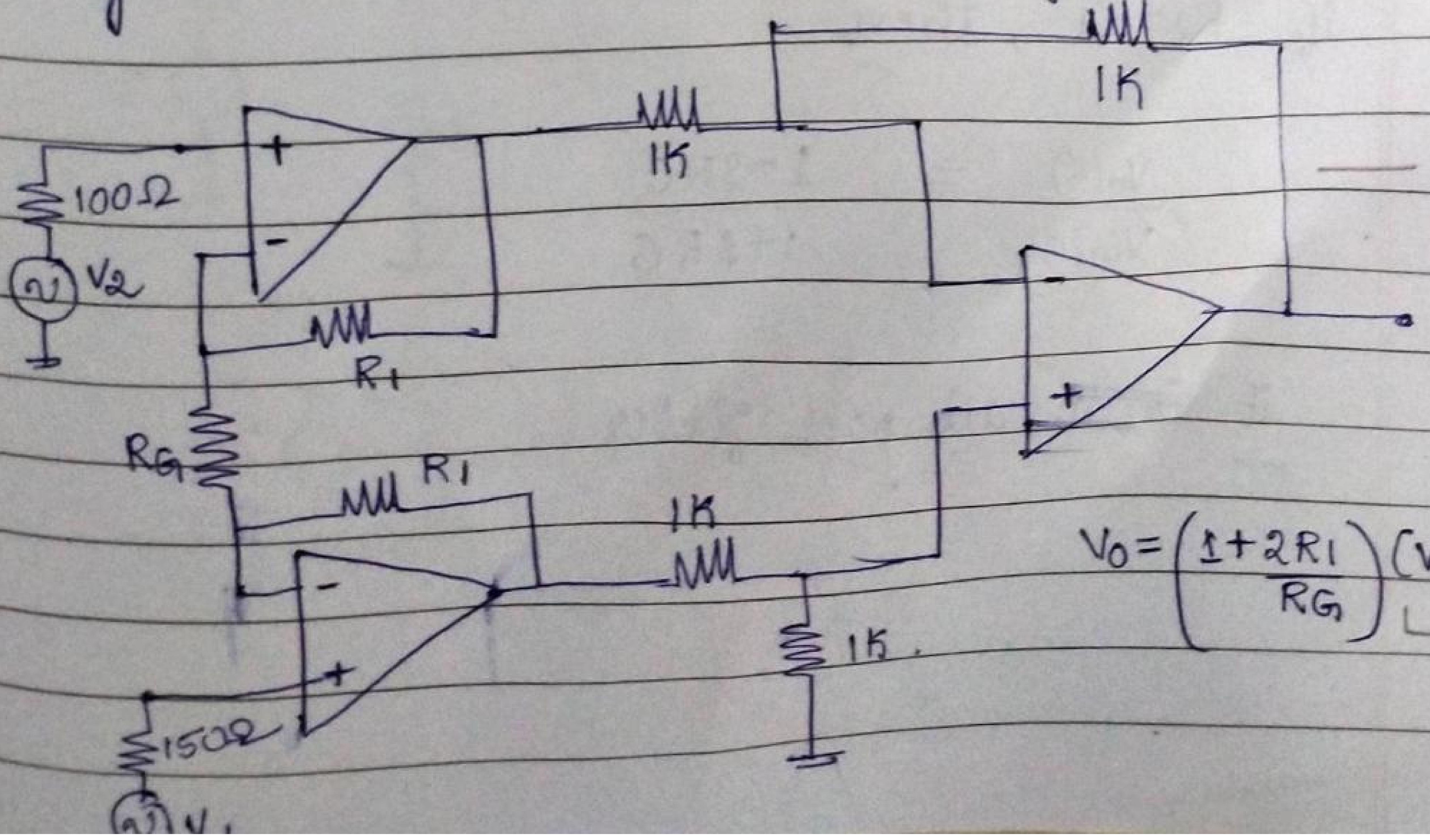
$$V_{o2} = \left(\frac{-1K}{1.1K}\right) V_2 \quad \text{— (2)}$$

$$V_o = V_{o1} - V_{o2}$$

(2)

It is observed that V_o not proportional to $(V_{o1} - V_{o2})$

→ The V_o can be made proportional to $(V_1 - V_2)$ by using the instrumentation amplifier.

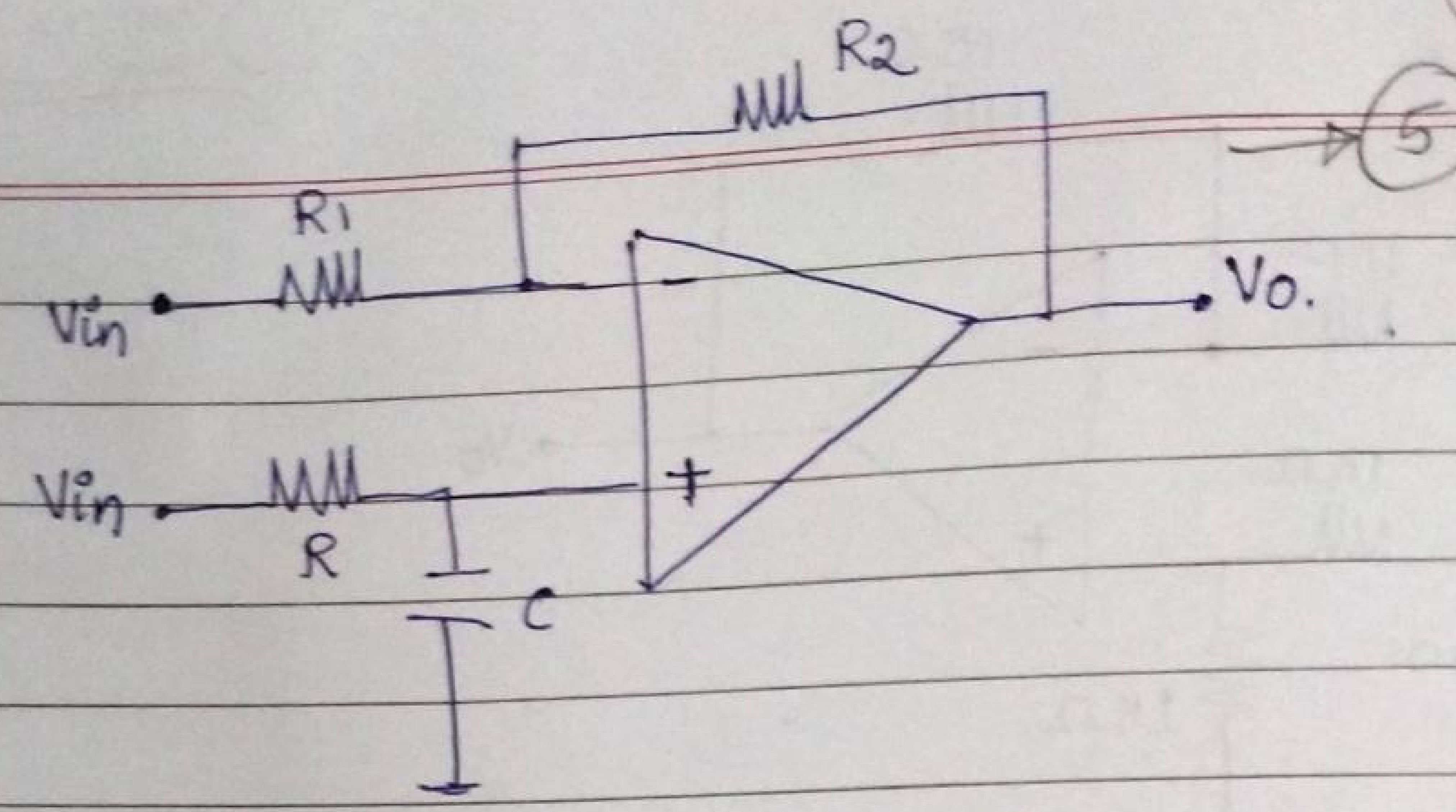


— (2)

$$V_o = \left(1 + \frac{2R_1}{R_G}\right)(V_1 - V_2)$$

(2)

(3).



o/p voltage due to i/p @ non-inverting only

$$V_{o1}(s) = \left(1 + \frac{R_2}{R_1}\right) \frac{V_{in}(s)}{1 + sRC} \quad \text{—(a)} \quad \text{—(2)}$$

o/p voltage due to i/p @ inverting only

$$V_{o2}(s) = \frac{-R_2}{R_1} V_{in} \quad \text{—(b)}.$$

$$V_o(s) = \frac{V_{in}(s)}{1 + sRC}\left(1 + \frac{R_2}{R_1}\right) - V_{in}\frac{R_2}{R_1}$$

$$\frac{V_o(s)}{V_{in}(s)} = \frac{(1 + R_2/R_1)\left[1 - \frac{(R_2/R_1)}{(1 + R_2/R_1)}(1 + sRC)\right]}{1 + sRC} \rightarrow 5$$

if $R_2 = R_1$, then

$$\frac{V_o(s)}{V_{in}(s)} = \frac{1 - sRC}{1 + sRC}$$

it is a all pass filter.