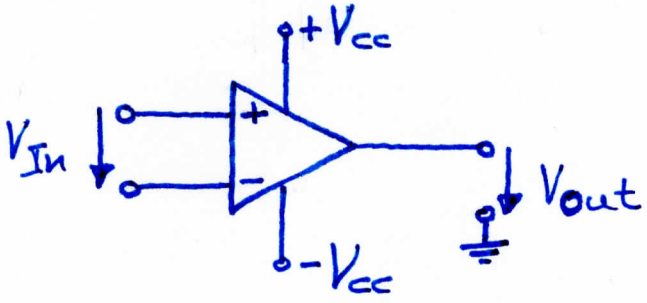
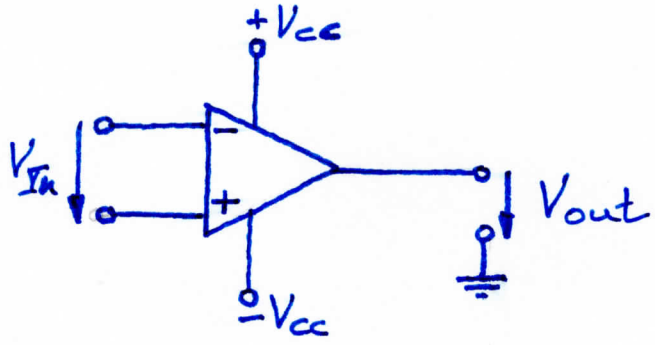
Differential amplifier

Supply voltage $+V_{cc}$ and $-V_{cc}$

⊕ Non-inverting input ⊖ Inverting input

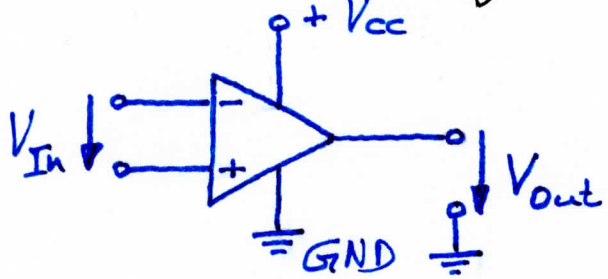


* V_{In} = positive ⇒
  ⇒ V_{out} = positive
* Output V-range:
  $V_{cc} \geq V_{out} \geq -V_{cc}$



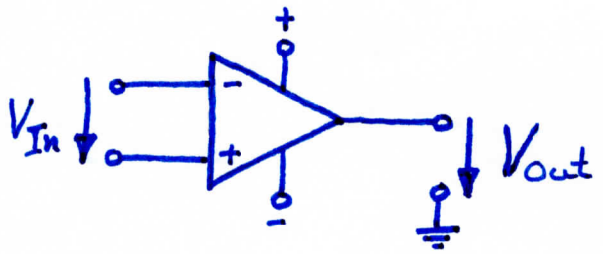
* V_{In} = positive ⇒
  ⇒ V_{out} = negative
* Output V-range:
  $V_{cc} \geq V_{out} \geq -V_{cc}$

Alternative voltage supply: $+V_{cc}$ & **GND**



* Output V-range:
  $V_{cc} \geq V_{out} \geq 0$

The ideal differential amplifier



Differential amplifier is a voltage-to-voltage amplifier.

Ideal properties

* Input impedance $= Z_{In} = \frac{V_{In}}{I_{In}} = \infty$
* Amplification $= A = \frac{V_{out}}{V_{In}} = \infty$
* Output impedance $= Z_{out} = \frac{d\,V_{out}}{d\,I_{out}} = 0$

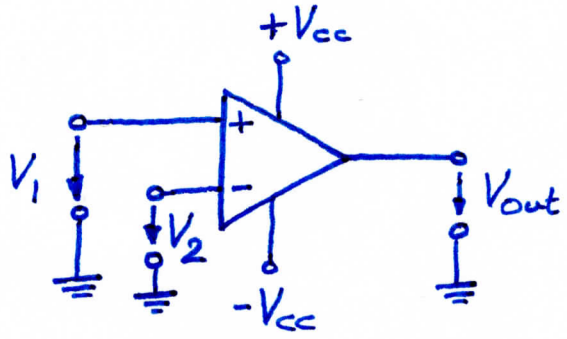
Consequences of ideal properties

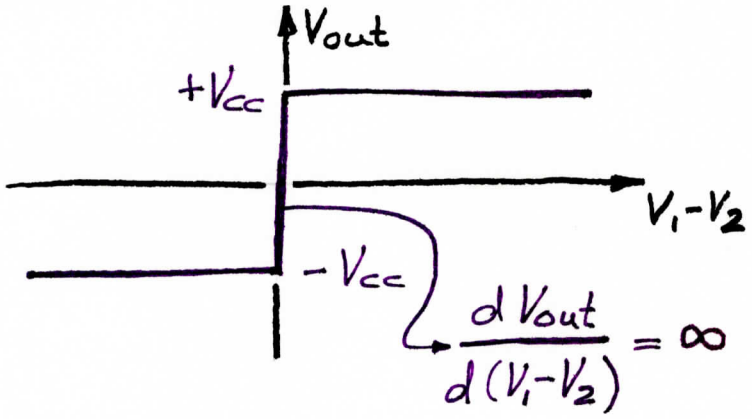
⇒ $V_{In} = 0$ Why? If V_{out} = finite, and $A = \infty$ then $V_{In} = \frac{V_{out}}{\infty} = 0$

⇒ $I_{In} = 0$ Why? $Z_{In} = \infty$

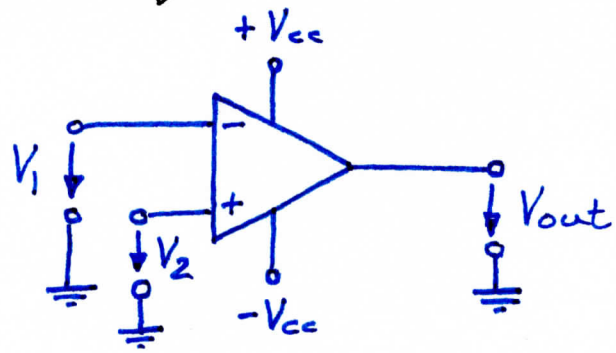
⇒ If ⊕ connected to GND, then ⊖ may be called "virtual GND" Why? $V_{In} = 0$

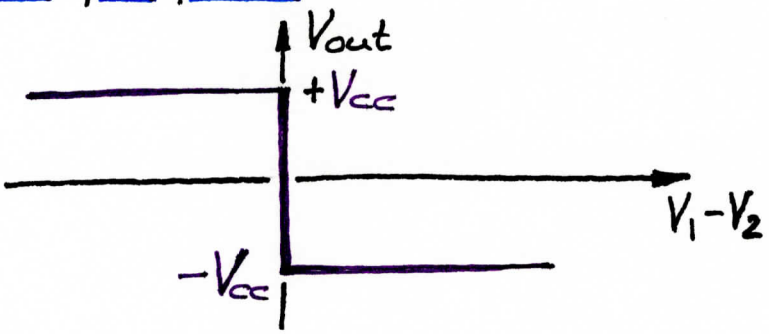
Non-inverting differential amplifier





Inverting differential amplifier





Alternative power supply : +Vcc & GND