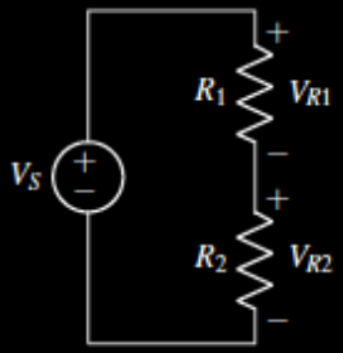
# Lecture 5C

## Agenda:

- → Circuit Design (Examples)
- → Intro to GPS

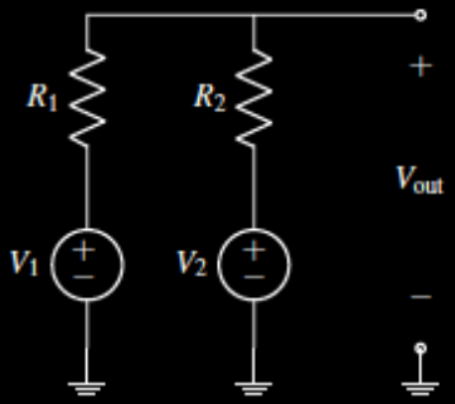
# OP-AMP CHEAT SHEET

## Voltage Divider



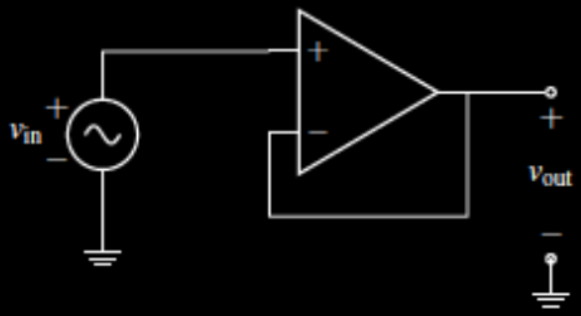

$$V_{R2} = V_S\left(\frac{R_2}{R_1+R_2}\right)$$

## Voltage Summer



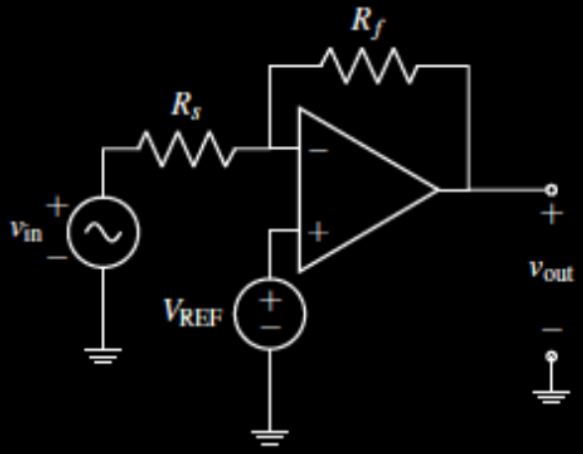

$$V_{out} = V_1\left(\frac{R_2}{R_1+R_2}\right) + V_2\left(\frac{R_1}{R_1+R_2}\right)$$

## Unity Gain Buffer



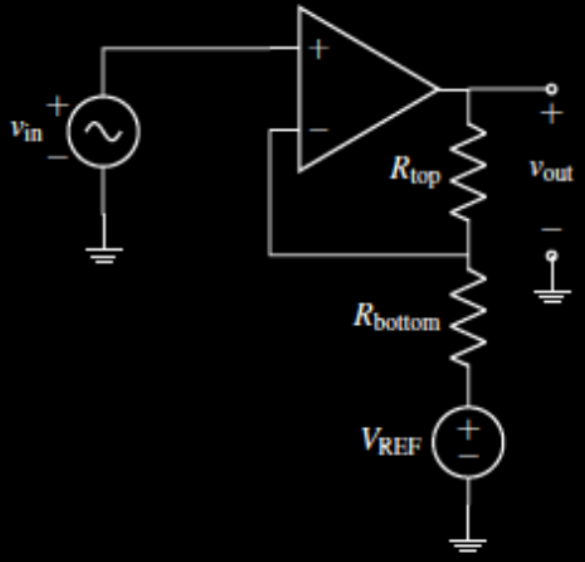

$$\frac{v_{out}}{v_{in}} = 1$$

## Inverting Amplifier



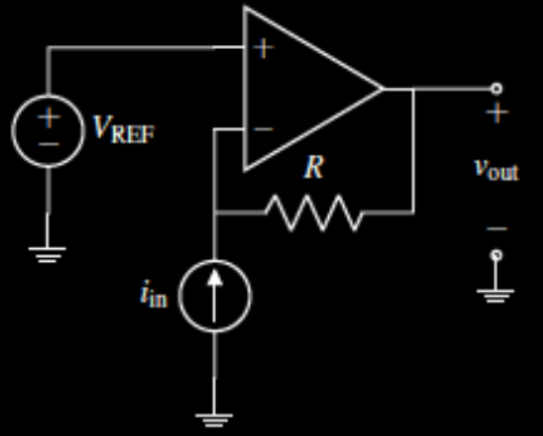

$$v_{out} = v_{in}\left(-\frac{R_f}{R_s}\right) + V_{REF}\left(\frac{R_f}{R_s}+1\right)$$

## Non-inverting Amplifier




$$v_{out} = v_{in}\left(1+\frac{R_{top}}{R_{bottom}}\right) - V_{REF}\left(\frac{R_{top}}{R_{bottom}}\right)$$

## Transresistance Amplifier

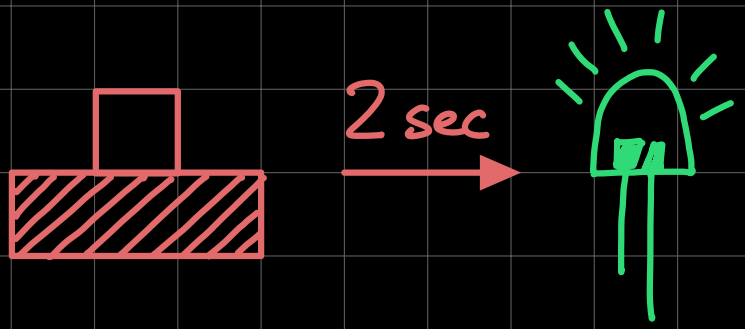



$$v_{out} = i_{in}(-R) + V_{REF}$$

# Design

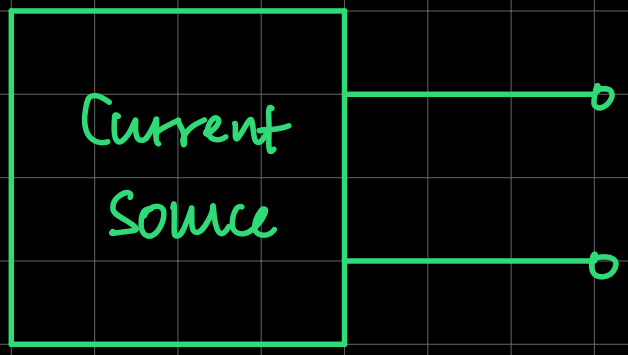
1. Specification - Restate your design goals
2. Strategy - Describe your strategy
3. Implementation - Implement components of your strategy
4. Verification - Check your design from Step 3

# Countdown Timer




Objective →

# Current Source



# Integrator

# Differentiator

# Navigation (Intro to GPS)

## In 1 Dimension

# In 2 Dimension