

Lecture 6 : Op Amp Output Error

(Quiz)

0. Review
1. Input Bias Current
2. Input Offset Current
3. Input Offset Voltage

Textbook reading:

15-4 : Input characteristics of an op amp

- Today { Quiz
Lab 1 report due
- PreLab 3 due at lab session
↳ Choose Design Project topic, teammates, preliminary design
- HW3 due next Fri (Oct 11) in box outside my office.
→ No class Oct 8 + 10

0. Review

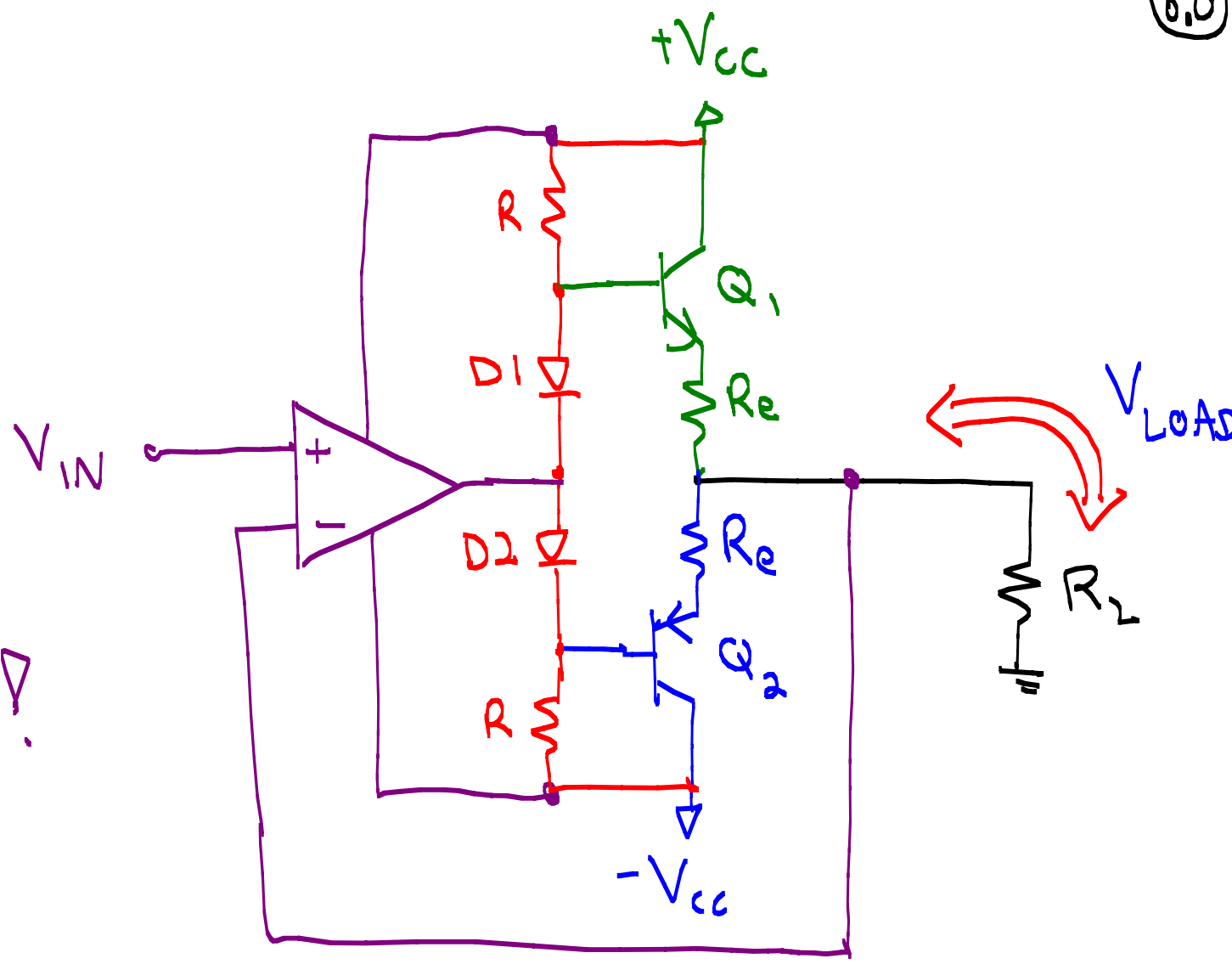
• Class AB Output Stage

→ Push-pull current booster

* Biasing diodes make Q_1 and Q_2 slightly on

⇒ Greatly reduces crossover distortion!
😊

* R must be low enough to provide sufficient current to diodes AND transistor bases



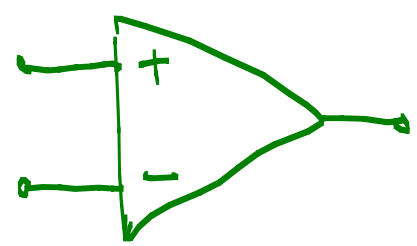
1. Input Bias Current

Example

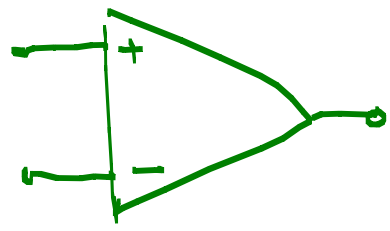
Real op amps do NOT produce zero output when the input is zero.

Q: What causes ΔV_{IN} ?

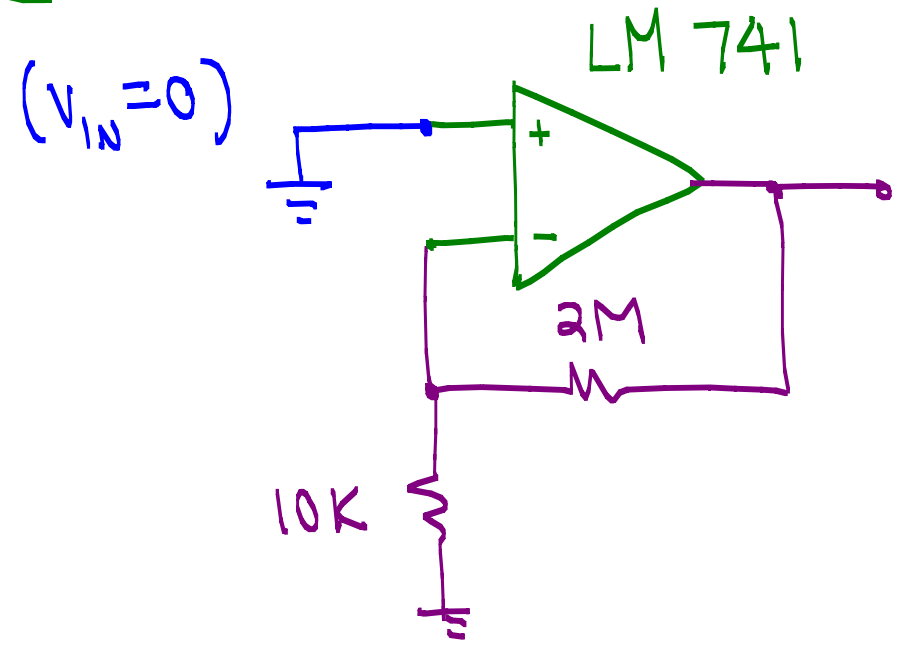
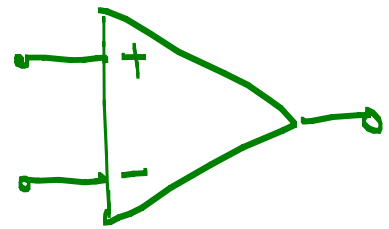
①



②



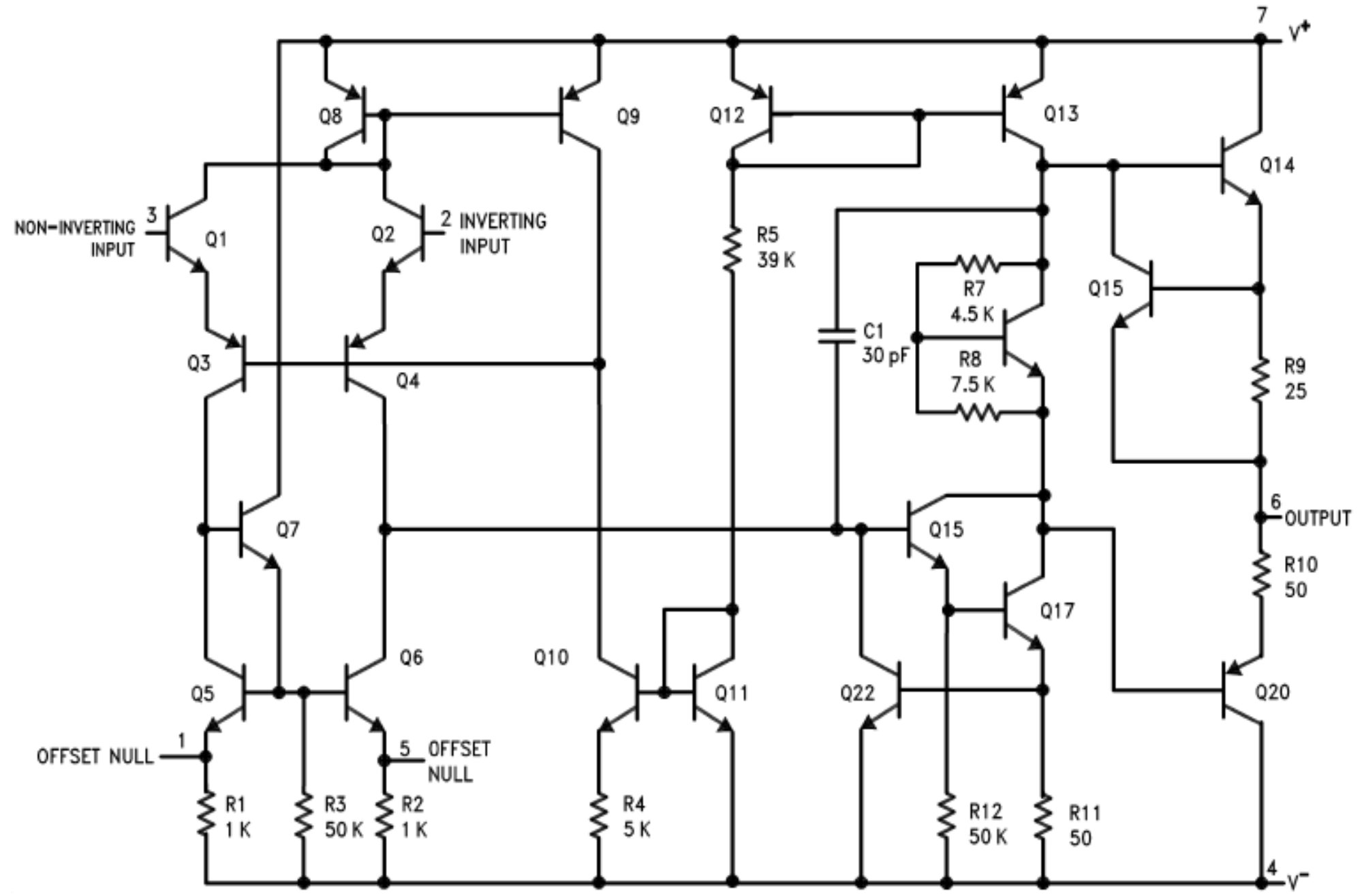
③



741
Op Amp

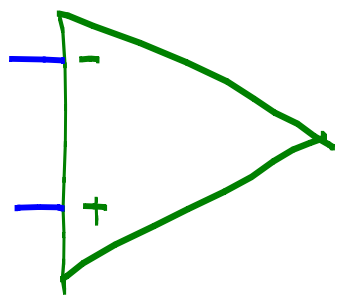
Schematic Diagram

6.2

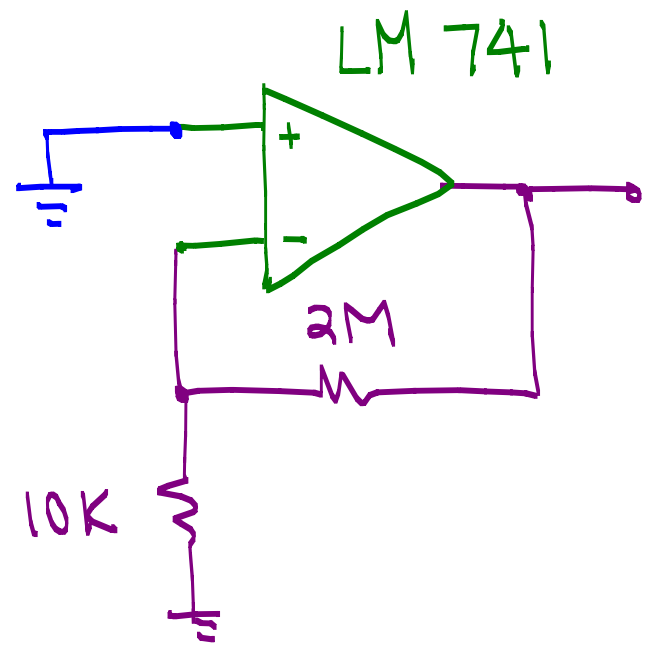


• Effect of input bias current $I_{IN(BIAS)}$

$$\Delta V_{IN} =$$

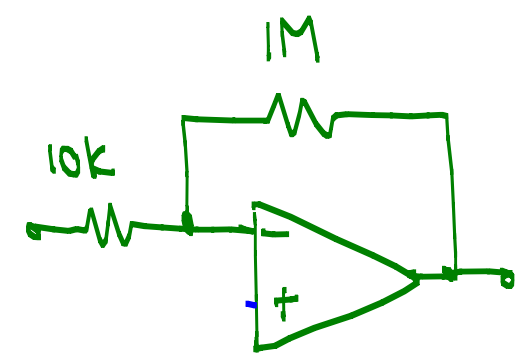


Example LM741: $I_{IN(BIAS)} = 80 \text{ nA (TYP)}$

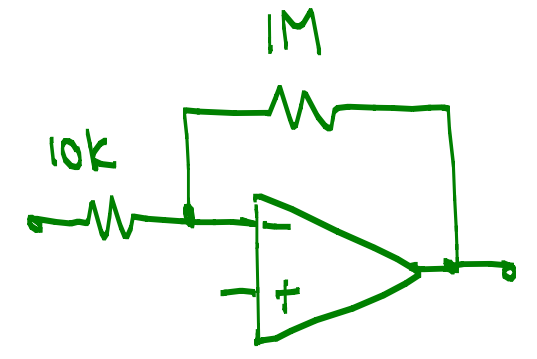


Q: How to minimize error due to $I_{IN(BIAS)}$?

① Try to make



VS.



② use a

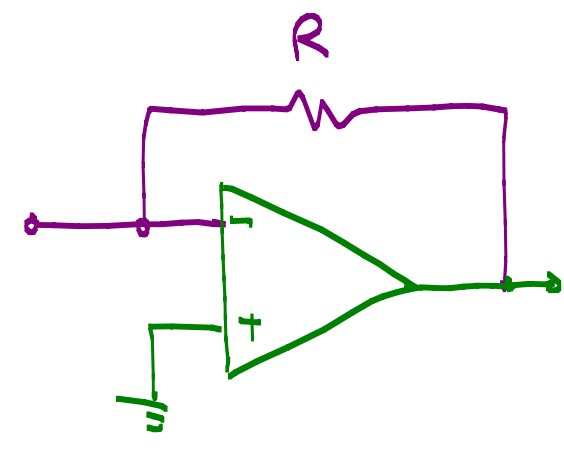
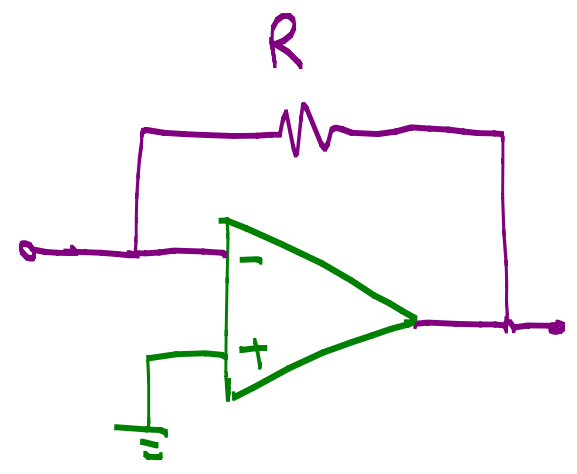
Example Transimpedance Amplifier

Ideal

741C : $I_{BIAS} =$

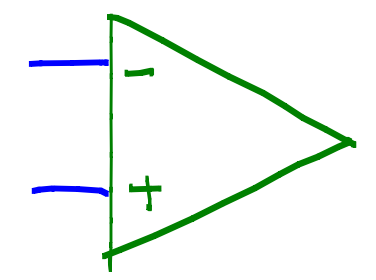
LF356 : $I_{BIAS} =$

Actual

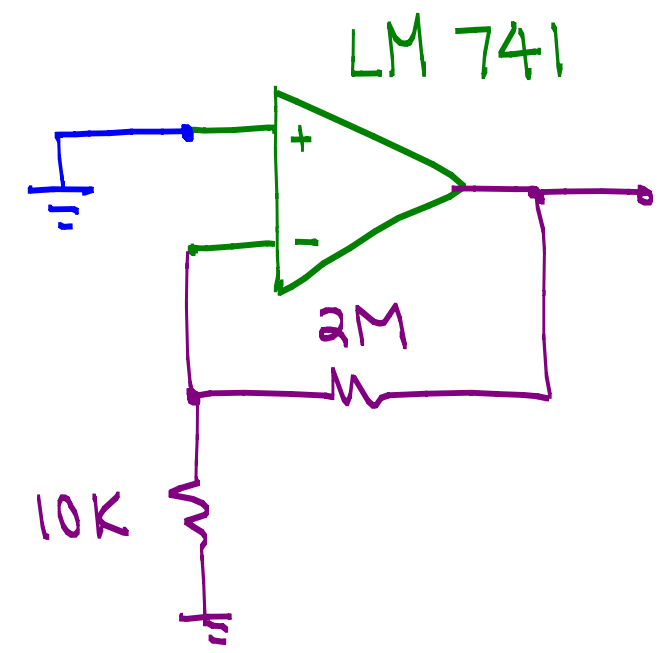


2. Input offset current

$$\Delta V_{IN} =$$



Example LM741: $I_{IN(05)}$



3. Input offset voltage

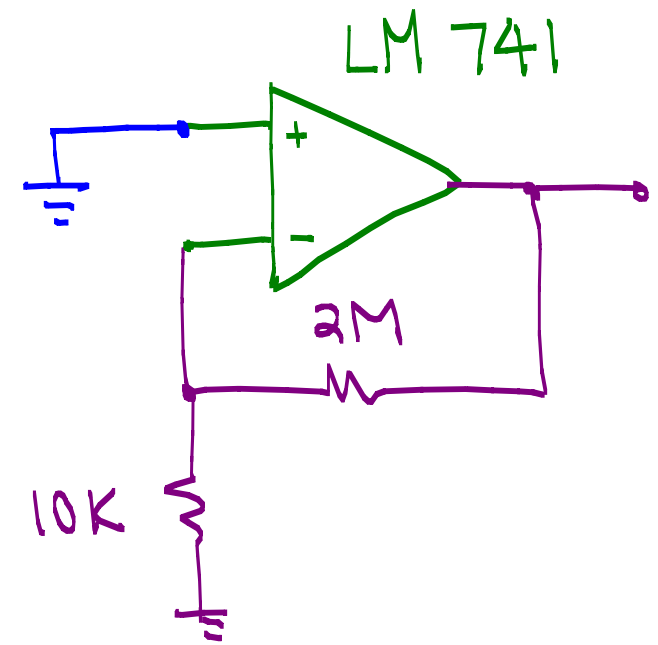
Example LM741: $V_{IN(COS)} = 1\text{mV (TYP)}$

• Putting it all together:

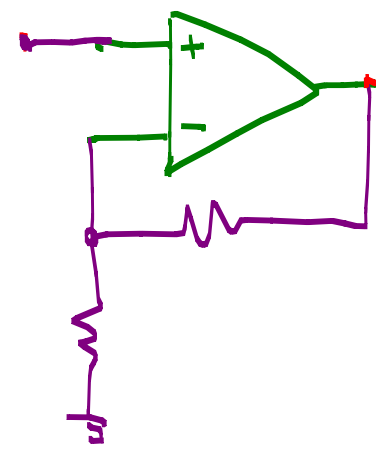
$$I_{IN(BIAS)} : \Delta V_{OUT} =$$

$$I_{IN(COS)} : \Delta V_{OUT} =$$

$$V_{IN(COS)} : \Delta V_{OUT} =$$



AC amplifier

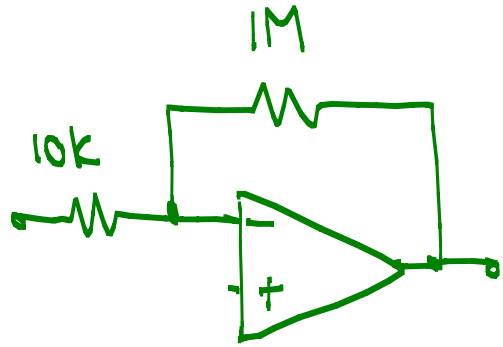


• Techniques to reduce ΔV_{out} error.

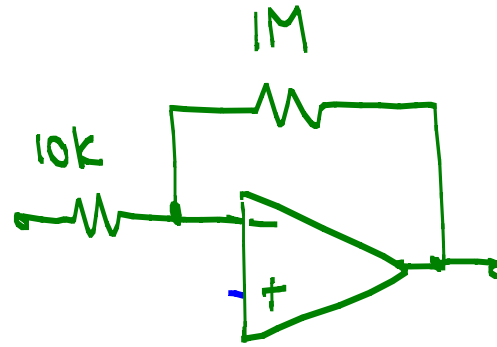
③

6.8

① Make



VS.



② Use

