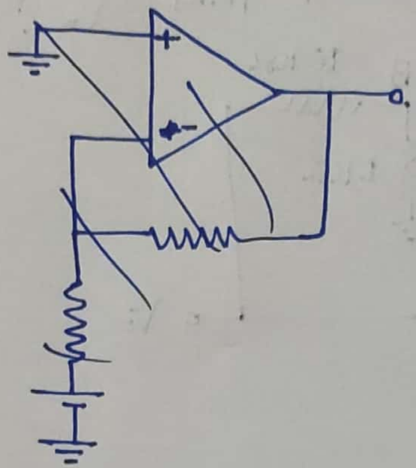
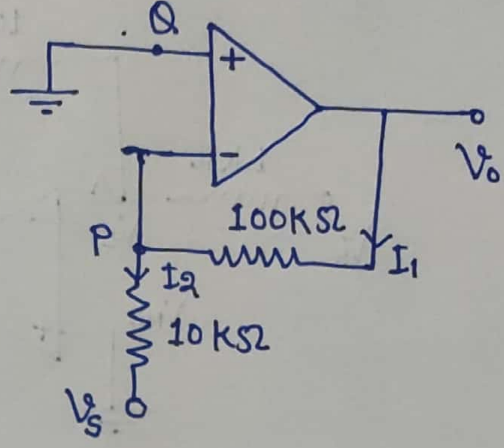
Q.1: Considering op-amp ideal, find $\frac{V_o}{V_S}$?





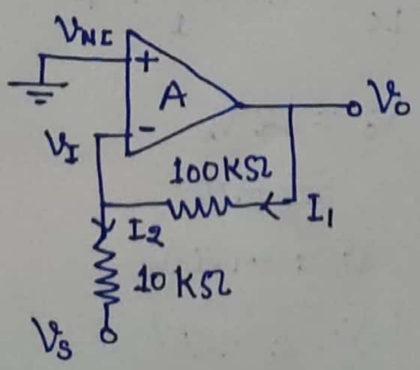
Sol: $V_P = V_Q = 0$ $\{\because$ Ideal op-amp and negative feedback

$I_1 = I_2$

$$\frac{0 - V_S}{10} = \frac{V_o - 0}{100}$$

or $\frac{V_o}{V_S} = -10$

Q.2: Find $\frac{V_o}{V_S}$ if $A = 10$.



Sol: $V_o = V_d \cdot A$

$= (V_{NI} - V_I) \cdot A$

$= (0 - V_I) \cdot A$

$V_o = -V_I \cdot A$

$= -10 V_I$ — ①

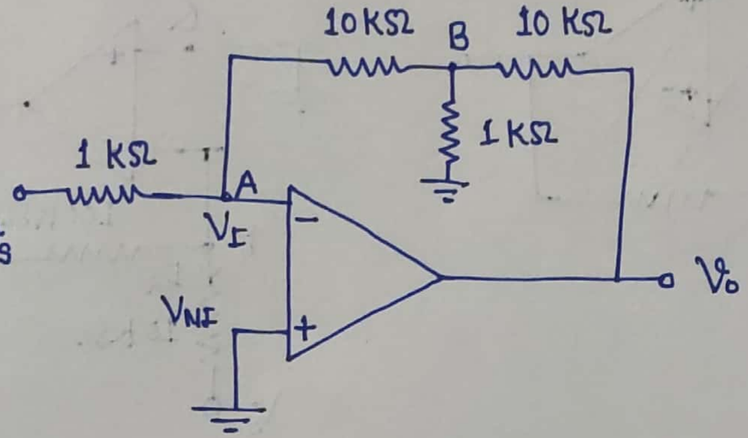
$I_1 = I_2$

$$\frac{V_o - V_I}{100} = \frac{V_I - V_S}{10} \quad \text{— ②}$$

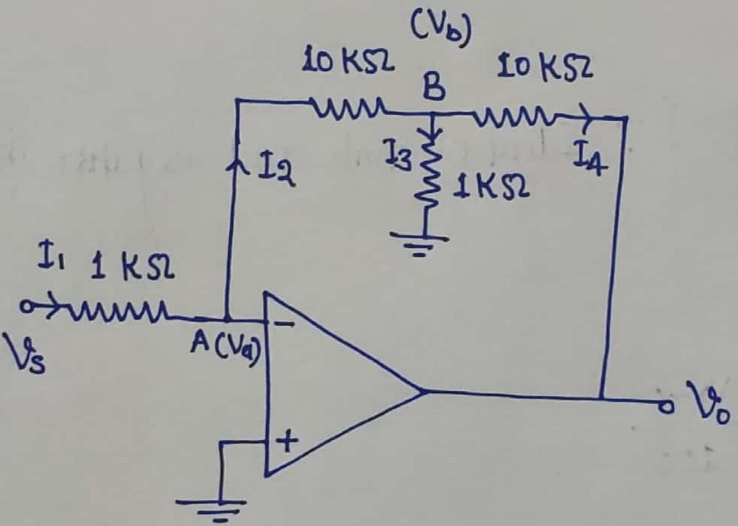
From ① & ②,

$$\boxed{\frac{V_o}{V_s} = -\frac{100}{21}}$$

Q.3: Assuming the op-amp to be ideal, find $\frac{V_o}{V_s}$?



Sol:



Apply KCL at A

$$I_1 = I_2$$

$$\frac{V_s - 0}{1} = \frac{0 - V_b}{10}$$

~~or $V_o = -10 V_s$ ①~~

$$V_b = -10 V_s \quad -①$$

Apply KCL at B

$$I_2 = I_3 + I_4$$

$$\frac{0 - V_b}{10} = \frac{V_b - 0}{1} + \frac{V_b - V_o}{10}$$

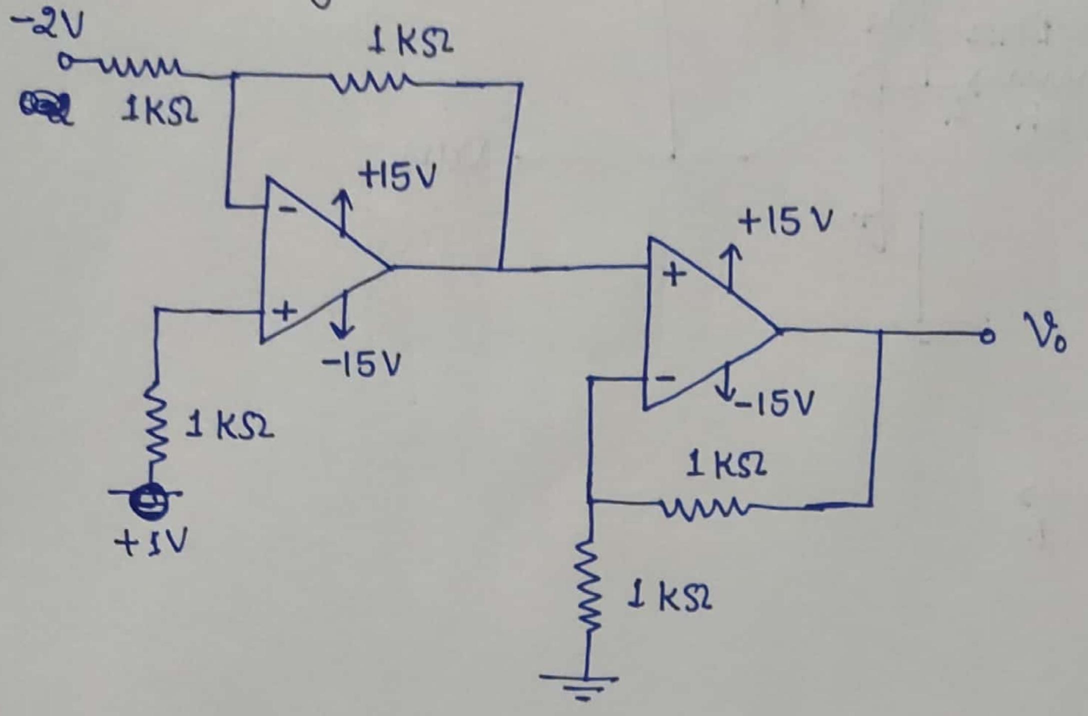
$$V_o = 12 V_b$$

From ①

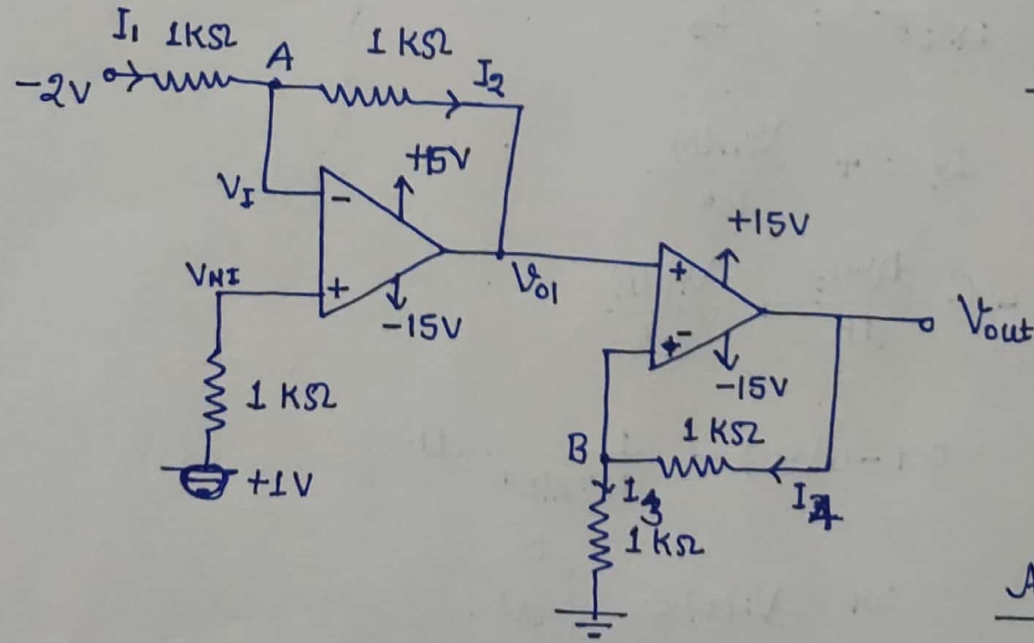
$$V_o = -120 V_s$$

$$\boxed{\frac{V_o}{V_s} = -120}$$

Q. 4: Assuming that op-amps are ideal. ~~Find Vout~~ Find V_{out}?



Sol:



KCL at A

$I_1 = I_2$

$\cancel{\frac{-2-0}{1}}$

$$\frac{-2-1}{1} = \frac{1-V_{01}}{1}$$

$V_{01} = 4V$

Apply KCL at B

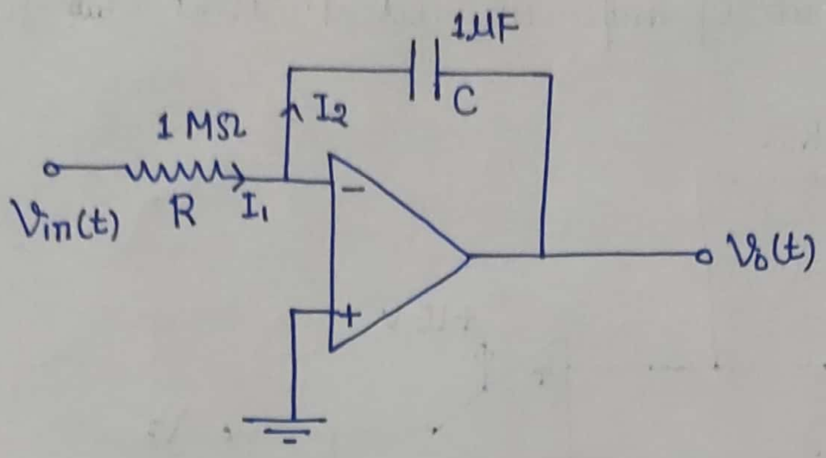
$I_3 = I_4$

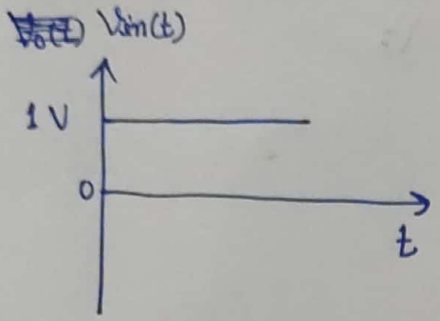
$\cancel{\frac{4-0}{1} = \frac{V_{out}-4}{1}}$

$$\frac{4-0}{1} = \frac{V_{out}-4}{1}$$

$\boxed{V_{out} = 8V}$

Q.5: Find $V_o(t)$? Assume that op-amp is ideal..





Sol:

$$I_1 = I_2$$

$$\frac{V_{in}(t) - 0}{1 \times 10^6} = I_2$$

or $$I_2 = +\frac{V_{in}(t)}{10^6}$$

$$-C\frac{dV_o(t)}{dt} = \frac{V_{in}(t)}{10^6}$$

or $$-dV_o(t) = \frac{1}{10^6 \times 10^{-6}}\,dt$$

or $$V_o(t) = -\int_0^t dt$$

$$V_o(t) = -t + C$$

or $$V_o(t) = -t$$

$\left\{ \because \text{at } t = 0 \cdot \; V_o(t) = 0 \right.$

$\left\{ q = CV \quad \frac{dq}{dt} = I = C\frac{dV}{dt} \right.$