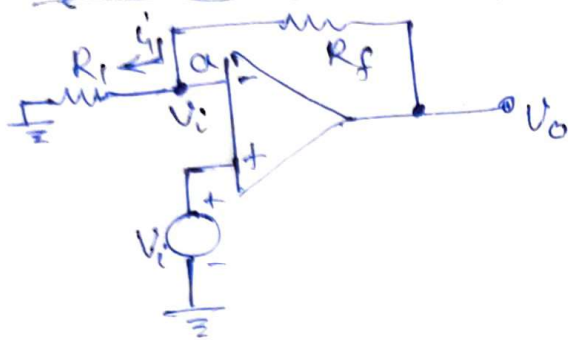


## Non-inverting Amplifiers



$$V_i = \frac{V_o}{R_i + R_f} R_i$$

$$\Rightarrow \frac{V_o}{V_i} = \frac{R_i + R_f}{R_i} = 1 + \frac{R_f}{R_i}$$

$$A_{CL} = \frac{V_o}{V_i} = 1 + \frac{R_f}{R_i}$$

Q → Design an amplifier with a gain of +5 using an op-amp

Since gain is positive, we have to make a non-inverting amplifier

Select  $R_i = 10k\Omega$

$$A_{CL} = 1 + R_f/R_i$$

$$5 = 1 + R_f/10k\Omega$$

$$R_f = 40k\Omega$$

→ Let  $R_i = 5k\Omega$ ,  $R_f = 20k\Omega$  and  $V_i = 1V$ . A load resistor of  $5k\Omega$  is connected at the OP. Calculate (i)  $V_o$  (ii)  $A_{CL}$  (iii)  $i_L$  (iv)  $i_o$  indicating proper direction of flow

$$(i) V_o = \left(1 + \frac{R_f}{R_i}\right) V_i = \left(1 + \frac{20k}{5k}\right) 1 = 5V$$

$$(ii) A_{CL} = \frac{V_o}{V_i} = \frac{5}{1} = 5$$

$$(iii) i_L = \frac{V_o}{R_L} = \frac{5}{5k} = 1mA$$

$$(iv) i_i = \frac{V_i}{R_i} = \frac{V_o - V_i}{R_f} = 0.2mA$$

$$i_o = i_L + i_i = 1.02mA$$