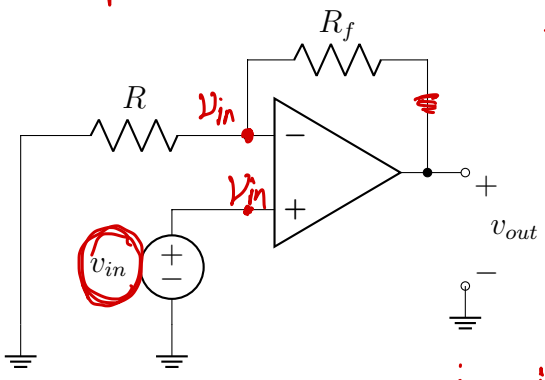
Exercises 09
-
Operational Amplifiers

Exercise 1 - Circuit 1

ideal op a



$\frac{-v_{in}}{R} = \frac{v_{in} - v_{out}}{R_f}$

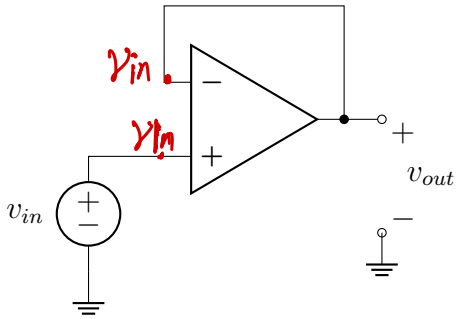
$\Rightarrow v_{out} = R_f \cdot \left(\frac{1}{R_f} + \frac{1}{R}\right) v_{in}$

$= \left(1 + \frac{R_f}{R}\right) v_{in}$

non-inverting op a.

- Determine v_{out}. What is the name of that circuit?

Exercise 2 - Circuit 2



$v_{out} = v_{in}$

non-inverting op a

voltage follower

- Determine v_{out}. What is the name of that circuit?

Exercise 3 - Circuit 3

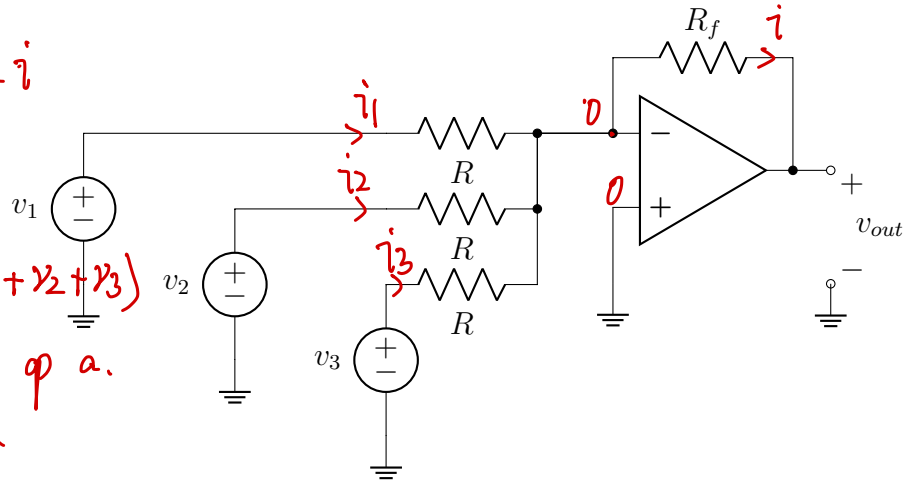
$\frac{v_1}{R} + \frac{v_2}{R} + \frac{v_3}{R} = i$

$i = \frac{-v_{out}}{R_f}$

$\Rightarrow v_{out} = -\frac{R_f}{R}(v_1 + v_2 + v_3)$

negative feedback op a.

summing amplifier



- Determine v_{out}. What is the name of that circuit?

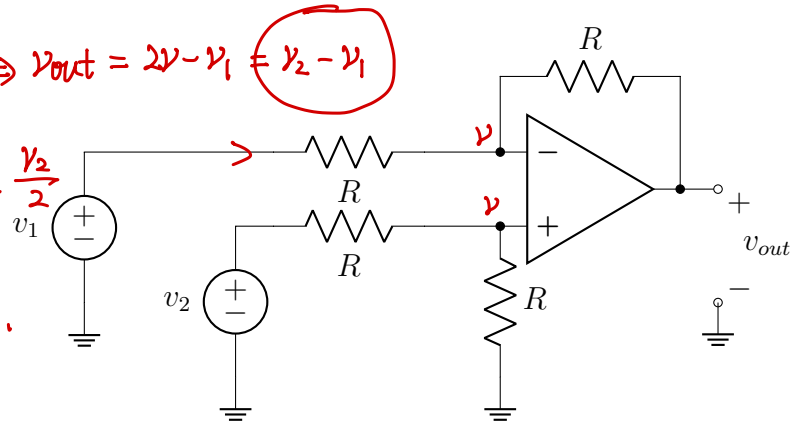
Exercise 4 - Circuit 4

$\frac{v_1 - v}{R} = \frac{v - v_{out}}{R} \Rightarrow v_{out} = 2v - v_1 = v_2 - v_1$

$\frac{v - v_3}{R} + \frac{v}{R} = 0 \Rightarrow v = \frac{v_2}{2}$

positive-feedback op a.

difference op. a.



- Determine v_{out}. What is the name of that circuit?

Exercise 5 - Circuit 5

$\frac{v_{in}}{R} = C \cdot \frac{dv_c}{dt}$

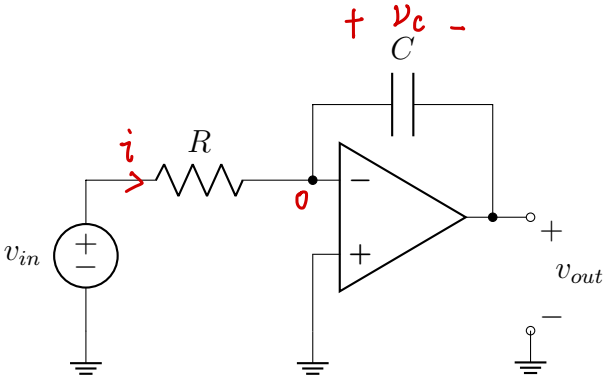
$v_c = -v_{out}$

$\frac{dv_{out}}{dt} = -\frac{v_{in}}{R \cdot C}$

$v_{out} = \int_0^t -\frac{v_{in}}{R \cdot C} dt$

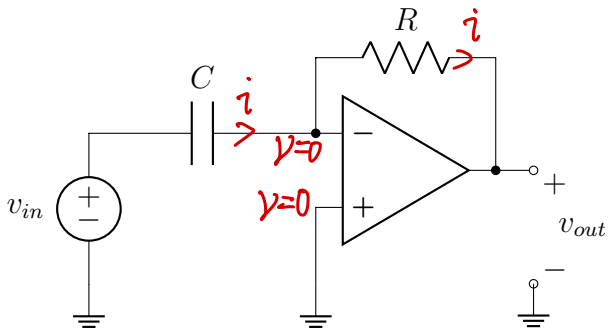
inverting op. a.

integrator op. a.



- Determine v_{out}. What is the name of that circuit?

Exercise 6 - Circuit 6



- Determine v_{out}. What is the name of that circuit?

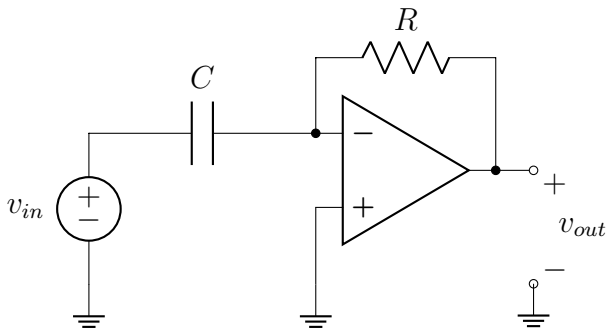
$C \cdot \frac{dv_{in}}{dt} = \frac{0 - v_{out}}{R}$

$v_{out} = -\frac{R}{C} \cdot \frac{dv_{in}}{dt}$

negative feedback op. a.

differential amplifier.

Exercise 6 - Circuit 6



- Determine v_{out}. What is the name of that circuit?