Today, we will:

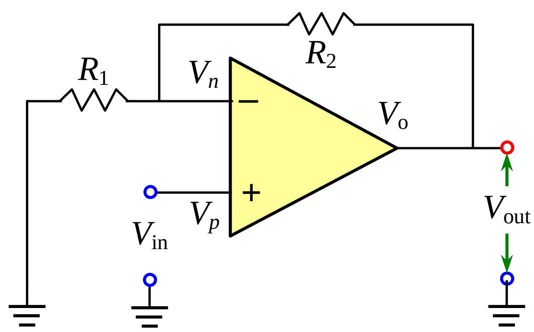
- Do some more example problems – op-amps
- Continue reviewing the pdf module: **op-amps (active filters, clipping circuits)**
- Discuss input and output impedance in more detail

Example: Op-amp circuits

Given: The circuit shown, with

- R_1 = 20 kΩ
- R_2 = 80 kΩ

The supply voltages to the op-amp are +15 V and –15 V (not shown).



To do:

(***a***) Is this is an *inverting* or a *noninverting* amplifier?

(***b***) For an *ideal* op-amp, when V_{in} = 1.50 V DC, calculate V_n in Volts.

(***c***) For an *ideal* op-amp, calculate the gain *G* of the circuit.

(***d***) For a *real* op-amp, when V_{in} = 1.50 V DC, calculate V_{out} in Volts.

(***e***) For a *real* op-amp, when V_{in} = 4.20 V DC, calculate V_{out} in Volts.

Example: Op-amp circuits

Given: Two voltage input signals, V_1 and V_2 are to be combined to produce an output voltage: $V_o = 4(3V_1 + V_2)$.

To do: Design a circuit that will produce this output, using only op-amps and resistors. Use *inverting* amplifiers [which deal with noise better than noninverting amplifiers], as will be discussed later. Assume that the only resistors you have are 20 kΩ.

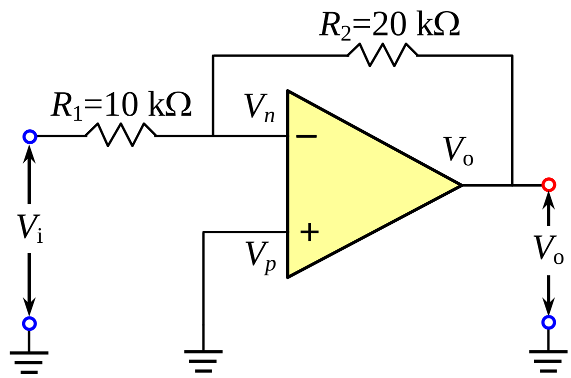
Solution:

Example: Op-amp circuits

Given: The circuit shown to the right.

(*a*) To do: Calculate V_o in terms of V_i.

Solution:

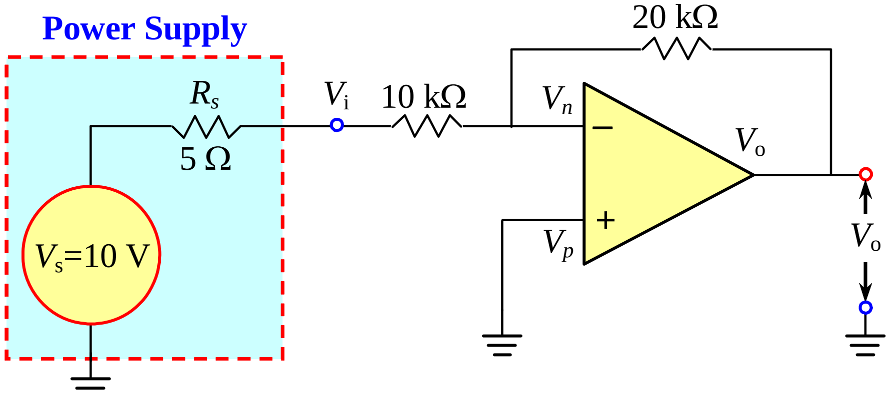


(*b*) To do: Calculate the input impedance of the amplifier.

Solution:

(*c*) To do: Suppose V_i is supplied by a cheap power supply with an output impedance of 5.0 Ω. The power supply is adjusted to provide exactly 10 V (V_s = 10 V). Thus, V_i = 10 V when there is *no load* on the supply. Calculate the voltage V_i when this power supply is connected to the above op-amp circuit (i.e., we add a *load* to the power supply).

Solution:



Since the input impedance of an inverting amplifier op-amp circuit is equal to R_1, the input impedance here is 10 kΩ. Thus, the equivalent circuit (from the power supply's point of view) is: